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ENCYCLOPÆDIA BRITANNICA

VOLUME 7

DAMASCUS TO EDUCATION IN **ANIMALS**

DAMASCUS, the name of a Sanjak and town of Syria, 57 m. from Beirut and situated in 33° 30′ N. and 36° 18′ E. Its origin is unknown, and the belief that it is the oldest city in the world still inhabited has much to recommend it. It is mentioned in the account of the battle of the four kings against five, in the book of Genesis (ch. xiv.), where Abram (Abraham) is reported to have pursued the routed kings to Hobah north of *Damascus (v.* 15).

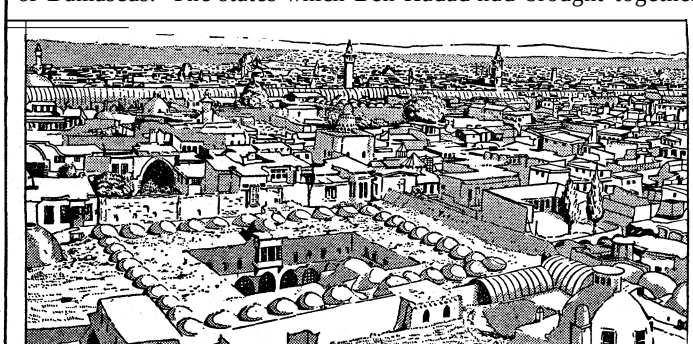
In the period of the Egyptian suzerainty over Palestine in the 18th dynasty Damascus (whose name frequently appears in the Tell el-Amarna tablets) was capital of the province of Ubi. The name of the city in the Tell el-Amarna correspondence is Dimashka. Towards the end of that period the overrunning of Palestine and Syria by the Khabiru and Sutu evidently changed the conditions, language and government of the country, and the Aramaean form, Darmesek, appears in an inscription of Rameses III.

Damascus soon reached such strength that though Tiglath-Pileser I. reduced the whole of northern Syria, and by the fame of his victories induced the king of Egypt to send him presents, yet he did not venture to attack Kadesh and Damascus, so that this kingdom acted as a "buffer" between Assyria and the rising kingdom of Israel.

David made an expedition (2 Sam. viii) against Damascus as a reprisal for the assistance the city had given his enemy Hadadezer, king of Zoba. The Israelite possession of Syria did not last long. A subordinate of Hadadezer named Rezon (Raṣun) succeeded in founding a dynasty there, and throughout Solomon's reign he was a constant enemy to Israel (1 Ki. xi. 23 *seq.).*

It is inferred from 1 Ki. xv. 19 that Abijah, son of Rehoboam, king of Judah, made a league with Tab-Rimmon of Damascus to assist him in his wars against Israel, and that afterwards Tab-Rimmon's son Ben-Hadad came to terms with the second successor of Jeroboam, Baasha. Asa, son of Abijah, followed his father's policy, and bought the aid of Syria, whereby he was enabled to destroy the border fort that Baasha had erected (1 Ki. xv. 22). Hostilities continued between Israel and Syria. Syria established a quarter for Syrian merchants in Samaria (1 Ki. xx. 34.). A Syrian defeat at Aphek, when the king of Israel acted too leniently, was the cause of a prophetic denunciation (1 Ki. xx. 42). According to the Assyrian records Ahab fought as Ben-Hadad's ally at the battle of Karkar against Shalmaneser in 853 B.C. This seems to indicate the vassalage of Ahab, of which no direct record remains; and it was perhaps in the attempt to throw this off that he met his death in battle (1 Ki. xxii. 34–40). In the reign of Jehoram, Naaman, the Syrian general, came and was cleansed by the prophet Elisha of leprosy (2 Ki. v.).

In 842 Hazael assassinated Ben-Hadad and made himself king of Damascus. The states which Ben-Hadad had brought together



GENERAL VIEW OF THE CITY OF DAMASCUS, SHOWING, IN THE DISTANCE, THE COVERED "STREET WHICH IS CALLED STRAIGHT"

into a coalition against the advancing power of Assyria all revolted; and Shalmaneser, king of Assyria, took advantage of this and attacked Syria (841). He wasted the country, but could not take the capital. Jehu, king of Israel, paid tribute to Assyria, for which Hazael afterwards revenged himself, during the time when Shalmaneser was distracted by his Armenian wars, by attacking the borders of Israel (2 Ki. x. 32).

Adad-nirari III. invaded Syria and besieged Damascus, *c.* 805–802; and Jehoash, king of Israel, seizing the opportunity, recovered the cities that his father had lost to Hazael. In 735 Ahaz of Judah was attacked by Rezon (Raṣun, Rezin), king of Damascus; at the same time the Edomites and the Philistines revolted. The king of Assyria, Tiglath-Pileser III., was besought to help; and, invading Syria, reduced Damascus in 733.

Except for the abortive rising under Sargon in 720, we hear nothing more of Damascus for a long period. In 333 B.C., after the battle of Issus, it was delivered over by treachery to Parmenio, the general of Alexander the Great. It had a chequered history in the wars of the successors of Alexander, being occasionally in

Egyptian hands. In 112 B.C., the empire of Syria was divided by Antiochus Grypus and Antiochus Cyzicenus; the city of Damascus fell to the share of the latter. Hyrcanus took advantage of the disputes of these rulers to advance his own kingdom. Demetrius Eucaerus, successor of Cyzicenus, invaded Palestine in 88 B.C., and defeated Alexander Jannaeus at Shechem. On his dethronement and captivity by the Parthians, Antiochus Dionysus, his brother, succeeded him, but was slain in battle by Ḥāritha (Aretas) the Arab. Ḥāritha yielded to Tigranes, king of Armenia, who in his turn was driven out by Q. Caecilius Metellus. In 63 B.C. Syria was made a Roman province.

In the New Testament Damascus appears only in connection with Acts ix., xxii., xxvi., 2 Cor. xi. and Gal. i. In A.D. 106 under Trajan, Damascus became a Roman provincial city. On the establishment of Christianity Damascus became the seat of a bishop who ranked next to the patriarch of Antioch, and the great temple of Damascus was turned into a Christian church.

In 635 Damascus was captured for Islam by Khalid Ibn Welīd. After the murder of Ali, the fourth caliph, his successor Moawiya transferred the seat of the Caliphate (*q.v.*) from Mecca to Damascus and thus commenced the great dynasty of the Omayyads, whose rule extended from the Atlantic to India. Ninety years later it was supplanted by that of the Abbasids, who removed the seat of empire to Mesopotamia; and Damascus passed through a period of unrest in which it was captured and ravaged by Egyptians, Carmathians and Seljuks in turn. The crusaders attacked Damascus in 1126, but never succeeded in keeping a firm hold of it. It was the headquarters of Saladin in the wars with the Franks. The chief later events are the Mongolian capture in 1260, its Egyptian recapture by the Mameluke Kotuz; the ferocious raid of Timur (Tamerlane) in 1399; and the conquest by the Turkish sultan Selim, whereby it became a city of the Ottoman empire (1516). Of its more recent history, one may mention the massacre of July 1860, when the Muslim population rose against the Christians, burnt their quarter, and slaughtered about 3,000 adult males. (See SYRIA.)

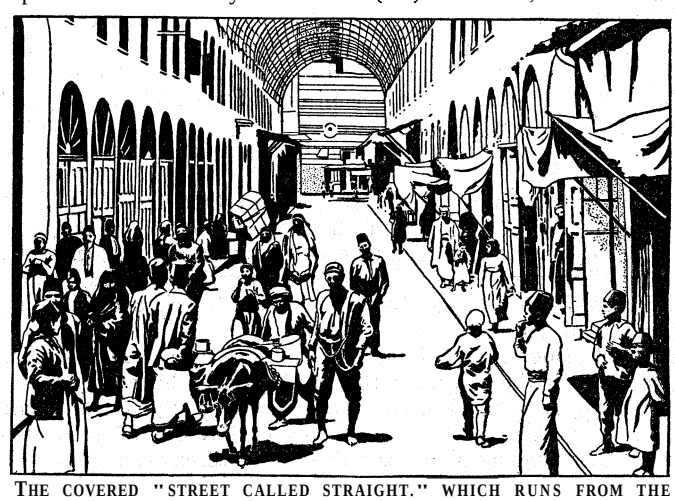
See also Kraeling, *Aram and Israel* (New York, 1918); *Wissenschaftliche Veröffentlichungen des Deutsch-Turkischen Denkmalschutz-Kommandas,* edit. Theodor Wiegand, Carl Watzinger and Karl Wulzinger, iv. *Damascus, die antike Stadt,* **(1921)**; *die islamische Stadt* (1924). (S. A. C.; X.)

Modern City.—Damascus is the chief town of the new state of Syria; 2,200 ft. above sea-level; pop. 188,000 (21,000 Christians, 16,000 Jews). It stands on both banks of the main channel of the Baradā about 2 m. from the point where it emerges from a gorge of the Antilibanas to branch off eventually fanwise and irrigate a wide area. Damascus stands on the north-west edge of this extensive tract of amazingly fertile ground (the *Ghūtah*), where, intermingled with fields of wheat, barley and maize, are orchards of apricot, fig, pomegranate, pistachio and almond, and groves of poplar and walnut, whilst vine boughs trail everywhere. Viewed from a point of vantage (as at the suburb Sālihīyah), the white minarets of the city bathed in sunlight rising above the mass of verdure leave an ineffaceable impression on the mind of the beholder. The ancient city, rudely rectangular in shape, was huddled within a wall on the southern bank of the Baradā. The modern city is spoon-shaped, the handle to the south whither the city has been drawn a long way on the Meccan road forming the quarter known as the *Meidān.* A suburb, *El-Amāra,* has been built on the northern bank, and farther off towards the north-west is another suburb, *Sālihīyah.* Damascus is supplied with water from the Baradā by an extensive system of canals and conduits. Its streets, for the most part narrow and protected overhead, are by no means clean, and the high walls which conceal private dwellings belie the magnificence to be found within. Its public buildings, mosques, schools and Khans reveal many fine examples of Arabian art. To a partial extent sheltered by hills to the north, west and south, the city lies open to the east and its trying and prevalent winds. It suffers a great variation in temperature in the course of the year. In winter frost and snow are not unknown, and summer temperatures are high but the nights are always cool. Fever, dysentery and ophthalmia due to the climatic conditions are prevalent.

In recent, as in earlier times, the development of the city has been affected by great outbreaks of fire. The Great Mosque was gutted in 1893, and in 1912 a conflagration destroyed a considerable tract of bazaars. Great damage was done by the French bombardments of Oct. 1925 and May 1926. It is said that Damascus has 240 mosques, mostly dilapidated, of which 70 are still in use. Catholic and Protestant missions support a large number of educational institutions and hospitals. The municipality has erected a public hospital and a hospital for lepers. There is a resident British consul.

Antiquities.—The ground plan of the city may be said to have remained unaltered since the Mohammedan occupation at least, and a conflagration such as reduced the city to ashes in 1401 merely cleared the site for fresh building. Material and facilities for archaeological study are consequently less than might have been expected. The hand of the Roman workman is visible in what is left of the city walls and gates, in the area of the Great Mosque, in the *Darb-el-Mustakīm,* which was probably colonnaded, and in an aqueduct in the western quarter. The Great Mosque (or Umayyad mosque) was originally the Church of St. John Baptist, whose building was begun by the emperor Theodosius (375) and completed by his son Arcadius (395–408). It occupied the site of an earlier temple, probably that of Rimmon (cf. 2 Ki. v. 18). The Caliph El-Watid deprived the Christians of their building (A.D. 705), and destroyed it in great part before re-erecting it as a mosque. It was burned down in 1069, pillaged by Tamerlane (1401) and badly damaged by fire (1893). In this mosque in 1905 some valuable Syriac and Kufic manuscripts were discovered. The citadel in the north-west of the city was built in 1219 by Mālik el-Ashraf, refortified by Beibars (1262) and by the Turks (16th century). The French have established an Institute of Mohammedan Archaeology and Art (its archaeological collection suffered heavily from fire and pillage in Oct. 1925), and a School of Arabic Decorative Art to revive the work in glass and wood and the colouring of stuffs. They aim at reproducing the best Arabic work of the best period. A new Syrian National Museum has also been instituted.

Commerce.—From its happy situation Damascus has ever had much to offer to the nomad and from the earliest times it has been the market of the desert. Ezekiel (xxvii. 18) mentions its "wine of Helbon" and its wool. In classical times it had a reputation for its Chalybonian wine (*i.e.,* of Helbon, mod. *Halbūn,*



THE COVERED "STREET CALLED STRAIGHT," WHICH RUNS FROM THE EASTERN TO THE WESTERN GATE OF DAMASCUS

13 m. N.N.W. of Damascus). Its dried fruits (*pruna et* cottana: Juvenal iii. 83) were a valued present, and its linens, cloths and cushions were famous. For centuries the "Damascene blade" carried far afield the reputation of the city's armourers. Diocletian promoted this industry but it perished when Tamerlane carried off the smiths in 1401. The silk looms are not so important now as of old, but modern industries such as leather work, the filigree work of gold and silversmiths (who are all Christians), inlaid work in wood and metal (brass, copper), have survived. Damascus was hard hit by the World War and in-

dustry has revived but slowly. Egypt since World War I has manufactured goods previously made in Syria and many artisans from Damascus have migrated thither. The textile industry suffers from foreign competition, and dyeing has declined in sympathy. Railway connection with the Hauran (1894), Beirut (1895) and Haifa (1905) has diminished its caravan trade. Damascus is tending more and more to become a centre for foreign imported goods as well as local produce, and with the development of motor transport an increase in transit trade may be expected. The shops of Damascus are famous for the wealth and variety of their goods and its streets for the mixture of races that throng them.

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THE TWENTIETH CENTURY

During World War I, Damascus served as the headquarters of the Turkish and German forces which tried under General Liman von Sanders to attack the Suez canal and later to stop the British counteroffensive into Palestine. The Egyptian expeditionary force under Lord Allenby and the Arab army, commanded by Emir Feisal (*q.v.*), ad anced into Syria and entered Damascus on October 1, 1918. Emir Feisal made his formal entry into the capital of Syria on Oct. 3, and was rapturously greeted by the Arab population. Backed by the arrdngements made during the war, he proceeded to establish the government for an independent Arab state which was to include the districts of Damascus, Homs, Hama, and Aleppo with Damascus as the capital.

Supported by the enthusiasm of the population, the formation of the new state was in good progress, when with the arrival of General Henri Gouraud as French High Commissioner in Beirut on Nov. 22, 1919, the French tried to gain control of Syria. A Syrian national congress had been elected and met at Damascus, offering, on March 11, 1920, the royal crown of Syria to Feisal and unanimously adopting on July 3 a democratic constitution for a united Syria, including the Lebanon, Palestine and Trans-Jordan.

But the progress was checked by General Gouraud's ultimatum on July 19 which demanded Syria's submission to French administration. An Arab army under Yussuf el Azmi, the minister of war, met the French at Khan Meizalun on July 24 and was defeated, Damascus was occupied by the French, Feisal forced to flee and the short-lived existence of the kingdom in Damascus came to an end.

French policy in the mandated territory of Syria inclined toward the partition of the country into different administrative areas, so as to weaken the national sentiment and to destroy the unity of the country. For some time Damascus was the capital of one relatively small administrative area, but all these partitions and divisions proved purely temporary and futile. In the summer of 1924 the then French High Commissioner, General Weygand, again created a larger administrative unit, called Syria, and made Damascus the capital.

The French High Commissioner, however, continued to reside in Beirut, the capital of the newly created state of the Great Lebanon, thus relegating Damascus to a secondary rank Yet the population of Damascus never ceased to express its national aspirations and its violent opposition to the policy pursued by the French administration.

On April 1, 1922, Charles Crane visited Damascus. The great mass demonstrations during his presence led to severe government repression. Similar demonstrations on a vast scale occurred in April 1925, when Lord Balfour visited Damascus. These demonstrations were intended as a protest against Zionism and

KHAN SULEIMAN PASHA, AN OLD ROOFLESS BUILDING NAMED AFTER THE GREAT SULTAN OF TURKEY WHICH WAS FORMERLY AN INN, BUT IS NOW A THRIVING BAZAAR

the separation of Palestine from Syria. A constitution granted on Dec. 5, 1924, provided for a Syrian state with an elected president, a ministry appointed by him, and an elected legislative council, but no real power was given to the newly created native authorities, the partition of the country was maintained and thus Syrian discontent continued, until it flared up in the violent and long-lasting nationalist revolution of 1925.

This revolution began in the mountains of the Druse state in July 1925. After the first successes, achieved under the leadership of Sultan Pasha el Atrashi, Damascus joined in the revolution. A provisional government was constituted, and for months the fertile and thickly populated oasis of Damascus formed a battleground. Nor did Damascus itself escape. From Oct. 18 to Oct. 20 violent encounters were fought in the streets of the ancient city, while the French army withdrew from the town and bombarded it from the neighbouring hills, reducing much of it to ruins and destroying partly the Palais Azm, the most beautiful building in the city. In spite of the strong measures taken by the French, the revolution continued and only subsided in 1927. Damascus was bombarded a second time by French artillery and aircraft on May 7, 1926, when the greater part of the Meidān quarter was destroyed and probably about 1,000 persons killed. Only in 1927 did Damascus and its environment regain a more or less normal character and communications become re-established with the outside world on a peacetime basis.

The French administration now tried a more conciliatory policy. In February, 1928, Taj-ed-Dine-el-Hassani was appointed prime minister and elections were held for a national constituent assembly, which was opened in Damascus on June 9. After long negotiations, full of conflict and suspense, a new Syrian constitution was promulgated on May 14, 1930. Yet the time of trouble for Damascus was in no way ended. A treaty between Syria and France, suggested by the French government, was rejected in

Nov. 1933 by the Syrians as completely unsatisfactory. A new vehement agitation, starting in January 1936, finally brought a more satisfactory treaty in 1936, but, though accepted by the Syrians it was never ratified by the French. Finally, World War II brought a change in the situation at Damascus.

The fall of France in June 1940, and the nomination of General Henri Dentz, a leading adherent of full French collaboration with Germany, brought the danger of a German use of Damascus as a center of axis propaganda and strategy in the middle east. Under these conditions allied forces, British, Australian, Free French and Indian, moved in June, 1941, into Syria and entered Damascus on June 21.

On September 16 the Free French authority proclaimed the independence of Syria with Damascus as its capital and Taj-ed-Dine became first president of the new republic. Damascus which in 1919 had for a short time been the capital of an independent Arab state, regarding itself as the nucleus of a unification of all the Arab lands, became so again the capital of an independent Arab state and the center for the hopes of achieving the longed-for Arab unity.

Throughout the 20th century Damascus aspired to this leading position in the Arab world to which its past, its size, its trade and the intensity of its national spirit entitle the ancient city.

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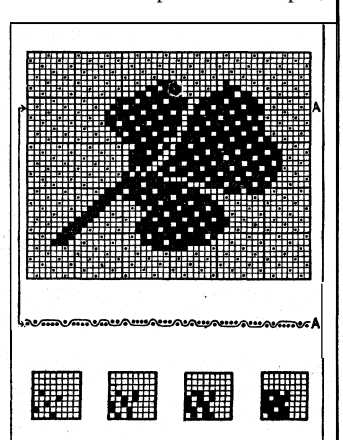
(H. Ko.)

DAMASK, the technical term applied to certain distinct types of fabric. The term owes its origin to the ornamental silk fabrics of Damascus, fabrics which were elaborately woven in colours, sometimes with the addition of gold and other metallic threads. At the present day it denotes a linen texture richly figured in the weaving with flowers, fruit, forms of animal life, and other types of ornament. "China, no doubt," says Dr. Rock (*Catalogue* of Textile Fabrics, Victoria and Albert Museum), "was the first country to ornament its silken webs with a pattern. India, Persia and Syria, then Byzantine Greece followed, but at long intervals between, in China's footsteps. Stuffs so figured brought with them to the West the name 'diaspron' or diaper, bestowed upon them at Constantinople. But about the 12th century the city of Damascus, even then long celebrated for its looms, so far outstripped all other places for beauty of design, that her silken textiles were in demand everywhere; and thus, as often happens, traders fastened the name of damascen or damask upon every silken fabric richly wrought and curiously designed, no matter whether it came or not from Damascus."



DETAILS OF A DAMASK DESIGN
The name "damask," originally given to the woven silks of Damascus, today signifies a linen texture elaborately designed in the weaving

The term is perhaps now best known in reference to damask table-cloths, a species of figured cloth usually of flax or tow yarns, but sometimes made partly of cotton. The finer qualities are made of the best linen yarn, and, although the latter is of a brownish colour during the weaving processes, the ultimate fabric is pure white. The high lights in these cloths are obtained by long floats of warp and weft, and, as these are set at right angles, they reflect the light differently according to the angle of the rays of light; the effect changes also with the position of the observer. Subdued effects are produced by shorter floats of yarn, and sometimes by special weaves. Any subject, however intricate, can be copied by this method of weaving, provided that expense is no object. The finest results are obtained when the so-called double damask weaves are used. These weaves are shown under DIE, and it will be seen that each weave gives a maximum float of seven threads. (In some special cases a weave is used which gives a float of nine.)

The small figure here shown to illustrate a small section of a damask design is composed of the two single damask weaves; these give a maximum float of four threads or picks. No shading is shown in the design, and this for two reasons—(1) the single damask weaves do not permit of elaborate. shading, although some very good effects are obtainable; (2) the available space is not sufficiently large to show the method to advantage. The different single damask weaves used in the shading of these cloths appear, however, at the bottom of the figure, while between these and the design proper there is an illustration of the thirty-first pick interweaving with all the 48 threads.

The principal British centres for fine damasks are Belfast and Dunfermline, while the medium qualities are made in several places in Ireland, in a few places in England, and in the counties of Fife, Forfar and Perth in Scotland. Cotton damasks, which are made in Paisley, Glasgow, and several places in Lancashire, are used for toilet covers, table-cloths, and similar purposes. They are often ornamented with cdlours and sent to the Indian and West Indian markets. Silk damasks for curtains and upholstery decorations are made in the silk-weaving centres.

DAMASK STEEL or **DAMASCUS STEEL,** a steel with a peculiar watered or streaked appearance, as seen in the blades of fine swords and other weapons of Oriental manufacture. One way of producing this appearance is to twist together strips of iron and steel of different quality and then weld them into a solid mass. A similar but inferior result may be obtained by etching with acid the surface of a metal, parts of which are protected by some greasy substance in such a way as to give the watered pattern desired. The art of producing damask steel has been generally practised in Oriental countries from a remote period, the most famous blades having come from Isfahan, Khorasan, and Shiraz in Persia.

DAMASUS, the name of two popes.

DAMASUS I., Saint, was pope from 366 to 384. As a deacon he protested against the banishment of Pope Liberius (355), but when the emperor Constantius sent to Rome the anti-pope Felix II., Damasus, with the other clergy, rallied to his cause. When Liberius returned from exile and Felix was expelled, Damasus again supported Liberius. On the death of Liberius (366) he was nominated successor; but the irreconcilables of the party of Liberius set up against him another deacon, Ursinus. A serious conflict ensued which quickly led to rioting. The prefect of Rome recognized the claims of Damasus, and Ursinus and his supporters were expelled. The new pope also secured the sympathy of the people by his zeal in discovering the tombs of martyrs, and in adorning them with precious marbles and monumental inscriptions. The inscriptions he composed himself, in mediocre verse, full of Virgilian reminiscences. In Rome he erected or embellished the church which still bears his name (S. Lorenzo in Damaso).

The West was recovering gradually from the effects of the Arian crisis, and Damasus endeavoured to eliminate from Italy and Illyria the last champions of the council of Rimini. The bishops of the East, however, under the direction of St. Basil, were involved in a struggle with the emperor Valens, whose policy was favourable to the council of Rimini. Damasus, to whom they appealed for help, was unable to be of much service because that episcopal group, viewed askance by St. Athanasius and his successor Peter, was incessantly combated at the papal court by the hatred of Alexandria. The Eastern bishops triumphed in the end under Theodosius, at the council of Constantinople (381), in which the Western church took no part. They were invited to a council at Rome in 382, but few attended.

This council had brought to Rome the learned monk Jerome, for whom Damasus showed great esteem. To him Damasus entrusted the revision of the Latin text of the Bible. A short time before the pope had received a visit from the Priscillianists after their condemnation in Spain and had dismissed them. Damasus died on Dec. 11, 384.

His writings are printed in Migne, *Patrol. Lat.* XIII. ***See*** **also**

Duchesne, *Liber Pontificalis* I. 212; J. Wittig, *Papst Damasus* I. (Rome, 1902) and *Die Friedenspolitik des Papstes Damasus I.* (Breslau, 1912).

DAMASUS II., pope from July 17 to Aug. 9, 1048, was the ephemeral successor of Clement II. His original name was Poppo, and he was bishop of Brixen when the emperor Henry III. raised him to the papacy.

DAME, properly a name of respect or a title equivalent to "lady," now surviving in English as the legal designation of the wife or widow of a baronet or knight, or of a dame of the Order of the British Empire; it is prefixed to the Christian name and surname. It has also been used in modern times by certain societies or orders, *e.g.,* the Primrose League, as the name of a certain rank among the lady members, answering to the male rank of knight. The ordinary use of the word by itself is for an old woman. As meaning "mistress," *i.e.,* teacher, "dame" was used of the female keepers of schools for young children, which have become obsolete since the advance of public elementary education. At Eton college boarding-houses kept by persons other than members of the teaching staff of the school were known as "Dames' Houses," though the head might not necessarily be a lady. As a term of address to ladies of all ranks, from the sovereign down, "Madam," shortened to "ma'am," represents the French *madame,* my lady.

"Damsel," a young girl or maiden, now only used as a literary word, is taken from the O.Fr. *dameisele,* formed from *dame,* and parallel with the popular *dansele* or *doncele* from the M. Lat. *domicella* or *dominicella,* diminutive of *domina.* The French *damoiselle* and *demoiselle* are later formations which developed merely to the title of a young unmarried lady, the *mademoiselle* of modern usage, the English "miss." At the court of France, after the 17th century, *Mademoiselle,* without the name of the lady, was a courtesy title given to the eldest daughter of the eldest brother of the king, known as *Monsieur.* Anne Marie Louise is known to history as *La Grande Mademoiselle.* The English literary form "damosel" was another importation from France in the 15th century. In the early middle ages *damoiseau,* M. Lat. *domicellus, dameicele, damoiselle, domicella,* were used as titles of honour for the unmarried sons and daughters of royal persons and lords *(seigneurs).* Later the *damoiseau* (in the south *donzel,* in Béarn *domengar)* was specifically a young man of gentle birth who aspired to knighthood, equivalent to écuyer, esquire or *valet* (*q.v.*).

DAME'S VIOLET, the name for *Hesperis matronalis,* a biennial herb belonging to the family Cruciferae, and closely allied to the wallflower and stock; called also dame's rocket. It has an erect, stout, leafy stem, 2 to 3 ft. high, with irregularly toothed, short-stalked leaves and white or lilac flowers, $\frac{3}{4}$ in. across, which give off a scent in the evening. The slender pods are constricted between the seeds. The plant is a native of Europe and temperate Asia, and is found in Great Britain and in the eastern United States and Canada as an escape from gardens.

DAMGHAN, town, Iran, in 36° 10′ N., 54° 20′ E., 216 mi. from Tehran, on the high road to Khurasan; elevation 3,737 feet. Pop. 16,500. Damghan was an important city in the middle ages, but there are few remains of that period. Near the city are the remains of Hecatompylos, extending from Frat, 16 mi. S. of Damghan, to near Gúsheh, 20 mi. W. Damghan was destroyed by the Afghans in 1723. Fath Ali Shah was born here in 1772. There is considerable trade in pistachios and almonds, the latter with very thin shells, for which Damghan is famous.

DAMIANI, PIETRO, SAINT (*c.* 1007–1072), celebrated ecclesiastic, was born at Ravenna, and after some years of teaching about 1035 entered the hermitage of Fonte Avellana, near Gubbio, where he became superior some eight years later. He entered into communication with the emperor Henry III., addressed to Pope Leo IX. in 1049 his *Liber Gomorrhianus* denouncing the vices of the clergy, and soon became associated with Hildebrand in the work of reform. As a trusted counsellor of successive popes he was made cardinal bishop of Ostia in 1057, and presided over a council at Milan in 1059. He assisted Alexander II. in his struggle with the anti-pope, Honorius II.; and having served the papacy as legate to France and to Florence, was allowed to resign his bishopric in 1067. After a period of retirement at Fonte Avellana, he proceeded in 1069 as papal legate to Germany, and persuaded the emperor Henry IV. to give up his intention of divorcing his wife Bertha. He died at Faenza on Feb. 22, 1072. Damiani was a determined foe of simony and clerical marriage, and a vigorous controversialist.

His works published by Cardinal Cajetan, 4 vols. (Rome, 1606–15) are reprinted in Migne, *Patrol Lat.* v. 144 and 145. *See* F. Neukirch, *Das Leben des Peter Damiani* (Gottingen, 1875); Kleinermanns, *Der heilige Petrus Damiani* (Steyl, 1882); R. Biron, St. *Pierre Damien* (1908); J. A. Endres, *Petrus Damiani und die weltliche Wissenschaft* (Miinster, 1910).

DAMIEN, FATHER, the name in religion of JOSEPH DE VEUSTER (1840–1889), Belgian missionary, born at Tremeloo, near Louvain, on Jan. 3, 1840. In 1858, he joined the Society of the Sacred Heart of Jesus and Mary (also known as the Picpus Congregation), and while still in minor orders, in 1863 went as a missionary to the Pacific islands, taking the place of his brother, who had been prevented by illness. On reaching Honolulu he was ordained priest in 1864. Struck with the sad condition of the lepers, whom the Hawaiian Government deported to Molokai island, in 1873 he volunteered to take spiritual charge of the settlement. Besides attending to the spiritual needs of the lepers, he managed, by the labour of his own hands and by appeals to the Hawaiian Government, to improve the water-supply, the dwellings, and the victualling of the settlement, and after five years received assistance from other resident priests. He succumbed to leprosy on April 15, 1889. Some ill-considered imputations upon Father Damien by a Presbyterian minister produced a memorable tract by Robert Louis Stevenson *(An Open Letter to the Rev. Dr. Hyde,* 1890).

See *Life and Letters of Fr. Damien,* ed. by his brother, Fr. Pamphile (London, 1889) and M. Quinlan, *Damien of Molokai* (London, 1909), which reproduces Stevenson's letter.

DAMIENS, ROBERT FRANÇOIS (1715–1757), a Frenchman who made an attempt on the life of Louis XV. on Jan. 5, 1757. As the king was entering his carriage, he rushed forward and stabbed him with a knife, inflicting only a slight wound. His mind seems to have been unhinged by the ecclesiastical controversies of the moment. He was condemned as a regicide, and sentenced to be torn in pieces by horses in the Place de Grève. Before being put to death he was barbarously tortured.

See *Pièces originales et procédures du procès fait à Robert François Damiens* (Paris, 1757).

DAMIETTA, a town of Lower Egypt, on the eastern (Damietta or Phatnitic) branch of the Nile, a few miles above its mouth and 125 mi. N.N.E. of Cairo by rail. Pop. (1937) 40,332. The town is built on the east bank of the river between it and Lake Menzala. Though ill-built and partly ruinous, the town possesses some fine mosques, with lofty minarets, public baths and busy bazaars. Along the river-front are many substantial houses with terraces and steps leading to the water. Their wooden lattices of saw-work are very graceful. Once the third town in Egypt, it enjoys now little more than a coasting trade, and ships of over 6ft. draught must anchor in the offing.

Damietta is a Levantine corruption of the Coptic name *Tamiati,* Arabic *Dumyat.* The original town was 4mi. nearer the sea than the modern city. Under the Saracens it had great wealth and commerce, and, as the eastern bulwark of Egypt, was frequently attacked by the crusaders. In June 1249, Louis IX. of France occupied Damietta without opposition, but being defeated near Mansura in the February following, and compelled (April 6) to surrender himself prisoner, Damietta was restored to the Muslims as part of the ransom exacted. To prevent further attacks from the sea the Mameluke sultan Bibars blocked up the Phatnitic mouth of the Nile (about 1260), razed old Damietta to the ground, and transferred the inhabitants to the site of the modern town. Damietta gives its name to dimity, a kind of striped cloth, for which the place was at one time famous. Cotton and silk goods are still manufactured here and there is some trade in rice and salted fish.

DAMĪRĪ, the common name of KAMĀL UD-DĪN MUHAMMAD IBN MŪSĀ UD-DAMĪRĪ (1344–1405), Arabian writer on canon law and natural history; he belonged to one of two towns called Damira near Damietta and spent his life in Egypt. Of the Shafi'ite school of law, he became professor of tradition in the *Rukniyya* at Cairo, and also at the mosque el-Azhar; in connection with this work he wrote a commentary on the *Minhāj ut-Tālibin* of Nawāwi. He is, however, better known in the history of literature for his Life of Animals (*Hayāt ul-Hayawān*), which treats in alphabetical order of 931 animals mentioned in the Koran, the traditions and the poetical and proverbial literature of the Arabs.

The use of the animals in medicine, their lawfulness or unlawfulness as food, their position in folk-lore are the main subjects treated, while occasionally long irrelevant sections on political history are introduced.

Several editions have been made at various times of extracts, among them the poetical one by Suyiiti (*q.v.*), which was translated into Latin by A. Ecchelensis (1667). Bochartus in his *Hierozoicon* (1663) used Damiri's work. There is a translation of the whole into English by Lieutenant-Colonel Jayakar (Bombay, 1906–1908).

DAMJANICH, JÁNOS (1804–1849), Hungarian soldier, was born at Stása in the Banat. On the outbreak of the Hungarian war of independence he was promoted to be a major of the third Honvéd regiment at Szeged, for although he was an orthodox Serb, he was from the first a devoted adherent of the Magyar Liberals. At the beginning of 1849 he was appointed commander of the 3rd army corps in the middle Theiss on account of his reputation for ability and valour. He fought battle after battle, so that after the battle of Isaszeg, Kossuth, at the ensuing review at Gödöllö, expressed the sentiments of the whole nation when he doffed his hat as Damianich's battalions passed bv. Alwavs a fiery democrat, Damjanich uncompromisingly supported the extremist views of Kossuth. and was appointed commander of one of the three divisions which, under Görgei, entered Vácz in April 1849. After the catastrophe of Vilagós, Damjanich surrendered to the Russians, by whom he was handed over to the Austrians, who shot him in the market place of Arad a few days later.

See Ödön Hamvay, *Life* of Jdnos Damjanich (Budapest, 1904).

DAMMAR or **DAMMER,** a resin, or rather series of resins, obtained from various coniferous trees of the genus *Agathis* (*Dammara*). East Indian dammar or cat's eye resin is the produce of Agathis *Dammara,* which grows in Java, Sumatra, Borneo and other eastern islands and sometimes attains a height of 80–100ft. The resin oozes in large quantities from the tree in a soft viscous state, with a highly aromatic odour, which, however, it loses as it hardens by exposure. The resin is much esteemed in oriental communities for incense-burning. Dammar is imported into England by way of Singapore; and as found in British markets it is a hard, transparent, brittle, straw-coloured resin, destitute of odour. It is readily soluble in ether, benzol and chloroform, and with oil of turpentine it forms a fine transparent varnish which dries clear, smooth and hard. The allied kauri gum, or dammar of New Zealand (Australian dammar), is produced by Agathis australis, or kauri-pine, the wood of which is used for wood paving. Much of the New Zealand resin is found fossil in circumstances analogous to the conditions under which the fossil copal of Zanzibar is obtained. Dammar is besides a generic Indian name for various other resins, which, however, are little known in western commerce. Of these the principal are black dammar, yielded by *Canarium strictum* (family Burseraceae) and white dammar, Indian copal, or piney varnish, the produce of Vateria *indica* (family Dipterocarpaceae). Sal dammar is obtained from *Shorea* robusta; *Symplocos* micrantha is the source of rock dammar and other species yield resins which are similarly named and differ little in physical properties.

DAMMARTIN, a small town of France, in the department of Seine et Marne, 22 mi. N.E. of Paris. Pop. (1936) 1,479. Situated on the plateau of la Goele, it is known as Dammartin-en-Goële to distinguish it from Dammartin-sous-Tigeaux, a small commune in the same department. Hugh, the earliest recorded count of Dammartin, made himself master of the town in tne 10th century. His dynasty was replaced by another family in the 11th century. Reynald I. (Renaud), count of Dammartin (d. 1227), who was one of the coalition crushed by Philip Augustus at the battle of Bouvines (1214), left two co-heiresses, of whom the elder, Maud (Matilda or Mahaut), married Philip Hurepel, son of Philip Augustus, and the second, Alix, married Jean de Trie, in whose line the countship was reunited after the death of Philip Hurepel's son Alberic. In the 15th century the countship was acquired by Antoine de Chabannes (d. 1488) by his marriage with Marguerite, heiress of Reynald V. of Nanteuil-Aci and Marie of Dammartin. Antoine de Chabannes fought under the standard of Joan of Arc, became a leader of the *Écorcheurs,* took part in the war of the public weal against Louis XI., and then fought for him against the Burgundians. The collegiate church at Dammartin was founded by him in 1480, and his tomb and effigy are in the chancel. His son, Jean de Chabannes, left three heiresses, of whom the second left a daughter who brought the countship to Philippe de Boulainvilliers, by whose heirs it was sold in 1554 to the dukes of Montmorency. In 1632 the countship was confiscated by Louis XIII and bestowed on the princes of Condé. It was the extreme point of the German drive on Paris in 1914.

DAMME, a decayed city of Belgium (pop. 1,100), 4½ m. N.E. of Bruges, once so important as a commercial port that it had its own maritime law, known as Zeerecht *van Damme.* It is on the canal from Bruges to Sluys (Ecluse), but in the middle ages a navigable channel called the Zwyn connected it with the North sea; the battle of Sluys, in which Edward III. destroyed the French fleet, was fought in 1340 at its mouth. In 1490 a treaty was signed at Damme between the people of Bruges and the archduke Maximilian, and very soon after the channel became completely silted up, and the foreign merchant gilds or "nations" removed to Antwerp. The marriage of Charles the Bold and Margaret of York, sister of Edward IV., was celebrated at Damme on July 2, 1468. The town, although long neglected, preserves some remains of its former prosperity. The tower of Our Lady, dating from 1180, is a landmark across the dunes, and the church, although a shell, merits inspection; out of a portion of the ancient markets a town hall has been constructed; and in the hospital of St. Jan are a few pictures; and in the Place is a statue (1860) to Jacob Van Maerlant, the Flemish poet, who was clerk to the magistrates of Damme in the late 13th century.

DAMOCLES, one of the courtiers of the elder Dionysius of Syracuse. When he spoke in extravagant terms of the happiness of his sovereign, Dionysius is said to have invited him to a sumptuous banquet, at which he found himself seated under a naked sword suspended by a single hair (Cicero *Tusc.* v. 21; Horace Odes, iii. 1, 17; Persius iii. 40).

DAMOH, a town and district of British India, in the Jubbulpore division of the Central Provinces. The town of Damoh is situated on the railway from Katni to Bina, a branch of the G.I.P. railway, 48 m. E. of Saugor. It has small local industries and a large cattle market, and is a distributing and collecting centre for the district. Being situated below rocky hills it is decidedly hot. In pre-railway days its population was about 8,000, which had increased to 17,000 in 1911. In 1921, owing to an epidemic, population fell to 15,296 but was 20,728 in 1931. Damoh was looted by mutineers from Jubbulpore in 1857 and the district office was burnt.

The DISTRICT OF DAMOH is one of the smallest in the Central Provinces, having an area of 2,818 sq.m. and a population of 305,568. It is one of the Vindhyan districts and on the north and north-east borders Bundelkhand. It is drained by the Sonar and Bearma rivers which flow northwards into the Ken, and thus eventually reach the Jumna. The district is mainly wheat producing, but its agriculture is liable to severe vicissitudes of drought and excessive rain, and its population and prosperity have fluctuated greatly. The central plain is rich and fertile but the areas to both the north and south are hilly and jungly. Its people, among whom Lodhis predominate, are turbulent in character. Agricultural losses have been responsible for a condition of indebtedness, for which special measures have at various times

been taken. Dyeing, weaving, pottery and the manufacture of bell-metal utensils are the chief industries. Cattle slaughtering for the export of dried meat, bones, hides, horns and hoofs has been established near Damoh, the old and infirm cattle from long distances being brought in for slaughtering. Except for a little iron ore and sandstone for building, there is no mineral wealth in the district. There are notable temples at Bandakpur and Kundalpur and there are old Hindu and Jain remains at Nohta.

DAMON AND PHINTIAS (not Pythias), Syracusan Pythagoreans, devoted friends. Condemned to death by Dionysius of Syracuse, Phintias begged a short respite that he might arrange his affairs. Damon pledged his life for the return of his friend; and Phintias returned in time. The tyrant released both and begged to be admitted to their friendship (Diod. Sic. x. 4; Cicero, De *Off.* iii. 4j; cp. Hyginus, fab. 257).

DAMOPHON, a Greek sculptor of Messene, who executed many statues for the people of Messene, Megalopolis, Aegium, and other cities of Peloponnesus. Considerable fragments, including three colossal heads from a group by him representing Demeter, Persephone, Artemis, and the giant Anytus, have been found on the site of Lycosura in Arcadia, where there was a temple of the goddess called "The Mistress." They are preserved in part in the museum at Athens and partly on the spot. Hence there arose controversy as to the date of the artist, who was assigned to various periods, from the 4th century B.C. to the 2nd A.D. G. Dickins, however, by the help of inscriptions proved the date to be the 2nd century B.C.

See G. Dickins, *Annual of the British School at Athens* (xii. and xiii.).

DAMP, vapour or mist, and hence moisture. In the vocabulary of coal-miners "firedamp" is marsh gas, which, when mixed with air and exploded, produces "choke damp," "after damp" or "suffocating damp" (carbon dioxide). "Black damp" consists of accumulations of irrespirable gases, mostly nitrogen, which cause the lights to burn dimly, and the term "white damp" is sometimes applied to carbon monoxide. As a verb, the word means to stifle or check, hence damped vibrations or oscillations are those which have been reduced or stopped, instead of being allowed to die out naturally; the "dampers" of the piano are small pieces of felt-covered wood which fall upon the strings and stop their vibrations as the keys rise; and the "damper" of a chimney or flue, by restricting the draught, lessens the rate of combustion.

DAMPIER, WILLIAM (1652–1715), English buccaneer, navigator and hydrographer, was born at East Coker, Somersetshire, in 1652. Raving early become an orphan, he was placed with the master of a ship at Weymouth, in which he made a voyage to Newfoundland. On his return he sailed to Bantam in the East Indies. He served in 1673 in the Dutch War under Sir Edward Sprague, and was present at two engagements (May 28, June 4); but then fell sick and was put ashore. In 1674 he became an under-manager of a Jamaica estate, but continued only a short time in this situation. He afterwards engaged in the coasting trade, and thus acquired an accurate knowledge of all the ports and bays of the island. He made two voyages to the Bay of Campeachy (1675–76), and remained for some time with the logwood-cutters, varying this occupation with buccaneering. In 1678 he returned to England, again visiting Jamaica in 1679 and joining a party of buccaneers, with whom he crossed the Isthmus of Darien, spent the year 1680 on the Peruvian coast, and sacking, plundering and burning, made his way down to Juan Fernandez island. After serving with another privateering expedition in the Spanish Main, he went to Virginia and engaged with a captain named Cook for a privateering voyage against the Spaniards in the South Seas. They sailed in Aug. 1683, touched at the Guinea coast, and then proceeded round Cape Horn into the Pacific. Having touched at Juan Fernandez, they made the coast of South America, cruising along Chile and Peru. They took some prizes, and with these they proceeded to the Galapagos islands and to Mexico, falling in with the latter near Cape Blanco. While they lay here Captain Cook died, and the command devolved on Captain Davis, who, with several other pirate vessels, English and French, raided the west American shores for the next year, attacking Guayaquil, Puebla Nova, etc. At last Dampier, leaving Davis, went on board Swan's ship, and proceeded with him along the northern parts of Mexico as far as southern California. Swan then proposed, as the expedition met with "bad success" on the Mexican coast, to run across the Pacific and return by the East Indies. They started from Cape Corrientes on March 31, 1686, and reached Guam in the Ladrones on May 20; the men, having come almost to an end of their rations, had decided to kill and eat their leaders next, beginning with the "lusty and fleshy" Swan. After six months' drunkenness and debauchery in the Philippines, the majority of the crew, including Dampier, left Swan and thirty-six others behind in Mindanao, cruised (1687–1688) from Manila to Pulo Condore, from the latter to China and from China to the Spice Islands and New Holland (the Australian mainland). In March 1688 they were off Sumatra, and in May off the Nicobars, where Dampier was marooned (at his own request, as he declares, for the purpose of establishing a trade in ambergris) with two other Englishmen, a Portuguese and some Malays. He and his companions contrived to navigate a canoe to Achin in Sumatra; but the fatigues and distress of the voyage proved fatal to several and nearly carried off Dampier himself. After making several voyages to different places of the East Indies (Tongking, Madras, etc.), he acted for some time, and apparently somewhat unwillingly, as gunner to the English fort of Benkulen. Thence he ultimately contrived to return to England in 1691.

In 1699 he was sent out by the English Admiralty in command of the "Roebuck," especially designed for discovery in and around Australia. He sailed from the Downs on Jan. 14, with twenty months' provisions, touched at the Canaries, Cape Verdes and Bahia, and ran from Brazil round the Cape of Good Hope direct to Australia, whose west coast he reached on July 26, in about 26° S. Anchoring in Shark's Bay, he began a careful exploration of the neighbouring shore-lands, but found no good harbour or estuary, no fresh water or provisions. In September, accordingly, he left Australia, recruited and refitted at Timor, and thence made for New Guinea, where he arrived on Dec. 3. By sailing along to its easternmost extremity, he discovered that it was terminated by an island, which he named New Britain (now Neu Pommern), whose north, south and east coasts he surveyed. That St. George's bay was really St. George's channel, dividing the island into two, was not perceived by Dampier; it was the discovery of his successor, Philip Carteret. Nor did Dampier visit the west coast of New Britain or realize its small extent on that side. He was prevented from prosecuting his discoveries by the discontent of his men and the state of his ship. In May 1700 he was again at Timor, and thence he proceeded homeward by Batavia (July 4–Oct. 17) and the Cape of Good Hope. In February 1701 he arrived off Ascension island, when the vessel foundered (Feb. 21–24), the crew reaching land and staying in the island till April 3, when they were conveyed to England by some East Indiamen and warships bound for home. In 1703–1707 Dampier commanded two Government privateers on an expedition to the South Seas with grievous unsuccess; better fortune attended him on his last voyage, as pilot to Woodes Rogers in the circumnavigation of 1708–1711. On the former venture Alexander Selkirk, the master of one of the vessels, was marooned at Juan Fernandez; on the latter Selkirk was rescued and a profit of nearly £200,000 was made. But four years before the prize-money was paid Dampier died (March 1715) in St. Stephen's parish, Coleman street, London. Dampier's accounts of his voyages are famous. He had a genius for observation, especially of the scientific phenomena affecting a seaman's life; his style is usually admirable—easy, clear and manly. His knowledge of natural history, though not scientific, appears surprisingly accurate and trustworthy. (C. R. B.)

See Dampier's *New Voyage Round the World* (1697); his *Voyages and Descriptions* (1699), a work supplementary to the *New Voyage;* his *Voyage to New Holland in . . . 1699* (1703, 1709); *Dumpier's Voyages* (ed. J. Masefield, 1906); W. C. Russell, *William Dumpier* ("English Men of Action," 1889); also Funnell's Narrative of the Voyage of 1703–1707; Dampier's *Vindication of his Voyage* (1707); Welhe's *Answer to Captain Dumpier's Vindication;* Woodes Rogers, *Cruising Voyage Round the World* (1712).

DAMROSCH, LEOPOLD (1832–1885), German-American musician and conductor, born in Posen, Prussia, Oct. 22, 1832. In early life a physician, he became konzertmeister at Weimar, then conductor of the Philharmonic Society at Breslau; he went to America as conductor at the Metropolitan Opera House and founded the Oratorio Society, New York, 1874, the New York Symphony Society, 1878, etc.

His son, WALTER JOHANNES DAMROSCH (1862–), American musician and conductor, was born at Breslau, Germany, Jan. 30, 1862. He went to America in 1871, and ten years later began his career as conductor in Newark, New Jersey. On the death of his father in 1885, he was appointed conductor of the Metropolitan Opera House, the New York Symphony Society and the Oratorio Society. In 1894 he founded the Damrosch Opera Company for producing Wagner and in 1896 produced Wagner's Parsifal in concert form for the first time in the United States. In 1903 he was appointed director of the New York Symphony Orchestra, remaining conductor up to Feb. 1927. He was then appointed musical adviser to the National Broadcasting Company, informal lectures on Wagner with music having developed into lecture recitals over the radio. His compositions include The Scarlet Letter (1894); Cyrano (1913); and music for Euripides' Media, *Iphigenia in Aulis* (Berkeley, 1911) and Sophocles' Electra (1917). He wrote an autobiography, *My Musical Life* (1923).

Another son, FRANK HEINO DAMROSCH (1859–1937), was born at Breslau. He became in 1905 director of the Institute of Musical Art, New York city, and wrote a Popular Method of *Sight Singing* and *Some Essentials in* the Teaching of *Music*.

DAMS. From immemorial times dams have been constructed of earth and masonry for the purpose of forming reservoirs for the storage of water to ensure regular supplies to communities for domestic purposes and for irrigation. There are records of a huge earthen dam on the Tigris and a large masonry darn on the river Nile, built almost in prehistoric times, which remained in service for incredibly long periods, and the Romans built numerous massive masonry dams in Italy and northern Africa. All the early masonry dams were characterized by excessive width of base usually three to four times the height.

The production of hydro-electric energy and the application of irrigation on a large scale are two forms of development which have expanded very rapidly in the 20th century in countries having the requisite conditions and resources and in many cases have involved enormously greater storage of water than that required for even the largest towns. The progress in scientific design and in magnitude of dam structures has been correspondingly extensive, and new types of structure have been introduced to meet the call for greater economy in a class of work which is seldom cheap.

Types of Dams.—The principal types are (a) earth dams, (b) solid masonry or concrete gravity dams, (c) rock-fill dams, (d) single horizontal arch, (e) multiple buttress dams, (f) timber dams, (g) steel dams.

While types (a), (b), and (f) have been used from antiquity, the others are products of the 19th and 20th centuries.

Earth Dams.—Earth dams are largely used on account of their permanence and cheapness and convenience of construction where suitable material is available in the vicinity. Security depends on the construction being adequately watertight to prevent scouring away of any of the earth by water passing through the dam, and on the installation of a spillway and spillway channel formed in masonry concrete or rock sufficient to pass the maximum flood without allowing any water to pass over the top of the earth bank. Water passing over the top would form ruts on the outer slope which would rapidly develop into a breach. Passage of water through the dam is usually prevented by the provision of a watertight core in the centre of the embankment extending from end to end of the dam and carried down in a trench below the ground surface until an impermeable stratum is reached. Although the best arrangement of materials consists of a core of fine impermeable silt or clay flanked on each side by coarse free draining sand or gravel, dams have been built entirely of fine material when coarse material was unavailable. When built of coarse materials, a central corewall of concrete or steel or an impervious apron on the up-stream face of the dam is required. Corewalls are not now in general use on large dams.

The slopes of the embankment vary according to the height of the dam and the nature of the material. Generally the slope next the water is made rather flat, frequently from 1:23 to 1:3½ while the outer slope is somewhat steeper, 1:2 to 1:3. In high dams the slopes in the lower part are flattened out still more as compared with the upper part and in all cases the water slope must be protected by stone or concrete paving or beaching sufficiently massive to withstand wave action and prevent the earth of the embankment from being disturbed.

FIG. 1.—CROSS-SECTION OF THE DAVIS BRIDGE DAM, VERMONT

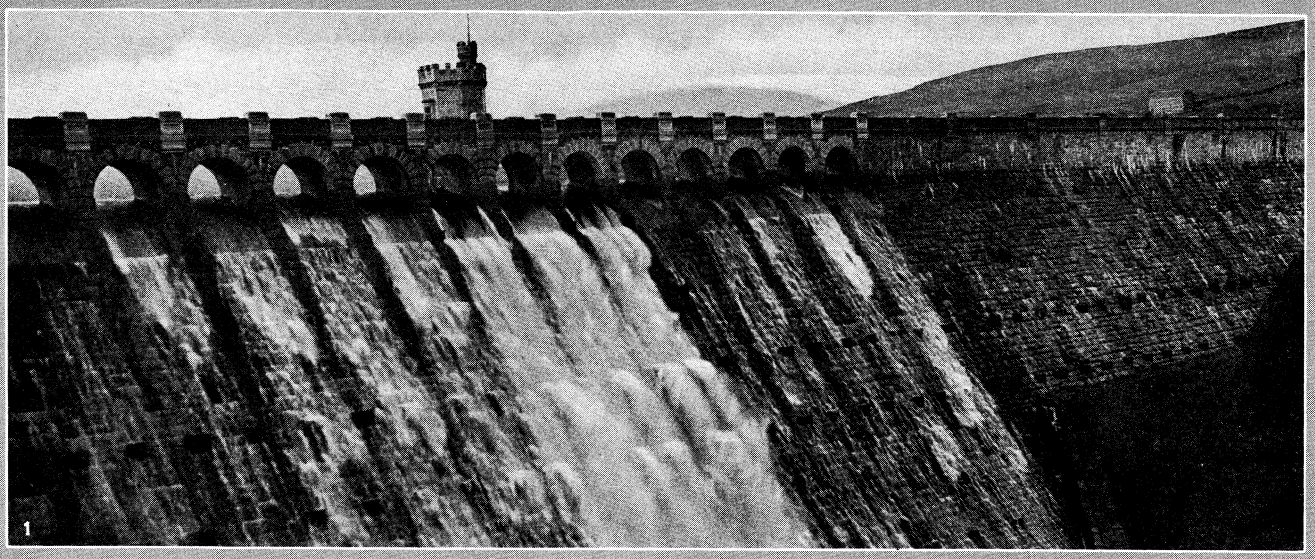
Earth dams are constracted either by the rolled fill or the hydraulic fill methods For the former. the material is placed in the dam in layers, each layer being well compacted by special rollers. For the latter, ihe material is hauled or sluiced to the dam and washed into place, the fines depositing in the centre.

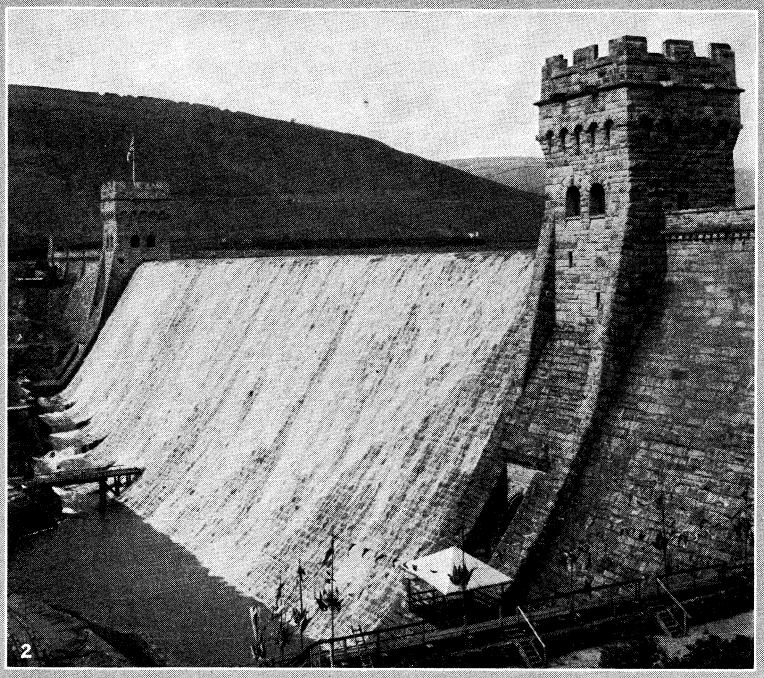
Fig. 1 shows a cross-section of the Davis Bridge hydraulic fill dam in Vermont, 200ft. high, with an earthworks volume of 1,900,000 cu yd., which was constructed in less than two years by this method

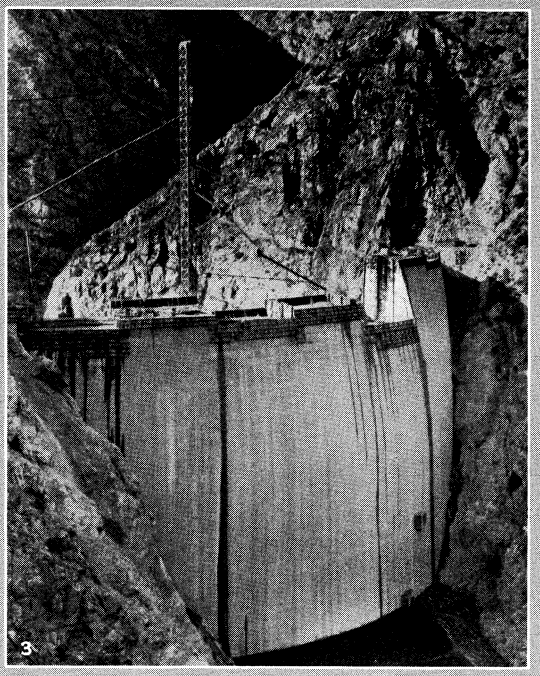
Rock-fill Dams.—A rock-fill dam depends for its stability on an embankment of tipped rock material and for its watertightness on a skin of reinforced concrete laid on a derrick-placed or hand-built water face and carried down in the form of a vertical cut-off wall to an impervious stratum. Lack of suitable earth material and excessive cost of concrete lead to consideration of the rock-fill type of dam. The embankment is usually formed with rock of all sizes as blasted from the quarry, the outer face being roughly built to a plain surface with large blocks and the inner face more carefully and solidly built to a uniform surface and formed with grooves or keyways to furnish a grip for the concrete. Care in constructing the hand-built face reduces somewhat the effect of the considerable settlement which is typical of rock-fill dams following construction The skin concrete must be well built to withstand this settlement as well as any possible wave action. The water face is steep (sometimes 1:1 or steeper) to minimize the quantity of materials, the outer face being generally somewhat flatter, about 1·25:1 or slightly flatter.

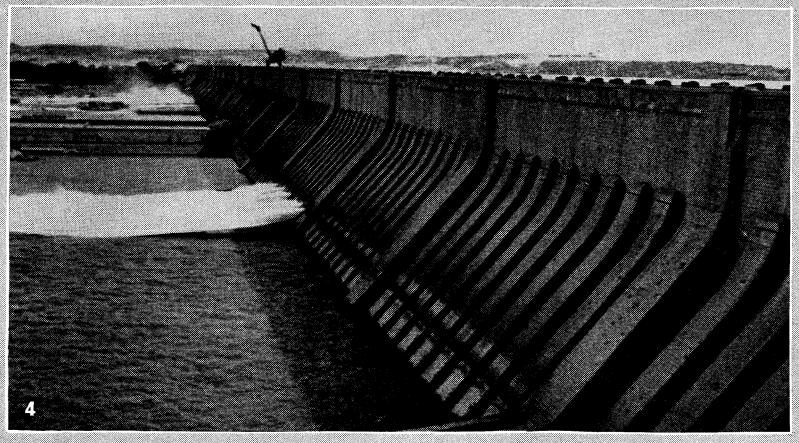
The largest dam of this type yet constructed is the Salt Springs darn in California, built 1929–31. This has a height of 328ft. and a volume of rock-fill of 3,000,000 cubic yards. The upstream slope averages 1·3:1 and is slightly concave to avoid any tendency toward buckling. Downstream, the slope averages 1·4:1. A thick layer on the upstream face was of derrick-placed large stones, while the rest of the material was side-tipped from trains. The watertight skin of reinforced concrete varies in thickness from 1ft at the top to 3ft. at the bottom.

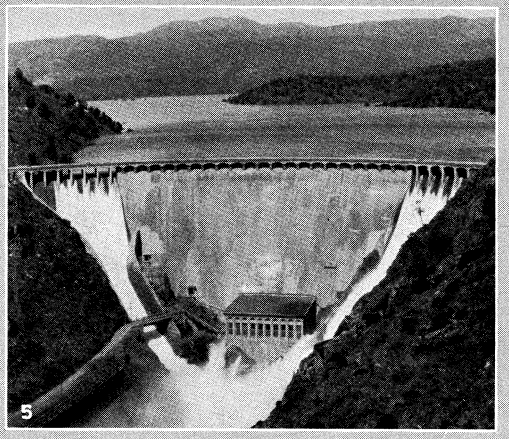
Gravity Dams.—Though dams of massive masonry have been used for thousands of years it was not till the 19th century that a proper scientific basis for design was developed by Prof. Rankine and others so that the width could be reduced from three to four times the height to something less than the height. The tendency in gravity dams is to use the simple triangular form for even the highest dam and to use concrete to the exclusion of masonry. The triangular form gives a uniform stability condition at any horizontal section, and the maximum stresses in the material are directly proportional to the depth below H.W.L. Assuming a usual inclination of the waterface, say 1:20, and concrete of normal density, the necessary inclination of the outer face will depend on the amount of upward water pressure on the base. If by means of effective drainage arrangements upward pressure is











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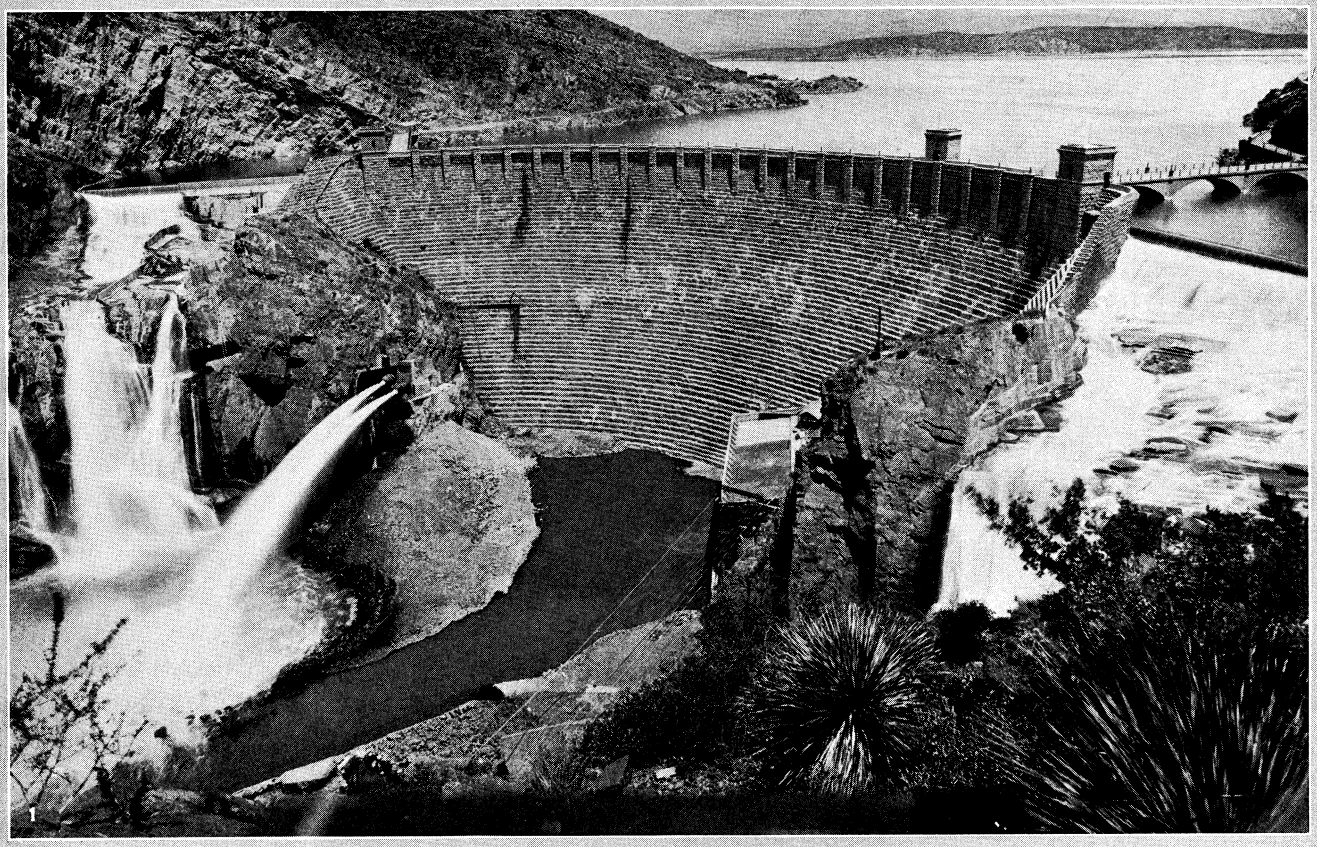
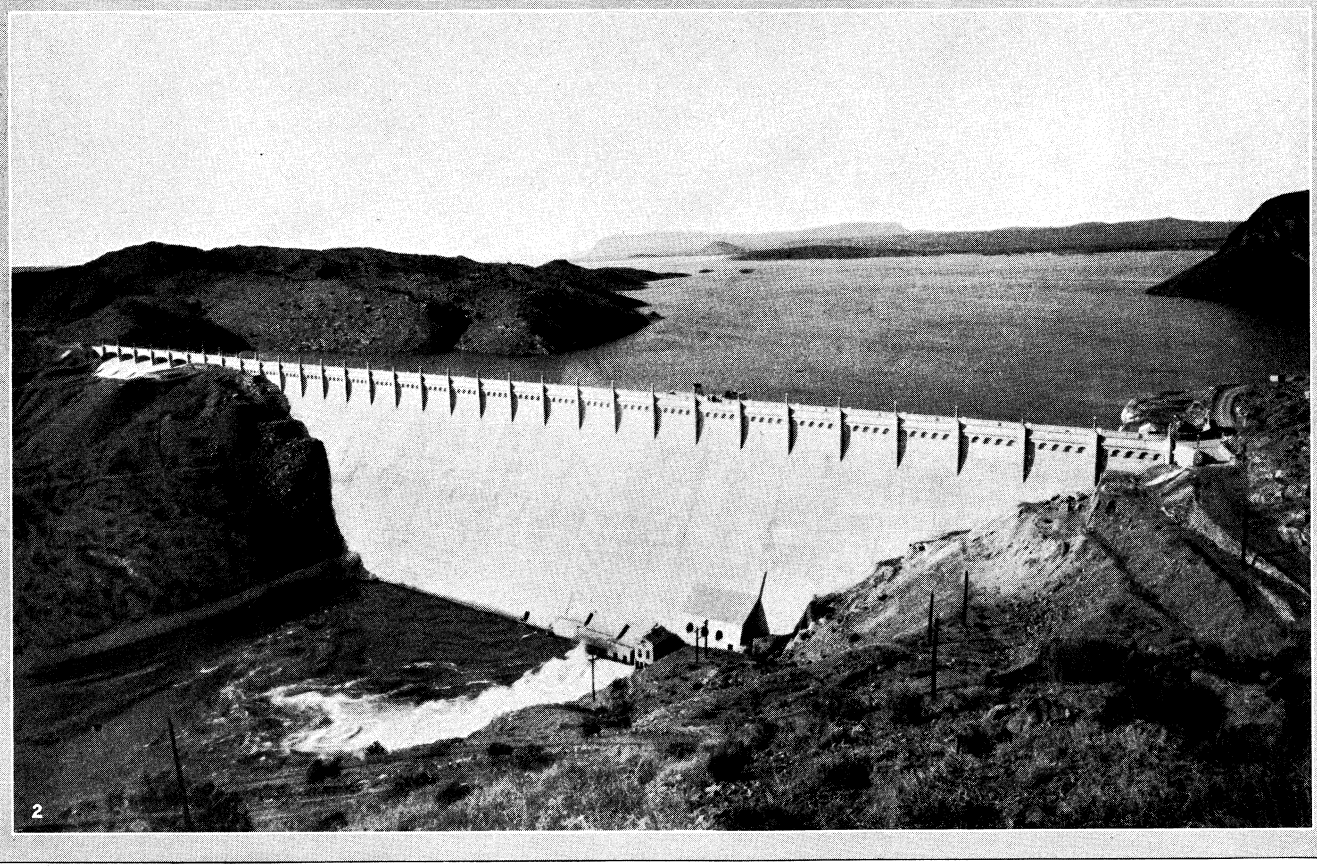
GRAVITY AND HORIZONTAL ARCH DAMS

1. Face of Angram dam, Yorkshire, England; masonry spillways
2. Stone spillway of Howden dam, Derwent valley, England
3. Upstream view of horizontal arch dam during construction
4. Downstream face of Aswan dam, Egypt
5. Gravity dam, California, spillways at sides

DAMS





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WATER SUPPLY DAMS FOR IRRIGATION PROJECTS

1. Roosevelt dam, Salt River irrigation project, Arizona. Curved gravity type of storage dam showing spillways at either side and discharge pipes at base of dam. Built in a narrow gorge, each end of dam is supported by natural rock abutments. Masonry is curved to natural radius ot a circle

2. Elephant Butte dam, Rio Grande irrigation project, New Mexico. Concrete gravity type of storage dam, built in triangular form with outlet at base. Construction is thickest at base, where water pressure is heaviest, tapering to width of roadway at the top of dam. Dimensions are determined by amount of water and rate of discharge

eliminated, an outer slope of about 0·65:1 will suffice. If the conditions require an allowance of upward water pressure on the base varying from the full head at the inner face to zero at the outer face, the outer slope will require to be about 0·80:1. If, in addition, it is necessary to allow for heavy ice pressure at the top of the wall, still greater slope, up to 0·85:1, will be required. These dimensions ensure that the resultant will pass within the

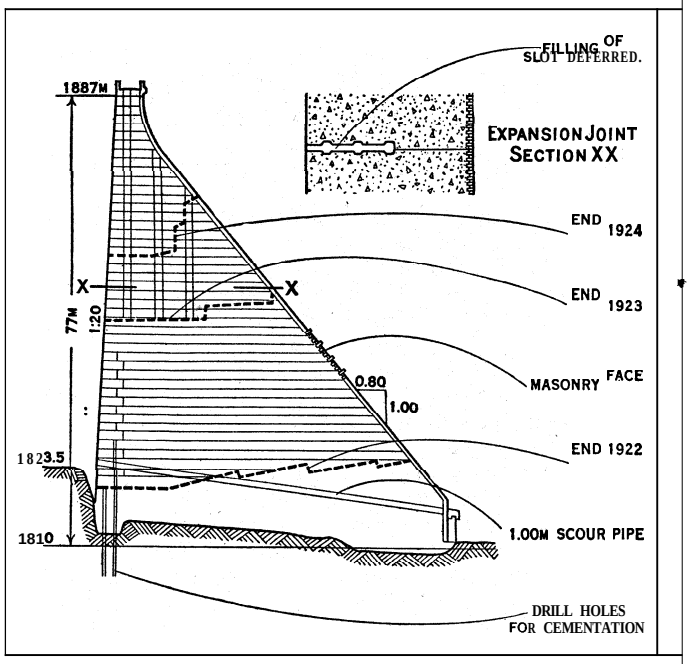


FIG. 2.— CROSS-SECTION OF BARBERINE DAM. SWITZERLAND

middle third, so that there will be no tension on the concrete. A dam having a height in excess of about 300ft. requires a flatter face in the lower part in order to spread the footing and keep the intensity of pressures within permissible limits. For some foundation conditions further precaution must be taken to avoid the possibility of the dam sliding on the foundation. For this purpose keys are constructed on the base of the dam, the depth of the key depending on the condition of the rock in the foundation.

To reduce tendency of the concrete to crack due to temperature changes and shrinkage, modem practice requires as lean a mix of concrete as is practical. However, some specifications require

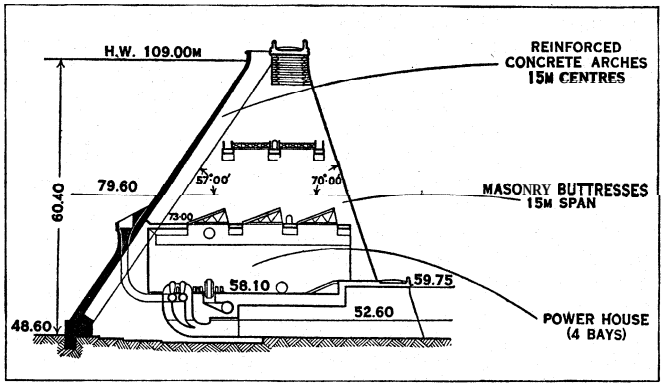


FIG. 3.— CROSS-SECTION OF THE TIRSO DAM. SARDINIA

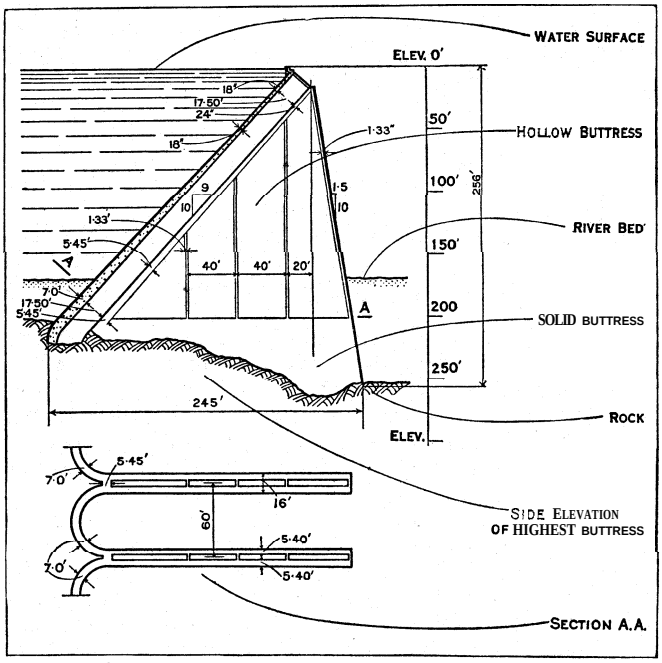
a rich concrete mixture on the outer faces to ensure durability against weathering. The proportion of cement to mixed aggregate may vary from 4 cwt. or less per cu.yd. for the body of the dam to about 5 cwt. on the faces.

The Barberine dam in Switzerland, completed 1925, and shown in cross section in fig. 2 illustrates the application of the triangular form, together with excellent arrangements for sealing the base by cement grouting in drill holes, and for providing for expansion and shrinkage in the upper part. The dam is of concrete with mixtures varying from 250 to 300 kg. of cement per cu.m., is without drainage arrangements and is designed for water uplift on the base varying from full-head at the inside to zero at the outside. The slope of the waterface is 1:20 and of the outer face 0·80:1. The section indicates an infrequent masonry facing of gneiss applied on the outer slope, which has a southern exposure and is subject to severe temperature variations.

The highest dam of this type yet projected is the Shasta dam of the Central Valley reclamation project which is to have a maximum height of 560ft., a downstream slope of 0·80:1 and will contain over 5,500,000 cu.yd. of concrete. The reservoir with a capacity of 4,500,000 ac.ft. will be one of the largest.

Horizontal Arch Dams.—The horizontal arch dam is suitable only for narrow gorges with sound rock at the sides to resist the great thrust from the abutments. Each horizontal section of the dam tends to act as an arch spanning the gorge. The fact that the dam is in contact with the bottom of the gorge-alters this tendency and part of the water load is resisted by a vertical cantilever action. This combined action produces stresses which are exceedingly complicated, and requires for accurate determination of stress the use of the trial load method of analysis which necessitates more calculations than any other type of dam. Considerable information was obtained in 1926 by construction of an experimental arch dam on Stevenson creek, California. A plan, profile, and cross-section of the dam is shown in fig. 5. The thickness of this experimental dam is much less than used for practical cases because of the very low safety factor used in its design.

The first arch dams were constructed generally with a constant radius throughout, with a resulting variation in the central angle. Increased economy in concrete can be obtained by Jorgensen's



BY COURTESY OF F. A. NOETZLI

FIG. 4.— PLAN OF LAKE PLEASANT (ARIZ.) MULTIPLE-ARCH DAM. SHOWING: ABOVE. SIDE ELEVATION OF HIGHEST BUTTRESS AND. BELOW. A SECTION THROUGH THE ARCHES AND HOLLOW BUTTRESSES

constant angle system of construction whereby the radius of the arch increases from the bottom of the dam to the top in accordance with the varying width of the gorge. The largest dam of this type, constructed in 1934, is the Sautet dam on the Drac river, a tributary of the Rhone river, with a maximum height of 414ft., thickness varying irregularly from 8ft. at the top to 56ft. at the bottom and radius of the water face varying from 230ft. at the top to about 85ft. at the bottom.

Multiple Buttress Dams.—In multiple buttress dams the water load may be supported and transferred to the buttresses either by reinforced flat slabs or by arches. With flat-slab construction a spillway section can readily be formed by providing flat slabs also on the outer face, formed to a suitable spillway

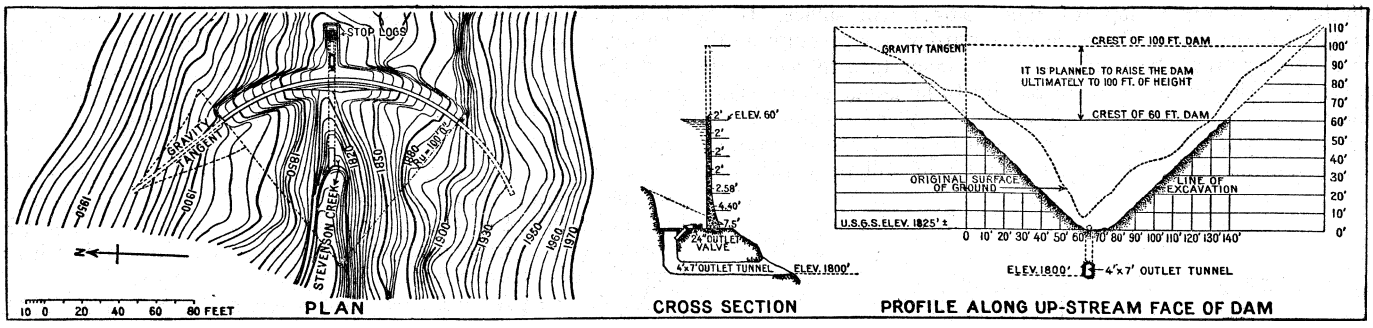


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FIG. 5.—PLAN, PROFILE AND CROSS-SECTION OF THE EXPERIMENTAL DAM AT STEVENSON CREEK

curve. The Junction Brook main dam of the Newfoundland Power and Paper company is of this type and about 1,000 ft. long and 75 ft. high and carries a single-line railway. The buttresses, spaced at 18 ft. centres, are of plain concrete from 16 in. to 44 in. thick. The slabs vary from 16 in. to 47 in. in thickness and are heavily reinforced as simple beams to support the water pressure. Flat slabs form an uneconomical type of construction for support of heavy water pressures as compared with arches and entail a multiplicity of buttresses with close spacing, the practicable maximum being about 20 feet.

In multiple arch dams the buttress spacing may be from 15 to 60 ft. depending on the general height of the dam. The highest multiple arch dam constructed in Europe to 1940 is the Tirso dam in Sardinia. The buttresses, spaced at 50 ft. centres, are of masonry with courses sloped at the outer face to suit the direction of maximum pressure and are designed to be independently stable and safe under the maximum loadings transmitted to them by the arches. The arches are of concrete, nearly semi-circular, lightly reinforced for temperature and shortening stresses, and have a thickness varying from 20 in. at top to $5\frac{1}{2}$ ft. at bottom.

The dam provides storage for the triple purposes of power production, irrigation, and river regulation, the power house being worked into the space between the buttresses.

The highest dam of this type constructed in the United States to 1940 is Bartlett dam in Arizona which has a maximum height of 273 feet. Arches and buttresses are of reinforced concrete with a centre to centre spacing of 60 ft. and the buttresses have an overall thickness of 22 ft. but are of cellular construction with double walls. Vertical and horizontal sections of a dam of this type are shown in fig. 4.

Flood Gates.—Special circumstances arise in regard to dams on large rivers, whether installed for purposes of irrigation or for the generation of hydro-electric power. It is generally necessary to control within close limits the flood and backing-up height above the dam, so that provision must be made for passing very large volumes of flood water. The circumstances are accentuated where a large part of the wet season flow of a river carrying much silt has to be stored to give a regulated supply during the dry season. For all such cases movable openings are necessary on a scale commensurate with the flood or maximum flow conditions and where close regulation is essential a series of large steel gates, usually of such weight as must be operated by machinery is most commonly used. The Aswan dam on the Nile (Plate I, fig. 4) has a length across the river of 6,400 ft., with a maximum height of 175 ft. and forms an irrigation storage reservoir with a capacity of over 4,000,000 acre feet. Water is shown being discharged from several of the many large sluice openings.

The Dnieprostroi dam on the Dnieper river, built for the soviet government, is the largest low head dam in the world constructed for hydro-electric power purposes. Gate and spillway arrangements are provided on a scale sufficient to pass a flood of 1,250,000 cusecs. Power can be developed up to 560,000 kw.

For the extreme case of a river transporting great quantities of silt where the barrage must not be allowed to become a trap for the settlement and accumulation of large quantities of material brought down during high floods, a continuous series of gates is used extending from bank to bank and having their sills at the river bed. The gates are separated by piers, usually of concrete. which must be capable of supporting the maximum water load from a panel of the barrage as well as the erections and machinery for operating the gates. The gates are fully opened to pass the first part of the wet season flood and scour the reservoir bed clean, and closed in time to conserve the later and cleaner part of the flow. The Vaal river barrage is an interesting example of this type of dam, on a river whose annual silt burden is estimated at 1,200,000 tons and maximum flood flow 187,000 cusecs.

(J. WI.; W. P. C.)

Boulder Dam.—Harnessing one of the world's great sources of hydro-electric power, the Colorado river, Boulder dam towers 727 ft. above the canyon floor, the highest dam in the world. Originally proposed as a concrete horizontal arch, the dam was finally built as a solid concrete gravity type, curved in plan. Its crest length is 1,282 ft. and it contains 3,241,553 cu.yd. of concrete. The great size of the dam required that it be built in vertical blocks rather than as one solid mass. One of the problems in constructing such large masses of concrete was the dissipation of the heat generated by the hydration of the cement in order to prevent any large amount of expansion and contraction after the concrete had taken its initial set. For this purpose more than 570 mi. of 1 in. tubing was buried in the concrete and refrigerated water pumped through it.

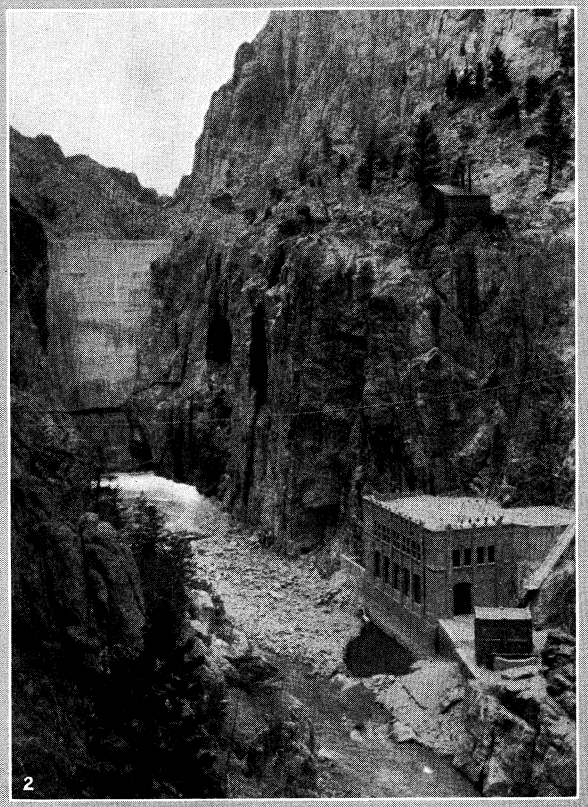
The concrete for the dam was supplied by eight mixers, each with a capacity of four cubic yards. These were located in two plants, one in the canyon for the lower half of the structure, and the other on the canyon rim for the remainder. Construction was facilitated by the erection of a huge cableway suspended over the site for transfer of concrete and other construction materials to all parts of the dam.

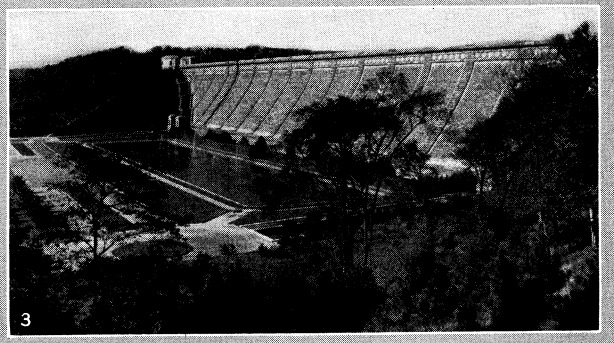
An important phase of this great task was the excavation of four large tunnels, 50 ft. in diameter, for diverting the river around the site while the dam was being built. The tunnels, two in each canyon wall, were bored through the solid rock for a combined distance of 15,946 feet.

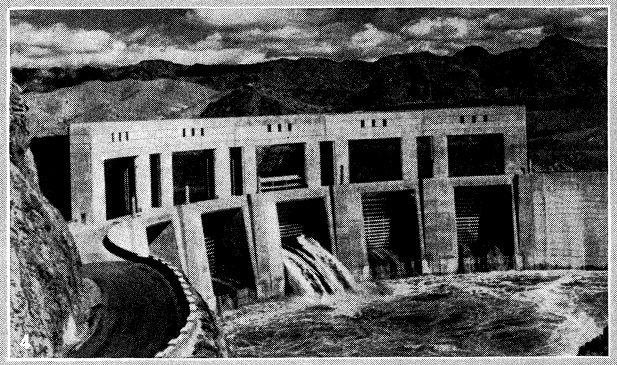
In spite of its magnitude, completion of the dam was effected March 1, 1936, more than two years ahead of schedule and requiring less than five years for its construction. Built for flood control, irrigation, and power development, Boulder dam stores more than 30,000,000 ac.ft. of water and will produce some 4,330,000,000 kilowatt-hours of firm power annually.

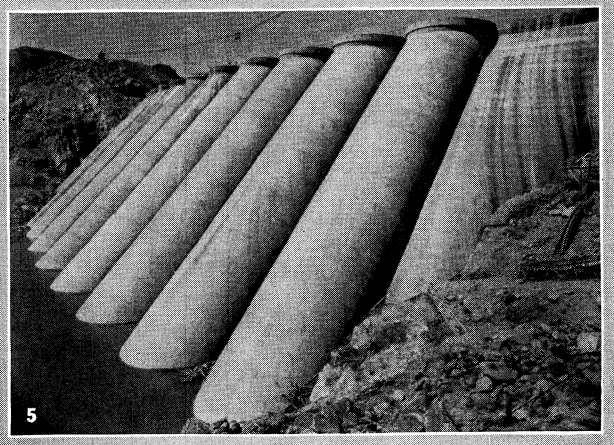
Grand Coulee Dam.—Surpassing even Boulder, the dam on the Columbia river at Grand Coulee is the largest masonry structure ever erected by man. Its 11,250,000 cu.yd. of concrete will be more than two-and-a-half times the size of Boulder dam and about seven times the great Cheops pyramid in Egypt. Unlike the pyramids, however, this structure is conceived as a great social benefit. Some 10,000 families will find new homes on the 1,200,000 acres which will be irrigated by the great dam.

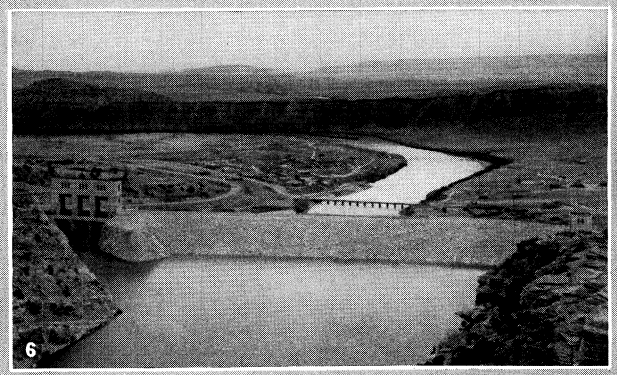
Grand Coulee dam is situated at a point where a glacier once dammed up the river forcing it to find a new course. Later the glacier receded and the river returned to its original bed 600 ft. below, leaving a dry canyon 50 mi. long and 2 to 5 mi. wide, now known as Grand Coulee. Part of the hydro-electric power generated at this dam will be used to pump water from the reservoir behind the dam into another reservoir which will be created in the

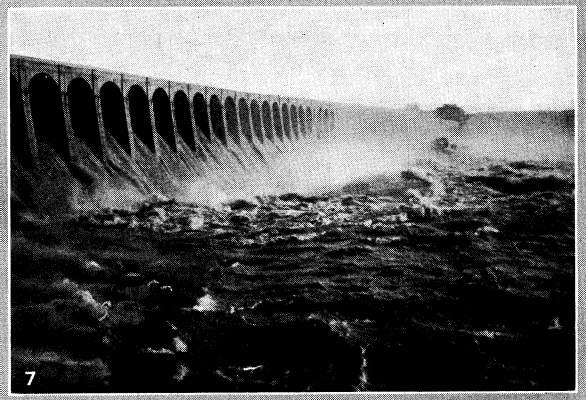


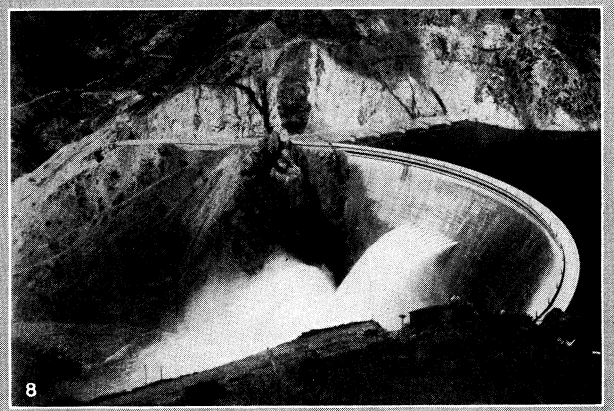










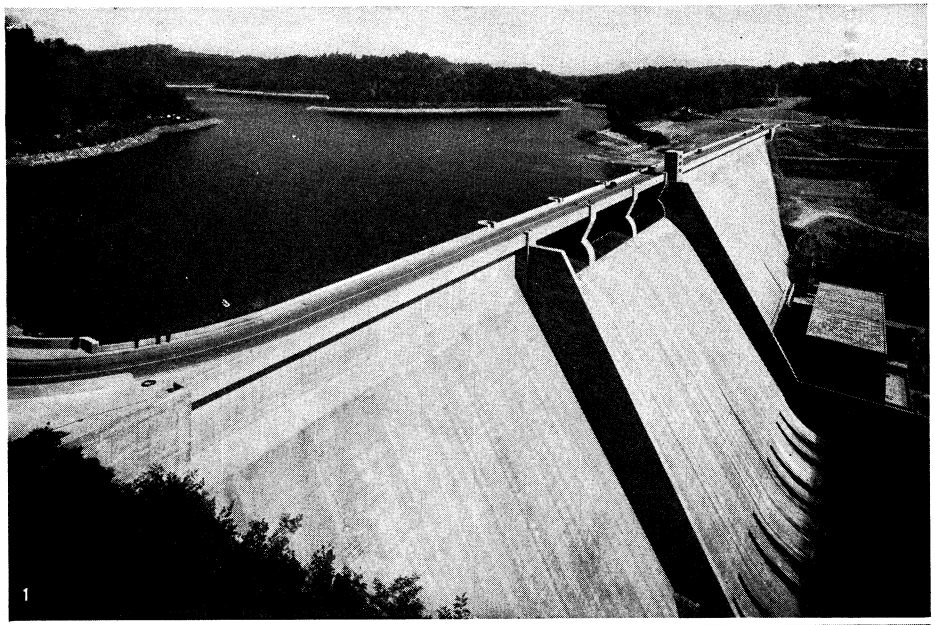


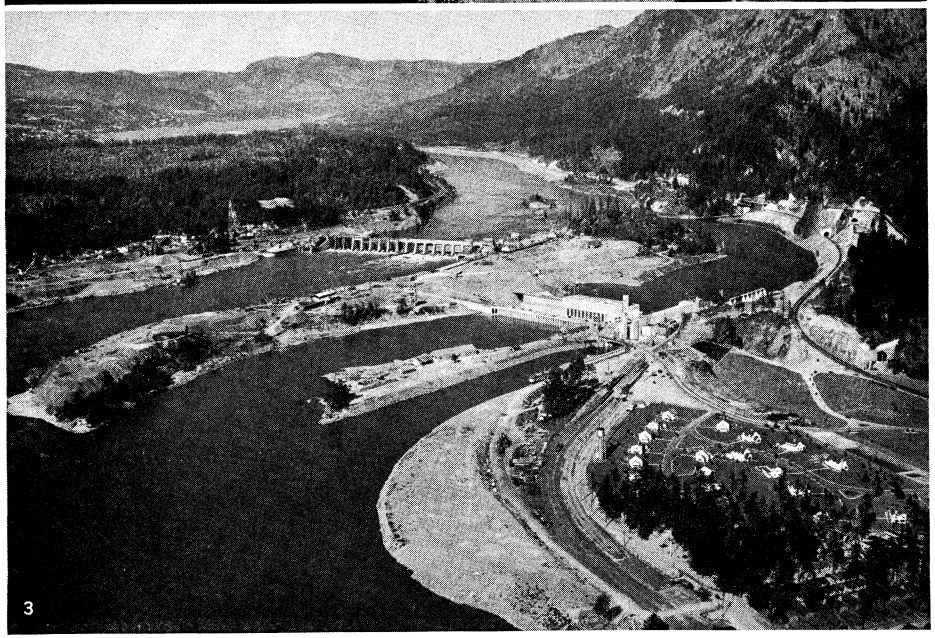
BY COURTESY OF (1, 3) THE BOARD OF WATER SUPPLY OF THE CITY OF NEW YORK, (2, 5, 6, 8) THE U.S. BUREAU OF RECLAMATION, (7) THE U.S. CORPS OF ENGINEERS; PHOTOGRAPH, (4) ACME

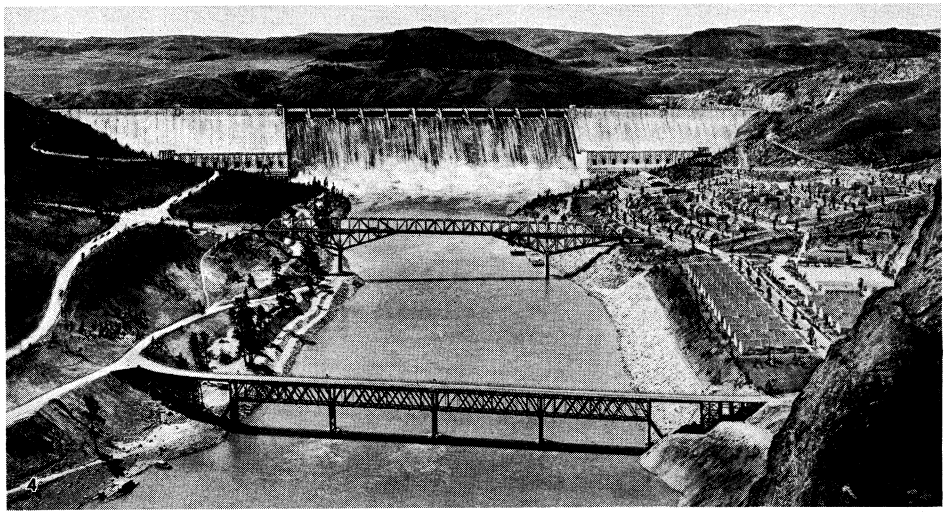
TYPES OF DAMS FOR POWER, WATER SUPPLY AND IRRIGATION

1. Gravity dam, Ashokan reservoir, principal structure of the New York city Catskill water-supply system
2. Power house and horizontal arch dam, Shoshone river project,
3. Kensico gravity dam, New York city water supply system
4. Parker dam on the Colorado river, starting point of a 242-mi. aqueduct to Southern California
6. Alcova am (earth and rockfill), North Platte river, Wyomi g
7. Overflo gravity-type, Wilson dam, Tennessee river
8. Curved ravity type, Arrowrock da Boise riv , Idaho

DAMS







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U. S. GOVERNMENT PROJECTS

1. The downstream face of Norris Dam, near Knoxville, Tenn., as seen from the west bank of the Clinch river
2. Boulder Dam, Colorado river, on the border of Arizona and Nevada. The dam is 727 ft. high
3. Bonneville Dam, Columbia river, 42 miles east of Portland, Oregon
4. An artist's conception of the Grand Coulee Dam, Columbia river, in the State of Washington. This structure, nearly three-quarters of a mile long, will be approximately 550 feet high. The regulated Columbia river will flow over the central section of the dam, the water surface being raised 355 feet. At the right can be seen the permanent Government city, Coulee Dam, Washington

upper end of the Grand Coulee by constructing two earth and rock-fill dams across it. This will involve lifting the water a maximum of about 370 feet. From this reservoir the water will flow through approximately 250mi. of main canal to irrigate the fertile basin of the Columbia river in the area known as the Big Bend. The Grand Coulee dam is 550ft. high, with a base width of 480ft. at its maximum section. Its total length is 4,500ft. with 1,650ft. of this used as a spillway capable of passing a flood of 1,000,000 cu.ft. per second. Such a flood would create a fall of water 5 times the average flow of Niagara Falls and 3 times as high.

The tremendous size of the dam presented the same construction problems as did Boulder, with the dam built in individual vertical blocks, usually about 50ft. square. Cooling water was circulated through 2,200mi. of 1 in. tubing. A unique construction feature was the use of a system of long conveyor belts to transport materials from the excavation and to deliver concrete aggregates.

Assisting materially in flood control and river regulation, Grand Coulee dam has a storage capacity of 9,610,000 acre feet. Ultimately nine generators will be housed in each of the two power plants at the dam. Their total capacity will be 2,550,000 horsepower. The energy from six of the generators in the plant on the west side of the river is to be used for pumping. The remainder is to be sold to the market that is expected to develop when the irrigated land comes into use. The generators are expected to produce over 8,100,000,000 kilowatt-hours of firm power annually.

Fort Peck Dam.—The largest dam in the world, Fort Peck, begun in 1934 and requiring six years for completion, is on the Missouri river in Montana. Built for purposes of flood control and power development, it has a maximum height of 242ft., a crest length of 9,000ft. and contains 100,000,000 cu.yd. of earth fill placed hydraulically. Four large dredges were built at the dam for purposes of dredging material from the valley bottom and pumping it into place on the dam through steel pipe lines 28in. in diameter and 5mi. long at certain stages of construction.

On Sept. 22, 1938, with over 95% of the fill completed, there occurred a considerable movement of the material in the upstream face of the dam near the east abutment, involving approximately 5,000,000 cu.yd. of fill. The damaged portion was entirely removed and rebuilt causing a delay of over a year in the final completion time of the structure.

Fort Peck will store 19,500,000 ac.ft. of water, exceeded only by Lake Mead, the storage reservoir created by Boulder dam.

Timber and **Steel** Dams.—Mention should be made of the relatively less important dams of steel and timber. The former type is in general similar to the multiple buttress type of concrete dam previously described, in that the water load is supported by steel decks resting on steel frames. Timber dams are sometimes built in the same manner but more frequently are rock filled cribs with timber decks. They are numerous but usually quite small and often only temporary, as for some major logging operation or for a cofferdam. Few steel dams have been built, probably due to lack of confidence in their permanence. Three large steel dams were constructed about 1900, but after one of these failed, although its destruction was attributed to a foundation failure and not in any way connected with the fact that it was built of steel, it was replaced by a concrete dam and since then none of any importance has been erected.

BIBLIOGRAPHY.—E. Wegmann, *The Design and Construction* of *Danzs* (8th ed., 1927); W. P. Creager, *Engineering for Masonry Dams* (2nd ed., 1929); A. Schoklitsch, *Hydraulic Structures* (1929); J. D. Justin, *Earth Danz Projects* (1932); Hanna and Kennedy, *Design* of *Dams* (2nd ed. 1938). (W. P. C.)

DAN, a tribe of Israel named after a son of Jacob and Bilhah, the maid of Rachel. The earlier home of the tribe was to the west of Judah, where it seems that they occupied the sea coast, covering the caravan routes, where the weakness of the later kings of the Egyptian 18th dynasty made it possible for them freely to plunder travellers (Judges v. 17; Gen. xlix.). The Philistine settlements naturally came into contact first with this tribe, and in the days of Samson their territory was reduced to small compass, embracing only the neighbouring villages of Zorah and Eshtaol. The story of Samson gives us traditions of the struggle which ended in the expulsion of the Danites. In Judges xvii. seq. we have the narrative of their migration to a new site in the far north. This was their home during the whole period of the northern monarchy, and their settlement centred round one of the most famous sanctuaries in Israel. The fact that several of the famous Israelite artists (especially in metal) are connected with the tribe of Dan (cf. *e.g.*, Exod. xxxi. 6; II Chron. ii. 13 seq.) has suggested that early tradition connected Dan with the Calebites and Kenites.

In the monarchic period the importance of Dan is almost entirely religious. It was a home of bull worship, and tradition ascribes the introduction of this cult to Jeroboam I. (I Ki. xii. 28–30), but the shrine is far older, and its priesthood traced its descent from Moses himself (Judges xviii. 30). Dan was subsequently either regarded as the embodiment of wickedness or entirely ignored (the list of the redeemed in Rev. vii. 5–8 omits the tribe of Dan altogether). Late speculation that the Antichrist should spring from it appears to be based upon an interpretation of Gen. xlix. 17.

DAN, a light-skinned patrilineal people (formerly cannibal) sometimes known as the Jula cannibals, on the French Ivory coast and in Liberia in the basin of the upper Kavally. The villages are independent. Family property is joint with individual ownership of personal possessions. They practise husbandry and arboriculture (millet, yam, kola, coco-nut oil and rubber). They are animists and practise ordeal by poison and by boiling oil.

See M. S. Vendeix, "Ethnographie du Cercle de Man, Côte d'Ivoire," *Revue Ethn.* et *Trad.* pop. (1924).

DAN, a town which marked the northern limit of Palestine reckoned "from Dan to Beersheba." It is now identified with Tell-el-Kadhi, a mound 4 m. west of Banias, in a jungle of rank vegetation. From its western base issues a mighty fountain (Leddan), the largest of the sources of the Jordan. Laish, or Leshem (Judges xviii.), was its name prior to its conquest by migrating Danites and it formed, seemingly, a colony or dependence of Sidon. Here the Danites set up Micah's graven image (Judges xviii. 30f.), and Jeroboam erected one of his golden calves (1. Ki. xii. 29). Its name disappears from history with its capture by Ben-Hadad of Damascus (1. Ki. xv. 20). An attempt has been made to locate Dan at Bāniās based on a direct statement of Theodore and a vague allusion of the Jerusalem Talmud; but it has against it the definite testimony of Josephus (*Antiq.* i. 10. i. etc.) and that of Eusebius and Jerome (*Onom.* Sac.) as well as the evidence from the survival of the name (both Dan and Kadhi signify judge). Tell-el-Kadhi is now in British Mandated Territory. A preliminary survey of the mound for excavation purposes has been made since the World War.

DANA, CHARLES ANDERSON (1819–1897), American journalist, was born in Hinsdale, N.H., on Aug. 8, 1819. In 1839 he entered Harvard, but the impairment of his eyesight in 1841 forced him to leave college. From Sept. 1841 until March 1846 he lived at Brook Farm (*q.v.*), where he was made one of the trustees. He had previously written for the Harbinger, the Brook Farm organ, and had written as early as 1844 for the Boston Chronotype. In 1847 he joined the staff of the New York Tribune, and in 1848 he wrote from Europe letters to it on the revolutionary movements of that year. Returning lo the Tribune in 1849, he became its managing-editor, and in this capacity actively promoted the anti-slavery cause. In 1862 his resignation was asked for, apparently because of wide temperamental differences between him and Greeley. Secretary of war Stanton immediately made him a special investigating agent of the war department; in this capacity Dana spent much time at the front, and sent to Stanton frequent reports. He went through the Vicksburg campaign and was at Chickamauga and Chattanooga, and urged the placing of Gen. Grant in supreme command of all the armies in the field. In 1864–65 Dana was second assistant-secretary of war. He became the editor and part-owner of the New York Sun in 1868, and remained in control of it until his death. Under Dana's control the Sun opposed the impeachment of President Johnson; it supported Grant for the presidency in 1868; it was a sharp critic of Grant as president; and in 1872 took part in the Liberal Republican

revolt and urged Greeley's nomination. It favoured Tilden, the Democratic candidate for the presidency, in 1876, opposed the Electoral Commission acd continually referred to Hayes as the "fraud president." In 1884 it supported Benjamin F. Butler, the candidate of Greenback-Labor and Anti-Monopolist parties, for the presidency, and opposed Blaine (Republican) and even more bitterly Cleveland (Democrat); it supported Cleveland and opposed Harrison in 1888, and in 1896, on the free-silver issue, it opposed Bryan, the Democratic candidate for the presidency. Dana's literary style came to be the style of the *Sun*—simple, strong, clear, "boiled down." *The Art of Newspaper Making,* containing lectures which he wrote on journalism, was published in 1900. With George Ripley he edited *The New American Cyclopaedia* (1857–63), reissued as the *American Cyclopaedia* in 1873–76. He edited an anthology, *The Household Book of Poetry* (1857). Dana's *Reminiscences of the Civil War* was published in 1898, as was his *Eastern Journeys, Notes of Travel.* He died at Glen Cove, Long Island, N.Y., on Oct. 17, 1897.

See James Wilson, *The Life of Charles A. Dana* (1907); and Frank M. O'Brien, *The Story of the "Sun," New York, 1833–1918* (1918).

DANA, FRANCIS (1743–1811), American jurist, was born in Charlestown (Mass.), June 13, 1743. He graduated at Harvard in 1762, was admitted to the bar in 1767, became a leader of the Sons of Liberty, and in 1774 was a member of the first provincial congress of Massachusetts. He was a member of the Massachusetts Executive Council (1776–80) and a delegate to the Continental Congress (1776–78). In the autumn of 1779 he was appointed secretary to John Adams, who had been selected as minister plenipotentiary to negotiate treaties of peace and commerce with Great Britain, and in Dec. 1780 he was appointed diplomatic representative to the Russian Government. He remained at St. Petersburg from 1781 to 1783, but was never formally received by the empress Catherine. In 1784 he was again chosen a delegate to Congress, and in 1785 he became a justice of the Massachusetts supreme court, over which he presided (1791–1806) with ability and distinction. He was an earnest advocate of the adoption of the Federal constitution, was a member of the Massachusetts convention which ratified that instrument and was one of the most influential advisers of the leaders of the Federalist party. He died at Cambridge (Mass.), April 25, 1811.

His son, RICHARD HENRY DANA (1787–1879), was born in Cambridge (Mass.), Nov. 15, 1787. After graduation from Harvard in 1808 he was admitted to the bar; but literature was his absorbing interest. From 1815 until 1821 he was associated with Jared Sparks and Edward T. Channing in the editorial control of the *North American Review,* and in 1821–22 he put forth a miscellany, *The Idle Man.* He published his first volume of *Poems* in 1827; and in 1833 appeared his *Poems and Prose Writings,* republished in 1850 in two volumes. An English edition, *The Buccaneer and Other Poems,* was issued in 1844. Dana died in Boston, Feb. 2, 1879.

RICHARD HENRY DANA (1815–1882), son of the last-mentioned, was born in Cambridge (Mass.), Aug. 1, 1815. He entered Harvard in the class of 1835, but an illness affecting his sight necessitated a suspension of his college work, and in Aug. 1834 he shipped before the mast for California, returning in Sept. 1836. This voyage was really a turning point in his career, renewing his health, turning him into a self-reliant, energetic man with broad interests and keen sympathies, and giving him the material for his *Two Years before the Mast* (1840), one of the best American books on the sea. Not only is this still widely read at home and abroad, but it also has historic significance. It created interest in California prior to the gold rush; with Melville's *White Jacket* (1850) it led to reforms in the treatment of sailors; and it vividly preserves a bygone epoch. Before the publication of his book, Dana had completed his legal training at Harvard, and he now began the practice of law, his former experience immediately bringing him a large number of maritime cases. In 1841 he published *The Seaman's Friend,* republished in England as The *Seaman's Manual,* a useful and readable book. In spite of the ostracism and danger it involved, Dana became prominently associated in 1848, with the Free Soil movement and volunteered his services for negroes seized under the Fugitive Slave Act. In 1857 he became a regular attendant at the meetings of the famous Boston Saturday club, to the members of which he dedicated his account of a vacation trip, *To Cuba and Back* (1859). He returned to America from a trip round the world in time to participate in the presidential campaign of 1860, and after Lincoln's inauguration he was appointed United States district attorney for Massachusetts. In this office in 1863 he won before the Supreme Court of the United States the famous prize case of the "Amy Warwick," on the decision in which depended the right of the Government to blockade the Confederate ports without giving the Confederate States an international status as belligerents. He brought out in 1865 an edition of Wheaton's *International Law,* his notes constituting a most learned and valuable authority on this subject and its bearings on American history and diplomacy; but Dana was charged by the editor of two earlier editions, William Beach Lawrence, with infringing his copyright, and was involved in litigation for 13 years. Dana's political aspirations were largely frustrated. He declined the position of United States district judge, but he became a member of the Massachusetts house of representatives (1867–68), and in 1867 was retained, with William M. Evarts, to prosecute Jefferson Davis, whose admission to bail he counselled. Although the Senate refused to ratify Grant's nomination of him for minister to England, he was, in 1877, one of the counsel for the United States before the commission that met at Halifax, N.S., to arbitrate the fisheries question between the United States and Great Britain. In 1878 he gave up his law practice, and he devoted the rest of his life to study and travel. He died in Rome, Italy, Jan. 6, 1882.

For the elder Richard Henry Dana, *see* J. G. Wilson, *Bryant and His Friends* (1885). For the younger, *see* C. F. Adams, *Richard Henry Dana: a Biography* (1890) and *Exercises . . . Celebrating the One Hundredth Anniversary of the Birth of Richard Henry Dana* (Cambridge, 1916).

DANA, JAMES DWIGHT (1813–1895), American geologist, mineralogist and zoologist, born in Utica, New York, on the 12th of February 1813. He early displayed a taste for science, which had been fostered by Fay Edgerton, a teacher in the Utica high school, and in 1830 he entered Yale College, in order to study under Benjamin Silliman the elder. Graduating in 1833, for the next two years he was teacher of mathematics to midshipmen in the navy, and sailed to the Mediterranean while engaged in his duties. In 1836–37 he was assistant to Professor Silliman in the chemical laboratory at Yale, and then, for four years, acted as mineralogist and geologist of a United States exploring expedition, commanded by Captain Charles Wilkes, in the Pacific ocean (*see* WILKES, CHARLES). His labours in preparing the reports of his explorations occupied parts of thirteen years after his return to America in 1842. In 1844 he again became a resident of New Haven, married the daughter of Professor Silliman, and in 1850, on the resignation of the latter, was appointed Silliman Professor of Natural History and Geology in Yale College, a position which he held till 1892. In 1846 he became joint editor and during the later years of his life he was chief editor of the *American Journal of Science and Arts* (founded in 1818 by Benjamin Silliman), to which he was a constant contributor, principally of articles on geology and mineralogy. A bibliographical list of his writings shows 214 titles of books and papers, beginning in 1835 with a paper on the conditions of Vesuvius in 1834, and ending with the fourth revised edition (finished in February 1895) of his *Manual of Geology.* His reports on *Zoophytes,* on the *Geology of the Pacific Area,* and on *Crzcstacea,* summarizing his work on the Wilkes expedition, appeared in 1846, 1849 and 1852–1854, in quarto volumes, with copiously illustrated atlases; but as these were issued in small numbers, his reputation more largely rests upon his *System of Mineralogy* (1837 and many later editions in 1892); *Manual of Geology* (1862; ed. 4, 1895); *Manual of Mineralogy* (1848), afterwards entitled *Manual of Mineralogy and Lithology* (ed. 4, 1887): and *Corals and Coral Islands* (1872; ed. 2, 1890). In 1887 Dana revisited the Hawaiian Islands, and the results of his further investigations were pub-

lished in a quarto volume in 1890, entitled *Characteristics of Volcanoes*. By the Royal Society of London he was awarded the Copley medal in 1877; and by the Geological Society the Wollaston medal in 1874. His powers of work were extraordinary, and in his 82nd year he was occupied in preparing a new edition of his *Manual of Geology*, the 4th edition being issued in 1895. He died on the 14th of April 1895.

His son EDWARD SALISBURY DANA, born at New Haven on the 16th of November 1849, is author of *A Textbook of Mineralogy* (1877; new ed. 1898) and a *Text Book of Elementary Mechanics* (1881). In 1879–80 he was professor of natural philosophy and then was professor of physics at Yale. He died June 17, 1935.

See *Life of J. D. Dana*, by Daniel C. Gilman (1899).

DANAE (Gr. dă-nă-ā, anglicized dăn'ă-ē), in Greek legend, daughter of Acrisius, king of Argos. According to the myth, her father, having been warned by an oracle that she would bear a son by whom he would be slain, confined Danae in a brazen tower. But Zeus descended to her in a shower of gold, and she gave birth to Perseus, whereupon Acrisius placed her and her infant in a wooden box and threw them into the sea. They were finally driven ashore on the island of Seriphus, where they were picked up and brought to Polydectes, king of the island. For her subsequent adventures *see* PERSEUS.

DANAGLA: *see* BARABRA.

DANAO, a municipality (with administrative centre and 30 *barrios* or districts) of the province and island of Cebu, Philippine islands, on the east coast, at the mouth of the Danao river, 17 mi. N.N.E. of Cebu, the provincial capital. Pop. (1939) 28,387, of whom only one was white. It is in the centre of a rich agricultural region producing rice, corn, sugar, copra and cacao. Coal is mined in the vicinity.

According to the census of 1939, there were 3,100 farms in Danao, 1,289 of which were farmed by the owners, 907 by part owners, 903 by share tenants and one cash tenant. The vernacular is Cebuano.

DANAUS, in Greek legend, son of Belus, king of Egypt, and twin-brother of Aegyptus. He was born at Chemmis (Panopolis) in Egypt, but having been driven out by his brother he fled with his 50 daughters to Argos, the home of his ancestress Io. The 50 sons of Aegyptus arrived in Argos, and Danaus was obliged to consent to their marriage with his daughters. But to each of these he gave a knife with injunctions to slay her husband on the marriage night. They all obeyed except Hypermestra, who spared Lynceus. She was brought to trial by her father, acquitted and afterwards married to her lover. Being unable to find suitors for the other daughters, Danaus offered them in marriage to the youths of the district who proved themselves victorious in racing contests (Pindar, *Pythia*, ix. 117).

According to another story Lynceus slew Danaus and his daughters and seized the throne of Argos (schol. on Euripides, *Hecuba*, 886). In the other world the Danaïdes were condemned to the endless task of filling with water a vessel which had no bottom. Crime and punishment alike have been variously explained by mythologists.

See articles in Pauly-Wissowa's *Realencyklopadie* and W. H. Roscher's *Lexikon der Mythologie;* Campbell Bonner, in **Harvard** *Studies*, riii. (1902).

DANBURITE, a rare mineral species consisting of calcium and boron orthosilicate, $CaB_2(SiO_4)_2$, crystallizing in the orthorhombic system and discovered in 1839 at Danbury, Conn., whence its name, and where it occurs embedded in dolomite. The crystals are transparent to translucent, and colourless to pale yellow; they are prismatic in habit, and closely resemble topaz in form and interfacial angles. There is an imperfect cleavage parallel to the basal plane; hardness 7; specific gravity 3.0. Splendid crystals have been found in Japan.

DANBURY, a city of southwestern Connecticut, 65 mi. N.N.E. of New York city, on the Still river; one of the county seats of Fairfield county. It is served by the New York, New Haven and Hartford railroad. The population was 18,943 in 1920 (21% foreign-born white) and was 22,339 in 1940 by the federal census. The city lies in a broad plain, surrounded by the foothills of the Berkshires, and retains much of the delightful aspect of a New England village. It is the seat of a state normal school, opened 1904. The predominant industry is the manufacture of felt hats, begun in 1780, which in 1940 was represented by over 30 factories. More than 4,000,000 hats are produced annually. Other important manufactures are hatmaking machinery, silver-plated ware, surgical instruments, silk braid, thread. ball and roller bearings. The factory output in 1937 was valued at $37,699,460. An agricultural fair is an annual event. Danbury was settled in 1684. The borough was chartered in 1822 and became a city in 1869. In 1776 a depot of military supplies was established here, which in April, 1777, was raided by Governor Tryon of New York. In his retreat he was attacked at Ridgefield (9m. S.) by the Americans under General David Wooster, who was fatally wounded in the conflict. Several books about Danbury were written by James Montgomery Bailey (1841–94), founder and for many years proprietor of the Danbury *News*, whose humorous sketches in the *News* made himself and the paper famous.

The "Danbury Hatters' Case," a suit for damages brought by a manufacturing firm against 186 hatters of Danbury in 1902, on the ground that their boycott was a violation of the Sherman Act, is important in the annals of organized labour in America. Damages were awarded to the plaintiff and his contention was upheld by a decision of the U.S. Supreme Court in 1915.

DANBY, THOMAS OSBORNE, EARL OF: *see* LEEDS, THOMAS OSBORNE, 1ST DUKE OF.

DANBY, FRANCIS (1793–1861), English painter, was born in the south of Ireland on Nov. 16, 1793, and died at Exmouth on Feb. 9, 1861. He led a wandering life, but spent his last 20 years in England. A good example of his work is "Fisherman's Home—Sunset" in the National Gallery, and the "Departure of Ulysses from Ithaca" (1854). His sons, James Francis (1816–75) and Thomas (1817?–86), were also well-known artists.

DANCE, the name of an English family distinguished in architecture, art and the drama. GEORGE DANCE, the elder (1700–1768), obtained the appointment of architect to the City of London, and designed the Mansion House (1739); the churches of St. Botolph, Aldgate (1741), St. Luke's, Old street; St. Leonard, Shoreditch; the old excise office, Broad street; and other public works of importance. His eldest son, JAMES DANCE (1722–1774), was educated at the Merchant Taylors' school and St. John's college, Oxford. He took the name of Love, and became an actor and playwright, connected for 12 years with Drury Lane theatre. He wrote a number of comedies—the earliest *Pamela* (1742).

George Dance's third son, SIR NATHANIEL DANCE-HOLLAND, BART. (1735–1811), studied art under Francis Hayman in Italy, where he formed a hopeless attachment for Angelica Kauffmann. From Rome he sent home "Dido and Aeneas" (1763). On his return to England he took up portrait-painting with great success, and contributed to the first exhibition of the Royal Academy, of which he was a foundation member, full-length portraits of George III. and his queen. These, and his portraits of Captain Cook and of Garrick as Richard III., engraved by Dixon, are his best-known works. In 1790 he became M P. for East Grinstead, taking the additional name of Holland. He was made a baronet in 1800.

George Dance's fifth and youngest son, GEORGE DANCE, the younger (1741–1825), succeeded his father as City surveyor and architect in 1768. He had spent several years abroad, chiefly in Italy, and had already distinguished himself by designs for Blackfriars bridge. His first important public work was the rebuilding of Newgate prison in 1770. The front of the Guildhall was also his. He, too, was a foundation member of the Royal Academy. His son, CHARLES DANCE (1794–1863), was for 30 years registrar, taxing officer and chief clerk of the insolvent debtors' court. In collaboration with J. R. Planché and others, or alone, he wrote a great number of extravaganzas, farces and comediettas. He was one of the first of the burlesque writers, and was the author of those produced so successfully by Madame Vestris for years at the Olympic.

DANCE. Dancing consists in the rhythmical movement of any or all parts of the body in accordance with some scheme of

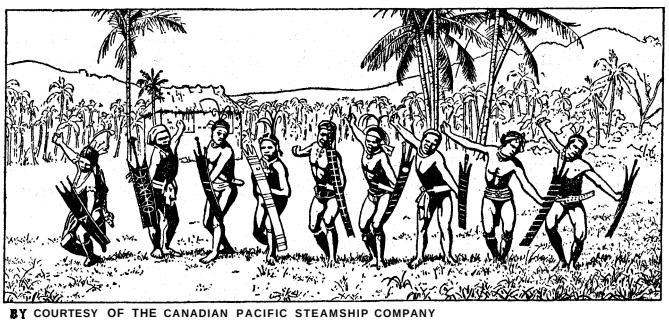
individual or concerted action which is expressive of emotions or ideas. Amongst primitive peoples it always has some accompaniment by means of which the rhythm is emphasized. In its simplest form this consists in clapping the hands, or beating a drum to mark the time; more elaborate is the accompaniment composed of several drums each with its own rhythm, or of an orchestra of different instruments. Frequently every dance has its own song which is sung by the performers themselves or by the onlookers.

Among primitive peoples the range of movements employed in dancing is very wide. All parts of the body are used, head, back, hips, arms, fingers and even the facial muscles are brought into play as well as the feet. Some performances demand great physical exertion, with leaping and many bodily contortions, as in the war *haka* of the Maori.[1] In others the dancers confine themselves to a monotonous movement of the hands and feet. Many observers have commented on the sameness and lack of beauty in savage dances, but such a condemnation is based upon the misconception that they are performed primarily for the pleasure of the spectator. Spectacular dances are not unknown, but generally the satisfaction of the dancers is of first importance.

Much has been written of the obscenity of primitive dancing and it has even been said that it is primarily sexual in intent. Evidence from many parts of the world does not bear this out. To a certain extent all dancing is sexually stimulating, but, except in courtship dances, this stimulus may be regarded as a by-product. Nor is it true that all primitive dance movements are mimetic. Some are undoubtedly so, as the totemic dances in Australia *(see* TOTEMISM), but in the Andaman islands there is no trace of any such significance. Often the movements seem to be artistic renderings of spontaneous actions resulting from some emotional state.

As a rule a dance is performed by a group or groups of people all of whom move in the same way. Solo dances are rare, though not infrequently there is a dance leader who has a special part to play. All the able-bodied adults of the community are expected to take part. Usually the sexes are segregated, though this is by no means universal, but the close embrace, customary in European round dances, is seldom countenanced. Sometimes certain dances are restricted to one sex. Unless the dance forms part of a secret ceremony, that section of the community which is not dancing acts as audience, and often performs the accompaniment. Children are seldom allowed to join their elders, but have dances and singing games among themselves.

Under certain conditions some individuals, such as those who are in mourning or in seclusion at puberty, are not allowed to dance. They are in an abnormal state and temporarily cut off from society, and are therefore excluded from dancing, which is essentially a social occupation. It is for this reason too that a dance is so often a part of the ceremony which terminates a period of isolation; by joining in its performance the individual re-establishes his membership of the group.



BY COURTESY OF THE CANADIAN PACIFIC STEAMSHIP COMPANY

ZIBILAE DANCE OF SEMI-BARBAROUS IGOROTS, PHILIPPINE ISLANDS

"The individual shouts and jumps for joy; the society turns the jump into a dance, the shout into a song." Dancing is a general means of enjoyment, often of rejoicing. But, as indicated above, it is more than this. Consciously or unconsciously it is a means of reaffirming social unity and occurs on all occasions which are socially important: at the close of *Passage Rites* (*q.v.*)—especially those of puberty and death; at the initiation and close of group activities such as fighting or the building of a communal house; or during inter-group activities such as the tribal corroboree in Australia, or the peace-making of the Andamans. The food supply is all-important to the community and thus among an agricultural people, for instance, seed and harvest time have social significance, and are therefore times of dancing.

But except on such occasions as the dance-meetings of local groups and the peace-making ceremonies of the Andamans, the sense of social unity is felt as a pleasurable accompaniment to dancing rather than as its conscious purpose. The significance of the dances to the dancers and their emotional accompaniment have been very insufficiently studied, and there has been much theorizing on little data. Many dances seem to be magical ceremonies by means of which human beings or natural phenomena are controlled. Thus the dances of the totemic ceremonies of central Australia are performed to promote the fertility of the animal species concerned, and many hunting and war-dances appear to be intended to influence the hunted game or the enemy, so they may be readily killed. The actions in such dances are mostly mimetic, and it is not uncommon for performers at important ceremonies to be killed if they make any mistake, probably because it is felt that such faults would detract from the efficacy of the dance. Accuracy of movement like accuracy of words is essential to the success of magical rites. From the way in which a dance is performed omens are frequently taken, any mistake or want of spirit being accounted evil.

BY COURTESY OF Y W C A.

CHINESE BOY IN COSTUME FOR DEVIL DANCE

The border-line between magic and religion is notoriously difficult to draw, but among some people dancing seems definitely to be a form of religious exercise akin to prayer.

Dancing as an incident in courtship is found among many species of birds and animals. In all dancing there is an opportunity for pleasurable exercise, but some dances are designed to create sexual excitement in both performers and onlookers. Thus in Torres Straits, the unmarried girls watch the bachelors dancing, and then each taps on the shoulder the one whom she has chosen; and in Australia the occasional periods of organized sexual licence are led up to by dancing.

Auto-intoxication is induced either intentionally or incidentally by dancing, the best known examples of this being the wild excesses of the bacchanals and of the shamans of Siberia, who use dancing as a means of becoming inspired by their tutelary spirit. Similar "possession" is induced by priests among savage peoples, and the power to do this is often a *sine qua non* of priesthood. In a war dance the condition produced is not so extreme, but is akin to this. The warriors work themselves into a frenzy of hatred, and they feel themselves exalted. Though many war dances may have a supposed magical effect on the enemy, this exaltation, this sense of heightened valour, is often one if not the only reason for their performance.

Nothing will survive in any human society unless it has a functional value. Within every individual in a community there is a conflict of desires. On the one hand there is a wish to be outstanding; on the other the longing for a sense of group fellowship. To both these desires dancing at once provides satisfaction. The dancer can display himself to the best advantage and can do so in harmony with others. On certain occasions one or other of these two aspects may be stressed, as, for instance, the individual aspect in dances of courtship, the group aspect in war or peace dances, but, to a greater or less extent, both aspects are always present. Therefore, because dancing is entirely satisfying emotionally, it survives in the savage and civilized world when beliefs in its magical or religious efficacy have passed away.

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(C. H. W.)

[1] E. Best, *The Maori, vol. II.*, pp. 102–103.

FROM PHOTOGRAPHS IN COLOUR POSED ESPECIALLY FOR THE ENCYCLOPÆDIA BRITANNICA

WESTERN INTERPRETATIONS OF FAR EASTERN DANCES

1. Ruth St. Denis in one of her interpretations of the Nautch dance of India

2. The same dancer in a pose similar to the ancient Chinese carvings representing Kwan Yin

HISTORY

The term "dancing" in its widest sense includes three things:—(1) the spontaneous activity of the muscles under the influence of some strong emotion, such as social joy or religious exultation; (2) definite combinations of graceful movements performed for the sake of the pleasure which the exercise affords to the dancer or to the spectator; (3) carefully trained movements which are meant by the dancer vividly to represent the actions and passions of other people. In the highest sense it seems to be for prose-gesture what song is for the instinctive exclamations of feeling. At a Mexican feast to the god Huitzilopochtli the noblemen and women danced tied together at the hands, and embracing one another, the arms being thrown over the neck. This resembles the dance variously known as the Greek Bracelet or Brawl, "Ορμος, or Bearsfeet; but all of them probably are to a certain extent symbolical of the relations between the sexes. In a very old Peruvian dance of ceremony before the Inca, several hundreds of men formed a chain, each taking hold of the hand of the man beyond his immediate neighbour, and the whole body moving forwards and backwards three steps at a time as they approached the throne.

The rude imitative dances of early civilization are of extreme interest. In the same way the dances of the Ostyak tribes (Northern Asia) imitate the habitual sports of the chase and the gambols of the wolf and the bear and other wild beasts, the dancing consisting mainly of sudden leaps and violent turns which exhaust the muscular powers of the whole body. The Kamchadales, too, in dancing, imitate bears, dogs and birds. The *Kru* dances of the Coast Negroes represent hunting scenes; and on the Congo, before the hunters start, they go through a dance imitating the habits of the gorilla and its movements when attacked. The Damara dance is a mimic representation of the movements of oxen and sheep, four men stooping with their heads in contact and uttering harsh cries. The canter of the baboon is the humorous part of the ceremony. The Bushmen dance in long irregular jumps, which they compare to the leaping of a herd of calves, and the Hottentots not only go on all-fours to counterfeit the baboon, but they have a dance in which the buzzing of a swarm of bees is represented. The Kennowits in Borneo introduce the mias and the deer for the same purpose. The Australians and Tasmanians in their dances called *corrobories* imitate the frog and the kangaroo (both leaping animals). The hunt of the emu is also performed, a number of men passing slowly round the fire and throwing their arrows about so as to imitate the movements of the animal's head while feeding. The Gonds are fond of dancing the bison hunt, one man with skin and horns taking the part of the animal. Closely allied to these are the mimic fights, almost universal among tribes to which war is one of the great interests of life. The Bravery dance of the Dahomans and the Hoolee of the Bhil tribe in the Vindhya Hills are illustrations. The latter seems to have been reduced to an amusement conducted by professionals who go from village to village,—the battle being engaged in by women with long poles on the one side, and men with short cudgels on the other. There is here an element of comedy, which also appears in the Fiji club-dance. This, although no doubt originally suggesttd by war, is enlivened by the presence of a clown covered with leaves and wearing a mask. The monotonous song accompanying the club-dance is by way of commentary or explanation. So, also, in Guatemala there is a public *baile* or dance, in which all the performers, wearing the skins and heads of beasts, go through a mock battle, which always ends in the victory of those wearing the deer's head. At the end the victors trace in the sand with a pole the figure of some animal; and this exhibition is supposed to have some historical reference. But nearly all savage tribes have a regular war-dance, in which they appear in fighting costume, handle their weapons, and go through the movements of challenge, conflict, pursuit or defeat. The women generally supply the stimulus of music. There is one very picturesque dance of the Natal Kafirs, which probably refers to the departure of the warriors for the battle. The women appeal plaintively to the men, who slowly withdraw, stamping on the ground and darting their short spears or *assegais* towards the sky. In Madagascar, when the men are absent on war, the women dance for a great part of the day, believing that this inspires their husbands with courage. In this, however, there may be some religious significance. These war-dances are totally distinct from the institution of military drill, which belongs to a later period, when social life has become less impulsive and more reflective. (The Greek καρπαία represented the surprise by robbers of a warrior ploughing a field. The gymnopaedic dances imitated the sterner sports of the palaestra) There can be little doubt that some of the characteristic movements of these primitive hunting and war-dances survive in the smooth and ceremonious dances of the present day. But the early mimetic dance was not confined to these two subjects; it embraced the other great events of savage life—the drama of courtship and marriage, the funeral dance, the consecration of labour, the celebration of harvest or vintage; sometimes, too, purely fictitious scenes of dramatic interest, while other dances degenerated into games. (The Greek Lenaea and Dionysia had a distinct reference to the seasons.) For instance, in Yucatán one man danced in a cowering attitude round a circle, while another followed, hurling at him *bohordos* or canes, which were adroitly caught on a small stick Again, in Tasmania, the dances of the women describe their "clamber for the opossum, diving for shell-fish, digging for roots, nursing children and quarrelling with husbands." Another dance, in which a woman by gesture taunts a chieftain with cowardice, gives him an opportunity of coming forward and recounting his courageous deeds in dance. The funeral dance of the Todas (another Indian hill-tribe) consists in walking backwards and forwards, without variation, to a howling tune of "ha! hoo!" The meaning of this is obscure, but it can scarcely be solely an outburst of grief. In Dahomey the blacksmiths, carpenters, hunters, braves and bards, with their various tools and instruments, join in a dramatic dance. We may add here a form of dance which is almost precisely equivalent to the spoken incantation. It is used by the professional devil-dancer of the wild Veddahs for the cure of diseases. An offering of eatables is put on a tripod of sticks, and the dancer, decorated with green leaves, goes into a paroxysm of dancing, in the midst of which he receives the required information. This, however, rather belongs to the subject of religious dances.

It is impossible here to enumerate either the names or the forms of the sacred dances which formed so prominent a part of the worship of antiquity. After the middle of the 18th century there were still traces of religious dancing in the cathedrals of Spain, Portugal and Roussillon—especially in the Mozarabic Mass of Toledo.

HISTORIC DANCES, 15TH–19TH CENTURY

France and Italy.—Italy, in the 15th century, saw the renaissance of dancing, and France may be said to have been the nursery of the modern art, though comparatively few modern dances are really French in origin. The national dances of other countries were brought to France. studied systematically, and made perfect there. An English or a Bohemian dance, practised only amongst peasants, would be taken to France, polished and perfected, and would at last find its way back to its own country, no more recognizable than a piece of elegant cloth when it returns from the printer to the place from which as "grey" material it was sent. The fact that the terminology of dancing is almost entirely French is a sufficient indication of the origin of the rules that govern it.

The earliest dances that bear any relation to the modern art are probably the *danses basses* and *danses hautes* of the 16th century. The *danse basse* was the dance of the court of Charles IX. and of good society, the steps being very grave and dignified, not to say solemn, and the accompaniment a psalm tune. The *danses hautes* or *baladines* had a skipping step, and were practised only by clowns and country people. More lively dances, such as the *Gaillarde* and *Volta,* were introduced into France from Italy by Catherine de' Medici, but even in these the interest was chiefly spectacular. Other dances of the same period were the *Branle* (afterwards corrupted to *Braule,* and known in England

as the Brawle)—a kind of generic dance which was capable of an almost infinite amount of variety. Thus there were imitative dances—*Branles mimés,* such as the *Branles des Ermites, Branles des flambeaux* and the *Branles des lavandières.* The *Branle* in its original form had steps like the *Allemande.*

Perhaps the most famous and stately dance of this period was the *Pavane* (of Spanish origin), which is very fully described in Tabouret's *Orchésographie,* the earliest work in which a dance is found minutely described. The *Pavane,* which was really more a procession than a dance, must have been a very gorgeous and noble sight, and it was perfectly suited to the dress of the period, the stiff brocades of the ladies and the swords and heavily-plumed .hats of the gentlemen being displayed in' its simple and dignified measures to great advantage.

In the *Pavane* and *Branle,* and in nearly all the dances of the 17th and 18th centuries, the practice of kissing formed a not unimportant part, and seems to have added greatly to the popularity of the pastime. Another extremely popular dance was the *Saraband,* which, however, died out after the 17th century. It was originally a Spanish dance, but enjoyed an enormous success for a time in France. Every dance at that time had its own tune or tunes, which were called by its own name, and of the *Saraband* the chevalier de Grammont wrote that "it either charmed or annoyed everyone, for all the guitarists of the court began to learn it, and God only knows the universal twanging that followed." Vauquelin des Yveteaux, in his 80th year, desired to die to the tune of the *Saraband,* "so that his soul might pass away sweetly."

The *Courante* was a court dance performed on tiptoe with slightly jumping steps and many bows and curtseys. The minuet and the waltz were both in some degree derived from it, and it had much in common with the famous *Seguidilla* of Spain. It was a favourite dance of Louis XIV., who was an adept in the art, and it was regarded in his time as of such importance that a nobleman's education could hardly have been said to be begun until he had mastered the *Courante.*

The dance which the French brought to the greatest perfection —which many, indeed, regard as the fine flower of art—was the *Minuet.* Its origin, as a rustic dance, is not less antique than that of the other dances from which the modern art has been evolved. It was originally a *branle* of Poitou, derived from the *Courante.* It came to Paris in 1650 and was first set to music by Lully. It was at first a gay and lively dance, but on being brought to court it soon lost its sportive character and became grave and dignified. It is mentioned by Beauchamps, the father of dancing-masters, who flourished in Louis XIV.'s reign, and also by Blondy, his pupil; but it was Pécour who really gave the minuet its popularity, and although it was improved and made perfect by Dauberval, Gardel, Marcel and Vestris, it was in Louis XV.'s reign that it saw its golden age. It was then a dance for two in moderate triple time, and was generally followed by the gavotte. Afterwards the minuet was considerably developed, and with the gavotte became chiefly a stage dance and a means of display; but it should be remembered that the minuets which are now danced on the stage are generally highly elaborated with a view to their spectacular effect, and have imported into them steps and figures which do not belong to the minuet at all, but are borrowed from all kinds of other dances. The original court minuet was a grave and simple dance, although it did not retain its simplicity for long. But when it became elaborated it was glorified and moulded into a perfect expression of an age in which deportment was most sedulously cultivated and most brilliantly polished. The "languishing eye and smiling mouth" had their due effect in the minuet; it was a school for chivalry, courtesy and ceremony; the hundred slow graceful movements and curtseys, the pauses which had to be filled by neatly-turned compliments, the beauty and bravery of attire—all were eloquent of graces and outward refinements which we cannot boast now. The fact that the measure of the minuet has become incorporated in the structure of the symphony shows how important was its place in the polite world.

The *Gavotte,* which was often danced as a pendant to the minuet, was also originally a peasant's dance, a *danse des Gavots,* and consisted chiefly of kissing and capering. It also became stiff and artificial, and in the later and more prudish half of the 18th century the ladies received bouquets instead of kisses in dancing the gavotte. It rapidly became a stage dance, and it has never been restored to the ballroom. Grétry attempted to revive it, but his arrangement never became popular.

Other dances which were naturalized in France were the *Écossaise,* popular in 1760; the *Cotillon,* fashionable under Charles X., derived from the peasant *branles* and danced by ladies in short skirts; the *Galop,* imported from Germany; the *Lancers,* invented by Laborde in 1836; the *Polka,* brought by a dancing-master from Prague in 1840; the *Schottische,* also Bohemian, first introduced in 1844; the *Bourre'e,* or French clog-dance; the *Quadrille,* known in the 18th century as the *Contre-danse;* and the Waltz, which was danced as a *volte* by Henry III. of France, but only became popular in the beginning of the 19th century. We shall return to the history of some of these later dances in discussing the dances at present in use.

Spain.—If France has been the nursery and school of the art of dancing, Spain is its true home. There it is part of the national life, the inevitable expression of the gay, contented, irresponsible, sunburnt nature of the people. The form of Spanish dances has hardly changed; some of them are of great antiquity, and may be traced back with hardly a break to the performances in ancient Rome of the famous dancing-girls of Cadiz. The connection is lost during the period of the Arab invasion, but the art was not neglected, and Jovellanos suggests that it took refuge in Asturias. At any rate, dances of the 10th and 12th centuries have been preserved uncorrupted. The earliest dances known were the *Turdion,* the *Gibidana,* the *Pié-de-gibao,* and (later) the *Madanta Orleans,* the *Alemana* and the *Pavana.* Under Philip IV. theatrical dancing was in high popularity, and ballets were organized with extraordinary magnificence of decoration and costume. They supplanted the national dances, and the *Zarabanda* and *Chacona* were practically extinct in the 18th century. It is at this period that the famous modern Spanish dances, the *Bolero, Seguidilla* and the *Fandango,* first appear.

Of these the *Fandango* is the most important. It is danced by two people in 6–8 time, beginning slowly and tenderly, the rhythm marked by the click of castanets, the snapping of the fingers and the stamping of feet, and the speed gradually increasing until a whirl of exaltation is reached. A feature of the *Fandango* and also of the *Seguidilla* is a sudden pause of the music towards the end of each measure, upon which the dancers stand rigid in the attitudes in which the stopping of the music found them, and only move again when the music is resumed. M. Vuillier, in his *History of Dancing,* gives the following description of the *Fandango:*—"*Like* an electric shock, the notes of the Fandango animate all hearts. Men and women, young and old, acknowledge the power of this air over the ears and soul of every Spaniard The young men spring to their places, rattling castanets or imitating their sound by snapping their fingers. The girls are remarkable for the willowy languor and lightness of their movements, the voluptuousness of their attitudes—beating the exactest time with tapping heels. Partners tease and entreat and pursue each other by turns. Suddenly the music stops, and each dancer shows his skill by remaining absolutely motionless, bounding again into the full life of the Fandango as the orchestra strikes up. The sound of the guitar, the violin, the rapid tic-tac of heels *(taconeos),* the crack of fingers and castanets, the supple swaying of the dancers, fill the spectator with ecstacy. The measure whirls along in a rapid triple time. Spangles glitter; the sharp clank of ivory and ebony castanets beats out the cadence of strange, throbbing, deepening notes—assonances unknown to music, but curiously characteristic, effective and intoxicating. Amidst the rustle of silks, smiles gleam over white teeth, dark eyes sparkle and droop and flash up again in flame. All is flutter and glitter, grace and animation—quivering, sonorous, passionate, seductive."

The *Bolero* is a comparatively modern dance, having been invented by Sebastian Cerezo, a celebrated dancer of the time of King Charles III. It is remarkable for the free use made in it of the arms, and is said to be derived from the ancient *Zarabanda,* a violent and licentious dance, which has entirely disappeared.

BY COURTESY OF JIRO HARADA

JAPANESE DANCES AS DANCED BY GEISHAS AND ACTORS

1. "Mochizuki," danced by geisha girls of Nagoya
2. Togashi in "Kwanjinchō," danced by an actor
3. "Dojoji," danced by geisha of Nagoya (Naga-uta)
4. Dance of the Lion with Butterflies, danced by actors

DANCE


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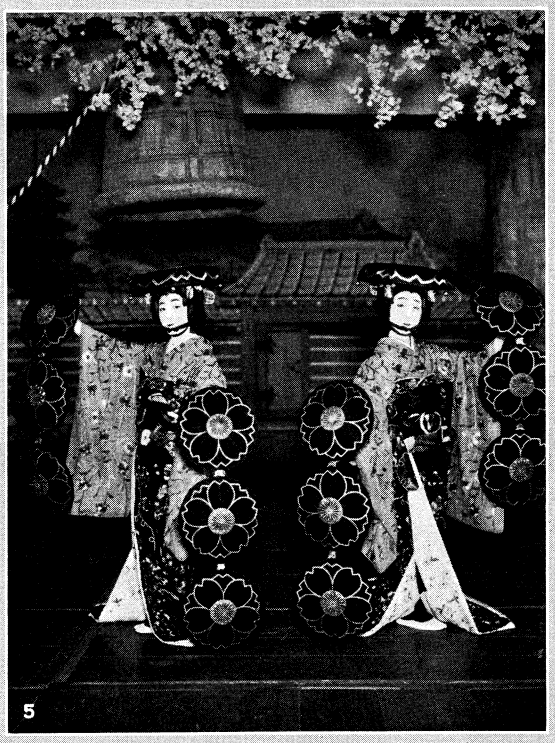
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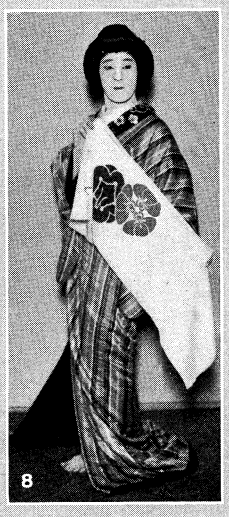
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BY COURTESY OF JIRO HARADA

CHARACTERISTIC DANCES OF JAPAN

1. Ghost of umbrella in "Hyaku Monogatarl," danced by an actor. 2. Dance called Manzai in "Noriai-bune," danced by actors. 3. "Kagami-jishi," danced by an actor. 4. "Fuji-musume" (wistaria-maid), danced by a girl dancer. 5. "Dojoji," a favourite dance, named after the monastery where it originated. 6. Fox in "Tadanobu," danced by a geisha of Nagoya. 7. "Dojoji," danced by a geisha of Nagoya. 8. Dancing with a ***tenugui*** (scarf) in "Kisen." 9 "Dojoji," by a girl dancer. 10. "Sagi-musume" (heron-maid) danced by a geisha of Nagoya

and with which the later Saraband has practically nothing in common. The step of the *Bolero* is low and gliding but well marked. It is danced by one or more couples. The *Seguidilla* is hardly less ancient than the *Fandango*, which it resembles. Every province in Spain has its own *Seguidilla*, and the dance is accompanied by *coplas*, or verses, which are sung either to traditional melodies or to the tunes of local composers; indeed, the national music of Spain consists largely of these coplas.

The *Jota* is the national dance of Aragon, a lively and splendid, but withal dignified and reticent, dance derived from the 16th-century *Passacaille*. It is still used as a religious dance. The *Cachuca* is a light and graceful dance in triple time. It is performed by a single dancer of either sex. The head and shoulders play an important part in the movements of this dance. Other provincial dances now in existence are the *Jaleo de Jerez*, a whirling measure performed by gipsies, the *Palotéa*, the *Polo*, the *Gallegada*, the *Muyneria*, the *Habas Verdes*, the *Zapateado*, the *Zorongo*, the *Vito*, the *Tirano* and the *Tripola Trapola*. Most of these dances are named either after the places where they are danced or after the composers who have invented tunes for them. Many of them are but slight variations from the *Fandango* and *Seguidilla*.

Great Britain. — The history of court dancing in Great Britain is practically the same as that of France, and need not occupy much of our attention here. But there are strictly national dances still in existence which are quite peculiar to the country, and may be traced back to the dances and games of the Saxon gleemen. The Egg dance and the *Carole* were both Saxon dances, the *Carole* being a Yule-tide festivity, of which the present-day Christmas carol is a remnant.

The oldest dances which remain unchanged in England are the *Morris* dances, which were introduced in the time of Edward III. (*See* MORRIS DANCE.)

Dancing practically disappeared during the Puritan *régime*, but with the Restoration it again became popular. It underwent no considerable developments, however, until the reign of Queen Anne, when the glories of Bath were revived in the beginning of the 18th century, and Beau Nash drew up his famous codes of rules for the regulation of dress and manners, and founded the balls in which the polite French dances completely eclipsed the simpler English ones.

The only true national dances of Scotland are reels, strathspeys and flings, while in Ireland there is but one dance — the jig, which is there, however, found in many varieties and expressive of many shades of emotion, from the maddest gaiety to the wildest lament. Curiously enough, although the Welsh dance often, they have no strictly national dances.

Popular Dances of Universal Importance. — The *Waltz* is no doubt the most popular of the 19th century dances. Its origin is a much-debated subject, the French, Italians and Bavarians each claiming for their respective countries the honour of having given birth to it. As a matter of fact the waltz, as it is now danced, comes from Germany; but it is equally true that its real origin is French, since it is a development of the *Volte*, which in its turn came from the *Lavolta* of Provence, one of the most ancient of French dances. The *Lavolta* was fashionable in the 16th century and was the delight of the Valois court. The *Volte* danced by Henry III. was really a *Valse à deux pas;* and Castil-Blaze says that "the waltz which we took again from the Germans in 1795 had been a French dance for four hundred years." The change, it is true, came upon it during its visit to Germany, hence the theory of its German origin. The first German waltz tune is dated 1770 — "Ach! du lieber Augustin." It was first danced at the Paris opera in 1793, in Gardel's ballet *La Dansomanie*. It was introduced to English ballrooms in 1812, when it roused a storm of ridicule and opposition, but it became popular when danced at Almack's by the emperor Alexander in 1816. The waltz *à trois temps* has a sliding step in which the movements of the knees play an important part. The *tempo* is moderate, so as to allow three distinct movements on the three beats of each bar; and the waltz is written in 3–4 time and in eight-bar sentences. Walking up and down the room and occasionally breaking into the step of the dance is not true waltzing, and the habit of pushing one's partner backwards along the room is an entirely English one. But the dancer must be able to waltz equally well in all directions, pivoting and crossing the feet when necessary in the reverse turn. It need hardly be said that the feet should never leave the floor in the true waltz. Gungl, Waldteufel and the Strauss family may be said to have moulded the modern waltz to its present form by their rhythmical and agreeable compositions. There are variations which include hopping and lurching steps; these are degradations, and foreign to the spirit of the true waltz.

The *Quadrille* is of some antiquity, and a dance of this kind was first brought to England from Normandy by William the Conqueror, and was common all over Europe in the 16th and 17th centuries. The term quadrille means a kind of card game, and the dance is supposed to be in some way connected with the game. A species of quadrille appeared in a French ballet in 1745, and since that time the dance has gone by that name. It then consisted of very elaborate steps, which in England have been simplified until the degenerate practice has become common of walking through the dance. The quadrille, properly danced, has many of the graces of the minuet. It is often stated that the square dance is of modern French origin. This is incorrect, and probably arises from a mistaken identification of the terms quadrille and square dance. "Dull Sir John" and "Faine I would," were square dances popular in England 300 years ago.

An account of the country-dance, with the names of some of the old dance-tunes, has been given above. The word is not, as has been supposed, an adaptation of the French *contre-danse*, neither is the dance itself French in origin. According to the *New English Dictionary*, *contre-danse* is a corruption of "country-dance," possibly due to a peculiar feature of many of such dances, like Sir Roger de Coverley, where the partners are drawn up in lines opposite to each other. The English "country-dances" were introduced into France in the early part of the 18th century and became popular; later French modifications were brought back to England under the French form of the name, and this, no doubt, caused the long-accepted but confused derivation.

The *Lancers* were invented by Laborde in Paris in 1836. They were brought over to England in 1850, and were made fashionable by Madame Sacré at her classes in Hanover Square Rooms.

The *Polka*, the chief of the Bohemian national dances, was adopted by society in 1835 at Prague. Josef Neruda had seen a peasant girl dancing and singing the polka, and had noted down the tune and the steps. From Prague it readily spread to Vienna, and was introduced to Paris by Cellarius, a dancing-master, who gave it at the Odéon in 1840. It took the public by storm, and spread like an infection through England and America. Everything was named after the polka, from public-houses to articles of dress. Mr. Punch exerted his wit on the subject weekly, and even *The Times* complained that its French correspondence was interrupted, since the polka had taken the place of politics in Paris. The true polka has three slightly jumping steps, danced on the first three beats of a four-quaver bar, the last beat of which is employed as a rest while the toe of the unemployed foot is drawn up against the heel of the other.

The *Galop* is strictly speaking a Hungarian dance, which became popular in Paris in 1830. But some kind of a dance corresponding to the galop was always indulged in after *Voltes* and *Contre-danses*, as a relief from their constrained measures.

The *Barn-dance* is no doubt of American origin, its height of popularity being toward the end of the 19th century. It was customary for the farmer who wished to build a new barn to call in his neighbours for a "working" and finish the job within a short time, after which a dance was "thrown." The dance is still very popular in certain rural sections, and does not necessarily confine itself to new or empty barns. The square dance, or some form of group dancing, is executed to the accompaniment of a two- or three-piece string band or the neighbouring fiddle.

The *Paul Jones* is one of the many "sets" that comprise an evening of barn-dancing. A number of couples are required for the performance as well as a "caller" who gives direction as to the action of each couple.

The *Washington Post* belongs to America.

The *Polka-Mazurka* is extremely popular in Vienna and Budapest, and is a favourite theme with Hungarian composers. The six movements of this dance occupy two bars of 3–4 time, and consist of a mazurka step joined to the polka. It is of Polish origin.

The *Polonaise* and *Mazurka* are both Polish dances, and are still fashionable in Russia and Poland. Every State ball in Russia is opened with the ceremonious Polonaise.

The *Schottische,* a kind of modified polka, was "created" by Markowski, who was the proprietor of a famous dancing academy in 1850. The *Highland Schottische* is a fling. The Fling and Reel are Celtic dances, and form the national dances of Scotland and Denmark. They are complicated measures of a studied and classical order, in which free use is made of the arms and of cries and stampings. The *Strathspey* is a slow and grandiose modification of the Reel.

Sir Roger de Coverley is the only one of the old English social dances which has survived to the present day, and it is frequently danced at the conclusion of the less formal sort of balls. It is a merry and lively game in which all the company take part, men and women facing each other in two long rows. The dancers are constantly changing places in such a way that if the dance is carried to its conclusion everyone will have danced with everyone else. The music was first printed in 1681, and is sometimes written in 2–4 time, sometimes in 6–8 time, and sometimes in 3–9 time.

The *Cotillon* is a modern development of the French dance of the same name referred to above. It is an extremely elaborate dance, in which a great many toys and accessories are employed; hundreds of figures may be contrived for it, in which presents, toys, lighted tapers, biscuits, air-balloons and hurdles are used.

Ballet. — *The* modern ballet (*q.v.*) would seem to have been first produced on a considerable scale in 1489 at Tortona, before Duke Galeazzo of Milan. It soon became a common amusement on great occasions at the European courts. The ordinary length was five acts, each containing several *entrées,* and each *entrée* containing several quadrilles.

BIBLIOGRAPHY.—For the old division of the *Ars Gymnastica* into *palaestrica* and *saltatoria,* and of the latter into *cubistzca, sphaeristica* and *orchestzca, see* the learned work of Hieronymus Mercurialis, *De arte Gymnastica* (Amsterdam, 1572). Cubistic was the art of throwing somersaults, and is described minutely by Tuccaro in his *Trois Dialogues* (Paris, 1599). Sphaeristic included several complex games at ball and tilting—the Greek κώρυκος, and the Roman *trigonalis* and *paganzca.* Orchestic, divided by Plutarch into *latio, figura* and *indicatio,* was really imitative dancing, the "silent poetry" of Simonides. The importance of the χειρονομία or hand-movement is indicated by Ovid:—"Si vox est, canta; si mollia brachia, salta." For further information as to modern dancing, *see* Rameaus *Le maître à danser* (1726); Querlon's *Le triomphe des grâces* (1774); Cahousac, La *danse ancienne et moderne* (1754); Vuillier, *Htstory* of *Dancing* (Eng. trans., 1897); Giraudet, *Traité de la danse* (1900).

(A. B. F. Y.)

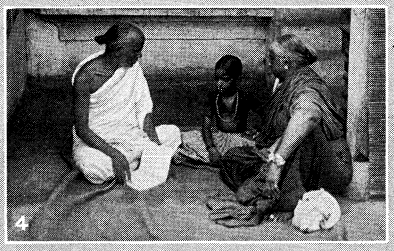
JAPAN

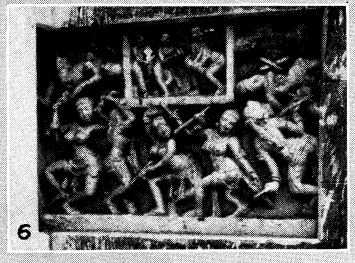
The dance in Japan has its origin in her mythical age. According to the 8th century *Kojiki,* when Amaterasu, the sun-goddess, retired in high dudgeon to a cavern, Ama-no-Uzumeno-mikoto danced at the cavern's mouth to lure her out. *Kagura,* the sacred dance of today, is traced back to this incident by the native literati. Records speak of the emperor Inkyō playing on a *wa-gon* (Japanese native *koto)* and the empress dancing at the imperial banquet given in 419 on the completion of their new palace building. In the Orient the dance is as old as history, and when some 7,000 Chinese families emigrated to Japan in 540 it is not to be doubted that they brought with them their cherished national custom. In 552 a Korean monarch sent a Buddhist mission to Japan and the dance formed a part of their religious ceremony. The old picturesque dance of China and Korea is still executed semi-annually, to the sound of flutes and waving of feathers in worship by the followers of Confucius. The dance became definitely established as a Japanese institution by Ashikaga Shogun Yoshimitsu's (1363–94) school for dancing, and the Shogun himself incorporated many historical themes of China into dramatic dances. With the invention of the *Nō* play by Kwanami Kiotsugu (1406) and its development by his equally famous son, Seami Motokiyo, the dance became closely associated with the national theatre. In the 16th century the fame of the beautiful Okuni popularized the dance among all classes of society. But the tradition begun by her was interrupted in 1643 when, for reasons of public morality, women were forbidden to appear upon the stage; male actors and the priests of Buddha continued the ancient custom of Korea and China. Western ballroom dances, such as waltzes and two-steps, were introduced to Japan in the last quarter of the 19th century and became a fashion for a time, but were soon dropped, and then revived again. (Y. K.)

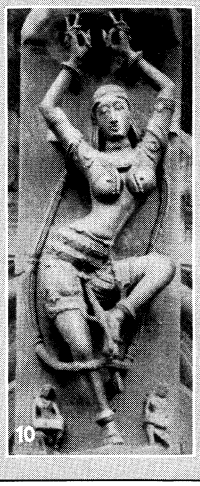
Visitors to Japan generally return deeply impressed with the beauty of cherry blossoms and the charming grace of the *geisha* girl dance. The dance is performed not only by the *geisha* and other dancing professionals, but is given in connection with the classical *Nō* drama, and it plays an important part in the old style of acting known as *kabuki* for, as an eminent actor of the old school has said, "an actor without ability to dance is like a wrestler without strength." Sacred dances called *kagura,* very simple in character, are given by maidens at some shrines, while Buddhist dances, such as *Nembutsu-odori,* may be seen in connection with some religious observances.

Speaking of the native dance of Japan, three terms are used: *mai, odori* and *furi* or *shosa,* all meaning dance, though technically differentiated. The first has been used to designate the older style of dancing which has been in vogue among the upper class and come to be performed by professionals. It is likened to the graceful movements of the crane at sunrise. The second, which does not appear in literature before the 15th century, has been applied to the dance that was born and has become a fashion among the common people. It means the spontaneous expression of joy with gesture of hands and feet common to all people. The third designates the dance woven into the acting on the stage. *Mai* may be said to designate a classical, *odori* a popular and *furi* a dramatic dance. However, the first may also be classified into two: classical and popular. The classical *mai* is preserved in the imperial court in connection with traditional observances, or in Shinto shrines as *kagura,* or in *Nō* drama, while the popular *mai* is practically the same as *odori* but called *mai* according to the custom peculiar to certain localities. It is generally maintained that in *ntai* the attitude is characterized by solemnity, the gesture by elegance and refinement, and the movement by an easy and natural flow, while in *odori* the dance is more natural and free in attitude and movement, and the gesture more active and subtle, with a greater freedom for variation, allowing even a comical or a rustic element to creep in. *Furi* is enlivened with dramatic quality. However, in many instances the distinction is hard, or even impossible, to draw. Moreover, the three terms may be said to represent different essential elements in the dance, rather than its kinds.

The dance of Japan may generally be divided into two classes: the popular and the special or professional. The former is for the pleasure of the mass of people who may acquire the art in several days or weeks, and it includes such dances as *Ise-odori* (time-honoured dance in the province of Ise), *Tanabata-odori* (for the festival of the star Vega) and others connected with popular festivals, as well as such religious dances as *Bon-odori* (held in summer in memory of the dead), *Nenzbutsu odori* (with Buddhist prayers), etc. The professional dances are acquired only by patient and laborious practice, requiring at least several years to master them. Some of these dances consist purely of graceful movements, while others are enlivened with dramatic elements. Those with dramatic elements try to narrate a story in rhythmic movements or to reveal feelings of joy, anger, sorrow, love, hatred, etc., either expressed or suggested in the songs or music played in accompaniment. The songs so used are of different styles, such as *naga-uta, tokiwazu* and *kiyomoto,* all rendered to the accompaniment of *samisen,* the three-stringed musical instrument, and some with drums and flutes in addition. The songs are descriptive of scenery; narrative of historical or traditional events; accounts of heroes; of love or madness; sometimes they deal with ghosts of men and women, or with the spirit of a lion or of a spider, etc., an effort being often made to transport the observer to the realm of dreams.







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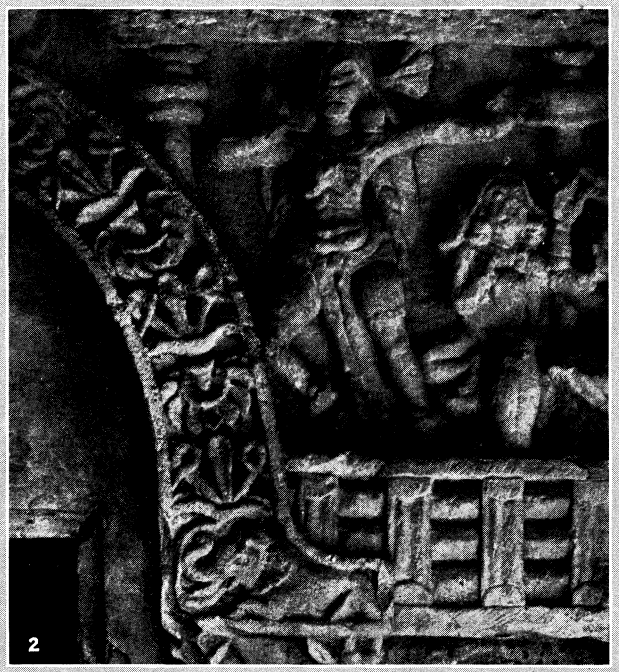
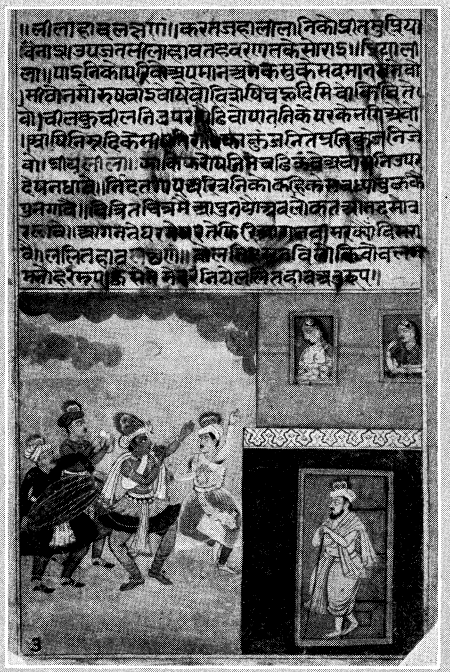
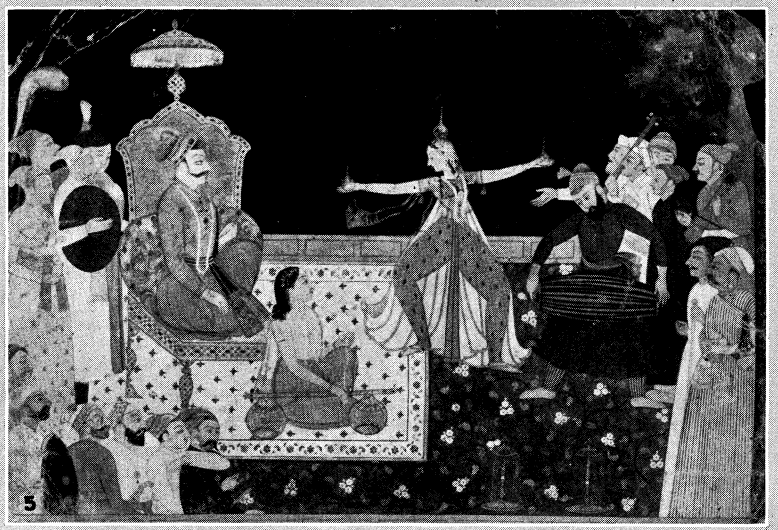
FOLK AND RELIGIOUS DANCES

1. Dancer of Northern India, wearing *peshwaz* and *dupatta*. The musicians are playing the *tabla* and *sarangi*. 2. Dancer of Southern India, wearing *sari* and *coli*. 3, 4. Dancing lesson, Tanjore, Madras. The girl pupil is usually taught practical exercises by a retired dancer; theory by a male Brahman. 5. Dance of Apsarases before a shrine, Barhut, 2nd century B.C. 6. Stave dance Mallesvara temple, Bezwada, Madras, 16th century. 7. Dance of Siva (Nataraja), Uttalur, 16th–17th century copper image. 8. Dance of Krsna (Krishna), 17th–18th century, Southern Indian copper. 9. Mughal (Mogul) dance from a Mughal painting, late 17th century. 10. Dancer, in a bracket figure, Palampur, Mysore, 12th–13th century. 11. Dancers and chorus in an 18th century Rajput painting







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RELIGIOUS AND COURT DANCES

1. One of a pair of dancers below a *dhamma-cakka* (wheel of the law), in a detail from an Amarāvatī relief, *c.* 200. Madras museum. The pose and lotus support are familiar in later Cambodian art
2. Dancer and part of chorus, in a *nātya-śāla*, a balcony relief in the verandah of the Rānī Gumphā (excavated monastery), at Udayagiri, Orissa, Eastern India, 150–100 B.C.
3. Pastoral dance, Krsna (Krishna) and herdsmen dancing before Rādhā. Miniature of mixed Mughal (Mogul) and Rajput style, illustrating the Priyā līlā, from a ms. of the Rasikpriyā of Keśava Dās, *c.* 1600, one of the oldest and most important Hindī works on love poetry. Metropolitan Museum of Art, New York
4. Dancing scene in a palace, relief from Amarāvatī, *c.* 200. British museum
5. Dancer before a prince, with chorus, an 18th century Pahārī Rajput painting

The dramatic dance was originally taught by actors themselves until about the beginning of the 18th century, when it became an independent profession. The pioneers of that profession in Tokyo were Denjiro Shigayama, who was originally an actor, Kwambei Fujima and Senzo Nishikawa, each the founder of his own school or style, followed by other masters who formulated styles of their own, each with a number of followers. The most influential styles of dancing in Tokyo are *Fujima-ryu, Hanayagi-ryu,* and *Wakayagi-ryu* (*ryu* meaning style or school). Those of Kyoto are *Inouye-ryu* and *Shinozaki-ryu;* those of Osaka are *Nishikawa-ryu, Yamamura-ryu* and *Umemoto-ryu,* while Nagoya is dominated by *Nishikawa-ryu.* Broadly speaking, the dances in vogue in Tokyo are those with a dramatic element, being bold and active, cheerful and witty in style, more fitting to be performed by men on the stage than in a room, while those of Nagoya, Kyoto and Osaka, which lay great stress upon the grace and charm of movement, are more appropriate to be seen in a room than on the stage, and performed by female rather than male dancers.

According to a rule, the dancer begins at a point one step behind the centre of the stage, and brings the dance to a close at the centre with a stamp of the foot. The first step is to be taken with an "active" effect and the last with a "passive" feeling. Generally the dancer, in the course of the performance, describes a shape of a folding fan, which symbolizes prosperity as it spreads out toward the end. In pose. the face or the head of the dancer is considered to stand for heaven, the shoulders for the earth, and the waist for the man, indicating the three most important points to be considered in the dancing, and suggesting the relation of the one towards the others in the order of the universe. However, all parts of the body are used to make the dance well balanced, graceful and effective. While limbs, chiefly arms and hands in an endless variety of graceful sweeps and powerful flourishes, are mainly relied upon for the rhythmic movement, the waist keeps the equilibrium. A fan or a *tenugui* (scarf) is often used in dancing, being manipulated to suggest all sorts of things as the occasion may require. To give a few examples in common practice: an open fan raised gradually in front signifies the rising sun; used in a drinking attitude it may represent a wine cup; a closed fan may be used to suggest a stick, a bow, an arrow, or a gun, etc.; a scarf may be doubled and thrust into the sash to indicate long and short swords worn by a *samurai;* when redoubled and held on the palm in a smoking attitude it may serve as a pipe; or it may be made to describe running water by holding one end of it and giving it a quick succession of jerks from one side to the other.

It has been the ideal of some great master dancers of Japan to give the dance dignity, refinement and charm by investing it with idealistic, rather than realistic, quality; to make it suggestive, rather than merely explanatory; to create an interesting design, rather than a conglomeration of decorations. The dance of Japan is unique in many respects, and rich in beauty and tradition as the cherry blossoms that adorn the country in spring. (See THEATRE, NŌ DRAMA; JAPANESE ARCHITECTURE; PANTOMIME; FAN.) (J. HAR.; Y. K.)

INDIA

The Dramatic Dance.—Dancing and the drama in India are inseparable. The same words *naṭa, naṭī,* actor, actress, also designate dancer, danseuse; and a theatre (*nāṭya-śālā,* ves'ma) is equally a dancing stage. The classic Indian theatre is a thing of the past, with perhaps some exceptions in the south, but its technique survives in the modern "nautch" (nhc). Dancing is of three sorts, according to the content, and two according to style. *Nāṭya* is dancing used in a drama (*nāṭaka*) as part of the plot (the word *nāṭayati,* "gesturing," or "acting as if," is a regular stage direction whenever a particular action or mood is to be portrayed); *nṛtya* is dancing that expounds a theme by means of explicit gestures; *nṛtta* is dancing to music, but without a definite theme, and includes folk (*deśī*) dancing. The first two are of the same character Beyond this, *tāṇḍava* is a masculine and vigorous style of dancing; *lāsya* a feminine and graceful style.

The dance in its higher forms (*nṛtya*), as distinguished from merely decorative, and from the folk-dance, is a sort of pantomime in which a story is told, or events or persons alluded to, by means of formal gestures (*aṅgikâbhinaya*) presented in a rhythmic sequence and accompanied by singing and instrumental music; it is a kind of visible poetry with a definite meaning. Treatises on dancing are essentially dictionaries of gesture defining certain positions and movements of the head, neck, eyes and, above all, the hands; the latter are particularly used to convey explicit meanings, the head and eyes to express emotions. A single "hand," for example, the "flag" (*patāka*) hand, in which the fingers are extended in contact as when giving a slap, may have twenty or more meanings, depending on the way in which it is moved or the position in which it is held, and on the context of preceding and following "hands." In this kind of dancing the movement of the lower limbs is restricted to a quite subordinate rhythmic accompaniment; the dancer may indeed be seated.

The dance is accompanied by singing (by the dancer or by a chorus) and by instruments (usually in the north a *sāraṅgī* and drums, in the south a tambura and drums). The whole course of the dance may be summarized as follows: "The song should be sustained in the throat; its meaning must be shown by the hands; the mood must be shown by the glances; rhythm is marked by the feet. For wherever the hand moves, there the glances follow; where the glances go, the mind follows; where the mind goes, the mood follows; where the mood goes, there is the flavour." (Coomaraswamy and Duggirala, Mirror of Gesture.)

Dance Songs.—The songs of bayaderes are the lauds and songs of devotion of classical poets; the theme of their dances, the deeds of Kṛṣṇa, and the interplay of hero and heroine with their esoteric meaning. All conditions in India are penetrated and illuminated by a devotional culture. Three examples of songs, sung by the dancer while dancing and forming the theme of the dance, may be quoted: the first from northern India (Mathura), the second from the south (*Tanjore*), the third with an antiquity of a millennium and a half:

THE LONELY WIPE

Left all alone, my darling gone to another land, how
can I pass the days and nights?
Left all alone, wringing both her hands, left all alone
The rainy season has begun, the lightning flashes, the
night is dark, left all alone,
Senseless is my darling, my bed lies empty, left all
alone!

It should be explained that it is usual to abandon warlike operations during the rainy season; hence, if a man has not at that time returned, the suffering of the woman left at home is intensified by every reminder of the time when he should have been expected. In the actual dance, which is one of those that can suitably be performed seated, not only is the emotional experience clearly expressed, but the rain, the lightning and the dark night can all be represented.

The words of a Tanjore song are descriptive of Viṣṇu:

Is he the great being who rides on Garuda?
Is he the great being who sleeps on a snake?
Is he the great being who lifted Mt. Govardhana
upon his little finger?
Is he the great being who assumed the form of
the Fish Avatār?

The avatars of Viṣṇu are then given successively.

The words of Mālavikā's dance in Kālidāsa's classical Sanskrit play, the *Mālavikāgnimitra* (Act ii.) are as follow:

My beloved is hard to obtain, be thou without hope with respect
to him, O my heart!
But lo, I feel a throbbing in the outer corner of my left eye[1];
How then is this man, seen only after a long time, to he won?
My Lord, reflect that I am devoted to thee with ardent longing!

The stage direction, *Iti yathārasam abhinayati,* is "She gestures in accordance with the flavour (or sentiment)."

Like Indian music, the dance form begins and ends, from a Western point of view, unexpectedly: there is no emotional crisis, no excitement. Above all, it is not an exposition of the dancer's

[1]A good omen.

personality. Aesthetic experience, from the Indian point of view, is the work of the spectator; all that the artist can do is to provide the conditions. The dance is in no way strange or exotic to the Indian audience; its continuous rhythm, which can be more nearly paralleled in Western art by the music of Bach than by that of Beethoven, leads the spectator not away from himself, but far into himself. It is just because the visible spectacle is not insistent, not something to be curiously observed, but something that penetrates beyond the threshold of consciousness to the inner world of each beholder, that it can be watched for many hours without fatigue. Circumstantially, of course, the dance is more varied than at first it seems to be; for example, not only do the themes of successive dances change, but with every hour of the night the modes of the accompanying music must change, in accordance with a well-understood convention. It is not this variation, however, that explains the lack of monotony; that is due to a quality inherent in the art itself, whereby the spectator loses consciousness of the passage of time. It will be understood that this is not an art which can be transported to a foreign land; and perhaps the only opportunity that Europeans in Europe have ever had to witness oriental dancing was when King Sisowath brought his Cambodian dancers to Marseille and Paris.

Aesthetic Experience. — Mention has been made above of flavour in Indian aesthetics. Flavour (rasa) is that emotional quality which distinguishes a work of art from a mere statement, and aesthetic emotion from the emotions experienced in daily life. To the Indian, the dance, like any other art, has a spiritual significance independent of its theme or charm, for "by clearly expressing the flavour, and enabling men to taste thereof, it gives them the wisdom of Brahma, whereby they may understand how every business is unstable; from which indifference to such business, and therefrom, arise the highest virtues of peace and patience, and thence again may be won the bliss of Brahma."

The so-called oriental dancing of the European stage is in almost all respects unlike the dancing of the East where, for example, the dancer is always more, and not less, fully clothed than are other women in daily life, and where, if there be in the dance some erotic allusion, this not only has a definite significance, but is made in such a way as entirely to escape the notice of a western audience. The movements of the so-called oriental dancers of the West are indeed sinuous; but the fluidity of eastern movement is something far more than this. It is not even serpentine, but more like the wreathing of smoke. Nothing in India corresponds to the ball-room dancing of Europe and America; the mixed dancing of this kind is shocking to Indian ideas of propriety.

Education. — Dancers (female) are to a certain extent trained (Plate I., figs. 3, 4) by performers of their own caste and sex, but more especially by male dancing-masters, Brahmans, who are familiar with the literature as well as the practice of the art. Gaṇadasa speaks of the art as "a pleasing sacrificial feast to the eyes of the gods . . . and the one chief amusement of human beings." He exhibits his pupil Mālavikā before the king, queen and certain courtiers. Her performance is adjudged perfect in the following terms: "All was blameless, and in accordance with the rules of art; for the meaning was completely expressed by her [upper] limbs, which were full of language, while the movement of her feet was in perfect time, and she represented the moods to perfection. . . . In the successive developments of the acting, emotion kept banishing emotion from its place; it was a vivid picture of a series of passions" (*Mālavikāgnimitra,* Act. ii.).

An account of the education of a dancer is found in the Tamil *Silappadigāram,* ch. iii. She is initiated in her fifth year by means of the *taṇḍiyampiḍipittu* ceremony. Here a horizontal rod, wound about with flowers and a new cloth, is held by two dancers. The new pupil, bringing offerings of coconut, betel leaves, etc., and standing on grains of rice, symbolizing plenty, touches the rod with folded hands, repeating verses chanted by the instructor in honour of Ganapati and Jayanta. At the same time the instructor holds the pupil's feet and moves them according to the steps of the dances, and anklets with bells are placed on the ankles. This is a life dedication to the calling of a dancer. Instruction is begun in her seventh year, and must last at least five years. The theoretical part is usually given by a Brahman teacher, the practical exercises by an elderly and retired danseuse. In her twelfth year the pupil may appear in public and the teacher receives a reward.

Domingo Paes, writing about 1520, describes a room in the Vijayanagar palace in which the royal dancers practised and performances were given. On one side was "a painted recess where the women cling on with their hands in order better to stretch and loosen their bodies and legs." Presumably there was a horizontal rod against the wall, like that used by modern ballet-dancers for practice. At the other end of the room was the place occupied by the king during a performance, and in the middle of the wall was a golden image of a woman, or rather girl of 12 years, with her arms in the position taken at the end of a dance.

Generally speaking, the costume of a dancer does not differ markedly from that of local fashion, except by its greater richness. One part of it, the bells, however, is special and essential: a string of these, a hundred or two hundred in number, is bound round the ankles at the time of dancing, and the sound of these bells, as the dancer moves her feet in time, forms part of the music. When the dancer ties them on before dancing, she will invariably touch them to her eyes and forehead and murmur a brief prayer, and those who are learned in the lore of dancing say that "that dancing is vulgar and inauspicious which the actress does not begin with prayer."

Like other vocations in India, that of music, dancing and acting is in the main an hereditary profession. There have always been and still are some Brahmans and others of high caste who are expert both in the theory and practice of music, but the profession as practised by members of special castes has always had a low social status. At the present day the "Anti-Nautch movement" represents an endeavour to boycott the professional dances on puritanical grounds (with reference to the morals of the dancers, not to the character of the dance). It is desired to banish the danseuse alike from private and public entertainments and from all connection with temple service.

HISTORY OF THE DANCE IN INDIA

Vedic Dances. — Ritualistic dances are mentioned in the Vedas. Thus, in the Mahāvrata ceremony, women celebrate to the sound of the lute the patrons of the ceremony; maidens dance round the fire with water-pitchers while the Stotra is being performed. They pour water on the fire, an act of sympathetic magic intended to produce rain, and the song shows that they desire richness in milk, as well as water for the cows. At the close of the Horse Sacrifice also girls dance round the Mārjālīya fire with water-pots on their heads, beating the ground with their feet and singing "This is honey." They are said to endow the sacrificers with might. Again, four or eight women dance at the house of the bride, at a wedding.

The word iyati in the Black *Yajur* Veda refers to the accompaniment of recitation by pantomimic gesture: the Nata *Sūtras* mentioned by Pāṇini must have been handbooks of gesture, analogous to the later works on *abhinaya.*

Dancing as a Court Function. — In the Buddhist and Epic periods, dancing is well known as a normal court function and as a means of paying honour to a king or distinguished guest. Thus the festival of the gods takes place in Indra's city; he is host, and the other gods come and take their seats in due order as spectators of the dance of the Gandharvas and Apsarases. The gods themselves may sing and dance in honour of a human saint, but the dancers and musicians proper are the Gandharvas and Apsarases. The latter are beautiful girls, often employed by the gods to seduce the great saints from their meditations, for which there is a parallel in the Buddha legend in the attempted seduction of Gautama by the three daughters of Māra, who dance before him. More often the Apsarases are simply the dancers in heaven, by whom the gods are entertained and honoured. Equally characteristic was the keeping of troupes of dancers at royal courts on earth. Whatever the social status of professional dancers may always have been, and despite the fact that the art, like others, is an

almost purely professional vocation, it is certain that dancing in the Gupta and mediaeval periods was also an aristocratic accomplishment, affording in this respect a parallel to the state of painting at the same time.

Dancing as an Accomplishment.—Dancing and music as a royal accomplishment may be illustrated by the following examples: In the *Divyāvadāna* (Cowell and Neill, p. 544 et seq.) King Rudrāyaṇa plays the lute (*viṇā*) while his wife Candrāvatī dances; the Gupta emperor, Samudragupta, had coins struck in which he is represented as seated and playing on the lyre or lute, while an inscription of the same great monarch at Allahabad records his skill in music. Kālidāsa represents King Agnivarman as competing with actors in their art. In Devendra's *Uttarādhyayana-ṭikā* (Meyer, *Hindu* Tales, p. 105) King Udāyana plays on the lute while his wife dances, but drops the plectrum of the lute, at which the queen is angered and asks "Why have you spoilt the dance?" In the *Mahāvaṁsa,* ch. lxiii. v. 82, 83, Parākrama Bāhu I. (of Ceylon) is said to have built a theatre beside his palace "that so he might listen to the . . . singers, and witness the delightful dance," while his queen Rūpavatī, who was young and beautiful, and an embodiment of all the traditional virtues of a Hindu wife "was skilled in dancing and was richly endowed with a mind as keen as the point of a blade of grass." These instances will suffice to show that the modern prejudice against dancing as an art to be studied by persons of honourable social status has no foundation in classic tradition.

Dancing as a Religious Office.—Still more interesting is the ritual service of dancing in temples. The proper occasions of dancing are festivals, celebrations, processions of men or gods, marriages, reunion of friends, first occupation of towns or houses, the birth of children and similar auspicious events. The dance is essentially an honour paid to the chief guest, and particularly to kings. Now the daily ritual or service performed at the shrine of a deity is essentially the same as the daily service of a king, and it is therefore only natural that dancing before the shrine should form a part of the regular morning and evening offices. At wealthy shrines a considerable number of Devadisis ("women servants of the deity") are permanently attached to the temple, both to perform this office and to take part in the dramas which are presented in the temple on certain holidays. This practice has survived in southern India to the present day, but we have earlier records of it on a more lavish scale (N. M. Penzer, The Ocean of Story). Inscriptions of Rājarāja and other of the Coḷa kings (in the Tanjore district, at the beginning of the 11th century) refer to theatres and the establishment of large numbers of dancers in connection with temples, and for this purpose we find that private as well as royal endowments were made. Thus the assembly or town council of Sāttanūr gave lands for the maintenance of Sanskrit plays; Rājarāja brought from other temples and settled at Tanjore as many as 400 dancing girls; Kulōttunga III. appointed an additional dancing-master in the temple who had to dance with gestures. The entertainment of the god enshrined is modelled upon that of a god in his heaven, and that of a king on earth.

DANCES OF THE GODS

The Veda knows of gods who dance; thus, in Rigveda x., 72, we have a creation hymn in which the gods, dancing apparently in a ring, set up a rhythmic flux in the primeval waters, and this magic dance sets all nature in motion:

> When there, O gods, ye stood in the primeval sea, holding each the other by the hand, then rose from you as dancers (*nṛṭyatām* iva) clouds of dust.

Indra is also said to appear as an aged dancer, as a presage of victory in battle; Uṣas, the Dawn, is called a dancer adorning herself. But none of these conceptions of a dancing god or gods seems to have had the importance later attained in the case of Siva, who as the divine dancer par excellence is known as Naṭarāja.

Dance of Śiva.—We find an invocation (commencement of the Mirror of Gesture) addressed to Śiva, the great patron of the drama and an actor whose gesture is the world process, whose speech is the sum of all languages and whose ornaments are the moon and stars. His dances are *tāṇḍava* dances, energetic and virile. The most significant is the *nadānta,* represented in the well-known south Indian metal images of Naṭarāja (Plate I., fig. 7). The significance of this dance is often alluded to in the mediaeval Śaiva literature: "Our Lord is the dancer, who, like the heat latent in firewood, diffuses his power in mind and matter, and makes them dance in their turn." More specifically, the dance represents the deity's five activities (*Pañcakṛtya*), viz., the world process of creation or evolution, maintenance, and destruction or involution; the embodiment of souls and their release from the cycle. The drum in the upper right hand stands for creative sound, the flame in the upper left for the fire of destruction or change. It should be understood that in Indian mythology the cosmic process is conceived as a succession of vast cycles of manifestation and non-manifestation, or creation and destruction; and also that the phenomenal world at all times is one of perpetual change, involving perpetual creation and destruction. The dance is the entire process in all its complexity; and it is only rightly apprehended when it is realized as taking place within the worshipper's own consciousness. Śiva is also called Sudalaiyiidi, Dancer of the Burning Ground (cemetery), and the heart of the lover of god, made bare of all else, is this bare field prepared for him. The same idea is met with in connection with the goddess in the form of Kali:

> I have made a burning-ground of my heart,
> That Thou, Dark One, haunter of the burning-ground
> Mayest dance the eternal dance therein.

Siva also performs an evening dance on Mt. Kailāsa, before the assembled gods and the goddess, and paintings of the subject are known. The elephant-headed deity, Gaṇeśa, son of Siva, is also spoken of as taking part in this evening dance, and is represented in sculpture as dancing. It is probable that most of the dances referred to above belong to the non-Aryan and ancient Dravidian elements in the personality of Śiva-Rudra. The *tāṇḍava* in particular, and the dance of Kālī, must have been originally orgiastic dances, later interpreted in a philosophical and mystical sense. The principal "primitive deity" in Ceylon, Gale Yakā, the God of the Rock, is worshipped by an annual dance on the summit of the rocks sacred to him, with which may be compared the ritual dances of south Indian hill-men in honour of Murugan.

While every Śaiva temple in southern India has a copy of the metal image of Śiva as Naṭarāja kept in a special Hall of Audience (*sabhā-maṇḍapa*) at Cidambaram, he is worshipped in this form as the principal deity; here in the Golden Hall (*kanaka-sabhā*) is the premier Naṭarāja image of the south. The western and eastern gopurams of this temple, dating from the 13th century, contain sculptured panels with accompanying text, illustrating no less than 93 of the 108 dancing poses described in the Bharatiya *Nāṭya-śāstra.*

Dances of Other Deities.—The elephant-headed deity, Gaṇapati, son of Siva, is a patron of the stage, and himself often dances. In Buddhist art numerous feminine divinities, corresponding in a general way to Kālī of the Hindu pantheon, are represented as dancing. Dances of victory are attributed in the Silappadigāram to Subrahmaṇya, the god of war. According to the commentator, Adiyārkunallār, Subrahmanya, having slain the demon Sūrapadmāsura, danced his war-dance of triumph on the heaving wave-platform of the ocean-stage, to the accompaniment of the rattle of his drum, and subsequently danced in derision of the flying demons the *kuḍaikūttu,* or umbrella dance. This dance is still sometimes performed during temple processions, when the god's umbrella-bearer cuts some capers with his unwieldy parasol borne before the deity. Other familiar dances of a deity are those of Kṛṣṇa, the cowherd incarnation of Viṣṇu. One of these is the pot-dance (*kuḍakūttu*), originally a pastoral folk-dance, but used by Kṛṣṇa as a dance of victory after the defeat of Bāṇāsura. Another dance of victory took place after the poisonous dragon Kāliya finally had been overcome. Kṛṣṇa is again often represented dancing a childish dance with a pat of butter, of which he was very fond. But the most significant of his dances is the

rāsa-maṇḍala, the circle of passion, a round dance in which the milkmaids took part on moonlit nights beside the Jamna.

FOLK DANCES

Folk dances (*deśī, i.e.,* "countrified") still are and no doubt have always been found all over India; among agriculturists and in primitive tribes everything is celebrated and solemnized with the dance. It should be observed that, as Col. Hodson has remarked, primitive culture is the matrix of the higher; thus the folk dances have not only an interest of their own, but also they provide the material from which the dances of the aristocracy and of the higher ritual are derived. Indeed, there are many folk dances which make their appearance in the most artistically sophisticated spheres as *dances de divertissement.* Before referring to these, however, we shall discuss the dances of the people in their original environment.

'There are, for example, courtship dances among the Santals. On full moon nights the drum is sounded and the girls assemble under a big banyan tree, their dresses decorated with flowers in spring. with feathers in winter. Meanwhile the young men with a banner and musical instruments gather in the rice-fields beyond. The girls do not seem to see them, but are chattering together and completing their toilet. Then the banner and drum come forward; the young men approach the girls, who stand in a row, linked in pairs, arm in arm. The girls sway to and fro with the music, bending and rising; they advance and retire, but never actually mix with the young men. It is only after the dancing that young men and women have any opportunity to meet and court. The Santals have also their decorative *dances de divertissement;* for example, "the gathering of indigo," and "the quarrelling of co-wives."

In Bengal there is a women's ritual dance, never seen by men, the drummer remaining behind a curtain. This takes place during the Indra-pūjā festival on full moon nights. The women dance and sing erotic songs and in the morning they go down to the river and bathe.

A kind of dancing especially characteristic of southern India and Ceylon is the so-called devil dance (*Yakkun neṭuma*). This is a violent male dance, thus of *tāṇḍava* character. Used primarily as a means of exorcism, it is performed in cases of sickness. The possessing yakkas, regarded as demons causing disease, are first invited by beat of drum to attend the performance; afterwards, having been thus entertained, they are asked to take their departure.

The Nongkrem dance, one of the greatest festivals in the Khasi hills, is an essential part of the goat sacrifice performed by the Siem of Nongkrem: "the sacrifice is followed by twenty-two men armed with swords and cowries (fly-flaps). Having danced before the altar, the party returns to the house of the Siem priestess and executes another dance in the great courtyard. . . . Then follows a great dance of girls and men in front of her house . . . then there is the dance of the men. . . . After gyrating for some time two men at a time rapidly approach one another and clash their swords together in mock combat. . . . Dancing forms part of the ceremony of placing the ashes in the sepulchre of the clan." With the last feature may be compared the honouring of the body of the Buddha before the cremation, with song, dance and music, as mentioned in the *Mahāparinibbāṇa Sutta.*

Primitive dances are often symbolical enactments of events which the people desire to be successfully accomplished. "The Bhils danced at their festivals and before battles . . . The object was to obtain success in battle by going through an imitation of a successful battle beforehand. . . The Sola dance of Gonds and Baigas in which they perform the figure of the grand chain of the lancers, only that they strike their sticks together instead of clasping hands as they pass, was probably once an imitation of a combat. It is still sometimes ddnced before their communal and hunting parties" Among the Angami Nagas, "Dancing. singing . . . go hand in hand with ceremonial dress . . . the songs sung include both particular songs traditionally associated with the occasion, and sometimes in archaic language not fully understood except by those skilled in them" or a highly developed sign language (Col. Hodson, *Primitive Culture of India*).

It is by no means unusual to meet with the folk dances in the environment of the higher culture. The Sangita Ratnākara, an authoritative work on music and dramatics, enumerates 10 varieties. The Tamil Silappadigāram enumerates 14 dances of which the majority are for use at the Indra Pūjā festival, and of these several, such as Koṭṭavai's dance with a rice measure, are of folk character. We also meet with these folk dances on the classical stage; as in the *Karpūramañjarī* of *Rājaśekhara* we have a circular dance performed by girls, another in which the dancers face each other in two rows, and also the stave dance (*daṇḍa rāsa*) referred to above. This *danda rdsa,* in which the dancers hold short staves in each hand, striking them against those of the neighbouring dancer alternately to right and left, is also frequently depicted in decorative temple sculpture (fig. 6). The *rāsa-maṇḍala* and other dances of Kṛṣṇa with the milkmaids of Bṛndāban are of folk character, being constantly represented in paintings of the Rājput school, and are typically circular dances in which the figure of Kṛṣṇa is multiplied. Not infrequently Kṛṣṇa and Rādhā occupy the centre of the field, whirling round with feet together and leaning .apart with hands clasped at full arm's length.

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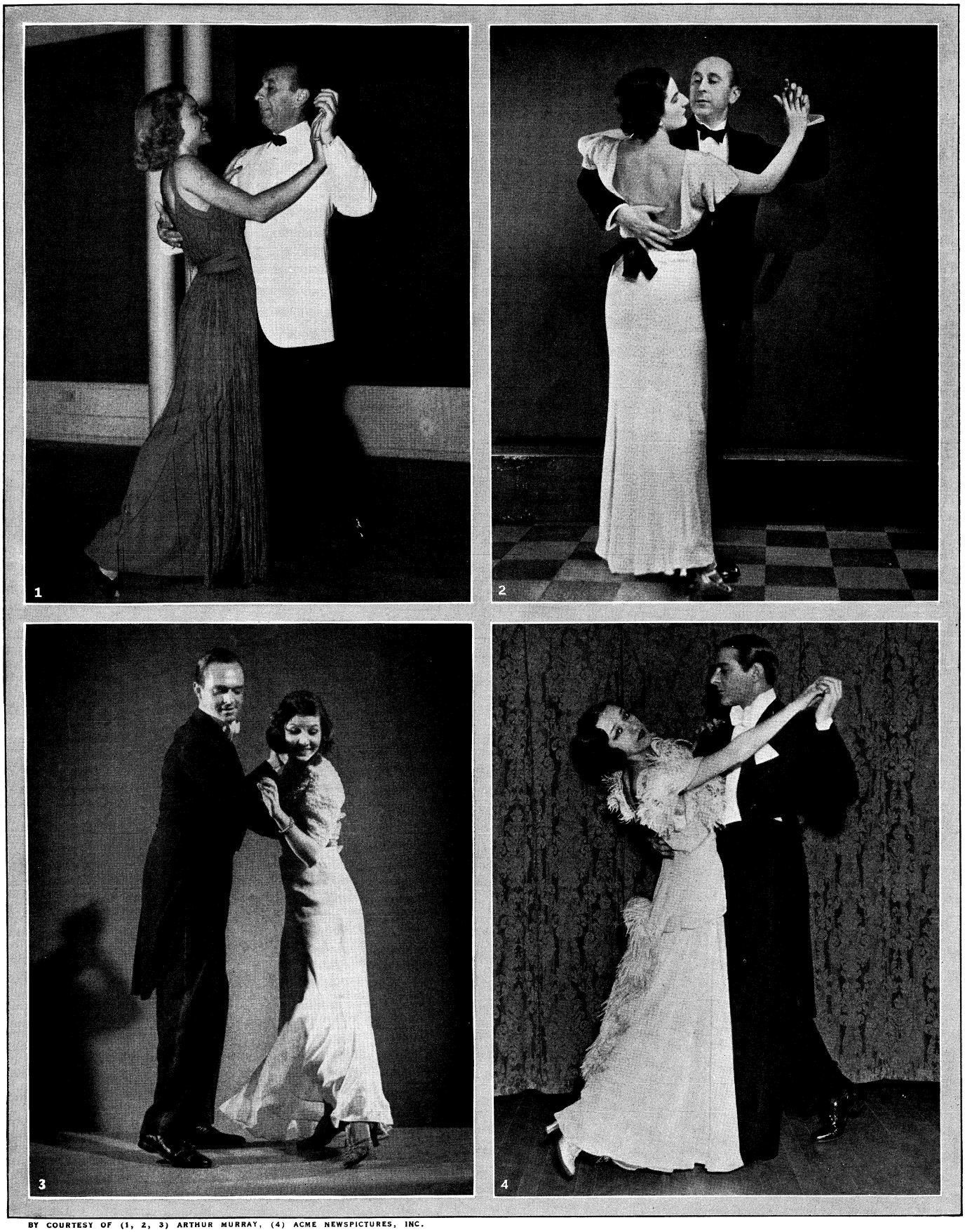
MODERN DANCING

Until 1912, modern dancing was a decadent phase of 18th and early 19th century forms. In that year began a new era of popular dancing, in which 20th century industrialized society finally broke away from the courtly steps which had expressed the emotions and social attitudes of another civilization and found new steps to fit a new cultural situation. America led the way in this renaissance. Until the turn of the century, dancing in the United States was a slavish imitation of standardized and well-worn European steps. The polka, schottische, Viennese waltz and cotillon were all favoured by Yankee dancing masters of the 19th century. Sectional groups in the country developed indigenous group dances, such as the Paul Jones and the square dance. But these failed to affect the prevailing trend.

In 1912, coincident with the rise of ragtime and jazz in popular music, the United States gave birth to a new form of dancing whose nervous and gyrating motions were well suited to express the emotions of a mechanical, urbanized civilization. The first jazz dances of this century, the Turkey Trot, Bunny Hug. and Grizzly Bear, were often crude, vulgar and ugly. But the sense of exhilaration and release experienced by the dancer of these steps caused them to sweep the country. Elderly people, as well as boys and girls, were caught up in a dance-enthusiasm that writers of that period called the "dance-craze." From then on, dancing was taken over by the common people, and became an authentic expression of their moods and feelings.

Before the World War of 1914 to 1918, Mr and Mrs. Vernon Castle were the principal exponents of popular dancing. They took the crudeness out of the early jazz steps, and introduced the first refinements into ballroom dancing. The most important of their original dances was the Castle Walk, a long-legged walking step in which the lady was backed around the room continuously The Castles also pioneered when they imported a Spanish-American dance to this country. They introduced the Tango, a sinuous and extremely graceful dance whose point of origin was Argentina. The Tango remained popular until very recent years.

Between 1912 and 1915 new dances sprung up and disappeared in very rapid succession Of more than one hundred new dances introduced during that time, the Hesitation, to Waltz music, and the Maxixe, imported from Brazil, were the most popular. Between 1915 and 1935, with the exception of the Charleston, which had a slight vogue in 1925, no new dance ever achieved any noticeable degree of popularity. The Charleston was most popular as an exhibition dance



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STEPS IN MODERN BALLROOM DANCING

1. and **2.** Arthur Murray and partners showing two views of the correct positions in dancing

3. Son, commonly known as the Rhumba

4. The French Tango, posed by Maurice and Cordoba

DANCE

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BALLROOM AND EXHIBITION DANCES

1. The Castle Walk, originated by Vernon and Irene Castle. This dance is a variation of the one-step and was popular from **1913** to **1915.** It consisted of long walking steps on one's toes, moving up and down after striking the beat
2. The Argentine Tango was popular between **1914** and **1916,** but was later replaced by the French Tango. Photograph shows Ricardo Cortez and Dolores Del Rio
3. The Maxixe had a brief popularity as a ballroom dance in **1914.** For a year afterwards it was used only as an exhibition dance, danced by Ramon and Renita
4. The Lula-Fado. Tato Polka, Braziliane had a brief vogue between **1914** and **1916.** Photograph shows Arthur Murray and partner in the Chinese Tato
5. There was a lull in dancing after the hectic craze which died down in **1917,** until **1926** when the Charleston became popular. Photograph shows Fred Astaire and Ginger Rogers, in a characteristic step of the Charleston
6. Tap Dancing. Eleanor Powell in a characteristic pose

by amateurs and was extensively used in tnusical comedy choruses. The Black Bottom followed on the heels of the Charleston, hut it was an ugly dance and short lived.

In 1925, Arthur Murray, a protege of Vernon Castle, standardized ballroom dancing. He simplified all modern dancing by introducing five fundamental steps. In 1930 Mr. Murray introduced the Westchester style of dancing popular with college students. This new youthful step called for a sixth basic movement—the Running Step.

The staple dance-steps of the present generation are the Waltz and the Fox Trot. After a lengthy popularity, the Tango died out: The Cuban Rhumba, an intricate dance, and the Conga are growing in public favour. Especially among the more sophisticated circles in larger cities, the Rhumba is close in popularity to the Fox Trot (1940).

Among the younger people of the more moderate economic classes the Shag and the Lindy Hop are popular. These two "jitterbug" dances followed on the heels of the craze for swing-music, which developed after 1935 and saw the inception of a second "dance-craze." The Shag is a fast, nervous, hopping dance, performed in time to strongly accentuated rhythm.

The growing popularity of swing-dancing led in 1937 to the first of a series of group-dances. The Big Apple, which swept the United States during 1937, was a combination of several "jitterbug" steps, including the Shag and the Lindy Hop, as well as the addition of such vivacious movements as the Suzy-Q and Truckin'. In the Big Apple, the "caller," an appendage of the 18th century group-dancing, came into being again. The Big Apple was generally performed by a group of eight or ten couples, formed into a ring. After a march by the group as a whole, the "caller" would shout for one or another of the swing steps and at each call one of the couples would enter the centre of the ring and perform a figure.

In the summer of 1938, Mr. Murray imported the Lambeth Walk from London. The simplicity of the Lambeth Walk quickly gained it nationwide popularity. Originally, the Lambeth Walk was an old English folk-step, performed in the Limehouse district of London. It was dressed up, polished, refined and brought to America. Essentially, it was a walking-dance, done in a jaunty, strutting fashion.

After the Lambeth Walk, three other group dances were imported from England in succession: The Palais Glide, Chestnut Tree and Boomps-a-Daisy. None of them matched the Lambeth Walk in public popularity.

The Fox Trot is still the most widely performed step, probably because its rhythm is simple enough to be easily and quickly learned by beginners, and because its possible combinations of steps are sufficiently varied to hold the interest of the most accomplished.

The Waltz, too, has become a standardized step for modern dancers. People who have learned the Waltz correctly are admittedly the most graceful dancers, and they are able to adopt other steps more readily.

All the modern dances are composed of combinations of the six Basic Steps. Without a thorough knowledge of these Basic Steps, one cannot hope to do any of the modern dances really well. With a knowledge of them, there are practically no combinations, done ordinarily in the Fox Trot and the Waltz, at least, which one should not be able to pick up readily. The six Basic Steps are: The Walking Steps, the Chassé, the Waltz, the Balance and the Pivot and the Running Steps.

Walking Steps: Each of the Walking Steps takes up two beats of the music. On the first beat, place the whole foot forward on the floor, toe first, the heel barely touching—if you are doing the man's part. If you are doing the woman's part, reach backward with the toe as far as possible. On the second beat, rise slightly on the toes to give spring and pep to your step, and finish.

Step smartly and lightly, shifting your weight from one ioot to the other. When you take a step with one foot, always lift the other off the floor. Never drag or slide the feet along.

Practice taking long, slow steps about the room. Women, in their practice, should give especial attention to walking backward. Keep the knees straight and firm and always make the toes lead. Dance as if you did not have a foot but only a great toe. Practice stretching your toes forward, or backward, as far as you can reach, and always keep them turned out to avoid a pigeon-toed appearance. Always step in a straight line, directly forward, directly back, or directly to the side. This is fundamental to a good balance, good appearance, and a sense of unity with your partner.

The Chassé: The Chasse is a short, quick step directly to the side—either to the right or to the left. For the left Chassé, step directly sidewise to the left and draw the right foot up to the left. For the right Chassé, step directly to the right with the right foot and draw the left foot up to the right. Complete the movement with smartness and precision by bringing the feet together so that they actually touch each time.

The Waltz: The Waltz is a combination of a Walking Step and a Chassé (in 3–4 time). In the modern Waltz, the accent falls upon the Walking Step, and ali the steps are of the same length and value. Practice the Waltz Steps to modern Waltz music, counting one-two-three with a definite accent each time on the "one." Or, better still, keep time with the words, "step, side, together," the accent falling upon "step."

The Waltz may be done forward, backward, or used as a turn to left or right. The Waltz may also be danced to Fox Trot music by holding the first step for two beats; the second and third steps of the Waltz each receive one beat.

The Balance: The Balance is a Hesitation. Step forward, back or to the side with the whole weight upon one foot, and rise, pointing the free foot forward, back or to the side with the toe just touching the floor. The Balance is used in many combinations in both the Fox Trot and the Waltz. When danced to Fox Trot music, it is given two counts. When danced to Waltz music, it is given three. It is a very graceful step, interesting to do, and, moreover, a sure means of developing a good sense of balance.

The Pivot is simply a particularly graceful and effective way of making a quick turn. Always see that one foot is directly in front of the other. Rock forward, on right foot, bringing the entire weight upon the ball of the forward foot, and spin round, making a quarter turn. Rock back on the left foot, and repeat the motion.

The Running Steps are known as syncopated steps because three steps are taken to four beats of the music; you take three quick running steps, then pause on the fourth beat. The syncopated steps are helpful to the lady in following because they teach her to step quickly. This is a decided asset to one who must change her step rapidly in order to follow various partners. Although the running steps are faster than walking steps, they are just as long. It is always best to take long steps, whether they be fast or slow. A short step betrays a lack of confidence.

A man must train his ieet by constant practice to do the various steps and combinations automatically in order to inspire confidence in his partner and to lead with that easy nonchalance that is the mark of an accomplished dancer. It is a mistaken idea that to be a strong leader a man must take a death grip upon his partner and push and pull her with force about the floor. Hold your partner firmly, yes—especially with your right hand—and then go through your steps with certainty and precision. If she knows the steps she will be able to follow. If she does not no amount of forceful guiding upon your part will be of any help to her.

The Rhumba, a graceful and exciting dance-step, is based on the Rhumba rhythm: one, two, three, pause; one, two, three, pause. Because the knees are actively employed in this step, the dancers stand about 8 inches apart. Stand erect, heels together, and relax your weight on the heel of the left foot and at the same time cross your right knee in front of the left. Then shiit your weight to the heel of the right foot and cross the left knee in front of the right. Once again shift your weight to the heel of the left foot and cross the right knee in front of the left. Pause after the third count. This is the basic Rhumba motion, unique for this dance, and employed in all Rhumba steps, whether forward or backward.

The Shag has one main step: step on left foot and hop with left, landing on left. Step on right foot and hop with right, landing on right. Shift weight quickly to left foot, lifting the right ioot about two inches off the floor. Shift weight quickly to right foot, lifting the left foot about two inches off the floor.

The Correct Position: The best position is the easiest and most natural. Stand erect on the balls of your feet, making yourself as tall as possible. Rest the weight upon the foot that you are not going to use first, leaving the other one free for your initial step. Keep the back straight, the shoulders relaxed, the chest out, head up, chin in, eyes directed over your partner's right shoulder, arms high, at about shoulder height. It is very important to keep the arms well up in dancing. Women who unconsciously allow their arms to sag always seem heavy, even though they may be very light on their feet.

The man holds the woman straight in front of him—never to one side—and firmly, just close enough to enable him to guide her easily. His right hand rests in the middle of her back, just below the shoulder blades. His left arm is extended to the side and bent slightly at the elbow, the left hand holding her hand lightly.

The woman rests her left hand lightly upon the back of the man's shoulder. She should never curl her hand under his arm. Trick holds are out of date. Her right arm is extended to the side in an easy, graceful curve with the right hand resting lightly in the man's. Be careful to avoid a spasmodic clutch. It betrays a tension and a lack of confidence that are destructive to your partner's pleasure in dancing with you.

In starting, the man steps forward directly toward his partner, leading with his left foot. The woman steps directly backward, leading with her right foot. Don't be afraid of stepping on your partner's feet. If you start on the proper foot and step in a straight line. directly forward or directly back, you never will get in your partner's way.

There is no fixed sequence for the six Basic Steps or any of their variations. In modern dancing, the leader may swing into any step at any time, as his fancy may dictate or the music seems to suggest. This is why it is so extremely important that the woman should be thoroughly familiar with the steps her partner may decide to do. The only way to gain confidence and to overcome self-consciousncss, awkwardness, and stiffness in dancing is to learn the steps and by constant practice to master them so perfectly that you could almost do them in your sleep.

Self-assurance, ease, grace, and relaxation come as a natural consequence of knowing how. Self-consciousness, stiffness, awkwardness will vanish, and you will find yourself dancing with ease and spontaneous

enjoyment. *See also* BALLET. (A. Mu.)

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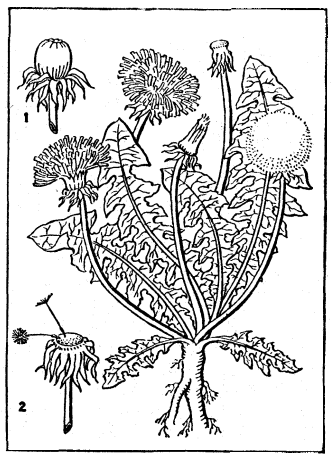
DANCOURT, FLORENT CARTON (1661–1725), French dramatist and actor, was born at Fontainebleau on Nov. 1, 1661. In 1685, in spite of the strong opposition of his family, he appeared at the Théâtre Français. One of his most famous impersonations was Alceste in the *Misanthrope* of Molière. His first play, *Le Notaire obligeant,* produced in 1685, was well received. *La Désolation des joueuses* (1687) was still more successful. *Le Chevalier à la mode* (1687) is generally regarded as his best work, though his claim to original authorship in this and some other cases has been disputed. In *Le Chevalier à la mode* appears the *bourgeoise* infatuated with the desire to be an aristocrat. The type is developed in *Les Bourgeoises à la mode* (1692) and *Les Bourgeoises de qualité* (1700). Dancourt was a prolific author, and produced some 60 plays in all. He died on Dec. 7, 1725. The plays of Dancourt are faithful descriptions of the manners of the time, and as such have real historical value. Most of them incline to the type of farce rather than of pure comedy. Voltaire defined his talent in the words: "Ce que Regnard était à l'égard de Molière dans la haute comédie, le comédien Dancourt l'était dans la farce."

His two daughters, Manon and Marie Anne (Mimi), both obtained success on the stage of the Théâtre Français.

See *Oeuvres complètes* (12 vols., 1760); *Théâtre choisi,* ed. F. Sarcey (5 vols., 1884). Also J. Lemaitre, *La comtdie après Molibre et le théâtre de Dancourt* (2nd ed., 1903).

DANDELION (*Taraxacum officinale*), a perennial herb belonging to the family Compositae (*q.v.*). The plant has a wide range, being found in Europe, Central Asia, North America, and the Arctic regions, and also in the south temperate zone. The leaves form a spreading rosette on the very short stem; they are smooth, of a bright shining green, sessile and tapering downwards. The name dandelion is derived from the French *dent-de-lion,* an appellation given on account of the tooth-like lobes of the leaves. The long tap-root has a simple or many-headed rhizome; it is black externally, and is very difficult of extirpation. The flower-stalks are smooth, brittle, leafless, hollow and very numerous. The flowers bloom from April till August, and remain open from five or six in the morning to eight or nine at night. The flower-heads are golden yellow, and reach 1½ to 2 in. in width; the florets are all strap-shaped. The fruits are olive or dull yellow in colour, and are each surmounted by a long beak, on which rests a pappus of delicate white hairs, which occasions the ready dispersal of the fruit by the wind; each fruit contains one seed. The globes formed by the plumed fruits are nearly two inches in diameter. The involucre consists of an outer spreading (or reflexed) and an inner and erect row of bracts. In all parts of the plant a milky juice is present. The root externally is brown and wrinkled, internally white, with a yellow centre and concentric paler rings. It is two inches to a foot long, and about a quarter to half an inch in diameter. The leaves are bitter, but are sometimes eaten as a salad; they serve as food for silkworms when mulberry leaves are not to be had. The root is roasted as a substitute for coffee. Several varieties of the dandelion are recognized by botanists; they differ in the degree and mode of cutting of the leaf-margin and the erect or spreading character of the outer series of bracts. *T. paludosum,* the marsh dandelion, aifects boggy situations, and flowers in late summer and autumn; it has nearly entire leaves, and the outer bracts of its involucre are erect.

The red-seeded dandelion (T. *laevigatum*), a native of Europe, very similar to the common species but smaller with red, shorter beaked fruits and more deeply and finely cut leaves, is now widely naturalized in the United States and Canada.



DANDELION. SHOWING THE LEAVES THAT ARE EATEN AS SALAD. THE ROOT IS USED FOR MEDICINAL PURPOSES
1. Unopened head
2. Ripe head, from which all the winged seeds except two have been removed

DANDIN (*fl.* 6th century A.D.), Sanskrit author and court poet of Siidraka. He wrote the *Kāvyādarśa,* a manual of poetics (Sanskrit text and Eng. trans. by S. K. Belvalkar, 1924), and *Daśakumāracharita* or "adventures of the ten princes" portraying low-class city life (latest Sanskrit and English edition published at Bombay, 1919).

DANDOLO, the name of one of the most illustrious patrician families of Venice, of which the earliest recorded member was one of the electors of the first doge (A.D. 697). The Dandolo gave to Venice four doges; of these the first and most famous was Enrico Dandolo (*c.* 1120–1205), elected on Jan. 1, 1193 (*more Veneto,* 1912). Although over 70 years old and of weak sight (the story that he had been made blind by the emperor Manuel Comnenus while he was at Constantinople is a legend), he proved a most energetic and capable ruler. He re-established Venetian authority over the Dalmatians who had rebelled with the king of Hungary's protection, but he failed to capture Zara, owing to the arrival of the Pisan fleet, and although the latter was defeated by the Venetians, the undertaking was suspended. In the meanwhile the Eastern emperor Isaac II. Angelus had been deposed, and the new emperor Alexius was unfriendly to the Venetians. Dandolo therefore listened to the proposals of the crusaders who asked Venice for free passage and the means of transport. Dandolo subsidized the crusaders heavily, and, with a promise that payment would be deferred, persuaded them to turn aside and assist him in the reduction of Zara. Dandolo himself commanded the expedition, and Zara was taken and sacked. He then induced the crusaders to listen to the proposals of Isaac's son, Alexius, for the dethronement of the emperor Alexius. The fleet wintered at Zara, and then, under Dandolo's command, sailed for the Bosporus. For the capture and sack of Constantinople and the erection of the Latin empire, *see* CRCSADES.

Immense booty was secured, the Venetians obtaining among other treasures the four bronze horses which adorn the façade of St. Mark's. Dandolo was one of the candidates for the imperial throne of the new Latin empire, but Count Baldwin of Flanders was elected and crowned on May 23. The Venetians were given Crete and several other islands and ports in the Levant, which formed an uninterrupted chain from Venice to the Black Sea, a large part of Constantinople (whence the doge assumed the title of "lord of a quarter and a half of Romania"), and many valuable privileges. But hardly had the new state been established when various provinces rose in rebellion and the Bulgarians invaded Thrace. A Latin army was defeated by them at Adrianople (April 1205), and the emperor himself was captured and killed, the fragments of the force being saved only by Dandolo's prowess. But he was now old and ill, and on June 23, 1205 he died.

Enrico Dandolo's sons distinguished themselves in the public service, and his grandson Giovanni was doge from 1280 to 1289. The latter's son Andrea commanded the Venetian fleet in the war against Genoa in 1294, and, having been defeated and taken prisoner, he was so overwhelmed with shame that he committed suicide by beating his head against the mast (according to Andrea

Navagero). Francesco Dandolo, also known as Dandolo Cane, was doge from 1329 to 1339. During his reign the Venetians went to war with Martino della Scala, lord of Verona, with the result that they occupied Treviso and otherwise extended their possessions on the *terra firma.* Andrea Dandolo *(c.* 1307–1354), the last doge of the family, reigned from 1343 to 1354. He had been the first Venetian noble to take a degree at the university of Padua, where he had also been professor of jurisprudence. The terrible plague of 1348, wars with Genoa, against whom the great naval victory of Lojera was won in 1353, many treaties, and the subjugation of the seventh revolt of Zara, are the chief events of his reign. The poet Petrarch, who was the doge's intimate friend, was sent to Venice on a peace mission by Giovanni Visconti, lord of Milan. "Just, incorruptible, full of zeal and of love for his country, and at the same time learned, of rare eloquence, wise, affable, and humane," is the poet's verdict on Andrea Dandolo *(Varior. epist.* xix.). Dandolo died on Sept. 7, 1354. He is chiefly famous as a historian, and his *Annals* to the year 1280 are one of the chief sources of Venetian history for that period; they have been published by Muratori *(Rer. Ital. Script.* tom. xxi.). He also had a new code of laws compiled (issued in 1346) in addition to the statute of Jacopo Tiepolo. Another well-known member of this family was Silvestro Dandolo (1796–1866), son of Girolamo Dandolo, who was the last admiral of the Venetian republic and died an Austrian admiral in 1847. Silvestro was an Italian patriot and took part in the revolution of 1848.

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DANDOLO, VINCENZO, COUNT (1758–1819), Italian agricultural chemist, a native of Venice, welcomed the advent of Napoleon in Italy (1796), and was a member of the grand council of the Cisalpine Republic at Milan. From 1805–09 he was governor of Dalmatia, where he sought to improve agriculture. He died at Venice on Dec. 13, 1819. Dandolo wrote several treatises on agriculture, vine-cultivation, and the rearing of cattle and sheep, and a work on silk-worms, which was translated into French by Fontanelle.

DANDURAND, RAQUL (1861–1942), Canadian lawyer and statesman, was born on Nov. 4, 1861, at Montreal. Educated at Montreal college and Laval university, he was admitted to the bar in 1883. He applied himself to the local organization of the Liberal Party, was called to the Senate in 1898, being Speaker 1905–9, and was minister without portfolio in the cabinet of 1926–30. His chief work is *Traité théorique et pratique de droit criminel* (Montreal, 1890). He was president of the 6th Assembly of the League of Nations. Dandurand died March 11, 1942.

DANDY, a word which about 1813–16 became a London colloquialism for the exquisite of the period. It is probably derived from the French *dandin,* "a ninny or booby," but in *The Northampton Mercury* (April 17, 1819), occurs the following: "Origin of the word 'dandy.' This term, which has been recently applied to a species of reptile very common in the metropolis, appears to have arisen from a small silver coin struck by King Henry VII., of little value, called a *dandiprat;* and hence Bishop Fleetwood observes the term is applied to worthless and contemptible persons."

It was Beau Brummell, the high-pricst of fashion, who gave dandyism its great vogue, though it existed before his day. About the middle of the 18th century was founded the Macaroni club. This was a band of young men of rank who had visited Italy and sought to introduce the southern elegances of manner and dress into England. Their costume is described as "white silk breeches, very tight coat and vest, with enormous white neckcloths, white silk stockings and diamond-buckled, red-heeled shoes." For some time the moving spirit of the club was Charles James Fox. It was with the advent of Brummell, however, that the cult of dandyism became a social force. Beau Brummell was supreme dictator in matters of dress, and the Prince Regent is said to have wept when he disapproved of the cut of the royal coat. Around the Beau collected a band of young men whose insolent and affected manners made them universally unpopular. Their chief glory was their clothes. They wore coats of blue or brown cloth with brass buttons, the coat-tails almost touching the heels. Their breeches were buckskin, so tight that it is said they "could only be taken off as an eel would be divested of his skin." A pair of highly-polished Hessian boots, a waistcoat buttoned incredibly tight so as to produce a small waist, and opening at the breast to exhibit the frilled shirt and cravat, completed the costume of the true dandy.

See Barbey D'Aurevilly, *Du dandysme et de G. Brummell* (1887); Sir A. Conan Doyle, *Rodney Stone* (1896).

DANEGELD, an English national tax originally levied by Aethelred II. as a means of raising the tribute which was the price of the temporary cessation of the Danish ravages. This expedient was first adopted in 991 and was repeated in 994, 1002, 1007 and 1012. With the accession of the Danish king Canute. the original *raison d'être* of the tax ceased to exist, but it continued to be levied, though for a different purpose, assuming now the character of an occasional war-tax. It was, apparently, not levied by Edward the Confessor in the latter part of his reign, but William the Conqueror revived it immediately after his accession, and it was with the object of facilitating its collection that he ordered the compilation of Domesday Book. It continued to be levied until 1163, in which year the name Danegeld appears for the last time in the Rolls. Its place was taken by other imposts of similar character but different name.

DANELAGH, the name given to those districts in the north and north-east of England which were settled by Scandinavian invaders in the 9th and 10th centuries and in which Danish customary law subsequently prevailed. The real settlement of England by Danes began in the year 876, when a division of the great army, which had been ravaging widely over England, divided out Northumbria among its members. Next year, another portion of the same army divided out Eastern Mercia and in 880 so much of the army as remained in England divided out East Anglia. A similar division of Wessex had been prevented by the victories of King Alfred (*q.v.*), and between 880 and 890 definite boundaries were drawn between Alfred's kingdom and that of Guthrum, king of East Anglian Danes. The boundary thus drawn ran along the Thames estuary to the mouth of the Lea (a few miles east of London), then up the Lea to its source, then due north to Bedford, then up the Ouse to Watling street at Stony Stratford. From this point the boundary is left undefined, perhaps because the kingdoms of Alfred and Guthrum ceased to be conterminous here. Thus Eastern Mercia, Northumbria from Tees to Humber, East Anglia, and the shires to the immediate west and south were handed over to the Danes and henceforth constitute the district known as the Danelagh.

The three chief divisions of the Danelagh were: (1) the kingdom of Northumbria, corresponding, roughly, to the modern Yorkshire, (2) the kingdom of East Anglia, (3) the district of the five (Danish) boroughs—lands grouped round Leicester, Nottingham, Derby, Stamford and Lincoln. Of the history of the two Danish kingdoms we know very little. Guthrum of East Anglia died in 890, and later we hear of a King Eric or Eohric, who died in 902. The history of the Northumbrian kingdom is yet more obscure. The original Danish kingdom seems to have come to an end in 909, but within a decade this region was overrun by fresh invaders of Norwegian rather than Danish extraction, and Northumbria was not brought definitely under English rule before the middle of the 10th century.

More is known of the history of the five boroughs. From 907 onwards Edward the Elder, working together with Aethelred of Mercia and his wife, worked for the recovery of the Danelagh. In that year Chester was fortified. In 911–912 an advance on Essex and Hertfordshire was begun. In 914 Buckingham was fortified and the Danes of Bedfordshire submitted. In 917 Derby was the first of the five boroughs to fall, followed by Leicester a few months later. In the same year after a keen struggle all

the Danes belonging to the "borough" of Northampton, as far north as the Welland (*i.e.,* the border of modern Northamptonshire), submitted to Edward and at the same time Colchester was fortified; a large portion of Essex submitted and the whole of the East Anglian Danes came in. Stamford was the next to yield, soon followed by Nottingham, and in 920 there was a general submission on the part of the Danes.

Although the independent existence of the Danelagh did not last for half a century, it profoundly affected the later history of this region. It was subsequently distinguished by a large population of free peasant landowners, who undoubtedly represent the descendants of the Danish settlers of the Viking age. The signs of Scandinavian occupation are particularly evident in Yorkshire and the territory of the five boroughs, where land was divided into ploughlands and oxgangs instead of hides (*q.v.*) and yardlands, where the Scandinavian *wapentake* replaces the English *hundred* (*q.v.*), and where many traces of Scandinavian methods of monetary and fiscal computation survived into the middle ages. For at least two centuries the language of this region must have been a Scandinavian dialect, gradually modified by English influences from the south. In the early 12th century the legal custom of the Danelagh was sharply distinguished from the customs of Wessex and English Mercia, and to the present day a Scandinavian institution, the *riding,* survives, in the three ridings of Yorkshire. A number of Danish place-names still exist in the original Danelagh.

See J. C. H. R. Steenstrup, *Normannerne* (4 vols., 1876–82); P. Vinogradoff, *English Society* in *the Eleventh Century* (1908); *F.* M. Stenton, *Danelaw Charters* (1920) and *The Danes in England* (1928). The place-names of this region are discussed by E. Ekwall in the *Introduction to the Survey of English Place-Names,* pt. *I.,* ch. iv. (1924). (A. M.; F. M. S.)

DANGERFIELD, THOMAS (*c.* 1650–1685), English conspirator, was born at Waltham, Essex, the son of a farmer. He began his career by robbing his father, and, after a wandering life on the continent, took to coining false money, for which offence and others he was many times imprisoned. Faithless to everyone, he first tried to involve the duke of Monmouth and others by concocting information about a Presbyterian plot against the throne, and, this having been proved a lie, he pretended to have discovered a Catholic plot against Charles II. This was known as the "Mealtub Plot," from the place where the incriminating documents were hidden at his suggestion, and found by the king's officers by his information. Mrs. Elizabeth Cellier—in whose house the tub was—almoner to the countess of Powis, who had befriended Dangerfield when he posed as a Catholic, was, with her patroness, actually tried for high treason and acquitted (1680). Dangerfield, when examined (Oct. 26, 1680) at the bar of the House of Commons, made other charges against the duke of York, the countess of Powis and the earl of Peterborough. He continued to defame the Roman Catholics in a long series of pamphlets, among others being *Dangerfield's Narrative.* This led to his trial for libel, and on June 29, 1685 he received sentence to stand in the pillory on two consecutive days, be whipped from Aldgate to Newgate, and two days later from Newgate to Tyburn. On his way back he was struck in the eye with a cane by a barrister, Robert Francis, and died shortly afterwards from the blow. The barrister was tried and executed for the murder.

DANGEROUS TRADES. By the British Factory and Workshop Act 1901, cases of industrial lead, phosphorus, arsenical and mercurial poisoning, also of anthrax, must be reported to the Chief Inspector of Factories, Home Office. Subsequently, carbon bisulphide, aniline and chronic benzene poisoning, also cases of toxic jaundice and of epitheliomatous and chronic ulceration, were included. Accidents in mines and factories had previously been notifiable. The inclusion of industrial poisoning at first presented difficulties from the point of view of workmen's compensation; for, could lead poisoning, for example, be regarded as an accident, since it is usually not of sudden onset? As in the case of anthrax, however, a workman might develop and die from pneumonia within 24 hours after infection, it was clear that certain industrial diseases must be scheduled. This circumstance marks a distinct and humane advance in factory legislation.

Lead Poisoning was among the first of the industrial diseases thus made notifiable; it is therefore compensable. Lead miners do not suffer from the malady but from disease of the lungs due to inhalation of rock dust. Smelters of the ore and refiners develop plumbism (Lat. *plumbum,* lead) through inhalation of the fumes. Workers in white lead factories are peculiarly prone to plumbism owing to white lead dust (carbonate) being soluble in the respiratory and digestive passages. A similar liability applies to house painters—especially during the "burning-off" and "dry-rubbing down" of old lead painted surfaces. The substitution of "wet" for "dry" rubbing down will diminish plumbism among painters. Opinions are divided as to whether the occupational illness of painters may not be as much due to the turpentine in the paint as to the pigments. Persons working in lead become anaemic. There is a personal and family idiosyncrasy to plumbism, and young females are if anything more predisposed to it than males. The symptoms are colic, the presence of a blue line on the gums close to the teeth, paralysis of the muscles of wrists and fingers, albuminuria, and in the acute and serious form blindness and convulsions. Lead is found in the internal organs after death.

As a result of periodical examination of workers in lead factories, also in potteries which use lead glazes, cases of plumbism have considerably decreased during the last 2j years, as well as in consequence of better ventilation of the workrooms, means for the removal of dust, personal hygiene, and attention to the bowels. Lucifer match making is no longer a dangerous trade owing to the substitution of sesquisulphide of phosphorus for the harmful white phosphorus. *Mercurial poisoning* occurs among men employed in the preparation of rabbits' skins by nitrate of mercury for hat making, in makers of scientific instruments of precision such as thermometers and barometers, and in men repairing electric meters. *Carbon bisulphide* used as *a* solvent in rubber industries causes a peculiar form of intoxication not unlike alcoholic, accompanied by staggering gait and mental excitement, also paralysis of the limbs in the more chronic cases. Carbon bisulphide is used extensively in the manufacture of artificial silk from cellulose. *Benzene* or *Benzol* used in "dry-cleaning" causes headache and drowsiness, while its nitric acid products, nitrobenzene and amido-benzene, destroy the red blood corpuscles inducing pallor of face with marked blueness of the lips, tongue and finger nails, irregularity of the heart's action and collapse. The blueness mentioned is due to the formation of aniline in the body. *Toxic jaundice* was occasionally met with during the war in persons in munition works handling the material of or inhaling vapours of dust from high explosives. *Anthrax, Wool-Sorters' Disease* or *Splenic fever* attacks workers employed in opening bales of infected wools. In the form of a local pustule the disease occurs in butchers and in men handling infected hides. It is due to an organism, the *bacillus anthracis,* which may gain entrance into the lungs by inhalation of dust to which spores are adherent; it may also enter through the broken skin or by the alimentary canal through persons eating infected flesh. The pulmonary form is extremely dangerous; it may cause death within 24 hours. If seen early the local pustule can be excised satisfactorily. A preventive serum has been used with encouraging results, but the essential thing is to have all bales of imported wool carefully opened and thoroughly disinfected before distributing it to the workers. During 1926 in Great Britain there occurred 38 cases of anthrax with three deaths.

Cancerous Ulceration.—Epitheliomatous or cancerous ulceration occurs in tar and mineral oil workers, makers of arsenical dip for sheep, and in mule spinners in cotton mills. Chimney sweeps have long been known to be subject to scrotal cancer. Workmen exposed to splashings of hot pitch and mineral oil develop brown patches and warts on their forearms. The warts may disappear or break down and are followed by ulceration which becomes malignant. Mule spinners in cotton mills have recently exhibited a high morbidity rate of epitheliomatous ulceration. In view of the increase of cancer generally, the large number of cases of scrotal cancer in mule spinners is not only a cause of anxiety but a matter calling for research.

Cases Notified Since Epitheliomatous Ulceration Was Added to the List in 1920

Industry	1920	1921	1922	1923	1924	1925	1926	Total
Manufacture of patent fuel (pitch)	30	17	19^{1}	14^{1}	11	25^{2}	27	143^{4}
Tar distillers	4	9^{2}	6	14^{1}	15^{2}	23^{4}	18^{3}	89^{12}
Gas works	4^{1}	4	2^{1}	6^{1}	1^{2}	9^{2}	15^{9}	41^{16}
Shale oil works (paraffin)	3	..	5^{1}	6	2^{1}	4	2	22^{2}
Mule spinning (mineral oil)	..	..	..	15^{1}	79^{17}	78^{35}	88^{20}	260^{73}

The raised figures refer to deaths.

Coal Mining.—The winning of coal is a hazardous occupation; the risks are: explosions followed by fire; gassing; also accidents mainly due to falls of stone from the roof. Apart from these, coal mining is not an unhealthy occupation.

It is generally known that in the United States more men are killed by accidents in proportion to the number of men working than in any of the leading European countries; on the other hand if fatalities are estimated by the number of tons of coal raised, fewer men are killed in U.S.A. than in any other country. Many mine accidents might be prevented by employing more supervisors to look after haulage equipment and falls of roof. Comparing the lie of coal and underground conditions these are more favourable to a larger output per man in U.S.A. than in European countries; the coal is near the surface, the seams are thicker, they are generally flat and uninterrupted. During the five years ending 1920 the average number of fatalities per one million tons of coal mined was, in U.S.A. 3.8 lives; in Great Britain 4·52 lives; France 6·9; Belgium 8·01, and in Prussia 11·85 lives. The following figures give the ratio of fatalities to numbers employed:

Number of Men Killed per 1000 Full Year (loo-day) Workers

	U.S.A.	Great Britain	France	Belgium	Prussia
1916	3'93	1·34	..	..	3·15
1917	4·25	1·41	..	..	3·73
1918	3'94	1'43	..	..	3·40
1919	4·27	1·13	1·43	1·30	2·47
1920	3·78	1·11	1·13	1·12	2·16
1921	4·19	1·08	..	·91	..
1922	4·89	1·09	..	·91	..

Machinery and electricity are also becoming increasingly employed in winning coal, and there is always the possibility of an electric spark firing inflammable gas or igniting coal dust.

The lesser maladies to which miners are liable are displacement of the cartilage of the knee joint, also "beat hand," an inflammation of the cellular tissue of the palm of the hand which may become septic. That coal miners arc a comparatively healthy class is shown by the following table:

Mean Annual Death Rate per rooo

	Coal miners		All males	
	1900–2	1910–12	1900–2	1910–12
All causes	885	727	1004	790
Phthisis	89	75	187	141
Cancer	53	61	69	78

Cotton **Industry.**—As indicating improvement in general occupational mortality the cotton industry may be cited with reference to diseases of the nervous, respiratory and circulatory systems, and also to tuberculosis. As regards bronchitis and circulatory diseases, the morbidity incidence is higher among certain operatives in cotton mills than among other textile workers. The phthisis rate, which in occupied and retired males was during 1900–02 187, and in 1910–12 141, was in cotton operatives for the same periods 197 and 120, while bronchitis, which was 58 and 38 in males generally, reached in cotton operatives 92 and 57 respectively. The unhealthy influences are dust and high temperatures with humidity. Males suffer more from chest diseases than females. the latter more from digestive troubles and anaemia. Dust rich in silica is present in all the dry processes. The high temperatures and humidity predispose to colds, and the dust to asthma. Female operatives standing at work all day in high temperatures develop varicose veins and ulcers on the limbs, and suffer from debility and anaemia. Weavers suffer from "twister's cramp," an infection of the muscles of the forearm, thumb and index finger, attended by a considerable amount of pain and followed by muscular weakness. Of accidents in cotton mills the largest numbers occur on Tuesday and on Friday, and in relation to the hours of the day the maximum appears to be reached between the hours of 10 to 11 A.M. with a progressive decrease thereafter to the end of the working day.

Compressed Air.—Divers and men working in caissons in compressed air are liable to illness of a special kind. Inside the caisson men work practically speaking without discomfort; in order to enter this iron chamber they must pass through an attached "compression" lock and be gradually subjected to a rise of air pressure equal to that inside the caisson into which they will descend. Inside the caisson, beyond possibly experiencing unpleasant sensations due to the drums of the ears being forcibly driven inwards, the men are capable of doing even more work than on the surface; but all the while, owing to air being passed into the chamber under high pressure, their blood and tissues are becoming supersaturated with the nitrogen in the atmospheric air. In the body the gas becomes liquefied. It is not until the end of the shift when men are about to leave work and undergo "decompression" that symptoms arise. The men return to the lock wherein they had been "compressed" to undergo "decompression," and if this is done too rapidly bubbles of nitrogen gas gradually appear in the minute blood vessels, which arrest the circulation, or blebs of gas develop in the liver and central nervous system. So that a man who has been too rapidly decompressed may emerge from the chamber apparently well, yet on his way home be overtaken with severe pains in the limbs (bends) and be seen to stagger and fall, paralysed in his legs. Should such an event happen close to his work and the individual be carried back and placed in a warmed "recompression" chamber, upon being subjected to increasing increments of pressure and kept therein for two or three hours and then slowly decompressed, his pains will usually disappear and the power of walking be regained. By this mode paralysed caisson workers have been relieved and their muscular function and equilibration restored three hours after having left work. Some men are more liable to the malady than others, stout men particularly, for fat dissolves by bulk more nitrogen than the blood and tissues. Men above 40 years of age should not be employed in caissons. Supersaturation of the body liquids and tissues with atmospheric nitrogen is determined by the amount of pressure in the caisson, duration of exposure, and the absorbability of the tissues. Symptoms hardly ever occur in men who have worked under 28lb. pressure. Danger arises when the pressure mounts to 40–50lb. above that of the outside atmosphere. The essential thing is slow decompression, not less than 2mins. for every 3lb. of pressure worked in, and should this have exceeded 30lb. then at a rate of 1min. per lb. Professor John Haldane introduced as a means of treatment "stage" decompression, *i.e.*, decompression is suddenly made, for example from 30lb. to 15, and thereafter at a uniform slow rate.

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DANIEL, the name given to the central figure of the biblical book of Daniel (see below). Two other personages mentioned in the Old Testament bear this name; see I Chron. iii. 1, Ezra viii. 2, Neh. x. 6. Daniel the prophet is known to us only as a character in Jewish fiction. He is mentioned in Ezek. xiv. 14, 20, between Noah and Job, as one of three foremost saints of Israel, and in xxviii. 3 as the type of wisdom. This may mean either that such stories as those in our book of Daniel were in circulation as early as the 6th century B.C., or (in the present writer's opinion)

much more probably that the book of Ezekiel was written in the 3rd century B.C. (see below).

According to Dan. i. 3, the Babylonian chief eunuch was commanded to bring to the court certain youths of the Judaean captivity, "of the children of Israel, and of the king's seed, and of the nobles," to serve in the king's palace. It is apparent that Daniel is thought of as one of the nobles, or even of the royal line. Thus Josephus, Ant. x. 10, 1, and the Lives of *the Prophets* (various Greek recensions), the latter adding that his birthplace was Upper Beth-Horon, and that he was buried in the royal vault in Babylonia. In the biblical account, the earlier narrator says that his life extended "to the first year of king Cyrus" (1. 21, cf. vi. 29), while the later author represents him as still living "in the third year of Cyrus" (x. 1). In the late rabbinical tradition (*Midr.* Šir *ha-širim* vii. 8) he is said to have returned to Jerusalem among the exiles freed by the royal edict. The Jewish traveller Benjamin of Tudela (12th cent. A.D.) was shown his tomb in Susa, and notices of this tomb are found as early as the 6th century.

Daniel, Book of.—The Book of Daniel stands between Esther and Ezra in the third great division of the Hebrew Bible known as the *Hagiographa,* in which are classed all works which were not regarded as forming part of the Law or the Prophets.

The book consists of two widely different portions: a didactic and popular narrative in successive episodes, chaps. i.–vi.; and a series of prophetic visions, chaps. vii.–xii. Chaps. ii.–vii. are in Aramaic, the remainder is Hebrew. The unity of the whole has been maintained by the great majority of scholars (Bevan, Comm., pp. 6, 23 note). Recently, however, theories of composite authorship have gained ground; see Dalman, *Worte* Jesu (1898), p. 11, and the works named below. The differences between the two parts are indeed many and striking, notably in the following particulars. (1) Style, irrespective of the changes in language and subject matter. In the first half, including the Hebre chapter i., it is generally simple and without any unusual features; in the second half it is obscure and difficult to a remarkable degree. (2) In the mental attitude of the author, and his portrayal of the character of Daniel, there is a profound difference to be seen. (3) The Persian words, so numerous in i.–vi., are entirely absent in vii.–xii. (4) There is nothing in the first half of the book to suggest the presence of the arch-enemy, Antiochus Epiphanes, always in the background of the second half; contrast ii. 39–43 with vii. 23–25. (5) There is a manifest contradiction between i. 21 (*cf.* vi. 29), the statement that Daniel "continued *until* the *first* year of Cyrus," and x. 1, the account of the vision in that king's *third* year. It is natural to suppose that a later author had in mind the words of vi. 29, but forgot, or chose to disregard, those of i. 21. (6) The use of the two languages finds its only convincing explanation in the theory of dual authorship (see following).

The great majority of scholars at the present day agree that neither the whole book nor the first half, containing the narratives, can have been written in the time of the Babylonian monarchy, or even in the earlier part of the Persian period. The chief reasons for this conclusion are the following:

1. The position of the book among the Hagiographa seems to show that it was introduced after the final collection of the "Later Prophets" had been made. The collectors of the prophetical writings, who in their care did not neglect even the parable of Jonah, would hardly have ignored the record of so great a prophet and foreteller of future events as Daniel is represented to have been.

2. Jesus ben Sirach (Ecclesiasticus), who wrote about 180 B.C., in his otherwise complete list of Israel's leading spirits, makes no mention of Daniel.

3. The internal evidence is even stronger than the external, as will appear in the particulars which here follow. The historical inaccuracies in the narrative chapters are such as could be credited only to a writer who lived long after the events described. The statement at the very beginning of the book, that "in the third year of the reign of Jehoiakim" Nebuchadrezzar berieged and captured Jerusalem, and carried the Jewish king and the vessels of the temple to Babylonia, finds no support in the history known to us, but seems to be the work of a writer who combined II Chron. xxxvi. 6 f. with II Rings xxiv. i. The use of *Kasdim,* "Chaldaeans," as the name of a class of magicians is a striking anachronism (see CHALDAEA); and the position of Daniel, a devout Israelite, as "the master of the magicians" at the Babylonian court (iv. 6) is more easily comprehensible in edifying romance than in actual history.

The four kingdoms of chap. ii. introduce a still greater difficulty. The first kingdom is the Babylonian (vs. 38), the fourth is the Greek empire (cf. chap. viii.); the third, immediately preceding the Greek (viii. 20 f., x. 20), is the Persian. The identity of the second kingdom is then made certain by numerous passages; it is the kingdom of the Medes, whose reigning king, called "Darius the Mede," took possession of Babylonia upon the death of Belshazzar, and at the close of his reign was succeeded by Cyrus (v. 30, vi. 1, 29; cf. ix. 1, x. 1, xi. 1). There was, however, in fact no Median power which came "after" the Babylonian (ii. 39) and in turn yielded the throne of Babylonia to the Persians (xi. 1). The name Darius is not Median, and we have certain knowledge that the immediate successor of Nabonidus and Belshazzar as ruler of Babylonia was Cyrus. Comparison with the list of Persian kings in the book of Ezra seems to show that in the last centuries B.C. the Jewish learned tradition transposed the reign of Cyrus with that of Darius I. Hystaspis, the latter being regarded as king of the Medes. The reign of Cyrus was believed to have been immediately followed by those of Xerxes and Artaxerxes, Ezra iv. 5 (where the reference is to Darius II. Nothus), 6; cf. Montgomery, Comm., p. 423. (See EZRA and NEHEMIAH, Books.)

The highly interesting narratives of Nebuchadrezzar and Darius can hardly be regarded as true pictures of these monarchs. The former erects a golden image and commands all the people in his realm to fall down and worship it at a given signal; afterwards he confesses the God of Israel, and decrees that any subject of his who shall say anything against this God shall be cut in pieces. Darius commands by royal statute that "whosoever shall ask a petition of any god or man for 30 days," save of the king himself, shall be cast into the den of lions. After Daniel's rescue, the king confesses the God of Israel, and writes to all the peoples, nations, and languages, commanding them to fear this living God, whose dominion is everlasting. All this is plainly popular narration rather than historical record, even though one and another of the items have an undoubted basis of fact. The picture of Belshazzar in chap, v. has quite generally been pronounced unhistorical by modern scholars, but recent discoveries have tended to show that the historical background of the chapter is substantially correct. Documents in cuneiform prove that Belshazzar, the son of Nabonidus, exercised at Babylon such administrative powers as belonged to no mere crown prince; indeed, it is expressly stated that in the third year of Nabonidus the king entrusted *the* kingship to his eldest son, Belshazzar (Sidney Smith, Babylonian Historical Texts, 1924, *pp.* 84 sqq.). This would seem to explain the dignity of "the third ruler in the kingdom," conferred upon Daniel. Whether, and in what way, Belshazzar could be correctly described as the lineal descendant ("son") of Nebuchadrezzar is a question which future discoveries may settle.

4. The late date of the second half of the book, chaps. vii.–xii., is evidenced in many ways, not merely by the fact that its author presents a detailed sketch of contemporary history, especially in chap. xi., extending down to the time subsequent to the desecration of the temple at Jerusalem by Antiochus Epiphanes. In both literary and religious character it is a product of the later Greek period. The "apocalypse" as a distinct branch of Jewish literature makes its first appearance at this time, in the books of Daniel and Enoch, and continues henceforth in many similar compositions; its most characteristic features clearly represent a late stage in the history of Jewish thought. See the article "Apocalypse" in the *Jewish* Encyclopaedia; Montgomery, Comm., 78–81. The way in which Daniel in ix. 2 refers to the authoritative scriptures naturally suggests a time subsequent to the final redaction of the Law and the Prophets. A like impression is given by the

angelology of the visions, including the names of the archangels Gabriel and Michael (cf. the book of Tobit). The doctrine of the resurrection, xii. 2, appears now for the first time in clear and definite form (it had already received expression in Is. xxvi. 19). Not only the resurrection of the righteous but also that of at least a part of the wicked among the Jews is predicted; and the fact well illustrates the growing prominence of the individual, as contrasted with the nation, in the type of theology here represented. Some scholars have seen in this doctrine, as well as in other features of the theology of the book, evidence of the influence of Zoroastrianism (thus Kohut, Bousset, and especially Eduard Meyer, *Ursprung und Anfänge* des Christentums), but the arguments in support of this theory are unconvincing.

5. Finally, the linguistic evidence points unequivocally to a date more than two centuries later than the supposed time of the prophet Daniel. Comparison of the language of the sufficiently abundant inscriptions and papyri shows beyond question that the Aramaic of Dan. ii.–vii. represents a type which cannot possibly be carried back of 300 B.C. (Torrey, Ezra Studies, 161–166; G. R. Driver, *Journal* of Bibl. Lit. xlv. 110 sqq., 323; and especially Baumgartner, "Das Aramaische im Buche Daniel," *Z. A. T. W.*, xlv. [1927], 122 *sqq.*). The Hebrew of the book is also of a very late type; see Bevan, Comm., 28–35. The presence of Greek words, especially the names of the musical instruments in iii. 7, 10, 15, adds its significant contribution to the many-sided argument.

The book, then, is not a record of historical fact, but in its first half an edifying romance, and in its second half a typical apocalypse. The narrative portion is excellently suited to its purpose, and in the handling of the successive episodes the author's ability as a story-teller is as evident as his religious fervour. Chapter v., in particular, is powerfully dramatic, a gem of the world's literature. The popularity of the stories is early attested by the existence of varying recensions. The old Greek version (as old as the middle of the 2nd century B.C.), now extant in a single ms., supported by the Syriac Hexaplaric version, differs very considerably from the standard text in chaps. iv.–vi., and is here probably the rendering of a text which was reproduced frqm memory. (Our standard Greek is the rendering of Theodotion, 2nd century A.D.) The influence of the second half of the book, the visions, was even more powerful and pervasive than that of the stories, determining to a considerable extent the course of the Jewish apocalyptic tradition, and affecting profoundly the early Christian scriptures. The visions are strongly patriotic in their immediate purpose, and there is abundant evidence that they gave in full measure the encouragement and the new religious impulse that they were designed to give. Very little attention is paid in them to the unseen world; their author does not concern himself with the secrets of the universe (contrast the book of Enoch). The eschatology of the book—immensely important as it is, and strongly emphasized by the author himself—is given the briefest possible space, vii. 13 seq., 27, xii. 1–3. That to which everything else is subordinated is the prediction of the immediate future. The Jews are soon to be delivered from their oppressors, and the faithful will triumph forever. In making his final and most vivid prophecy, the writer at length passes over from the known to the unknown in a very striking manner. In chap. xi., verses 3–39 present in the form of a prediction the detailed history of the Greek empire in the East, from the conquest of Alexander down to the latter part of the reign of Antiochus Epiphanes. Verses 40–45 continue this with an almost equally vivid description of events which *had* not yet taken place, but were only expected by the writer, namely, the wars which should result in the death of Antiochus and the fall of his kingdom. The mysterious symbolism employed in the computation of various intervals of time is another highly characteristic and significant feature of the Daniel visions. Thus, the "time, times, and a half" (xii. 7) which must elapse before the end which has been foretold; the "weeks" (seven-year periods) of ix. 24–27; and the enigmatic numbers of days in viii. 14 and xii. 11 sqq. For the interpretation of these ever-fascinating riddles the reader is referred to the standard commentaries. The influence of the book of Daniel on the Messianic hope of the Jews is still another fact of great importance. The "*man*" ("son of man") of vii. 13 becomes henceforth a definitely Messianic title, as in the Book of Enoch and the Christian scriptures; on the other hand, the "anointed one" of ix. 26 doubtless refers to the high priest Onias III., who was assassinated at Antioch c. 171 B.C. (II Macc. iv. 33–38), referred to in xi. 22 as "the prince of the covenant."

The strange manner of occurrence of the two languages, first Hebrew, then Aramaic, then Hebrew again, the alternation not corresponding to any changes in subject matter or literary character, furnishes a riddle which many scholars have been content to abandon as insoluble. The view that the book, as we have it, is in its original linguistic form and the work of a single author (Behr, Kamphausen) certainly leaves the principal difficulties unexplained. It has been a favourite theory that the book was originally written in Hebrew, and that a portion of it was lost or destroyed in the Maccabaean wars and afterward supplied from an Aramaic version (so Lenormant, Bevan, Prince). "This hypothesis stumbles on the fact that the Aramaic begins neatly at the appropriate point" (Montgomery, *Comm.*, p. 92). There are other significant features, mentioned above, for which it fails to account. A theory first proposed by the present writer and adopted by Montgomery, Comm., recognizes two distinct halves of the book, an earlier and a later, and explains the alternation of languages as the work of the later writer, who himself devised this way of joining his own work to that of his predecessor. The original work, consisting of popular narratives written in Aramaic, comprised the first six chapters, vi. 29 forming the natural conclusion. The author of the apocalyptic chapters, vii.–xii., writing in the name of Daniel and with the purpose of supplementing the book already existing, composed his first vision, chap. vii., in Aramaic; wrote the remaining chapters, viii.–xii., in Hebrew (the natural, almost essential, language of the older Jewish apocalypses); and replaced the original Aramaic of i. 1–ii. 4*a* with his own rendering of it into Hebrew. An excellent place for making the transition was offered by ii. 4, the verse in which the Chaldaean soothsayers first address the king. This ingenious proceeding made of the whole an indissoluble unit. Chap. i. is indispensable to ii. seq , while on the other hand viii. seq. (Hebrew) could not possibly be separated from vii. (Aramaic), for the successive revelations are manifestly all of one piece, and viii. 1*b* significantly alludes to the preceding vision.

The date of the latter half of the book (and thus of the complete work) is given approximately by allusions to contemporary events. It was written in the time of Antiochus IV. Epiphanes, after the desecration of the temple (viii. 11–14), which took place in Dec. 167 B.C. (for this date, and the others here given, see Kolbe's epoch-making *Beiträge zur* syrischen und jiidischen Geschichte, Berlin, 1926). If, as some think, viii. 14 implies that the writer had seen the rededication of the sanctuary (Dec. 164), while on the other hand the passage xi. 40–45 shows, as all agree, that the death of Epiphanes (April 163) was still in the future, the visions are dated almost to the month.

The date of the first half of the book, the stories, is indicated with great probability by the allusions and the symbolism in chap. ii. The historical sketch terminates with the attempted alliance, through marriage, of the Ptolemaic and Seleucid kingdoms (so most comms) at a time when the contrast between the two was like that between iron and clay. This would perfectly apply to the political conditions at the time when the crushing blow was inflicted on the northern kingdom by Ptolemy III. Euergetes in 246 B.C., immediately after the murder of Antiochus II., the Seleucid king, and his newly espoused wife, Berenice, the daughter of Ptolemy II. At no other time in the history of the two kingdoms was the contrast so strongly marked; the northern kingdom was not only impotent, it was actually crumbling. The provinces of the Euphrates and Tigris were now lost; Asia Minor was soon to follow; the two sons of Antiochus II. were arrayed against each other. The most probable date for Daniel i.–vi. would seem to be between 246 and 240, the year of the peace concluded between Ptolemy III. and Seleucus II. This dating satisfies all the conditions known to us; nor is there any evident objection to it, if

the fact of composition is accepted. Those few who postulate for Ezekiel a date *c.* 230 obtain an interval sufficient to account for the allusions to Daniel *(see* above) and for the mention of Ezekiel by the Siracide.

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The "additions to Daniel" are three in number: *Susannah and the Elders, Bel and the Dragon,* and *The Song of the Three Children.* The two former have no organic connection with the book of Daniel; the last is inserted between verses 23 and 24 of chap. iii.

Susannah.—This addition was placed by Theodotion before chap. i., and *Bel and the Dragon* at the close, whereas by the Septuagint and the Vulgate it was reckoned as chap. xiii. after the twelve canonical chapters, *Bel and the Dragon* as xiv. Theodotion's version is the source of the Peshitto and the Vulgate, for all three additions, and the Septuagint is the source of the Syro-Hexaplaric, which was published by Ceriani *(Mon. Sacr.* vii.). The legend recounts how that in the early days of the Captivity Susannah, the beautiful and pious wife of the rich Joakim, was walking in her garden and was there seen by two elders who were also judges. Inflamed with lust, they made infamous proposals to her, and when repulsed they brought against her a false charge of adultery. When brought before the tribunal she was condemned to death and was on the way to execution, when Daniel interposed and, by cross-questioning the accusers apart, convinced the people of the falsity of the charge.

The most interesting part of the story is the latter half, which deals with the trial. It has been plausibly conjectured that the characteristic features of this section point to its composition about 100–90 B.C., when Simon ben Shetah was president of the Sanhedrin, and when the Pharisees were attempting to bring about a reform in the administration of the law courts. *See* Ball in the *Speaker's Apocrypha,* ii. 329 f.

The language was Semitic. The original of Theodotion's Greek seems to have been Hebrew; notice especially the idiom (not Aramaic) in vs. 15. In the "Septuagint" version the evidence is not so clear; certain features seem rather to point to Aramaic. *See* further Ball in the *Speaker's Apocrypha;* Rothstein in *Kautzsch's Apokryphen;* D. M. Kay in Charles' *Apocrypha.*

Bel and the Dragon.—We have here two independent narratives, in both of which Daniel appears as the destroyer of heathenism. It is possible, as the comms. have remarked, that some details of the story of the dragon were suggested by the Babylonian mythology. The legend of Habakkuk, who brings food to Daniel in the lions' den, is an interesting feature. The Greek exists in two recensions, those of the "Septuagint" and Theodotion. The original language, which was certainly Semitic, seems to have been Hebrew, though this has not been demonstrated conclusively. *See* Ball and Rothstein (as above); Witton Davies in Charles' *Apocrypha.*

Song of the Three Children. — This section is composed of the Prayer of Azariah and the Song of Hananiah, Azariah and Mishael, and was inserted after iii. 23 of the canonical text of Daniel. The original language of both prayer and hymn was certainly Hebrew, and the insertion was made in the Aramaic text. Careful comparison with the Greek versions shows that our canonical text has the original form of verses 21–25. *See* Ball and Rothstein (as above); Bennett in Charles' *Apocrypha.*

(R. H. CH.; C. C. T.)

DANIEL (DANIL), of Kiev, the earliest Russian travel-writer, and one of the leading Russian travellers in the middle ages. He journeyed to Syria and other parts of the Levant about 1106–07. He was the *igumen,* or abbot, of a monastery probably near Chernigov in Little Russia. He visited Palestine in the reign of Baldwin I., Latin king of Jerusalem (1100–18), and apparently soon after the crusading capture of Acre (1104); he claims to have accompanied Baldwin, who treated him with marked friendliness, on an expedition against Damascus *(c.* 1107). Though Daniel's narrative beginning at Constantinople, omits some of the most interesting sections of his journey, his work has considerable value. His picture of the Holy Land preserves a record of conditions (such as the Saracen raiding almost up to the walls of Christian Jerusalem, and the friendly relations subsisting between Roman and Eastern Churches in Syria) peculiarly characteristic of the time; his three excursions—to the Dead sea and Lower Jordan, to Bethlehem and Hebron, and towards Damascus —gave him an exceptional knowledge of certain regions. In spite of blunders in topography and history, his observant and detailed record is among the most valuable of mediaeval documents relating to Palestine: it is also important in the history of Russian language, and in the study of ritual and liturgy. Several Russian friends and companions, from Kiev and an old Novgorod, are recorded by Daniel as present with him at the Easter Eve "Miracle" in the church of the Holy Sepulchre.

There are 76 mss. of Daniel's Narrative, of which only five are anterior to A.D. 1500; the oldest is of 1475 (Leningrad, Library of Ecclesiastical History, 9/1086). Three editions exist, of which I. P. Sakharov's (1849) is perhaps the best known (in *Narratives of the Russian People,* vcl. ii. bk. viii. pp. 1–45). *See* also the French version in *Itinéraires russes en orient,* ed. Mᵉ B. de Khitrovo (Geneva, 1889) (*Société de l'orient latin*); and the account of Daniel in C. R. Beazley, *Dawn of Modern Geography* (1897) etc. ii. 155–174.

DANIEL, ARNAULT (*fl.* late 12th century), French troubadour, was born at Ribeyrac in Périgord and became a member of the court of Richard, the lion-hearted. He has become famous through the praise of Dante who ranks him with the Lustful in the seventh circle of purgatory. Arnault's amatory poems, though often obscure, are technical masterpieces of versification.

See E. Canello, *La Vita e le opere del trovatore Arnaldo Daniel* (Halle, 1883) and *Les Poésies d'Arnaut Daniel, Réédition critique d'après Canello* (Toulouse, 1910).

DANIEL, GABRIEL (1649–1728), French Jesuit historian, was born at Rouen on Feb. 8, 1649. He entered the Jesuit order at the age of 18, and became superior at Paris. He is best known by his *Histoire de France depuis l'établissement de la monarchie française* (first complete edition, 1713). Daniel published an abridgment in 1724 (Eng. trans., 1726), and another abridgment was published by Dorival in 1751. Daniel also wrote a *Histoire de la milice française,* etc. (1721) and a reply to Pascal's *Provincial Letters,* entitled *Entretiens de Cléanthe et d'Eudoxe sur les lettres provinciales* (1694); two treatises on the Cartesian theory as to the intelligence of lower animals, and other works.

See Sommervogel, *Bibliothdque de la Compagnie de Jésus,* t. ii.

DANIEL, SAMUEL (1562–1619), English poet and historian, was born near Taunton in 1562, and died at Beckington, near Devizes, on Oct. 14, 1619. His brother, John Daniel, was a musician and the author of *Songs for the Lute, Viol and Voice* (1606). In 1579 Samuel was admitted a commoner of Magdalen hall, Oxford, where he remained for about three years. He was first encouraged and, he says, taught in verse, by Sir Philip Sidney's sister, Mary, countess of Pembroke, whose household he had entered as tutor to her son, William Herbert. His first known volume of verse is dated 1592; it contains the cycle of sonnets to *Delia* and the romance called *The Complaint* of *Rosamond.* Twenty-seven of the sonnets had already been printed at the end of Sir Philip Sidney's *Astrophel and Stella* without the author's consent. Several editions of *Delia* appeared in 1592, and they were very frequently reprinted during Daniel's lifetime. The *First Pour Books of the Civil Wars,* an historical poem in *ottava rima,* appeared in 1595. *Poetical Essays,* apparently first printed in 1599, contained, besides the "Civil Wars," "Musophilus," and "A letter from Octavia to Marcus Antonius," poems in Daniel's finest and most mature manner. About this time he became tutor to Anne Clifford, daughter of the countess of Cumberland. On the death of Spenser, in the same year, Daniel received the title of poet-laureate, which he seems, however, to have shortly resigned in favour of Ben Jonson. About this time, and at the recommendation of his brother-in-law, Giovanni Florio, he was taken into

favour at court, and wrote a *Panegyric Congratulatorie offered to the King at Burleigh Harrington in Rutlandshire,* in *ottava rima.* In 1603 this poem was published, and in many cases copies contained in addition his *Poetical Epistles* to his patrons and a prose essay called *A Defence of Rime* (originally printed in 1602) in answer to Thomas Campion's *Observations on the Art of English Poesie,* in which it was contended that rhyme was unsuited to the genius of the English language. Daniel's essay and Campion's were published together, *Bodley Head Quartos,* No. 14 (New York, 1925). In 1603 Daniel was appointed master of the queen's revels. In this capacity he brought out a series of masques and pastoral tragi-comedies, of which were printed *A Vision of the Twelve Goddesses,* in 1604; *The Queen's Arcadia,* an adaptation of Guarini's *Pastor Fido,* in 1606; *Tethys Festival or the Queene's Wake,* written on the occasion of Prince Henry's becoming a knight of the bath, in 1610; and *Hymen's Triumph,* in honour of Lord Roxburgh's marriage in 1615. Meanwhile had appeared, in 1605, *Certain Small Poems,* with the tragedy of Philotas, which brought its author into difficulties, as Philotas, with whom he expressed some sympathy, was taken to represent Essex. In 1607, under the title of *Certaine small Workes heretofore divulged by Samuel Daniel,* the poet issued a revised version of all his works except *Delia* and the *Civil Wars.* In 1609 the *Civil Wars* had been completed in eight books. In 1612 Daniel published a prose *History of England,* from the earliest times down to the end of the reign of Edward III.

Daniel was made a gentleman-extraordinary and groom of the chamber to Queen Anne, and was now acknowledged as one of the first writers of the time. Later in life he threw up his titular posts at court and retired to a farm called "The Ridge," which he rented at Beckington, near Devizes, in Wiltshire, where he died.

Of Daniel's works, the sonnets are now, perhaps, most read. They depart from the Italian sonnet form in closing with a couplet, as is the case with most of the sonnets of Surrey and Wyat, but they have a grace and tenderness all their own. Of a higher order is *The Complaint of Rosamond,* a soliloquy in which the ghost of the murdered woman appears and bewails her fate in stanzas of exquisite pathos. Among the *Epistles to Distinguished Persons* will be found some of Daniel's best work. The epistle to Lucy, countess of Bedford, is remarkable among those as being composed in genuine *terza rima,* till then not used in English. *Hymen's Triumph* is perhaps the best of all his dramatic writing. An extract from this masque is given in *Lamb's Dramatic Poets,* and it was highly praised by Coleridge. In elegiac verse he always excelled, but most of all in his touching address *To the Angel Spirit of the Most Excellent Sir Philip Sidney. Musophilus* is one of the most characteristic writings of Daniel. It is a dialogue between a courtier and a man of letters, and is a general defence of learning, and in particular of poetic learning as an instrument in the education of the perfect courtier or man of action. It is addressed to Fulke Greville, and written in a sort of *terza rima,* or, more properly, *ottava rima* with the couplet omitted. Daniel is wanting in fire and passion, but he is pre-eminent in scholarly grace and tender, mournful reverie.

Daniel's works were edited by A. B. Grosart in 1885–96; ***Selected Verse*** (Pembroke Booklets, No. 6, 1905).

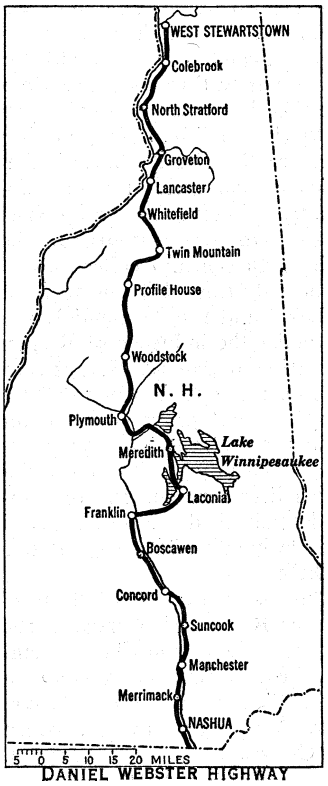
DANIELL, JOHN FREDERIC (1790–1845), English chemist and physicist, was born in London on March 12, 1790, and in 1831 became the first professor of chemistry at the newly founded King's College, London. His name is best known for his invention of the Daniell cell *(Phil. Trans.,* 1836; *see* BATTERY), still extensively used for telegraphic and other purposes. He also invented the dew-point hygrometer known by his name (*Quar. Journ. Sci.,* 1820), and a register pyrometer *(Phil. Trans.,* 1830); and in 1830 he erected in the hall of the Royal Society a water-barometer, with which he carried out a large number of observations *(Phil. Trans.,* 1832). A process devised by him for the manufacture of illuminating gas from turpentine and resin was in use in New York for a time. His publications include *Meteorological Essays* (1823), an *Essay on Artificial Climate considered in its Applications to Horticulture* (1824), which showed the necessity of a humid atmosphere in hothouses devoted to tropical plants, and an *Introduction to the Study of Chemical Philosophy* (1839). He died suddenly on March 13, 1845, in London, while attending a meeting of the council of the Royal Society, of which he became a fellow in 1813 and foreign secretary in 1839.

DANIELL, THOMAS (1749–1840), British painter, born at the Chertsey inn, Surrey, in 1749, and died at Kensington. London, March 19, 1840. Up to 1784 he painted topographical subjects and flower pieces. By this time his two nephews *(see* below) had come under his influence, the younger, Samuel, being apprenticed to Medland, the landscape engraver, and the elder, William, being under his own care. In this year (1784) he embarked for India accompanied by William, and remained there ten years; on returning to London he published his largest work, *Oriental Scenery,* completed in 1808.

WILLIAM DANIELL (1769–1837), his nephew, was 14 when he accompanied his uncle to India. He executed engravings in aquatint, and was elected R A. in 1822.

SAMUEL DANIELL (1775–1811), was brought up as an engraver, and first appeared as an exhibitor in 1792. He travelled into the interior of Africa, with his sketching materials in his haversack, and published *African Scenery.* He left for Ceylon in 1806, where he spent the remaining years of his life, publishing *The Scenery, Animals and Natives of Ceylon.*

DANIELS, JOSEPHUS (1862–), American editor and politician, was born at Washington, N.C., on May 18, 1862. He studied at the Wilson (N.C.) institute and also the University of North Carolina, and at 18 became editor of *The Wilson Advance.* He was admitted to the bar in 1885, but preferred newspaper work, becoming in that year editor of the Raleigh *State Chronicle.* He was printer for the State of North Carolina from 1887 to 1893; and then, for two years, was chief clerk of the Department of the Interior. From 1904 he was editor of the Raleigh *News and Observer,* with which his former paper was consolidated. He was on two occasions a delegate to the national Democratic convention, and from 1896 to 1916 was a member of the Democratic national executive committee. In 1913 he was appointed secretary of the Navy by President Wilson. His personal interest in the enlisted men was shown by his provision of opportunities for training in various trades. On retiring from this office in 1921 he resumed the editorship of his newspaper. He was the author of *The Navy and the Nation* (1919); *Our Navy at War* (1922); *Life of Worth Bagley* (1924) and *Life of Woodrow Wilson* (1924).



DANIEL WEBSTER HIGHWAY

DANIEL WEBSTER HIGHWAY, American thoroughfare extending from the Massachusetts-New Hampshire State boundary line to the Connecticut river at Canaan, Vermont. This highway was established by the New Hampshire legislature in 1921 to commemorate the great statesman whose name it bears; at Franklin it passes near his birthplace. It traverses the White Mountains and the heart of the State, and is hard surfaced or paved throughout its length of 200 miles. Lake Winnepesaukee, Mt. Washington, Old Man of the Mountains, the Indian Head and Franconia Notch are among the scenic attractions along its route.

DANISH LANGUAGE AND LITERATURE. The territory of Old Danish included the present Denmark, the southern Swedish provinces Halland, Skåne and Blekinge, the whole of Schleswig, and for a short period also a great part of

Britain, and parts of Normandy. The oldest monuments of the language are runic inscriptions, altogether about 225 in number. The oldest of them go as far back as to the beginning of the 9th century. No Danish literature arose before the 13th century. The oldest manuscript dates from the end of that-century, written in runes and containing the law of Skåne. From about the year 1300 we possess a manuscript written in Latin characters and containing the so-called Valdemar's and Erik's laws of Zealand, the Flensborg manuscript of the law of Jutland, and a manuscript of the municipal laws of Flensborg. These three manuscripts represent three different dialects—that, namely, of Skåne, Halland and Blekinge, that of Zealand and the other islands, and that of Jutland and Schleswig. There existed no uniform literary language in the Old Danish period.

The form of the language hardly differs at all during the period between A.D. 800 and 1200 from Old Swedish. In the oldest literature the differences are not important, and are generally attributable to the fact that Danish underwent a little earlier the same changes that afterwards took place in Swedish. Internally, they show considerable differences; the law of Skåne most nearly corresponds with the Swedish laws, those of Zealand keep the middle place, while the law of Jutland exhibits the most distinctive individuality. The vocabulary, which in earlier times only borrowed a few, and those mostly ecclesiastical, words, became chiefly owing to the predominant influence of the Hanse towns—inundated by German words.

The earliest traces of literary production in Denmark may be found as far back as the Germanic migration. The mythical events of that period provided inspiration for a Danish epic, which has been lost. Its outline and its ideas can be found in the free version in Latin made by Saxo about 1200 (see Axel Olrik, *Danmark's Heltedigtning*). During the first centuries after the arrival of Christianity in the country, the Danish mind was almost exclusively engaged in a slow process of assimilation. This was completed by the year 1200, when Denmark came into touch with the Latin civilization common to Europe, partly through translations and partly through adaptations. To this time belong many legends (the earliest about Knud the saint, by the English monk Aelnoth); the Hexaemeron, a poem about the creation, by Archbishop Andreas Sunesøn; annals of monasteries and chronicles, the most important being the *Compendiosa Historia Regum Daniae* by Sven Aggesen, and the Gesta Danorum of Saxo Grammaticus. In the Danish language we find, during the 13th century, collections of legal customs which before that time only existed in the form of oral tradition; *e.g.*, the "Scanian Law" and the "Seeland Law." The "Jutland Law" was somewhat under the influence of Roman and canonical law. The medical treatises of Henrik Harpestreng were written at the same time. From the 14th century dates a version of *Lucidarius*, the collection of old proverbs by Peter Laale, and a history of Denmark in verse (*Rimkrøniken*). This was the first book in Danish to be printed (1495). The most significant section of mediaeval Danish literature consists of folk-songs. In 1591 Anders Sørensen Vedel published 100 songs. Svend Grundtvig began a complete and scholarly edition in 1883. It was continued after his death by Axel Olrik.

Effect of the Reformation.— The 16th century was influenced by Humanism, but the struggle of the Reformation engaged the energies of all that was most significant in the nation. The humanist, Poul Helgesen, who had been trained by Erasmus, was a passionate Catholic polemist, while Hans Tausen (d. 1561 as bishop of Ribe) was a Protestant agitator. A useful mediator between the old and the new tendencies was Christiern Pedersen (d. 1554). In 1534 he adapted the French poems about Holger Danske—a book which remained popular for three centuries. Finally he was the principal author of the first complete Danish translation of the Bible (1550). Peder Palladius (d. as bishop of Seeland in 1560) transports us into the very midst of the fight for the Lutheranization of the national life in his *Visitatsbog*, consisting of notes made for his visits of inspection as a bishop.

The Danish hymn originated during this period. The earlier hymn-books have been lost, but their contents can be found in the first larger collection published by Hans Thomisen in 1569. A little later Hans Christensen Sthen wrote hymns in the style and in the tender tone of folk-songs.

The main part of the non-religious literature of the 16th century has been lost. The most important is the translation from the low German of Reynard the Fox by Herman Weigere (1555). The earliest trace of dramatic poetry in Denmark can also be found in that century—miracle- and morality-plays and farces in naïve style, enacted by the pupils of the schools. The oldest-known work is a miracle-play, *Ludus* de Sancto *Canuto* (c. 1530). The most talented dramatic author of the period was Hieronymus Justesen Ranch (d. 1607), rector in Viborg.

Apart from belles-lettres we have to mention the *Skiby-chronicle* by Poul Helgesen, the excellent translation of Saxo in 1575 by Anders Sørensen Vedel, the translation of Snorre's *Heimskringla* by the Norwegian, Peder Clausøn Friis, as well as the *Danmarks Riges Krønike* (Chronicle of the Danish State) by the chancellor Arild Huitfeld. Fantastical historiography is represented by Claus Lyschander, who carries the origin of the Danish royal house back to Adam.

Coming of the Renaissance.— During the Thirty Years' War Denmark was drawn into the European literary renaissance. The first representative of the new tendency was Anders Arrebo (1587–1637) for some time bishop in Trondhjem. He translated the Psalms into verse, and wrote an adaptation of the Hexaemeron by Du Bartas. Anders Bording (d. 1677) wrote lively topical poems and poems in the sentimental and gallant pastoral manner. He also wrote Den *Danske Mercurius*, a court-journal written in Alexandrine verse (1666), which was the first Danish weekly newspaper. By far the greatest poet is the writer of hymns, Thomas Kingo (1634–1703), the son of an emigrated Scottish weaver. After some smaller collections of hymns (including admirable morning- and evening-hymns) he published at the invitation of the king his sketch of a new hymn-book. A large part of this work was incorporated in the authorized hymn-book, the so-called hymn-book of Kingo of 1699.

The prose of this period contained a large amount of creative work. Ole Worm (1588–1654) is the originator of research into national antiquities, with the Monumenta Danica (1643), which described and interpreted all runic inscriptions known in his time. The Teutonic renaissance, which a century later was to come over from England as a reaction against the one-sided worship of French classicism, was already making itself felt in works such as the edition and translation of some of the older songs of the Edda by Peder Resen (1665), and in the essay De *Causis contemptae* Mortis a *Danis* (1689) by Thomas Bartholin the Younger. For the first time the living language was the object of serious study, in Latin by Bishop Erik Pontoppidan (1668) and in Danish in the Danske Sprogkunst, and in the Considerations about the *Cymbric Language* by the priest Peder Syv (1631–1702). At the end of the century two scholarly ladies appear, Brigitte Thott, who translated Seneca in 1658, and the daughter of Christian IV., Leonora Christina Ulfeldt, who in the unique human document *Jammersmindet*, first discovered and published in 1869, has described in a moving manner the history of her 20 years' imprisonment. Famous anatomists were Thomas Bartholin (d. 1680), Nicolaus Steno (d. 1686), who also founded geognosy, and Ole Rømer (d. 1710), who discovered the velocity of light.

The 18th Century.— In the first half of the 18th century Ludvig Holberg (*q.v.*, 1684–1754), puts all other names in the shade. He is called the father of Danish literature and contributed to nearly every branch of it. He wrote satires, 34 comedies, novels and epigrams. Unprejudiced and humorous, a raisonneur in the English and particularly in the French manner, he poured forth popular philosophical letters and moral considerations, and for the first time in Denmark, catered for the general cultured public.

Frederik Eilschow, popular philosopher, who died at the age of 25 in 1750, was a pupil of Holberg, as was Jens Schelderup Sneedorff (d. 1764), editor of a review in the manner of Addison, called *The* Patriotic Spectator. Historians of the period include Hans Gram (1685–1748), a critical student of sources and a scholarly annotator, founder of the "Videnskabernes Selskab" (Scientific Association, 1742), and Jakob Langebek (1710–78) who was

first and foremost an editor. He began the great edition of *Scriptores Rerum Danicarum*. Erik Pontoppidan the Younger (*q.v.*, d. 1764) wrote Danzsche Kirchengesclziclzte and the topographical work Danske Atlas. Apart from Holberg, poetry in the first half of the 18th century has little importance.

After Holberg's death English and French influences became increasingly marked. Pope's didactic poetry and the nature poems of Thomson found an imitator in Christian Braunman Tullin (1729–65). An association for improving the people's taste had been founded in accordance with the rules established by French aesthetics. These rules were strictly applied in the first original Danish tragedy Zarine (1772) by the Norwegian, Nordahl Brun. After 1770, other tendencies appeared. It was through Klopstock, who spent a great part of his life in Denmark, that the German Renaissance, which had its starting point in Young, Macpherson and Percy, was imported into Denmark. Its most talented representative is Johannes Ewald (*q.v.*, 1743–81), perhaps the most important lyrical poet in the pathetic manner of the 18th century. Ewald began as an adherent of French classicism, but was afterwards influenced by Shakespeare and Ossian. He wrote the first national tragedies, choosing his subjects from Saxo and the Edda (Rolf Krage and Balder's Death). In the musical play The Fishermen we find expressed for the first time the love of the sea and admiration for the common seaman. In his autobiography *Levned* og Meninger his delicate mind found its best medium of expression. Here we find humour and sensitiveness like Sterne's and the self-analysis of Rousseau.

The Norwegian, Johan Herman Wessel (1742–85), was a lover of clearness, wit and elegance. He caricatured insincere pathos and servile imitation in his tragic parody Kaerlighed *uden Strømper* (Love without Stockings, 1772). He was the wittiest of the clever literary people who gathered in the "Norske Selskab" (Norwegian Association). Jens Baggesen (*q.v.*, 1764–1826) was a man of restless nature but charming mind and real facility. His best work was done in his rhymed epistles and in Labyrinten, a description of travel in the manner of Sterne (1792).

The poets of the last decade of the 18th century are not of great importance, but, in a tentative way, they tried new tunes. Thomas Thaarup described the peasants in dramatic idylls with a patriotic tendency, e.g., *Høstgildet* (Harvest Festival, 1791). Ole Samsøe (d. 1796) chose a subject from the national past for his tragedy Dyveke (the mistress of Christian II.). O. C. Olafsen (1764–1827) wrote the best comedy since Holberg, Gulddaasen. Political and social satire predominate in the work of Peter Andreas Heiberg (1758–1841), who wrote plays (De Vonner og de Vanner), articles for periodicals and club-songs. Having been punished several times for his audacious criticism, he was banished in 1800 and settled in Paris. The same fate befell Malte Conrad Bruun (1775–1826) because of the *Aristokraternes Katekismus*.

The growing interest taken in political and public affairs manifested itself in the formation of clubs where social life was inspired by the punch-bowl and by songs. The most fertile and amiable song-writer of the period was Knud Lyhne Rabbek (1760–1830). He also contributed to the periodicals *Minerva* and The Danish Spectator. As an editor and a historian of literature he collaborated with the scholarly philologist Rasmus Nyerup (1759–1829) and with Werner Abrahamson (1744–1812), aesthete and critic. During this period Danish prose acquired increasing flexibility, clearness and irony. The doctor Johan Clemens Tode (d. 1806) wrote witty essays, Ove Malling aimed at arousing the patriotic sense of the Danes with anecdotes from the national history, Store og gode *Handlinger* (Great and Good Deeds, 1777), and Peter Frederik Suhm (1728–98) wrote a book about Odin and a history of Denmark, rich in material. Niels Treschow (1751–1833) was a philosopher with a style of Gallic delicacy.

The Golden Age.—The period between the battle of the roadstead of Copenhagen (1801) and the battle of Diippel (1864) was the golden age of Danish poetry. The Danish romantic movement shows an unusually harmonious blend of nationalism, of Christianity and of humanity. The first representative of the movement was Adolph Wilhelm Schack von Staffeldt (1769–1826), who was born in Germany and whose lyricism is profound and thoughtful, though rather heavy and lacking in polish. In the appreciation of the public he was entirely put in the shade by Adam Oehlenschlaeger (1779–1850), the most richly endowed poetical genius of Denmark. It was the Norwegian Henrik Steffens, whose conversations and lectures (1802) introduced Oehlenschlaeger to the world of romantic thought. The following years were the creative period, when Oehlenschlaeger wrote his romances, tragedies, poetic stories of adventure and sagas, works which are still the culminating point of Danish poetry. The power and beauty of his style and its picturesqueness influenced the poetry of the whole century that followed; the world of the Northern gods and heroes became as visible and tangible in Oehlenschlaeger's poetry, as that of the Greek Olympus in Homer. In *Aladdin* and in the figures of his tragedies the nation found an idealized picture of its own character, open, naïve, innocent, pious and true. Nicolaj Frederik Severin Grundtvig (*q.v.*, 1783–1872) was a clergyman, poet and historian. He developed through hard inner conflicts into a mighty advocate of religious and national awakening which, particularly through the Grundtvigian folk high schools, has been of enormous importance to the Danish people. He wrote historical and popular poems and a great number of hymns, some of which by their mixture of prophetic inspiration, simplicity and depth rank among the foremost in the world's literature. He was also a learned mythological and historical writer and gave, during three visits to England about 1830, an impetus to Anglo-Saxon studies. The importance of Bernhard Severin Ingemann (*q.v.*, 1789–1862) also lay in his awakening and strengthening the national self-confidence. This he effected by his historical novels of the middle ages, written somewhat in the manner of Scott, and by his cycle of romances *Holger Danske*. Carsten Hauch (*q.v.*, 1790–1872) was a pupil of Oehlenschlaeger and was romantic in the manner of Tieck and Novalis. His profound and noble personality expressed itself in historical dramas and novels, and especially in his lyrical poems.

The New Realism.—It is in the 'nos of the 19th century that the first traces of an interest in reality can be detected in the choice of poetical subjects. Poul Martin Møller (1794–1838), a strong and vital personality, portrayed, particularly in his novel En dansk Students Euentyr (The Adventures of a Danish Student, 1824), the types of his own time. Jute Steen Steensen Blicher (1782–1848) also wrote of contemporary life. His starting point was the 18th century. He began in 1807 with a prose translation of Ossian. Later he translated Pope's Abelard and The Rape of the Lock, Goldsmith's Vicar of *Wakefield* and several of the Percy folk-songs. Sterne also strongly influenced him. He was the first to describe in his poems Jutland, its heaths and its inhabitants. After 1824 he also did this in his short stories. Particularly original is E. *Bindstouw*, a collection of poems and stories written in Jutish dialect. Blicher was a clergyman and, completely in the tradition of the 18th century, he aimed at the enlightenment and practical reform of his flock. The divorced wife of P. A. Heiberg, Thomasine Gyllembourg-Ehrensvard (*q.v.*, 1773–1856), was much admired in her own time on account of her short stories, Hverdags-historier (Stories of Everyday Existence). She described the troubles of the heart, drawing upon her own experience, with an unprejudiced and delicate human understanding. Her nephew Carl Bernhard (pseudonym, Andreas Saint-Aubain) revealed similar qualities in his novels, while Carl Baggers's (d. 1846) short story (The Life of *My* Brother), which is full of audacious realism and Byronic pride, shocked the few readers it found.

About 1830 the other naïve romanticism gave way to a poetical realism, more contemplative and conscious, more artistic than national, more interested in form than in matter. The leader of this movement is Johan Ludvig Heiberg (*q.v.*, 1791–1860). His vaudevilles heralded the newer Danish comedy and his romantic dramas *Elverhøj* (The Hill of the Fairies) and *Syvsoverdag* ousted the serious tragedies of Oehlenschlaeger from public favour. Heiberg was the first Danish critic who founded himself upon clearly defined principles. The upper classes allowed him to dictate their taste, until they accepted the doctrines of Georg Brandes. Henrik Hertz (q *v.*, 1797–1870) was another author of

comedies, also a champion of good taste. He was a creature of delicate moods and style, of an artistic mind rather than forceful personality. Christian Winther (*q.v.*, 1796–1876) was the fertile singer of the natural beauties of Seeland and the first great lyrical love poet in Danish. Ludvig Adolf Bødtcher (1793–1874) and Emil Aarestrup (1800–56) are excellent lyrical writers in the small manner.

Hans Andemen.—Unique, and one of the greatest figures was Hans Christian Andersen (*q.v.*, 1805–75). He experimented in several genres without much success until in his *Eventyr* (Fairy-tales), which came out in small instalments from 1835 onwards, he succeeded at last in expressing his real self, his sublime simplicity, his all-inspiring fancy, his deep sentiment and his quaint humour, which always plays between smiles and tears. The fairy tales were told for a childish audience in a very lively and impressionistic style, but their ideas are for adults—a mixture of simple idealism and bitterness caused by personal experiences.

In the '40s political liberalism was acquiring an increasingly powerful hold, and a growing sense of actuality and of realism began to undermine the old aesthetic humanism. Heiberg, with his superior sarcasm, condemned what he called the spiritless outlook of this time in his satirical work En *Sjael* efter *Døden* (A Soul after Death, 1841). Paludan Müller's (1809–76) point of view however was ethical. His chief work was the epic poem Adam Homo (1841–48), in Byronic stanzas, full of reminiscences of Don Juan. He was one of the masters of Ibsen. So was Søren Aaby Rierkegaard (*q.v.*, 1813–55), the most original genius of the '40s. He was a fascinating and at the same time a profound writer, a captivating stylist, a subtle philosophic and religious author. He set forth his conception of life, his views on aesthetic, ethical and religious problems, in *Enten-Eller* (Either-Or) and Stadier *paa Livets* Vej (Stages on the Road of Life).

The Jew Meir Aaron Goldschmidt (1819–87) was a figure of transition, a Danish Disraeli. He edited the first satirical weekly, Corsaren (The Corsair). He was the first writer who gave a sympathetic description of Jews. In his novel *En Jøde,* a Jew (1845), and in his delicate short stories, he displayed a psychological penetration and depth of mood, which pointed towards a newer poetry. In the '40s a certain liveliness was displayed by the students who carried the banner of aesthetic liberalism and of the pan-Scandinavian idea. Carl Ploug (1813–94) and Jens Christian Hostrup (1818–92) were their leaders. They wrote songs and students' comedies. Many of the lyrical poets of the middle of the century are delicate in expression even if they are somewhat colourless and vague—Christian Richardt (d. 1892); Hans Vilhelm Kaalund (d. 1887); Christian Molbech (d. 1888), who also translated Dante; Edvard Lembcke (d. 1897), the translator of Byron and Shakespeare. Eric Bøgh (1822–99) was a skilled writer of songs and of vaudevilles in the popular humorous taste.

Prose-writers also followed in the traces of the older generation. Herman Frederik Evald (1821–1908) and J. C. C. Brosbøll (pseudonym, Carit Etlar, d. 1900) wrote entertaining historical novels in the manner of Blicher and Ingemann. A series of schoolmasters took the same line (Thyregod, Anton Nielsen, Zacharias Nielsen). They widened the circle of readers and in their works probed deeper into popular life than any writer before them. Vilhelm Bergsøe was a capable maker of novels which suited the easily satisfied taste of the upper-classes (Piazza del Popolo, 1866). The most original was Hans Egede Schack. His novel *Phantas*terne (The Phantasts, 1857) reveals considerable psychological gifts.

The period which ends about 1870 is rich in important names in the sphere of scholarship. C. J. Thomsen (d. 1865) and J. J. Asmussen Worsaae (1821–85) were the first to place on a firm foundation the study of Nordish archaeology. Niels Matthias Petersen (1791–1862) wrote a pioneer work on the History of Danish Literature, and translated, about 1840, the Seelandish sagas. Christian Molbech (1783–1857), a learned historian and acute critic, published the first good Danish dictionary. Other historians were Engelstoft (1774–1850) and K. F. Allen (1811–71). In philosophy specially notable personalities were Frederik Christian Sibbern, the Hegelian Rasmus Nielsen (d. 1884) and Hans Brøchner (d. 1875), the master of Georg Brandes.

The Work of **Brandes.**—Georg Brandes (*q.v.*, 1842–1927) is undoubtedly the leading Danish representative of the new outlook on life which manifested itself during the second half of the 19th century. The brilliance and ingenuity of his manner are shown as much in his lectures about The *Principal* Tendencies of *19th* Century Literature as in his literary essays and critical portraits (Holberg, Kierkegaard, Shakespeare, Goethe, Voltaire). He shattered the national self-confidence and linked the general thought of Denmark with the mind of Europe, especially in the direction of positivism and individualism. His historical and psychological criticism, formed in the school of Taine and Sainte-Beuve, indicated the direction in which all subsequent Danish literary history was to move. Finally he pointed the way to the poets of his time in the direction of a truer psychology, a more characteristic style, and in particular towards a more daring and more modern choice of subject matter. His critical attitude towards tradition shocked many people. But most of the talented among the younger generation were delighted and enthusiastic. Until 1900 literature had essentially been a debate between old and new, national and foreign, a choice between tradition and freedom. For deeper natures it had meant a debate between the rights of dreams and those of the outer world, between the romanticism of the heart and the realism of the intellect. That is how Holger Drachmann (*q.v.*, 1846–1908) the greatest lyrical poet of the period, saw the conflict. He was a great writer of love poems and of vivid poems about the sea and seamen, but his inner life oscillated restlessly between the old and the new.

Jens Peter Jacobsen (*q.v.*, 1847–85), in his stories and novels, went much deeper into the same problems of dream and reality, especially in Niels Lyhne. In Marie *Grubbe* he introduced the naturalism of Flaubert. In this genre he showed himself capable of closer observation and of deeper psychological interpretation than any of his predecessors.

Sophus Schandorff (1838–1901) painted racy and robust pictures of peasant and lower middle-class life. (Little *Folk,* 1880). He caricatured priests and noblemen in the true manner of an agitator. His successor was Gustav Wied (1858–1914) whose pictures of provincial towns were witty distortions of reality, and exposed the hypocrisies of social life (*Slaegten, Satyrspil*). Erik Skram (1847–1923) became, with Gertrude *Colbjørnsen* (1879), a member of the corporation of iconoclasts. Marl Gjellerup (1857–1919) began with a contentious and anti-theological novel, The Disciple of *Teutons,* in homage to Georg Brandes. But soon his religious and humanitarian sentiments made him turn his back on naturalism. In drama (*Brynhild, Wuthorn*) and novels *Minna, Møllen* (The Mill), he dealt with eternal problems in the ethical manner of Schiller.

Representatives of the modernist doctrines of Brandes were Edvard Brandes (1847–1931) in his modem tendentious drama, the mocking Peter Nansen (1861–1918) in his stories in the style of Maupassant, and Carl Evald (1856–1908) in his natural-history tales with a Darwinian tendency. In his comedies (e.g., En *Skandale*), Otto Benzon (1856–1927) battles against the hypocrisy of society, and Gustav Esmann (1860–1904) pokes fun at the older generation, *e.g.,* in Den kaere *Familie* (The Dear Family). Less of an agitator and more bound by tradition is Einar Christiansen (1861–). Sven Lange (1868–1930) was a poet and an individualist unburdened with doctrines, as he showed in his drama Samson and *Delila,* in his novel *Hjertets* Gerninger which describes the early '90s, and in The First Conflicts, in which the young Georg Brandes is the principal figure. A typical Copenhagen poet was Karl Larsen (1860–1931), with an acute perception and a perfect capacity for expression. He described the types of the big town, from the lowest classes upward: *Udenfor Rang*klasserne (Outside the Upper Classes). In Den gamle Historie (The Old Story), which is really an autobiography, he has given us a picture of the exaltation of the '70s.

Outside the Brandes movement were the subtle exponent of feminine psychology Wilhelm Topsøe (1840–80) and the more modern Herman Bang (1857–1912). Bang's outlook on life was decadent and pessimistic. He is fascinating because of the

virtuosity of his impressionistic technique His special subjects are the uneventful existences, those poor nonentities. old or lonely women with a hidden tragedy in their lives that are made up out of nothing at all *(Ved Vejen:* Away from the Trodden Path; *Ludvigsbakke:* Ludvigshill; *Irene Holm).* Henrik Pontoppidan (1857–1943) is another important author, although in a somewhat older style. In 1917 he shared the Nobel prize with Karl Gjellerup. In a series of great novels *(Det forjaettede Land:* The Promised Land; *Lykkeper; De Dødes Rige:* The Kingdom of the Dead) he has exposed in a forceful and mordantly ironical way the weaknesses of his time.

The '90s in Denmark. — About 1890, a reaction against uninspired naturalism set in, with a deeper impulse towards beauty, a consciousness of duty towards the universe. This applies especially to a number of lyrical poets in the '90s. The most important was Johannes Jørgensen *(1866–*). He was first attracted by Modernism but became converted to Catholicism. In his youth he was a refined stylist; afterwards in his collections of Poems: *Fra det Dybe* (From the Depths), *Blomster og Frugter* (Flowers and Fruit); and in his prose works: *St. Francis of Assisi, The Goethe Book,* he revealed the depth of his feeling and his gentle simplicity. His friend Viggo Stuckenberg (1863–1906) was a poet who sang of every-day existence and fidelity. Sophus Claussen (1864–1931) was a capricious, but always an elegant, poet (*Dansk Sommer:* Danish Summer; *Djaevlerier:* Devilries; *Heroica*) and translator, *e.g.,* of Shelley.

Ludvig Holstein (1864–) was a successor of Christian Winther, as Valdemar Rørdam (1872–) was the successor of Holger Drachmann. Rørdam is also the translator of Kipling. Thor Lange (1851–1915), Ernst v. d. Recke (1848–1933), and Niels Møller (1859–) have also to be mentioned, as well as Sophus Michaëlis another refined prose writer.

A special group is formed by the Jutland authors who are inspired by love of their land, its natural beauty and its inhabitants, and its daily life in field, farmyard and home. Jeppe Aakjaer (1866–1930) was a great lyrical poet of popular inspiration, a pupil of Blicher and of Burns. Johan Skjoldborg *(1861–*) is the poet of the Jutland smallholders (*En Stridsmand; Kragehuset*). Marie Bregendahl (1867–) is important for her descriptions of local life which are astonishingly true to life and full of faith in the deeper forces of the world. Jakob Knudsen (1858–1917) stands entirely by himself. He was a writer of strong personality, who broke away from modernism, individualism and intellectualism (*Gaering-Afklaring:* The Fermentation Subsides. *Angst og Mod:* Fear and Courage, a book about Luther; *Den Gamle Praest:* The Old Priest: *Sind).* Johannes V. Jensen (1873–), the most genuine of the Jutland authors, expanded the Jutish movement into an Anglo-Saxon movement. In *The Gothic Renaissance* (1900) he attacked the sickness and tiredness of the end of the 19th century. At the same time he is the greatest language reformer since Oehlenschlaeger. His chief works are: *Stories from Himmerland, Myths and Hunts, Exotic Stories,* which are based on his travels, and a series of novels; e g., *The Long Journey.* He also wrote a *History of the Northern Races from the Ice-age to the Vikings* (translated into English in *1924).*

Other modern Danish prose writers of merit are Martin Andersen Nexø (1869–), author of the monumental epic of proletarian life *Pelle the Conqueror* and *Ditte Girl Alive;* Harald Kidde (1878–1918) who lacks Nexø's social interests but deals in a subtle manner with complex psychological difficulties (*Aage and Elsa; The Hero);* Thorkild Gravlund (1879–) who specializes in Danish national psychology; Knud Hjortø (1869–1931) who painted pictures of provincial town-life. Johannes Buchholtz *(1882–*) describes provincial life in a baroque and fanciful manner (*Egholm's Gud; The Miracles of Clara v. Hang).* Hans Poulsen (*Julie Pandum,* 1927) is subtle and penetrating, and studies the same *milieu.* Otto Rung (1874–) depicts in his novels (*The Bird of Paradise*) and in his dramas *(The Bridge)* the dregs of the urban population as well as the "high-brows." Poul Levin (1869–1929) takes his amiable and pleasant subjects from the life of the upper middle-class. Harry Søiberg (1880–), in his *Country of the Living* (1920), has given a description of great value of the religious struggles among the population of West-Jutland. Lighter food is provided in the witty literary portraits and pastiches by Svend Leopold *(1874–*), and in Svend Fleuron's *(1874–*) widely-read animal stories.

After the **World War.**—The ferment of the period after the War has been noticeable in Denmark. Anker Larsen *(1874–*) deals with general conceptions of life in his novels, especially in *The Philosopher's Stone,* which obtained the Gyldendal prize for literature in 1923. Among the younger writers the most original are Tom Kristensen *(1893–*) *(The Arabesque of Life)* and Jakob Paludan (1896–) *(Birds round the Fire* and *The Field is Ripening).* In lyrical poetry we find again Tom Kristensen, Emil Bgnnelycke, the poet of town life, the epicurean Hans Hartvig Seedorff Pedersen *(1892–*) *(Vine and Ivy)* and the pithy satirical painter of the provinces, Harald Bergstedt *(1877–*). The lyrical and dramatic works of Helge Rode *(1870–*) and the work of Jute Thøger Larsen (d. *1928)* deal more and more with religious and national questions. Finally we may mention Olaf Hansen, L. C. Nielsen and Kai Hoffmann, lyrical poets.

There are a few dramatists besides those already mentioned: Svend Lange, Helge Rode and the fertile Carl Gandrup (1880–). The Jew Henri Nathansen (1868–) deals with the troubles of his race. He has written the dramas *Daniel Hertz* and *Within the Walls,* and a novel, *The Life of Hugo David.*

There are many women writers, some important: Ingeborg M. Sick (1869–) and Karin Michaëlis *(1872–*), whose novel *The Dangerous Age* (1910) has been translated into most European languages. The novelist and dramatist Agnes Hennigsen (1868–) depicts the love-life of modern women. Thit Jensen has discussed problems of feminine life. Gyrithe Lemcke (1866–) has given a good description of the life of several generations of a merchant family during the course of a century (*Edwardsgave*). The novels of Astrid Ehrencrone Kidde about Värmland are delicate and full of atmosphere. Inga Nalbandian (1879–) has described the terrpr in Armenia with fiery hatred. (For the contribution of Icelandic authors to Danish literature *see* ICELANDIC LITERATURE)

Amongst historical writers since 1870 are Troels Lund (1840–1921) who wrote *Daily Life in Northern Europe during the 16th Century;* the South Jute A. D. Jørgensen (1840–1897); the historian of the Normans and Vikings Johannes Steenstrup (1848–1935); the critic of sources of mediaeval history Kristian Erslev (1852–1930); and Eric Arup (1876–), who collaborated in a Danish history written from a social-economic viewpoint. Folklorists were Svend Grundtvig, H. F. Feilberg (author of a Jutish dictionary) and Axel Olrik. In 1879 Trap finished the first edition of his great statistical and topographical work *Denmark,* and in 1905 appeared Bricka's biographical dictionary. Julius Lange (1838–96) is the author of the monumental work *The Human Figure in the History of Art.* Karl Madsen (1855–) dealt with national art and with the Netherlands; Frederik Poulsen (1876–) with the art of the ancients; Wilhelm Wanscher (1875–) especially with the Renaissance. A fascinating writer on the history of national literature is Vilhelm Andersen (1864–) whose chief work is *Times and Types in the History of the Danish Mind.* Valdemar Vedel (1865–) has given scholarly pictures of historical types from the middle-ages to the 17th century (*Lives of Heroes, Town and Burgher, Monastic Life, Baroque*). Amongst younger writers, Paul V. Rubow (1896–) is notable for outlook, method and critical sagacity. Harald Nielsen (1879–) was the most independent judge of the literature of his day, but he became increasingly interested in the observation of the social and moral aspects of his own time, and a modern mediaevalist like Chesterton. In philosophy Harald Høffding (1843–1931) is the greatest name.

Finally we may mention the annual publications and the scholarly editions of the Danish Association for National Language and Literature (*Sprog og Litteraturselskab)* founded in 1911, which also edits the great Danish dictionary.

An extensive bibliography may be found in Krarup and Erichsen, *Danish Historical* **Bibliography** (1917), part *iii.* and in the Danish biographical ***Hand Lexicon*** (ended *in* 1926). (G. CH.)

DANRL, VIKTOR, FREIHERR VON (1854–), Austro-Hungarian general, was born in Udine on Sept. 18, 1854. In the World War he commanded at the outset the I. Army and defeated the Russians in the battle of Krasnik (Aug. 23–25, 1914). After the Italian declaration of war he became in May 1915 commander of the defence forces in Tirol. As an army commander in the following years he took a successful part in the offensive against Asiago-Asiero, but shortly afterwards retired from his post on account of ill-health.

DANNAT, WILLIAM T. (1853–1929), American artist, was born in New York city in 1853. He was a pupil of the Royal Academy of Munich and of Munkacsy, and became an accomplished draughtsman and a distinguished figure and portrait painter. He early attracted attention with sketches and pictures made in Spain, and a large composition, "The Quartette," now in the Metropolitan Museum of Art, New York, was one of the successes of the Paris Salon of 1884. Dannat settled in Paris; he is represented in the Luxembourg, was president of the Paris Society of American Painters, and a member of the National Institute of Arts and Letters. He died in France on March 12, 1929.

DANNECKER, JOHANN HEINRICH VON (1758–1841), German sculptor, was born at Stuttgart, on Oct. 1j, 1758, and died there on Dec. 8, 1841. His father was employed in the stables of the duke of U'urttemberg. The boy was entered in the military school at the age of 13, but after two years he was allowed to follow his taste for art. The duke made him sculptor to the palace (1780), and employed him on child angels and caryatids for the decoration of the reception rooms. In 1783 he left for Paris with Scheffauer, and placed himself under Pajou; in 1785 he went to Rome, where he worked for five years. Goethe and Herder were then in Rome, and became his friends, as well as Canova, who was the hero of the day, and who had undoubtedly a great and powerful influence on his style. The marble statues of Ceres and Bacchus (in the Schloss at Stuttgart) were done at this time. On his return to Stuttgart, which he never afterwards quitted, except for short trips to Paris, Vienna and Zürich, the double influence of his admiration for Canova and his study of the antique is apparent in his works. The Ariadne (1806), in the Bethmann museum, Frankfurt, is the most popular of his works. Many of the illustrious persons of the time were modelled by him, among others, Lavater, Metternich, Countess Stephanie of Baden and General Benckendorif. Of the three portrait busts of Schiller the first in date (1 797) is life-size, and is at Weimar; the second, modelled in colossal size, is in the Stuttgart museum; the third was made for the then Crown Prince Louis of Bavaria. Dannecker was director of the Gallery of Stuttgart, and received many academic and other distinctions.

DANNEWERK or **DANEWERK** (Dan., *Dannevirke* or Danevirke, "Danes' rampart"), the ancient frontier rampart of the Danes against the Germans, extending 10½m. from just south of the town of Schleswig to the marshes of the river Trene near the village of Hollingstedt. The rampart was begun by Guðoðr (Godefridus), king of Vestfold, early in the 9th century. In 934 it was passed by the German king Henry I., after which it was extended by King Harold Bluetooth (940–986), but was again stormed by the emperor Otto II. in 974. The chronicler Saxo Grammaticus mentions in his Gesta *Danorum* the "rampart of Jutland" (Jutiae moenia) as having been once more extended by Valdemar the Great (1157–82), which has been cited among the proofs that Schleswig (*Sønderjylland*) forms an integral part of Jutland (*Manuel hist.* de la question de *Slesvig,* 1906). After the union of Schleswig and Holstein under the Danish crown, the Danevirke fell into decay, but in 1848 it was hastily strengthened by the Danes, who were, however, unable to hold it in face of the superiority of the Prussian artillery, and on April 23 it was stormed. From 1850 onwards it was again repaired and strengthened at great cost, and was considered impregnable; but in the war of 1864 the Prussians turned it by crossing the Schlei, and it was abandoned by the Danes on Feb. 6 without a blow. It was thereupon destroyed by the Prussians; in spite of which, however, a long line of imposing ruins still remains. The systematic excavation of these, begun in 1900, has yielded some notable finds, especially of valuable runic inscriptions (F. de Jessen, La Question *de Slesvig,* pp. 25, 44–50, etc.).

See Lorenzen, *Dannevirke og Omegn* (2nd ed., Copenhagen, 1864); H. Handelmann, *Das Dannewrrk* (Kiel, 1885); Philippsen and Sünksen, *Führer* durch *das Danewerk* (Hamburg, 1903).

DANNREUTHER, EDWARD (1844–190j), German pianist, teacher and writer on music, was born at Strasbourg on Nov. 4, 1844, and was brought up in the United States. He studied music (1859–63) at Leipzig under Moscheles, Hauptmann and Richter, and settled in London in 1863. There he rendered great service to the English musical world in a variety of ways—by his own interpretations of the great German classics, by his musical writings in general, and by his propagandist labours on behalf of Richard Wagner in particular. He was professor of the pianoforte at the Royal College of Music from 1895. Dannreuther's principal works are: *Musical* Ornamentation (1893–95), the standard English work on the subject, and vol. vi. ("The Romantic Period") of the Oxford History of *Music.*

DANSVILLE, a village of Livingston county, New York, U.S.A., 49 mi. S. of Rochester, adjoining Stony Brook state park. It has an airport, and is served by the Dansville and Mount Morris and the Lackawanna railways. Pop. (1940) 4,976. Large nurseries for growing fruit and ornamental trees and several manufacturing plants are there. The Instructor, a magazine for teachers, with a national circulation, is published there. There is a sanatorium in the village. Clara Barton established the first chapter of American Red Cross in Dansville, Aug. 1881. Dansville was settled about 1800 and incorporated in 1845.

DANTAN, JEAN PIERRE (1800–1869), French sculptor, born in Paris on Dec. 28, 1800. His father was a carver in wood, and Jean in company with his brother Antoine Laurent were trained in his studio. The two brothers then studied under Bosio and in 1828 went to Rome. On his return to Paris Jean Pierre became known for his caricature statuettes. He portrayed many famous men (Talleyrand, Wellington, Rothschild, William IV, Brougham, Liszt, Victor Hugo and many others). He died in Baden-Baden on Sept. 6, 1869.

ANTOINE LAURENT DANTAN (1798–1878), brother of Jean Pierre, made many monuments for churches, public buildings and squares (St. Raphael in the Madeleine, Paris; St. Duquesne in Dieppe; La Place in Caen).

JOSEPH EDUARD DANTAN (1848–1897), French historic painter, son of Jean Pierre, studied under Pils. He exhibited regularly in the Salon des Artistes Français; and he also illustrated Zola and Victor Hugo.

DANTE (or **DURANTE) ALIGHIERI** (1265–1321), the greatest of Italian poets, was born at Florence about the middle of May 1265. He was descended from an ancient family, but from one which at any rate for several generations had belonged to the burgher and not to the knightly class. Dante himself does not, with the exception of a few obscure and scattered allusions, carry his ancestry beyond the warrior Cacciaguida, whom he met in the sphere of Mars (Par. xv. 87 seq.). Of Cacciaguida's family nothing is known. The name, as he told Dante (Par. xv. 130, 135), was given him at his baptism. He further tells his descendant that he was born in the year 1091, and that he married a lady from the valley of the Po, from whom the name Aldighieri or Alighieri passed to his descendants. He also mentions two brothers, Moronte and Eliseo, and that he accompanied the emperor Conrad III. upon his crusade into the Holy Land, where he died (1147) among the infidels. From Aldighiero, son of Cacciaguida, were descended the Alighieri. Bellincione, son of Aldighiero, was the grandfather of Dante. His father was a second Alighiero of whom little is known. Dante appears to have been the son of Alighiero's first wife, Bella, whose family name is doubtful. By his second wife, Lapa di Chiarissimo Cialuffi, Alighiero had a son Francesco and a daughter Tana (Gaetana); another daughter, who married Leone Poggi and whose name is not known, was perhaps the poet's sister. Thus the family of Dante held a most respectable position among the citizens of his beloved city; but had it been reckoned in the very first rank they could not have remained in Florence

after the defeat of the Guelphs at Montaperti in 1260. It is clear, however, that Dante's mother at least did so remain, for Dante was born in Florence in 1265. The heads of the Guelph party did not return till 1267.

Apart from his love for Beatrice, we know very little of Dante's boyhood and early life. His early biographers, Boccaccio and Leonardo Bruni, represent him as an assiduous student. From the age of 18 he, like most cultivated young men of that age, wrote poetry assiduously, in the philosophical amatory style of which his friend, older by some years than himself, Guido Cavalcanti, was a great exponent, and of which Dante regarded Guido Guinicelli of Bologna as the master (*Purg.* xxvi. 97, 8). He doubtless owed much to the paternal influence of Brunetto Latini (d. 1294), the philosopher and rhetorician, who figured largely in the councils of the Florentine commune. Of Brunetto Latini Dante himself speaks with the most loving gratitude and affection, though he does not hesitate to brand his vice with infamy. He had some knowledge of drawing; at any rate he tells us that on the anniversary of the death of Beatrice he drew an angel on a tablet; he is said to have been an intimate friend of Giotto, who has immortalized his youthful lineaments in the chapel of the Bargello. Nor was he less sensible to the delights of music. Milton had not a keener ear for the loud uplifted angel trumpets and the immortal harps of golden wires of the cherubim and seraphim; and the English poet was proud to compare his own friendship with Henry Lawes with that between Dante and Casella, "met in the milder shades of purgatory." There is some evidence that Dante was at Bologna not later than 1287, but it is doubtful whether, as Boccaccio states, he studied at the university. It is clear that, from his youth onwards, he began to make himself master of all the sciences of his time, while playing his part in society and in touch with every aspect of Florentine life.

PORTRAIT OF DANTE. FROM A WOOD-CUT OF 1521

Political Life.—We must now consider the political circumstances in which lay the activity of Dante's manhood. From 1115, the year of the death of Matilda, countess of Tuscany, Florence developed as a self-governing commune attached to the cause of the Church. According to tradition, the Guelph and Ghibelline factions were introduced into the city in 1215. Buondelmonte de' Buondelmonti, a noble youth of Florence, being engaged to marry a lady of the house of Amidei, allied himself instead to a Donati, and was attacked and killed by the Amidei and Uberti at the foot of the Ponte Vecchio, close by the pilaster which bore the image of Mars (Par. xvi. 136–147). Although a number of noble families, headed by the Uberti, now ranged themselves with the Ghibellines, the commune remained Guelph; but, in 1248, with the aid of German horsemen sent by Frederick II., the Uberti and the Ghibellines gained the upper hand and expelled the Guelph nobles. In 1250, when the emperor was dying, there was a revolution by which the Primo Popolo, the first democratic constitution of the republic, was established, with a captain of the people to counterbalance the podestà, and the Guelphs were recalled. The Uberti and other Ghibellines—in understanding with Manfred who had succeeded his father Frederick as king of Sicily—attempted to rebel in 1258, were expelled from the city and their houses and towers destroyed. The reception of the exiles in Siena brought on the war which resulted in the great battle of Montaperti, Sept. 4, 1260, "which dyed the Arbia red," in which the Florentine Guelphs and their allies were completely defeated by the Sienese and the German troops of Manfred. At a congress at Empoli, in which the Ghibelline cities of Tuscany were represented, it was proposed to destroy Florence—a proposal defeated by the bold patriotism of Farinata degli Uberti (*Inf.* x. 91–93).

The Ghibellines now held sway in Florence as elsewhere in Tuscany, until Charles of Anjou—to whom the pope had offered the crown of Apulia and Sicily—came to Italy, and on Feb. 26, 1266, defeated and killed Manfred at Benevento. In 1267 the Guelphs were recalled, and the Ghibellines were driven out. Florence was for a while under the suzerainty of Charles of Anjou; but in 1282, after the "Sicilian Vespers," the Secondo *Popolo*—the second democratic constitution of Florence—was established. By this the government was placed in the hands of the Priors of the Arts, who, associated with the Captain of the People, became the chief magistrates of the republic. The Arts or Gilds—seven maggiori and 14 minori—were organized, to be the backbone of the State. The Priors, elected from the Arts, were six in number and held office for two months. Siena had become Guelph, but Pisa and Arezzo remained Ghibelline, and Florence led a Guelph Tuscan league against them in a war which culminated on June 11, 1289, at Campaldino near Poppi, in the Casentino, where the Ghibellines were utterly defeated. They never again recovered any hold in Tuscany but the violence of faction survived under other forms. Several allusions in the *Commedia* (Inf. xxii. 1, xxi. 95; Purg. v. 92) indicate that Dante saw military service in this war, and a passage in a letter of his, no longer extant but quoted by Leonardo Bruni, states that he fought in the front rank at Campaldino.

Meeting with Beatrice.—As he tells us in the Vita *Nuova,* Dante had first met the girl whom he calls Beatrice, the love for whom was to be the guiding-star and inspiration of his life, in 1274, when she was at about the beginning of her ninth year, and he at about the end of his ninth year. If she has been rightly identified with Bice Portinari, she married Simone de' Bardi. Beatrice died on June 8, 1290 (the date June 9 is due to a mystification in the Vita *Nuova*). The last chapter of the Vita *Nuova* relates how, after the lapse of some undefined time, "it was given me to behold a wonderful vision, wherein I saw things which determined me to say nothing further of this blessed one until such time as I could discourse more worthily concerning her. And to this end I labour all I can, as she in truth knoweth. Therefore if it be His pleasure through Whom is the life of all things that my life continue with me a few years, it is my hope that I shall yet write concerning her what hath not before been written of any woman. After the which may it seem good unto Him who is the lord of courtesy that my spirit should go hence to behold the glory of its lady, to wit, of that blessed Beatrice who now gloriously gazes on the countenance of Him *qui* est per *omnia saecula benedictus.*" In the *Convivio* he resumes the story of his life. "When I had lost the first delight of my soul (that is, Beatrice) I remained so pierced with sadness that no comforts availed me anything, yet after some time my mind, desirous of health, sought to return to the method by which other disconsolate ones had found consolation, and I set myself to read that little-known book of Boetius in which he consoled himself when a prisoner and an exile. And hearing that Tully had written another work, in which, treating of friendship, he had given words of consolation to Laelius, I set myself to read that also." At some unascertained date, perhaps about 1292, he married Gemma, daughter of Manetto Donati, a connection of the celebrated Corso Donati, afterwards the leader of the party opposed to Dante's own. By this wife he had two sons, Jacopo and Pietro, and either one or two daughters (Antonia being perhaps the same as the daughter who became a nun, Suora Beatrice, at Ravenna). Although he never mentions his wife in the *Divina* Commedia, and although she did not accompany him into exile, there is no clear evidence for the belief that the union was otherwise than happy. Certain it is that he spares the memory of Corso in his great poem, and speaks with affection of his kinsmen Piccarda and Forese, the latter of whom was one of his own intimate friends.

In 1293 Giano della Bella, a man of old family who had thrown in his lot with the people, induced the commonwealth to adopt the so-called "Ordinances of Justice," a severely democratic addition to the constitution, by which among other things it was enacted that no man of noble family, even though engaged in trade, could

hold offices as prior, or be a member of the popular councils of the State, and a new magistrate, the *Gonfaloniere di Giustizia,* was added to the Signoria. Two years later Giano was banished, but the ordinances remained in force, though their severity was modified.

Banishment.—Dante now began to take an active part in politics. He was inscribed in the *arte* of the *Medici* and *Speziali,* which made him eligible for the priorate. Documents still existing in the archives of Florence show that he took part in the deliberations of the several councils of the city from the latter part of 1295 onwards, and there is record of an important speech of his in the Council of the Hundred on June 5, 1296. In May 1300 he served on a special embassy, to the commune of San Geimignano. From June 15 to Aug. 14, 1300, he sat in the Signoria as one of the six Priors, which, he says, was the cause and origin of all his misfortunes. The spirit of faction had again broken out in Florence. The two rival families were the Cerchi and the Donati—the first of great wealth but recent origin, the last of ancient ancestry but poor. A quarrel had arisen in Pistoia between the two branches of the Cancellieri—the Bianchi and Neri, the Whites and the Blacks. The quarrel spread to Florence, the Donati took the side of the Blacks, the Cerchi of the Whites. Pope Boniface was asked to mediate, and sent Cardinal Matteo d'Acquasparta to maintain peace. He arrived just as Dante entered upon his office as prior. The cardinal effected nothing, but Dante and his colleagues banished the heads of the rival parties in different directions to a distance from the capital. The Blacks, including Corso Donati, were sent to Città della Pieve in the Tuscan mountains; the Whites, arnong whom was Dante's dearest friend Guido Cavalcanti, to Sarzana in the unhealthy Maremma. After the expiration of Dante's office the banished Whites were allowed to return, Guido Cavalcanti so ill with fever that he shortly afterwards died. In the following year, 1301, in consequence of a treasonable meeting in the church of S. Trinità, a number of the Blacks were banished, and a fresh sentence passed against Corso Donati. The Whites now controlled the politics of Florence, and expelled the Blacks from Pistoia.

In this-same year, 1301, we have several records of Dante's political activity. One of these is noteworthy. The pope had demanded the service of 100 Florentine horsemen, and on June 19, in the council of the Hundred, Dante urged *"Quod de servitio faciendo domino Papae nihil fiat,"* thus showing himself a firm opponent to papal interferences in Florentine politics. Pope Boniface had already sent for Charles of Valois, brother of the French king, Philip the Fair, to act as "peacemaker." The priors sent at the beginning of October, three ambassadors to the pope, one of whom, according to the chronicler Dino Compagni, was Dante. Charles entered Florence on All Saints' day, 1301, and was followed by Corso Donati and his allies. The Blacks, restored to power, appointed Cante de' Gabrielli of Gubbio as podestà, a man devoted to their interest. More than 600 Whites were condemned to exile and cast as beggars upon the world. On Jan. 27, 1302, Dante, with four others of the White party, was charged before the podesti with *baratteria,* or corrupt practices in and out of office and with offences against the Guelph party, and, not appearing, was condemned to pay a fine of 5,000 lire of small florins. If the money was not paid within three days their property was to be destroyed; if they did pay the fine they were to be exiled for two years from Tuscany and never again to hold office in the republic. Dante's innocence of "barratry" is unquestionable; his real offence was his opposition to the policy of Boniface and his Florentine supporters. On March 10, Dante and 14 others were condemned to be burned alive if they should come into the power of the republic.

Dante's Wanderings in Exile.—It is probable that Dante had not returned from his embassy to the pope. Leonardo Bruni states that he received the news of his banishment at Siena. He probably joined his fellow-exiles who met at Gargonza, a castle between Siena and Arezzo, and made Arezzo their headquarters preparing to make their way back to Florence by arms. On June 8, 1302, a meeting was held at San Godenzo, a place in the Florentine territory, Dante's presence at which is proved by documentary evidence, and an alliance was there made with the powerful Ghibelline clan of the Ubaldini. In Sept. 1303 the fleur-de-lis had entered Anagni, and Christ had a second time been made prisoner in the person of his vicar *(Purg.* xx. 86–90). Boniface did not survive the insult long, but died in the following month. He was succeeded by Eenedict XI., and in March, 1304, the cardinal Niccolb da Prato came to Florence, sent by the new pope to make peace. The people received him with enthusiasm; ambassadors came to him from the Whites; and he did his best to reconcile the two parties. But the Blacks resisted all his efforts. He shook the dust from off his feet, and departed, leaving the city under an interdict. In July, with aid from the Ghibellines of Tuscany and other regions, the exiles made an unsuccessful attempt to enter Florence from Lastra, the failure of which further disorganized the party.

Dante had, however, already separated from the "ill-conditioned and foolish company" *(Par.* xvii. 61–69) of his fellow-exiles who rejected his counsels of wisdom, and had learnt that he must henceforth form a party by himself. He appears to have been for a while at Forli in Romagna, of which city Scarpetta degli Ordelaffi was lord, and, probably towards the end of 1303, he went to Bartolommeo della Scala, lord of Verona, where the courtesy of the great Lombard gave him his first refuge and his first hcspitable reception. Cangrande, to whom he afterwards dedicated the *Paradiso,* was then a boy. Bartolommeo died in 1304, and it is possible that Dante may have remained in Verona till his death. It is very difficult to determine with exactness the order and the place of Dante's wanderings. He was probably at Bologna in 1304 and 1305. A rather questionable document attests his presence at Padua in Aug. 1306, the time when Giotto was working upon the frescoes of the Madonna dell'Arena. In Oct. 1306 he was unquestionably the guest of the Marquesses of the house of Malaspina in Lunigiana, where he acted as their ambassador in making peace with the bishop of Luni. From this time till the arrival of the emperor Henry VII. in Italy, Oct. 1310, all is uncertain. His old enemy Corso Donati had at last allied himself with Uguccione della Faggiuola, the leader of the Ghibellines, and in 1308 was declared a traitor, attacked in his house, put to flight and killed.

It is not impossible that Dante about this time visited Paris, but that he ever crossed the Channel or went to Oxford may safely be disbelieved. The election in 1308 of Henry of Luxemburg as emperor stirred again his hopes of a deliverer. At the end of 1310, in a letter to the princes and people of Italy, he proclaimed the coming of the saviour; at Milan he did personal homage to his sovereign. The Florentines, in alliance with King Robert of Naples, made every preparation to resist the emperor. Dante wrote from the Casentino a letter dated March 31, 1311, in which he rebuked them for their stubbornness and obstinacy, and another on April 17, to the emperor himself, upbraiding his delay and urging him on against Florence. A new sentence against the poet was pronounced on Sept. 2. Henry passed from Genoa to Pisa, and on June 29, 1312, was crowned by the pope's legates in the church of St. John Lateran at Rome; the Vatican being in the hands of his adversary King Robert of Naples. Then at length he moved towards Tuscany and reached Florence on Sept. 19. He did not dare to attack it, but returned in November to Pisa. In the summer of the following year he prepared to invade the kingdom of Naples; but in the neighbourhood of Siena he caught a fever and died at the monastery of Buonconvento, on Aug. 24, 1313. He lies in the Campo Santo of Pisa; and the hopes of Dante and his party were buried in his grave.

After the death of the emperor Henry (Bruni tells us) Dante passed the rest of his life as an exile, sojourning in various places throughout Lombardy, Tuscany and the Romagna, under the protection of various lords, until at length he retired to Ravenna, where he ended his life. After the death of the French pope, Clement V, he addressed a letter, in the spring or summer of 1314, to the cardinals in conclave, urging them to restore the papacy to Rome. About this time he probably came to Lucca, then lately conquered by Uguccione della Faggiuola. In May

1315 a general recall of exiles offered Dante an opportunity of returning to Florence. The conditions given to the exiles were that they should pay a fine and be subjected to the ceremony of "oblation" as penitents in the Baptistery. Dante refused to tolerate this shame; and the letter is still extant in which he declines to enter Florence except with honour, secure that the means of life will not fail him, and that in any corner of the world he will be able to gaze at the sun and the stars, and meditate on the sweetest truths of philosophy. In Aug. 1315, Uguccione won the great battle of Montecatini over the united armies of Florence and Naples, but lost Pisa and Lucca at the beginning of the following year. A fresh sentence of death had been pronounced by Florence upon Dante in Nov. 1315, and he seems now to have taken refuge with his most illustrious protector Cangrande della Scala of Verona, then a young man of 25, rich, liberal and the favoured head of the Ghibelline party, whose name has been immortalized by an eloquent panegyric in the 17th canto of the *Paradiso.*

The last few years of the poet's life were spent at Ravenna, under the protection of Guido da Polenta. In his service Dante undertook an embassy to the Venetians, on his return from which he caught a fever and died in Ravenna on Sept. 14, 1321. His bones still repose there. His doom of exile has been reversed by the union of Italy, which has made the city of his birth and the various cities of his wanderings component members of a common country. His son Piero, who wrote a commentary on the *Divina Cornmedia,* settled as a lawyer in Verona, and died in 1364 His daughter Beatrice lived as a nun in Ravenna, dying at some time between 1350 (when Boccaccio was commissioned to bring her a present of ten gold crowns from a Florentine gild) and 1371. His direct line became extinct in 1509.

The **Divina** Cornmedia.--Of Dante's works, that by which he is known to all the educated world, and in virtue of which he holds his place as one of the half-dozen greatest writers of all time, is of course the *Commedia.* (The epithet *divina,* it may be noted, was not given to the poem by its author, nor does it appear on a title-page until the 16th century.) The poem is absolutely unique in literature; it may safely be said that at no other epoch of the world's history could such a work have been produced. Dante was steeped in all the learning, which in its way was considerable, of his time; he had read the *Summa Theologica* of Aquinas, the *Trésor* of his master Brunetto, and other encyclopaedic works available in that age; he was familiar with most of what was then known of the Latin classical and post-classical authors. Further, he was a deep and original political thinker, who had himself borne a prominent part in practical politics. The age was essentially one of great men; of free thought and free speech, of brilliant and daring action, whether for good or evil. It is easy to understand how Dante's bitterest scorn is reserved for those "sorry souls who lived without infamy and without renown, displeasing to God and to His enemies."

The time was thus propitious for the production of a great imaginative work, and the man was ready who should produce it. It called for a prophet, and the prophet said, "Here am I" "Dante," says an acute writer, "is not, as Homer is, the father of poetry springing in the freshness and simplicity of childhood out of the arms of mother earth; he is rather. like Noah, the father of a second poetical world, to whom he pours forth his prophetic song fraught with the wisdom 'and the experience of the old world." Thus the *Commedia,* though often classed for want of a better description among epic poems, is totally different in method and construction from all other poems of that kind. Its "hero" is the narrator himself; the incidents do not modify the course of the story; the place of episodes is taken by theological or metaphysical disquisitions; the world through which the poet takes his readers is peopled, not with characters of heroic story, but with men and women known personally or by repute to him and those for whom he wrote. Its aim is not to delight, but to reprove, to rebuke, to exhort; to form men's characters by teaching them what courses of life will meet with reward, what with penalty, hereafter; "to put into verse," as the poet says, "things difficult to think." For such new matter a new vehicle was needed. We have Bembo's authority for believing that the *terza rima,* surpassed, if at all, only by the ancient hexameter, as a measure equally adaptable to sustained narrative, to debate, to fierce invective, to clear-cut picture and to trenchant epigram, was first employed by Dante.

The action of the *Commedia* opens in the early morning of the Friday before Easter, in the year 1300. The poet finds himself lost in a forest, escaping from which to ascend the mountain of felicity, he has his way barred by a wolf, a lion and a leopard. This seems to indicate that at this period of his life, about the age of 35, Dante went through some experience akin to what is now called "conversion." The strong vein of mysticism, found in so many of the deepest thinkers of that age, and conspicuous in Dante's mind, no doubt played its part. His efforts to free himself from the "forest" of worldly cares were impeded by the temptations of the world—cupidity (including ambition), the pride of life and the lusts of the flesh, symbolized by the three beasts. But a helper is at hand. Virgil appears and explains that he has a commission from three ladies on high to guide him. The ladies are the Blessed Virgin (representing the Divine Mercy), St. Lucy (symbol of illuminating grace) and Beatrice. In Virgil we are apparently intended to see the symbol of what Dante calls philosophy, what we should rather call natural religion; Beatrice standing for theology, or rather revealed religion. Under Virgil's escort Dante is led through the two lower realms of the next world, Hell and Purgatory, meeting on the way with many persons illustrious or notorious in recent or remoter times. as well as many well enough known then, but who, without the immortality, often unenviable, that the poet has conferred on them, would long ago have been forgotten. Popes, kings, emperors, poets and warriors, Florentine citizens of all degrees, are there found; some doomed to hopeless punishment, others expiating their offences in milder torments, and looking forward to deliverance in due time. It is remarkable to notice how rarely, if ever, Dante allows political sympathy or antagonism to influence him in his distribution of judgment. Hell is conceived as a vast conical hollow, reaching to the centre of the earth. It has three great divisions, corresponding to Aristotle's three classes of vices, incontinence, brutishness (which Dante identifies with violence) and malice. The first is outside the walls of the city of Dis; the second is within. The sinners by malice, which includes all forms of fraud or treachery, lie at the bottom of a gigantic pit, called Malebolge, with vertical sides, and accessible only by supernatural means; a monster named Geryon bearing the poets down on his back. The torments here are of a more terrible, often of a loathsome character. Ignominy is added to pain, and the nature of Dante's demeanour towards the sinners changes from pity to hatred.

At the very bottom of the pit is Lucifer, immovably fixed in ice; climbing down his limbs they reach the centre of the earth, whence a cranny conducts them back to the surface, at the foot of the purgatorial mountain, which they reach as Easter Day is dawning. Before the actual Purgatory is attained they have to climb for the latter half of the day and rest at night. The occupants of this outer region are those who have delayed repentance till death was upon them. They include many of the most famous men of the last 30 years. In the morning the gate is opened, and Purgatory proper is entered This is divided into seven terraces, corresponding to the seven deadly sins, which encircle the mountain and have to be reached by a series of steep climbs, compared by Dante in one instance to the path from Florence to Samminiato. The purifying penalties are not degrading, but rather tests of patience or endurance, and borne voluntarily by the souls; in several cases, Dante has to bear a share in them as he passes. On the summit is the Earthly Paradise. Here Beatrice appears in a mystical pageant; Virgil departs, leaving Dante in her charge. By her he is led through the various spheres of which, according to both the astronomy and the theology of the time, Heaven is composed, to the supreme Heaven, or Empyrean, the seat of the Godhead. For one moment there is granted him the intuitive vision of the Deity, and the comprehension of all mysteries, which is the ultimate goal of

mystical theology; his will is wholly blended with that of God, and the poem ends. The date of composition of the *Commedia* is still uncertain; but the *Paradiso* was unquestionably written in the last years of Dante's life.

Other Works.—The *Vita Nuova* (*Young Life* or *New Life*, for both significations seem to be intended) contains the history of Dante's love for Beatrice. He describes how he met Beatrice as a child, himself a child, how he feigned a false love to hide his true love, how he fell ill and saw in a dream the death and transfiguration of his beloved, how she died, and how the tender compassion of another lady nearly won his heart from its first affection, how Beatrice appeared in his imagination and reclaimed his heart, and how at last he saw a vision which induced him to devote himself to study that he might be more fit to glorify her who gazes on the face of God for ever. It is in the form of lyrics—canzoni, one ballata, and sonnets—set in a prose narrative with scholastic divisions and explanations, and was probably completed about 1293, though the reference to the vision may be later.

The *Convivio* or *Banquet* (less accurately *Convito*) is the work of Dante's manhood, as the *Vita Nuova* is the work of his youth. It consists, in the form in which it has come down to us, of an introduction and three treatises, each forming an elaborate commentary on a long canzone. It was intended, if completed, to have comprised commentaries on 11 more canzoni, making 14 in all, and in this shape would have formed a *tesoro* or handbook of universal knowledge, such as Brunetto Latini and others have left to us. It is perhaps the least well known of Dante's Italian works, but contains many passages of great beauty and elevation, the magnificent apotheosis of Rome and her empire in the fourth treatise being the first expression of his ideal imperialism. Indeed a knowledge of it is quite indispensable to the full understanding of the *Divina Commedia* and the *Monarchia*. It was probably written between 1304 and 1308.

Besides the poems contained in the *Vita Nuova* and *Convivio*, Dante composed a considerable number of canzoni, ballate and sonnets which are collected under the general title of *Rime* or *Canzoniere*, and which secure him a place among lyrical poets scarcely if at all inferior to that of Petrarch. Some scholars—very questionably—would attribute to Dante a rendering of the *Roman de la Rose* in 232 sonnets entitled *Il Fiore (The Flower)*.

The treatise *De vulgari eloquentia*, in Latin, is mentioned in the *Convivio*. It was probably written between 1304 and 1306. Its object was first to establish the Italian language as a literary tongue, and to distinguish the noble or "courtly" speech which might become the property of the whole nation, at once a bond of internal unity and a line of demarcation against external nations, from the local dialects peculiar to different districts; and secondly, to lay down rules for poetical composition in the language so established. The work was intended to be in four books, but only two are extant. The first of these deals with the language, the second with the style and with the composition of the canzone. It contains much acute criticism of poetry and poetic diction, and its treatment of the Italian dialects is of singular interest.

The Latin treatise *Monarchia*, in three books, contains the mature statement of Dante's political ideas. In it he propounds the theory that the universal temporal monarchy or empire is necessary for the well-being of the world, that the Roman people acquired this dignity by right, and that the authority of the emperor depends immediately upon God though he must reverence the pope as the first-born of the Father. Pope and emperor are the guides divinely appointed to lead the human race to eternal life and temporal felicity. Dante's ideal of the empire is a power above national conflicts to preserve universal peace and liberty, in order that the goal of civilization, the realization of all man's potentialities may be achieved. The work was probably composed at the time of the descent of Henry VII. into Italy, between 1310 and 1313. The book was first printed by Oporinus at Basle in 1559, and placed on the Index of forbidden books.

In the last years of his life Dante wrote two eclogues in Latin in ansaer to Giovanni dei Virgilio, who invited him to compose a Latin poem on some contemporary event and come from Ravenna to Bologna to receive the laurel crown. The most interesting passage is that in the first poem (1319) where he expressed his hope that when he has finished the third part of the *Commedia* his grey hairs may be crowned with laurel on the banks of the Arno.

The *Quaestio de aqua et terra* purports to be a discourse which Dante delivered at Verona in Jan. 1320 as a solution of the question which was being at that time much discussed—whether in any place on the earth's surface water is higher than the earth. It was first published at Venice in 1508, by an ecclesiastic named Moncetti. Since Dr. Moore, from internal evidence, made out a very strong case for it, its authenticity has been generally accepted.

There are 13 Latin *Letters* ascribed to Dante. Those to the princes and peoples of Italy announcing the coming of Henry of Luxemburg, to the Florentines, to the emperor himself, to the Italian cardinals and to a Florentine friend refusing the base conditions of return from exile, have been already mentioned. These are certainly authentic, as probably is also a long letter to Can Grande della Scala, containing directions for interpreting the *Divina Commedia*, with especial reference to the *Paradiso*. Of less importance are the letters to cardinal Niccolb da Prato, to the nephews of Count Alessandro da Romena, to the marquis Moroello Malaspina, to Cino da Pistoia, and three written in the name of the Countess of Battifolle.

Dante's reputation has passed through many vicissitudes, and much trouble has been spent by critics in comparing him with other poets of established fame. Read and commented upon with more admiration than intelligence in the Italian universities in the generation immediately succeeding his death, his name became obscured as the sun of the Renaissance rose higher towards its meridian. His fame is now fully vindicated as one of the world's universal poets and the national poet of Italy.

(**A. J.** Bu.; E. G. G.)

BIBLIOGRAPHY.—We have now two authoritative editions of the text of the complete *Opere di Dante:* the *testo critico* of the Società Dantesca Italiana, edited by M. Barbi and others on the occasion of the sixth centenary (Florence, 1921), reproducing the forms and orthography of the poet's own time; the *Oxford Dante* of Edward Moore revised and re-edited by Paget Toynbee (1923). Dr. Toynbee's *Concise Dictionary of Proper Names und Notable Matters in the Works of Dante* (1914) is invaluable. Concordances—based upon editions previous to the *testo critico*, but still highly useful—to the *Commedia* by E. A. Fay (Boston, 1888), to the minor Italian works by E. S. Sheldon and A. C. White (1905) and to the Latin works by E. K. Rand and E. H. Wilkins (1912), are due to American scholars.

Editions of the Divina Conzmedia and Commentaries: The first three editions of the *Commedia* were printed in 1472 at Foligno, Mantua and Jesi. They were reprinted, together with the Neapolitan edition of 1477, by Lord Vernon and A. Panizzi in *Le Prime Quattro Edieioni della D. C. letteralmente ristampate* (1858). The first Venetian edition is of 1477, the first Milanese (Nidobeatina) of 1478, the first Florentine of 1481. In 1502 Aldus produced the first "pocket" edition in his new "italic" type. The *Conzrnedia* began to be the subject of commentaries as soon as the author was in his grave; beginning, before 1330, with those of Dante's son, Jacopo Alighieri, and Graziolo de' Bambaglioli of Bologna on the *Inferno*, and of another Bolognese, Jacopo della Lana, on the whole poem. Somewhat later, but still before 1350, come the *Ottimo Commento* attributed to the Florentine notary Andrea Lancia, and those of Dante's other son, Pietro, and the Carmelite Guido da Pisa. Boccaccio's commentary, the substance of lectures delivered at Florence in 1373, stops short at *Inf.* xvii.; it is accessible, together with the two versions of his famous life of Dante; edited by D. Guerri, in the *Scrittori d'Italia series* (Bari, 1918). The great Latin commentary of Boccaccio's disciple, Benvenutc da Imola (1375–80), who lectured at Bologna, was published by William Warren Vernon with the aid of James Lacaita in 1887. Another noteworthy early commentator is Francesco da Buti who lectured at Pisa towards the close of the same century. Extracts from the early commentators are given by G. Biagi in *La D. C. nella figurazione artistica e nel secolare commento* (Turin, 1921, etc.). The foundations for the establishment of an accurate text were laid by Carl Witte in his edition of 1862. The fullest 19th century commentary, that of G. A. Scartazzini, is now somewhat out of date. Among the best of more recent editions. with notes or commentaries, are those of F. Torraca, of T. Casini, revised and amplified by S. A. Barbi, and of Isidoro del Lungo. An excellent pocket edition of the text alone with a critical introduction, is that of Mario Casella (Bologna, 1923). For English readers, the three small volumes in the Temple Classics, with text, translation and commentaries by H. Oelsner, T. Okey and P. H. Wicksteed, are very useful, as also the *Readings in the Inferno, Purgatorio* and *Paradiso* of William Warren Vernon.

Editions of the Minor Works: The *Vita Nuova* was first printed at Florence in 1576, the *Convivio* at Florence in 1490. The *De Vulgari Eloquentia* was first published in Trissino's Italian translation at Vicenza in 1529, and in the original Latin, from a ms. now preserved at Grenoble, at Paris in 1577; the *Monarchia* at Basle in 1599. There are critical editions of the *Vita Nuova* by M. Barbi (Florence, 1907), of the *De Vulgari Eloquentia* by Pio Rajna (1896), of the *Eclogues* by P. *H.* Wicksteed (*Dante and Giovanni del Virgilio,* 1902), and G. Albini (Florence, 1903), of the *Letters* with translation and commentary by Paget Toynbee (1920). The *Canzoniere,* or *Rime,* were first adequately edited, the genuine pieces separated from the doubtful and spurious, by Michele Barbi in the *testo critico* of the Societa Dantesca Italiana (1921).

English Translations: The entire *Divina Commedia* appeared first in English in the version of Henry Boyd (1802), and was followed by the admirable blank verse rendering of H. F. Cary (1814, 2nd ed., 1819), which has remained the standard translation. Of the numerous later translations may be mentioned those of Longfellow; of J. A. Carlyle *(Inferno* only), C. E. Norton and H. F. Tozer in prose; G. Musgrave of the *Inferno* in Spenserian stanzas; C. L. Shadwell, of the *Purgatorio* and *Paradiso* in the metre of Marvell's "Ode to Cromwell"; Haselfoot and M. B. Anderson in *terza rima.* D. *G.* Rossetti's translation of the *Vita h7uova* will always hold its place as a thing of beauty. Translations of the *Vita Nuova* by T. Okey, of the *Rime, Convivio, Monarchia, Letters, Eclogues, Quaestio de Aqua et Term,* by P. *H.* Wicksteed, and of the *De Vulgari Eloquentia* by *A.* G. F. Howell, are published in the Temple Classics, with full explanatory notes. *See,* in general, P. Toynbee, *Dante in English Literature from Chaucer to Cary* (1909), and *Britain's Tribute to Dante in Literature and Art 1380–1920* (1921).

Aids and Studies: It is only possible here to mention a few works useful to English readers. As general introduction, P. Toynbee, *Dante Alighieri, his Life and Works* (4th ed., 1910); E. G. Gardner, *Dante* (1923); N. Zingarelli, *Vita di Dante in compendio* (Milan, 1905), and his larger *Dante* (1903). Among critical studies, or elucidations of particular aspects of Dante's work, E. Moore, *Studies in Dante* (four series, 1896–1917); P. Toynbee, *Dante Studies and Researches* (1902), *Dante Studies* (1921); P. H. Wicksteed, *Dante and Aquinas* (1913), *From Vita Nuova to Paradiso* (1922); the volumes of Dante studies by F. D'Ovidio, now reprinting in the collected edition of his works; F. Torraca, *Studi danteschi* (1912) and *Nuovi Studi danteschi* (1921); *E.* G. Parodi, *Poesia e storia nella Divina Commedia* (1921); B. Croce, *La Poesia di Dante* (1921, Eng. trans. by D. Ainslie); C. Ricci, *L'ultimo rifugio di Dante* (new ed., 1921); F. Ercole, *Il pensiero politico di Dante* (Milan, 1928). Copious bibliographical indications on disputed points are given in the latest edition of the D. C. with the commentary of Casini and S. A. Barbi (Florence, 1926). The *Giornale Dantesco* and the *Studi Danteschi* directed by M. Barbi are important periodical publications dealing with every aspect of the subject.

Portraits of Dante: It is now generally agreed that the repainted figure of Dante in a fresco of the podestà's chapel in the Bargello in Florence is authentic and by Giotto,, probably painted (c. 1334) from a sketch taken in the poet's early life. The Torrigiani mask, now in the same chapel, long supposed to have been made from a death-mask, is probably a work of the 15th or 16th century. It is possible that the later representations of Dante may have been influenced by the portrait by Taddeo Gaddi in Santa Croce (destroyed in 1566). Noticeable among these are the miniature in codex 1040 of the Biblioteca Riccardiana *(c.* 1436); the fresco transferred to canvas of Andrea del Castagno in Sta. Apollonia *(c.* 1450); the symbolical picture by Domenico di Michelino (1465) in the duomo at Florence; the bronze bust at Naples (late 15th century); the recently discovered panel attributed to "Amico di Sandra." In the 16th century, we have the figure of Dante in Luca Signorelli's fresco at Orvieto, and in Raphael's "Parnassus" and "Disputa" in the Vatican. A famous signed sketch of Dante by Raphael is in the Albertina at Vienna. *See* R. T. Holbrook, *Portraits of Dante from Giotto to Raphael* (1911). Attempts have frequently been made to discover the portrait of Dante in various 14th century frescoes, and there have been recent "discoveries" of this kind at Assisi and elsewhere; the only one that is in the least plausible is that in Orcagna's "Paradise" in Santa Maria Novella at Florence.

(E. G. G.)

DANTON, GEORGES JACQUES (1759–1794), French revolutionary leader, was born at Arcis-sur-Aube on Oct. 26, 1759. He belonged to a respectable family of Champagne; his father, who died in 1762, was an attorney at the local tribunal, his maternal grandfather the roads and bridges contractor of the province. His mother neglected his upbringing, and the boy was allowed to run wild beside the Seine, finding vent for his animal spirits in rustic games, in wood and field, in wrestling with the beasts on the farm and in defying his schoolmistress, who tried to tame him with the whip. At the age of 14, after a short term at the small seminary at Troyes, this wild young ruffian, with pock-marked face, was entered at the *Oratoriens* to finish his studies. He won the prize for mythology, *accessits* for rhetoric and Latin verse, and for French essay. His imagination was fired by republican Rome, and this appeal to the essential part of his nature, was strengthened from day to day by his assiduous study of the ancient historians and moralists.

Deciding to study law he went to Paris in 1780, where, thanks to his confidence in himself, he was admitted to the chambers of Maître Jean Nicolas Vinot. The manifold sources of interest provided by the courts could not, however, entirely absorb him, and his passion for physical exercise found outlet in swimming, fencing and tennis. Once, in an interval between two cases, we find this high-spirited clerk plunging into the Seine and hurling angry imprecations against the towers of the Bastille as the symbol of oppression. Back at his lodgings he greedily read the *Encyclopédie,* the writings of Montesquieu and Voltaire, of Rousseau and Buffon, and Beccaria's *Traité des délits et des peines,* which, as early as 1764, heralded a revolution in European criminal law. As a probationer advocate in the *parlement,* Danton was engaged in pleading; in a case in which a shepherd was in dispute with his overlord, he asserted his love of equality, and obtained the approval of Linguet.

His marriage with Angélique Charpentier forced him to settle down—or to appear to do so. In 1787, therefore, he became advocate in the *conseils* du *roi.* This required him to take an oath "to observe and keep strictly the laws and ordinances of the kingdom" and also to deliver a speech in Latin on his admittance. He paid a high price for this post, but it gave him a thorough insight into public law and administration, civil and ecclesiastical affairs, commerce and finance, the whole machinery of monarchy, the intricacies of customary law, and the law of corporations and property. He was elected to the Masonic lodge of the *Neuf Soeurs,* to which Franklin and Voltaire had belonged, and there met Bailly, Desmoulins, Condorcet, Chamfort and Sieyès. He continued his studies, and it should be noted that he read and spoke fluently Italian and English; he had read, in the original, Pope, Shakespeare and Adam Smith's *Wealth* of *Nations.*

We may picture him at this time—a broad face with strong features, sharply curved mouth and brilliant eyes, blazing with inward fire and passion.

At the outbreak of the Revolution (1789) Danton belonged to Cordeliers district; his house was exactly where his statue stands to-day. He was as impetuous as he always had been from childhood in Champagne. As captain of the civic guard he attempted, on the night of July 15, to force the gates of the Bastille that he had before defied. He was already taking sides against both the supporters of the old régime and the moderates. He opposed Lafayette, elected to the States General by the nobility of Auvergne, who, after July 14, became chief of the National Guard, but who, on Oct. 5 and 6, defended the royal family. He went further than Bailly, the learned mayor of Paris. Danton's position is clear from the time of the events of October, when the king and the assembly, the only two lawful authorities, became prisoners of the people, when Louis XVI. had to leave Versailles and return to the Tuileries, escorted by a hunger-maddened mob. It was Danton who had the tocsin rung; and Danton who was charged by the general assembly of the Cordeliers to thank the king for having graciously taken up his residence in *sa bonne ville.* Although on Aug. 13, 1793, he was to affirm before the Convention that "the republic had existed in all men's minds 20 years before its proclamation," he, at this time, professed himself a good Royalist. His record at the *Palais Royal,* and even more at the Cordeliers, shows him quick in conciliating and incapable of refusing popular favour. At each re-election to the presidency of the district, the assembly "accompanies its unanimous vote with an outburst of enthusiasm." Persuasion and force of character made him, the popular tribune, dominant. "Danton, the president of the Cordeliers," writes Taine, "could secure in his district the arrest of any one he pleased. His violence in speech and counsel made him, in the absence of wider opportunities, the ruler of his quarter."

After the fall of the Bastille, the commune of Paris displaced the former council and took up its quarters at the hôtel de ville. This municipal organization was to play an important part in the Revolution. By the decree of May 21, 1790, it was divided into

48 sections with a mayor, 16 administrators, a municipal council of 32 members, and a general council of 96 notables, a *procureur syndic* and two deputies. Originally, with Bailly as mayor, the commune maintained a monarchist and moderate tone. Danton was elected to represent his district in Jan. 1790. After May 21, when the districts were suppressed, he founded the Cordeliers club, the Society of the Rights of Man and the Citizen, which met in the convent of that name, which stood on the site of the present school of medicine. He also joined in the debates of the Jacobin club, which met in the former library of the convent in the *rue St. Honork.* His violent and extreme views led to his defeat in the communal elections, but on Jan. 31, 1791, he was appointed administrator of the department. In this year he found a wider scope for his powers. He took a prominent part in events before and after the king's flight. On July 16, mounted on the altar dedicated to *la patrie,* in the *Champ de Mars,* he read in his powerful voice, the celebrated petition to the assembly to convoke new constituent and executive bodies, and to bring the king to trial. After the Varennes affair, the Cordeliers were induced, by the smooth running of the government during Louis XVI.'s absence, to declare for the republic. The attitude of Lafayette and Bailly at the massacres of the *Champ de Mars,* the shooting down of the petitioners, and the fears of the moderates, caused the first grave split amongst the revolutionaries. Danton, whose arrest had been decreed, took refuge first with his father-in-law at Fontenay, then at Arcis and Troyes. Thinking it more prudent to quit France, he fled to London, accompanied by his brothers-in-law, who went there to purchase weaving machines. During this period, the Cordeliers, long regarded askance by the Constituent assembly, for the decree of May 21, 1790, was directed against them, became more extreme than the Jacobins. They were accused of demagogy, and Danton was known to be the moving spirit. A split had at least begun to occur between the moderates and democrats. Danton, without hesitation, joined the latter.

His influence was in no way impaired by his exile; in his absence the *Théâtre Français* section appointed him their representative. At the electoral assembly on Dec. 6, 1791, he became assistant deputy to the *procureur* of the commune. Already, it may be noted, he had to meet murmurs against his wealth and accusations of taking tainted money. In his inaugural speech he laid down his principles, the reasons for his vehemence "how he risked being thought too violent so as never to be weak"; nor was he above self-praise: "I always act in accordance with the eternal laws of Justice." He declared himseli in favour of constitutional monarchy, but in the most threatening terms, and with assurances of devotion to the king that rang like a summons. Aug. 10, 1792, was destined to bring him into power at one bound, making him indispensable in the provisional executive committee which the assembly appointed after decreeing the suspension of the king.

The summer of 1792 was also the summer of Danton's career. The war declared by the assembly against the king of Hungary and Bohemia had started disastrously. Louis XVI.'s dismissal of the Girondin ministry led to an insurrection on June 20 and an attack on the Tuileries. Danton opened his campaign; he worked up the feelings of the deputies sent to the festival of the federation, persuaded his section to proclaim universal suffrage, excited the mob against the duke of Brunswick's manifesto, served out ball cartridges to the federalist Marseillais and brought them to the Cordeliers. His hurried journey to Arcis "to embrace his mother and settle his affairs" on Aug. 5 shows that he was determined to play the supreme part. It was he who on the night of Aug. 9 rang the tocsin and launched the attack; had Santerre appointed chief of the armed forces of Paris, and arrested Mandat, the commander of the king's troops. The revolutionary victory of Aug. 10 was his victory—the formation of the Convention was his work. As minister of justice, he took upon himself the full responsibility of his office. His circular of Aug. 19, published by André Fribourg, in his collection of *Speeches,* summarizes the tragic situation in terse phrases, each of which strikes home like a sword-thrust. The revolution of July 14 was now completed. Danton asserts the discovery in the archives of the *château,* of a "mass of proof of the most infamous perfidy and the blackest conspiracies," glorifies "holy insurrection," rejoices in the murder of Mandat and the king's suspension. He defines his programme. "The tribunals will find me unchanged. My whole efforts are concentrated on political and individual freedom, the maintenance of the laws, public tranquillity, the unity of the 83 departments, the glory of the State, the prosperity of the French people and on the equality of rights and happiness, though not on the chimerical equality of worldly goods."

This vigorous and clear conception of political liberty and of the unity of the country was the keystone of Danton's policy, based on an often expressed confidence in the people. During the disasters of August, the Prussian invasion of Lorraine, the fall of Longwy, the investment of Verdun, he kept his head against the stream of general panic. Michelet says that "at that sublime and sinister crisis, he was the voice of the Revolution and of France." On the evening of Tuesday, Aug. 28, he made his strenuous appeal in the legislative assembly, for resistance, for the mass levy and a general requisition. "Everything belongs to the country when the country is in danger." It is true that a school of historians to-day denies this reading of the part he played. Albert Mathiez, in his *Danton et la paix,* will not be moved even by his famous declaration of Sept. 2: *Il nous faut de l'audace, encore de l'audace et toujours de l'audace, et la France est sauvée!*—"we must dare, and dare, and dare again—and France is saved!" He will not believe the sincerity of his opposition—spirited as it was—to the removal of the government from Paris. Mathiez would have us believe that while openly prophesying a certain victory, secretly he was negotiating with Great Britain and saved the Prussian army by ill-timed conferences. But surely there is no contradiction in the fervour of a popular leader keeping up the *moral* of the nation, and the prudence of a statesman desirous of ending the war as soon as possible. To proceed, on Sept. 21, 1792, Danton resigned the Ministry of Justice to devote himself to his work in the Convention. On Dec. 1 he was sent on a mission to Belgium, and for several months, by his counsels and example, instilled courage into the army. He advocated the annexation of the Belgian provinces which were clamouring for union. In his view, the Republic should be extended as far as possible; "its frontiers are marked out by nature and we shall attain them on all four corners of the horizon—the Rhine, the Atlantic, the Pyrenees, the Alps. These are the natural frontiers of France." Thus Danton showed himself a disciple of Richelieu, and it cannot be denied that his politics were already tinged with imperialism. In a speech to the Convention he had revealed that, with Dumouriez, he even favoured the invasion of Holland and the declaration of war on England.

Meanwhile, Danton was continually attacked by his adversaries. They accused him of offering to save Louis XVI. in exchange for some millions of francs; of having secretly protected the *émigrés.* The statement of Théodore Lameth, the conversations with the duke of Chartres, the letters of the agent Miles, the assertions of Lord Acton carry no convincing proof. One may be shocked by his needlessly brutal words in casting his vote for death; one may consider that he stifled his real opinions in bidding for popular favour, without believing that Danton offered his influence for money. Many have accused him of prevarication; it seems certain that his financial affairs were in great disorder, and it cannot be denied that he increased his fortune during the Revolution. But venality has not been proved.

In April 1793, he was again called to a post of the gravest responsibility. The king's execution provoked the insurrection in the Vendée and the formidable coalition against France. Dumouriez was preparing his *coup d'e'tat.* The Convention, thus defied, created the Committee of General Security, the Revolutionary Tribunal, and the Committee of Public Safety, of which Danton was the real head. Once again his rôle had increased thanks to that secret logic which, since the days of 1789, had constantly increased his influence and, so to speak, his force of expansion. There is no cause for surprise that Danton should,

even to this day, be subject to suspicion—the very fervour of his opinions made enemies on every side. Far from hiding or exonerating himself, he summoned his adversaries to come out into the open. In the convention on March 30, 1793, he declared: "To-day I invite all sorts of doubts and suspicions, all manner of accusations, for I am resolved to state everything. . . . If any one of you entertains the slightest suspicion about my conduct as minister, if any one wishes for detailed accounts . . . let him rise and say so." On April 1 he again attacked his slanderers. If he really was corrupt, it must be admitted that his enemies were singularly wanting in clearness of vision or courage. He tried in vain to reconcile the two hostile sections of the assembly. The tribune, in his words, had become "an arena of gladiators." When he rose to speak he was greeted with murmurs, altercations and threats, and at times, *e.g.*, April 10, 1793, there was tumultuous disorder. The Montagnards and the Girondins attacked one another incessantly; the *commune* attempted to impose its wishes by force.

Amid these storms, Danton's sole concern was to organize the new régime which was to transform France. Never was his reasoning more lucid. He wanted complete religious liberty, subject only to the ordinary law. He championed a programme of public education for the children "whose fathers have leapt to arms for the defence of the frontiers," for "our chief need is enlightenment in the country and sounder patriotism in the towns." He asked that the nation "should be endowed as soon as possible with a republican constitution with settled laws." He determined to exploit all the benefits of the Revolution; his lucid reasoning led him straight to the kernel of the problem, and he appealed for rapidity of execution and, above all, for national unity for the sake of which he urged all Frenchmen to sink their differences. He never lost the revolutionary sense; his aim was to discipline the spirit of liberty—in no way to weaken or restrict it. When the Girondin, Isnard, president of the convention, seemed to threaten Paris because the *commune* sent a deputation to plead for the liberation of Hébert, Danton, in a heated extempore speech, defended and exalted the capital against the accusations brought by the counter-revolutionaries. "Paris," he cried, "will always be a worthy setting for the national representative body." In these impassioned struggles an event occurred, clearly illustrating the clash of ideas. On the night of May 30–31, the tocsin roused Paris yet again, and the alarm cannon was heard. The *Gironde* had demanded the appointment of a "Committee of Twelve" to enquire into the acts of the *commune*. Danton demanded the suppression of this committee to which arbitrary powers had been given, arguing that the ordinary tribunals were competent and that Paris, the advance guard of the Revolution, should be exempt from accusation.

The insurrection of May 31, the appointment of Hanriot by the *commune*, to command the army of Paris, the rising of June 2, when the Convention was forced to expel 27 Girondins, constitute a definite set-back to Danton's policy. Robespierre's star was rising. On July 10, he superseded Danton on the Committee of Public Safety, who, only the previous day, had seemed to be its master. Yet Danton eulogized "the holy insurrection of May 31" which, he maintained, had saved the republic. His sang-froid, and his confidence in the Revolution were unimpaired. On Thursday evening, Aug. 1, though it was no longer to his personal advancement, he pressed for the strengthening of government authority, and the constitution of a powerful central body. The course of events was rousing all Danton's passion. The adoption of a constitution granting universal suffrage increased his fervour; he was anxious, it would seem, at seeing the legislative gain power at the expense of the executive, and apprehensive of the dangers threatening the country since, at several points, the frontiers had been violated. Danton reverted to his policy of the past year. He became more and more vehement, clamoured for a "war of lions," enunciated the necessary measures for the war in which the whole forces of the nations were now engaged, and urged the mobilization, as we should say to-day, of men, grain and money. He maintained that in such times of crisis, the government had need of secret funds—proof of his corruption. it will be said; proof of his patriotic courage, it might be urged. At the most tragic moment of this crisis he was able to look ahead, and to resume his persistent advocacy of the cause of public education.

On July 25 the convention elected him president. Although he refused to serve again on the Committee of Public Safety, his influence, which dominated all the debates, remained formidable. When he spoke, it was to the applause of the assembly and the tribunes. His demands for vigorous action were carried out, and even exceeded. The convention decreed that the provisional government of France should continue to be revolutionary until the peace; in spite of gaps in the constitution, an executive power was formed, more powerful than it had ever been. But the stage was already set for Danton's fall.

On Oct. 12 he went for a holiday to Arcis-sur-Aube to restore his health This was an excellent opportunity for his enemies—for Billaud Varenne and Robespierre—to prepare his downfall. When he returned to Paris in November, it was soon obvious that quitting his post had cost him his position. Henceforward the Committee of Public Safety was the dictator, and Robespierre dictator to the Committee. The Terror was established. In truth Danton's withdrawal seems hard to account for, and it has been said that he opened negotiations with insurgents in Normandy; be that as it may, he was accused once more of taking money.

Having decided to put an end to the Terror, could Danton lay the monster low? No. The movement he had helped to unchain was to pursue its course with pitiless logic. Robespierre and Danton hated each other. Danton was superseded. In Nivôse 23, his friend, Fabre d'Eglantine, was arrested. In Ventôse the Hébertists were imprisoned. Robespierre, who was marching toward the dictatorship, attacked both the *Indulgents* and the *Enrage's*. Danton maintained his courage. He again denounced "the false patriots in red bonnets," but his very successes only compromised him the more. Hébert's execution brought him but an apparent triumph. Robespierre meant to deal quickly with the formidable adversary who, at one moment, seemed beaten, only to leap up again, and who in the midst of all his perils seemed calm, even to the point of light-heartedness.

Danton neglected to attack in self-defence. On Germinal 10, Robespierre had him arrested, impeached him before the intimidated Convention and cowed the Assembly. The decree for his trial was voted without one dissentient voice. Danton succumbed less to the ferocity of his enemies than to the pusillanimity of his friends. We do not possess his defence before the Revolutionary Tribunal; there seem to have been only a few indignant outbursts, haughty remonstrances against the accusation of having betrayed the people. Danton did not plead, he defied. He well knew that the crimes of which he was accused before the judges were not those that were really driving him to his death. "I have lived," he declared, "entirely for my country." "I am Danton till my death; to-morrow I shall sleep in glory." On April 6 (Germinal 16) Danton was guillotined. His age was 34 years and six months. (E. HE.)

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DANUBE (Ger. *Donau*, Hungarian *Duna*, Rumanian *Dunarea*, Lat. *Danubius* or *Danuvius*, and in the lower part of its course *Ister*), the most important river of southern Europe. Rising in the Black Forest mountains and emptying into the Black sea, it receives tributaries on the right bank from the eastern Alps, the Dinaric Alps and the Balkan mountains, and on the left bank from the Frankischer Jura, Bohmer Wald, Böhmisch-Mährisch Hohe, the Carpathians and the Transylvanian Alps. It is 1,750 m. long, drains an area of 320,200 sq.m. and is the most important river of Europe as regards the volume of its outflow, but inferior to the Volga in length and drainage area. The river is first called the Danube at Donaueschingen in the Black Forest, where three streams, the Brigach, the Brege and a smaller stream meet at an altitude of 2,185. feet. It is navigable for special river craft below Ulm (height 1,505 ft. above sea level), and it is fed by at least 300 tributaries many of which are themselves mighty streams.

The river can be divided into three sections; the upper course, above Bratislava, the middle course, between Bratislava and the Iron Gates and the lower course, below the Iron Gates.

The direction of the river in its upper course is determined by the structure of the Alpine foreland. Rising in the crystalline rocks of the Black Forest it flows eastward across a narrow belt of Jurassic rocks to Sigmaringen and from thence to Regensburg along the northern edge of the Swiss plateau (see ALPS), its bed being in the soft Molasse (Upper Oligocene and Miocene rocks) and its direction following the so-called Danube Fault, which passes from Schaffhausen to Regensburg. Below the latter town the river is deflected south-eastward by the Bohemian massif and flows in part upon the crystalline rocks of the latter and in part upon the Molasse, but at Krems it turns eastward across the Molasse and after passing Vienna it flows through the gap which separates the eastern Alps from the Carpathians. The valley of the Danube above Sigmaringen is narrow, the scenery being wild and beautiful, especially above Tuttlingen, where castles crown every possible summit on the neighbouring hills. Below Immendingen much water escapes by subterranean fissures into the river Ach, a tributary of the Rhine. After it is joined on the right bank by the Iller, which tributary rises in the Algauer Alps, the Danube attains a width of 78 yd. and an average depth of 3 ft. 6 in. and becomes navigable downstream for specially constructed craft of 100 tons. At Donàuwörth (height 1,330 ft.) it receives the Lech, which tributary rises near the Iller and flows in a direction parallel to it, whilst at Regensburg (height 949 ft.) the Danube receives on the left bank the river Naab which rises in the Fichtel Gebirge. Below Regensburg, at Deggendorf, it is joined by the Isar, on the banks of which stands Munich. The upper course of the Danube lies in German territory, rising in Baden and flowing through Wiirttemberg and Bavaria. At Passau (height 800 ft.) it enters Austria and approximately 100 m. of the north-western boundary of that country is formed by the Danube, its right bank tributary the Inn, and the Salzach which flows into the Inn on its right bank. The rivers Isar, Inn and Salzach drain a large portion of the eastern Alps and have many important towns on their banks. The Inn joins the Danube at Passau.

GREIN WHIRLPOOL

From Passau to Linz the Danube is hemmed in by mountains, but its valley becomes wider below the latter town where the river subdivides into several arms which unite again at the once famous whirlpool near Grein. Below Grein, the river flows through another narrow defile as far as Krems but once more subdivides as its passes toward Vienna. The district between Linz and Vienna is renowned for its beauty and for the numerous places of historical and archaeological interest along the river's banks. At Vienna the river is 316 yd. wide, and 429 ft. above sea level and below the town is the district of Marchfeld which is a low-lying country across which the Danube frequently subdivides forming numerous islands. An important left bank tributary, the March, which drains Moravia, joins the main stream here. Before reaching Bratislava (Pozsony, Pressburg), the Danube passes through the narrow gap between the lower spurs of the Alps and the Carpathians and enters upon the middle section of the river. At this gap the river also passes out of Austria and for a few miles is entirely in Czechoslovakia but it very soon becomes the boundary between that country and Hungary, until it reaches Esztergom (Gran), below which town it enters Hungary.

The Danube flows for the first 100 m. of its middle course upon alluvial and Quarternary deposits of the Little Hungarian Plain. This latter is separated from the Great Hungarian Plain by the Bakony Wald ridge, the innermost arc of the Carpathian mountain system, and the Danube breaks through this ridge at Esztergom. After leaving Bratislava, the river divides into three channels forming several islands, but these join together again at Kombrom where the river is also joined on its left bank by the river Waag which rises in the Carpathians. Higher up the stream at Györ (Raab), the southern branch of the divided Danube is joined by the river Raab which rises in the Styrian Alps. Between Esztergom and Waitzen (Vbcz) the valley becomes narrow until at the latter town the river turns southward to flow in that direction for 230 m. across the great Hungarian plain. In this long stretch, the Danube meanders about in a wide alluvium-filled valley, frequently dividing into two or more streams and passing Budapest, Baja (where it leaves Hungary and enters Yugoslavia) and Mohbcs. At Almas, 14 m. east of Osijek, the Danube is joined by the important right bank tributary, the Drave (height 81 ft.), which rises in Tirol and drains a large portion of the Eastern Alps. The Danube is again diverted eastward at Borovo by the Fruška Gora, and it flows along the northern edge of this range, passing Novi Sad (Újvidék), until it reaches Belgrade. Between these two towns, the Danube receives the important left bank affluent, the Tisa (Theiss), which, rising in the Carpathians, drains the greater part of the western slopes of those mountains, as well as the great Hungarian plain. At Belgrade, the Danube is joined by the important right bank affluent, the Save, which, rising in the Julian Alps, flows eastward and drains the greater part of western Yugoslavia, whilst the eastern part of that country is drained by the Morava, which joins the Danube between Belgrade and Bazias, also on its right bank.

The whole character of the Danube valley changes suddenly at Bazias, and between that town and Turnu Severin, the river has worn out for itself a channel through the mountain ridge which joins the Carpathian arc with the Balkan mountains. A large part of the great Hungarian plain, which covers an area of about 30,000 sq.m., is remarkably flat and low-lying, and the altitude rarely exceeds 300 ft. In consequence, natural drainage by the Tisa and the Danube is very poor, and where artificial drainage has not been carried out, the banks of the rivers are in many places lined by wide swamps and marshes, which in winter form large ice-fields. Until comparatively recent geological times, this plain formed an extensive inland sea, whose final effluent followed the present course of the Danube through the Kazan defile and the Iron Gates. By the lowering of its channel through the gap (the level of the Danube at Orsova is now 42 ft. above sea level), this epicontinental sea was drained, leaving the great Hungarian plain covered with a thick deposit of alluvial sands and gravels. Hemmed in by precipitous rocks, the river passes through the stupendous Kazan defile (162 yd. wide), then widens out to nearly a mile at Orsova, but becomes narrower again at the Iron Gates. The river has been cleared of numerous obstructions to make possible navigation along this stretch.

THE LOWER COURSE

The lower course of the Danube stretches from the Iron Gates to the Black Sea. From Bazias to the junction with the small right bank tributary, the Timok, the Danube forms the boundary between Yugoslavia and Rumania. From the Timok to a point 27 m. east of Ruschuk, it forms the boundary between Rumania and Bulgaria, after which it flows entirely through Rumanian territory. Along its lower course, the Danube flows over Quaternary deposits covered by river sands and gravels. Its north bank is low, flat and marshy with numerous small lakes, but its south bank is crowned by low heights which make excellent town sites, *e.g.,* Vidin, Lom-Palanka, Svishtov, Ruschuk and Silistra. At Ruschuk, the railway from Bucharest to Varna, crosses the Danube. The river receives many tributaries along this stretch, those on its left bank, of which the Oltul and Dambovita, on which stands Bucharest, are the most important, draining the Transylvanian Alps, and those on its right bank, draining the northern ridges of the Balkan mountains. At Cernavoda, where the river is crossed by the railway from Bucharest to Constantça, the Black sea port, the Danube is diverted northward by the hills of Dobruja, which form an isolated remnant of the Hercynian foreland of Europe. Along this stretch as far as Braila, the river subdivides into several channels, and spreads out over the surrounding country forming numerous lakes. The river changes its direction again at Galatz, the chief port on the delta of the Danube, and flows eastward toward its mouths. Sea-going vessels having a register up to 4,000 tons can ascend the river as far as Braila, but those up to 600 tons can sail as far as Turnu Severin. Two left bank affluents, the Seret and the Prut, which drain the eastern side of the Carpathian

mountains, enter the river near Galatz. For 30 m. in an easterly direction from Galatz, the Danube flows as a single channel until it breaks up into the several branches of its delta. Along the northern shore of the river from Galatz to-the sea there is a large number of shallow lakes, which indicates the poor drainage of the region. The most important mouths of the river are, reading from north to south, the Kilia, Sulina and St. George, and in 1905 the ratio of the discharge of these three branches was Sulina 9%, St. George 24%, and Kilia 67%. The mean annual outflow of all the mouths is estimated at 315,200 cu.ft. per sec., and the amount of silt brought down at 108 million tons per year. As the currents of the Black sea along this coast flow from north to south, the silt brought down by the Kilia branch tends to block up the mouths of the other channels.

The delta of the Danube, which is about 1,000 sq.m. in area, is a mere wilderness of swamps and marshes covered by tall reeds and through which the silt laden distributaries of the river slowly meander. The monotony of this waste of country is relieved here and there by isolated elevations covered by oak, beech and willows, many of them marking ancient coast lines. The most important towns in the delta region are Ismail, Chilia and Vilkof on the Kilia branch, Sulina at the mouth of the Sulina branch and Tulcea and St. George on the St. George's branch. The Kilia branch itself breaks up into a wide delta which is continually advancing seaward, and it is estimated that its various mouths pour into the sea 3,000 cu.ft. of sediment per minute. The Sulina branch breaks off from the Tulcea (St. George's) branch, 7 m. below the town of Tulcea, and the St. George's branch again subdivides before entering the sea.

Before engineeripg works were commenced to make the channels navigable, ships drawing only 8 ft. of water experienced great difficulty in entering, for the depth of water in few portions of the channels rarely exceeded this figure and the frequent occurrence of numerous sand banks and bars further added to the difficulty of shipping. To-day, ships drawing 22 ft. of water can reach Brăila.

Traffic.—The Danube may be divided for traffic purposes into the maritime Danube from the sea to above Brăila, and the fluvial Danube from this point up to Regensburg, where the river at present ceases to be navigable for large craft. Brăila and Galatz, situated respectively 171 and 150 kilometres from Sulina (at the mouth of the river), are the usual points for transhipment between seagoing vessels and barges. Besides transhipping goods on to barges, seagoing vessels also tranship on to railways at Brăila and Galatz. Traffic has never equalled that on the Rhine, where the countries are much more highly developed industrially.

The European Commission.—The administration of the Danube was formerly controlled by the single European commission of the Danube, an institution set up with a provisional character by the Treaty of Paris in 1856. Its headquarters were at Galatz, and it administered the Danubian delta only, eight interested nations being represented on it. The conservancy of the other Danubian reach of international importance—the Iron Gates—was entrusted to Austria-Hungary, and assigned by her to Hungary.

In the Treaty of Bucharest (May 1918) the Central Powers reduced the membership of the European commission to "states situated on the Danube or the European coasts of the Black sea." The Treaty of Versailles (June 1919) reinstated the commission in "the powers it possessed before the war." It went on that "as a provisional measure, only representatives of Great Britain, France, Italy and Rumania shall constitute this commission." The commission acquired definite character when the Danube statute was signed in Paris on July 23, 1921. In future, subject to the unanimous consent of the states represented on the commission, any European state which is able to prove its possession of sufficient maritime commercial and European interests at the mouths of the Danube may be represented on it. Up to 1926, however, the representation had not been increased.

The International Commission.—The Treaty of Versailles, Art. 347, provided that "from the point where the competence of the European commission ceases," *i.e.*, from above Brăila, "the Danube system referred to in Art. 331," *i.e.*, as far as the highest navigable point at Ulm, "shall be placed under the administration of an international commission composed as follows:—

Two representatives of German riparian States.

One representative of each other riparian State.

One representative of each non-riparian State represented in the future as the European commission of the Danube."

This commission was to carry on the administration provisionally until the conclusion of a definite statute concerning the Danube.

On July 23, 1921, this statute was signed. Many of its provisos simply followed the lines of the "convention on the régime of navigable waterways of international concern" concluded at Barcelona on April 20, 1921. Article 1 declared navigation on the Danube system to be unrestricted and open to all flags, on a footing of complete equality, from Ulm to the Black sea, and the internationalised portions of the Danube tributaries were defined. The provisional composition of the international commission was confirmed. It had to see that the declaration in Art. 1 was not infringed by any riparian State or States, to draw up a programme of public works for the improvement of the waterway on the basis of proposals submitted by the riparians, controlling and if necessary modifying the annual programmes of the riparian states for current works of maintenance. The cost of such works was borne by the riparian State concerned, assisted, if the commission so decided, by other States interested.

The cost of works of improvement (not maintenance) might be covered by navigation dues, to be imposed (with the commission's authorisation) by the riparian State which had executed the works, or by the commission itself, if it had executed them at its own charges. Dues were to be assessed on the ship's tonnage and not based on the goods transported, revenue from them was to be applied exclusively to the works for which they were imposed, there was to be no differential treatment of flags. Customs duties levied by a riparian on goods loaded or discharged at the Danubian ports in its territory were also to be levied without distinction of flag or hindrance to navigation, and were not to be higher than duties levied at other frontiers of the same state. The transport of goods and passengers, even between ports of the same riparian State, was to be unrestricted and open to all flags on a footing of perfect equality, with the exception of regular local services which may only be carried out by foreign craft subject to the observance of the national law of the local sovereign, and in agreement with the authorities of the riparian state concerned (Art. 22). Passage of goods and passengers in transit was to be free. Uniform police regulations were to be drawn up and applied by each riparian on its own territory. A special joint service of Rumania and Yugoslavia, organised with the approval of the commission, will have to take over the maintenance and improvement of the Iron Gates section, with headquarters at Orsova. The commission was to decide on special works to be undertaken (and dues to be levied for the purpose) and to have power to abolish the service when its work was done; it could inaugurate like services elsewhere if necessary.

The commission was to determine its own procedure and administer its own budget, the presidency being held for six months by each delegation in turn. Its seat was to be at Bratislava the first five years, and thereafter it might be established at other towns on the Danube, selected at its discretion, for five-year periods in rotation. Its property and members were to enjoy diplomatic privileges and it was to fly its own flag. It was to deal in the first instance with questions regarding the interpretation and application of the convention; but the special jurisdiction set up by the League of Nations would ultimately have to deal with complaints from a state that the commission was acting ultra *vires*, or from the commission against a state for neglecting to carry out its decisions. Every effort was made to insure uniformity between the workings of the International and the European commissions, and between different signatory states

The convention came into force on June 30, 1922. One of the

most important questions that has been raised since that date was connected with the interpretation of art. 22 (above), as certain states in eastern Europe were anxious to reserve to their own flag the passenger and goods traffic between ports in their own territory. In the discussion on art. 22, the Rumanian delegate stated that the carriage of goods on river craft between two ports in the same country did not constitute sabotage if the goods were subsequently transhipped to a seagoing vessel to export, and that art. 22 imposed no restriction on the traffic carried on up to that time by Greece. It would seem to be established by the decisions of the Powers' conference that casual transport by foreign vessels between two ports in the same state is to be unrestricted even if it takes place repeatedly. *(See* INLAND WATER TRANSPORT.)

The old Ludwigskanal connecting the Danube and the river Main has been enlarged and will form the Rhine-Main-Danube canal, thus making navigation between the Atlantic ocean and the Black sea through the European continent possible.

Many legends are woven around the course of the Danube. A district in former Austria near Grein is still called the Nibelungengau in memory of one of the most famous sagas.

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DANVERS, a town of Essex county, Massachusetts, 19 mi. N.E. of Boston, on the coast. It is served by the Boston and Maine railroad. The population was 14,179 in 1940. It is a residential suburb; has various manufacturing industries, with an output in 1937 valued at $4,147,150; and is the seat of a state hospital for the insane. Danvers was separated from Salem as a district in 1752 and incorporated as a town in 1757, but the act of incorporation was disallowed by the privy council. In 1775 it was again incorporated. Within its present limits was Salem village, the centre of the witchcraft delusion of 1692. Danvers was the birthplace of Israel Putnam (q v.).

See J. W. Hanson, *History* of *the Town* of *Danvers* (1848); and A. P. White, "History of Danvers" in *History of Essex County* (1888).

DANVILLE, a city of eastern Illinois, U.S.A., 124 mi. S. of Chicago, on the bluffs of the Vermilion river; the county seat of Vermilion county. It is served by the Chicago and Eastern Illinois, the Illinois Traction (electric), the New York Central and the Wabash railways. The population was 33,776 in 1920 (87% native white) and was 36,919 in 1940 by the federal census of that year.

Danville is the commercial centre of a rich farming and coal-mining region, and has substantial manufacturing industries, including railroad locomotive and repair shops, flour and lumber mills, large brick plants, glass works and a zinc smelter.

The bank clearings in 1940 were $25,703,207 The assessed valuation of property in 1940 was $20,385,459. There are large dairy and stock farms round about. At the western boundary of the city is Lake Vermilion, a reservoir 8 mi. long, with a capacity of 2,500,000,000 gal, completed in 1925. A branch of the National Home for Disabled Volunteer Soldiers was established there in 1898. The National Soldiers' Home for veterans of American wars has been converted into a neuropsychiatric unit of the veterans' administration. About 1,800 patients are cared for. Danville was the site of an Indian village, Piankeshaw, the centre of many trails. In 1824 Dan Beckwith, for whom the city was named, built his trading cabin there, and in 1826 the settlement became the county seat.

It was incorporated as a city in 1869. A commission form of government was adopted in 1927, a city plan (prepared in 1920) was in process of development.

DANVILLE, a city in the "blue grass" region of Kentucky, U.S.A., 70 mi. S.E. of Louisville; the county seat of Boyle county. It is served by the Southern railway system. The population was 5,099 in 1920 (27% Negroes) and was 6,734 in 1940 by the federal census. The city of Danville is an important market for horses, cattle, hogs and sheep, hemp, tobacco; is the trading centre for a large area; and has a clothing factory and railroad shops. It is the seat of the Kentucky school for the deaf (founded 1823), the first state institution of the kind in the U.S.A.; Centre college for men (Presbyterian; chartered 1819); and Kentucky (formerly Caldwell) college for women (Presbyterian; 1860). There are many fine old mansions in and near the city, and beautiful landscapes and river scenery in every direction. Herrington lake, created by the hydroelectric development on the Dix river, has 75 mi. of shore line. The battlefield of Perryville is 11 mi. west. At Pleasant Hill, 13 mi. north, are the massive stone buildings of an abandoned Shaker community. Danville was on the Wilderness road, and was one of the first settlements (1781) in Kentucky. It was the home of Dr. Ephraim McDowell (1771–1830), who in 1809 performed the first entirely successful operation for ovarian tumour; and was the birthplace of Justice John M. Harlan. From 1786 to 1790 an influential "political club" held long winter evening debates in the Gill tavern, and there met the nine conventions which discussed the terms of separation from Virginia and framed the first state constitution.

DANVILLE, a borough of Montour county, Pa., U.S.A., on the high northern bank of the Susquehanna river, at the base of Montour ridge, 110 mi. N.W. of Philadelphia; the county seat and an active manufacturing centre. It is on federal highway 11, and is served by the Lackawanna, the Pennsylvania and the Reading railways. The population was 7,185 in 1930, and was 7,122 in 1940 by the federal census. It is in the centre of a rich agricultural region and has varied industries. An outstanding mental hospital, the Danville state hospital (established 1868), is located there, as well as the Geisinger Memorial hospital, a noted general hospital, and the first Catholic Slovak Girls' academy in the U.S. Settlement was made there about 1776, and in 1792 a town was laid out, called Dan's Town, after Gen. Daniel Montgomery, the founder. Ore was discovered on Montour ridge and the town as an iron centre grew rapidly. It was incorporated in 1849. The first "T" rail in America was rolled there in 1845.

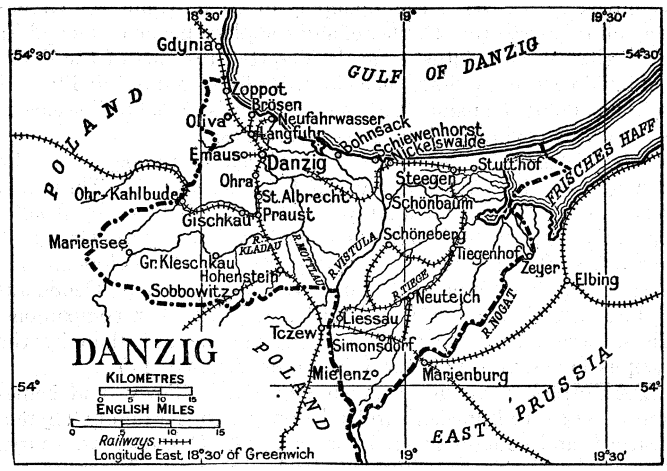
DANVILLE, a city of Virginia, U.S.A., on the high banks of the picturesque Dan river, near the southern boundary of the state; in Pittsylvania county but politically independent of it. It is on federal highways 29, 58 and 360, and is served by the Southern and Danville and Western railways. The population was 21,539 in 1920 (15·5% Negroes). The population for 1940, not including immediate suburbs, was 32,749. It is one of the largest markets in the country for bright-leaf tobacco, handling 50,000,000 lb. annually, and has one of the largest and oldest cotton mills in the south, valued at $34,000,000 and producing 2,000,000 sq.yd. of cloth per year. There are hosiery and silk mills, and other manufacturing industries. The output of 42 factories in the city in 1940 was valued at $25,000,000. Danville was settled about 1770, incorporated as a town in 1793, and as a city in 1833. After the evacuation of Richmond on April 2, 1865, the archives of the Confederacy were brought to Danville, and for a few days Jefferson Davis made it his capital. The building in which he met his cabinet is now a Confederate memorial and the city library.

DANZIG, Baltic port, town and territory close to the mouth of the river Vistula. Until Sept. 1, 1939, the town of Danzig was the administrative seat of the autonomous territory of the Free City of Danzig (*Freie Stadt Danzig*), whose absorption into the third reich has not been (1943) recognized by the United Nations.

The territory of the free city as established by art. 100 of the treaty of Versailles has an area of about 790 sq.mi. To the north it is bordered by the Gulf of Danzig and protected against heavy seas by the Polish peninsula of Hela. East of Danzig territory is the German province of East Prussia, west is situated the Polish province of Pomorze—also known as the Polish Corridor. At the

southerd tip of the'free city, Germany, Poland and Danzig meet. The river Vistula splits the territory into two nearly equal parts, the eastern Grosses Werder and the western Niederung and Hoehe. In the fertile alluvial lands of the river valley beet sugar and wheat are grown.

Apart from the municipality of Danzig the territory contains only smaller communities. An exception is the internationally-



MAP SHOWING BOUNDARIES OF THE FREE CITY OF DANZIG AS ESTABLISHED BY THE TREATY OF VERSAILLES, 1919. THE STATE, WHICH HAD A BOUNDARY LINE OF 147 MI., WAS UNDER THE PROTECTION OF THE LEAGUE OF NATIONS UNTIL 1939

known seaside resort of Zoppot (31,000 inhabitants), where a gambling casino is maintained. Noted for its surroundings, Zoppot organizes annual sport weeks and invites leading singers to the *Waldoper,* a natural theatre in the woods with 6,000 seats.

Danzig city is connected with the sea by two dead arms of the river Vistula, the Mottlau and the Tote Weichsel. These waters have been dredged to the depth of 15 ft. to allow larger ships approach of the inner wharves. For a distance of four miles the harbour canal is navigable for ships with a draught of 30 ft. During a flood in the '90s the flowing Vistula left its former bed and broke through to the gulf at the fisher village of Schiewenhorst, seven English miles east of Danzig city. Large parts of the old fortifications were removed in 1896 and turned into public parks.

To a remarkable degree Danzig has preserved its picturesque mediaeval scenery. Small streets with gabled houses and carved stone balconies (Beischlaege) are still called after the various professional guilds such as goldsmith alley and trousers-sewer alley. The old part of the city is overshadowed by the *Marien*-kirche, now one of the largest Protestant churches, built between 1343 and 1505. Hans Memlinc's painting ('The Last Judgment" is in the church. The *Uphagenhaus* on the main street, Langgasse, conveys the living conditions of the old patricians. Noteworthy for architecture are also the Gothic town hall, the stock exchange, the armoury (*Zeughaus*) and some of the old towers, like the Hohes Tor and Krantor. Danzig has a state theatre and a technical university of repute. It is connected by rail and air routes with Berlin, Warsaw and Moscow. Regular shipping lines exist with Scandinavia, England, the United States and other countries. In 1939 the free city had a population of about 410,000 and the Danzig municipality of 291,000. Of these, 95% were German speaking. Family names, however, are frequently Polish sounding and testify to a Germanizing influence. These German-speaking Danzigers of Polish descent—mostly Catholics—consider themselves Germans.

Two thirds of the populace is Protestant, one third Catholic. In 1933 Danzig counted about 10,000 Jews. Many emigrated before the outbreak of World War II. The remainder were forcibly removed during the war to the ghetto of Warsaw.

History.—Originally a Slavonic settlement, Danzig underwent in the 12th and 13th centuries Germanizing influence by tradesmen attracted by the famous amber of the region. From 1308 to 1454 under the Order of the Teutonic Knights, Danzig changed allegiance when the order decreased in power. As a member of the influential Hanseatic League, it entered into a personal union with the Polish crown which lasted from 1455 to 1793. During the 16th and 17th centuries Danzig (Polish *Gdansk*) rose to great wealth and fame as a trading-post between east and west. The Polish kings granted it extensive rights of autonomy and it was represented abroad by its own envoys. As a result of numerous Swedish-Polish wars fought at the gates of Danzig it became indebted. Its cultural life, however, continued to flourish. Schopenhauer, the philosopher, was born in Danzig. Also Fahrenheit, the inventor of the thermometer, and Chodowiecki, the engraver of the German classics.

At the third partition of Poland Danzig came for the first time to Prussia. After the latter's defeat by Napoleon Danzig was made in 1807 a free city under French-Saxon control. Marshal Lefebvre was appointed duke of Danzig. During the Napoleonic era it underwent several sieges, both parties rivalling for its possession. Not consulted, Danzig was assigned to Prussia by the Vienna Conference in 1815 and was made capital of the province of West Prussia. The merchant aristocracy of the ancient city remained irreconciled.

After its separation from Poland Danzig never regained its predominant shipping position in the Baltic. In the second half of the 19th century there occurred a moderate industrialization, mainly shipbuilding, sugar and arms manufactory. Danzig became provincial, with a large garrison and many officials and *rentiers.* The crown prince of Germany resided in the suburb of Langf uhr.

International Status.—According to arts. 100-108 of the treaty of Versailles, Germany ceded its rights concerning Danzig to the Allied and Associated Powers. The latter made Danzig a free city in an attempt to reconcile the principle of self-determination with the necessity of giving Poland a port for access to the sea.

The Danzig constitution, approved with minor alterations by the League of Nations, placed sovereignty in the people. The volkstag, a democratically-elected parliament, selects the government, or senate, headed by a *Senatspraesident.* The president of the senate and seven senators are elected for a term of four years while a vice-president and 13 senators are elected for an indefinite period, depending on parliamentary support. German is the official language, and legislature, administration and judicature were run on the German republican pattern.

Poland enjoyed commercial privileges and Poles were granted an extensive minority protection. Poland owned the major railways, and Danzig was included in the Polish customs except for a small free-port zone. The port of Danzig was administered by a mixed board consisting of an equal number of Poles and Danzigers with a Swiss subject at the head. Poland was entrusted with the conduct of Danzig's foreign affairs. Further details may he found in the Paris Convention of 1920 and the Warsaw Convention of 1921.

The League of Nations was set up as an arbiter for Danzig-Polish controversies and as a protector for the territorial integrity. Danzig's constitution was placed under the guarantee of the league. There resided in the city a league high commissioner who decided Danzig-Polish controversies in the first instance and who acted as an observer for the other league functions.

On Nov. 15, 1920, Danzig was formally proclaimed a free city and the allied troops were withdrawn. General Haking (English) acted as first league commissioner until 1923. Successive commissioners were M. S. MacDonnell (English); Professor van Hamel (Dutch), 1926; Count Manfredi Gravina (Italian), 1929; Helmer Rosting (Danish), 1932; Sean Lester (Irish), 1933–36; and Professor Karl Burckhardt (Swiss), 1937–39.

Politics.—Between 1920 and 1933 numerous Danzig-Polish frictions arose as a result of the conflicting policies of Germany and Poland. The council of the League of Nations was occupied repeatedly with Danzig-Polish controversies, Danzig often being referred to as the powder barrel of Europe. Danzig protested against installation of Polish mailboxes in the city, denied Poland the right to use its port as anchorage for warships, claimed the right of jurisdiction over the Polish railways in its territory. Danzig was dissatisfied with the distribution of customs receipts and protested against the use of the Westerplatte (place at the entrance of the port) as a munition depot. Poland was opposed to exchanges between Danzig and German officials and maintained that there was discrimination against Poles. The most important dispute centred around the problems created through the building of the Polish port of Gdpnia, 10 mi. north of Danzig territory. Danzig maintained Poland had the duty to direct all its overseas shipping via Danzig whereas Poland denied such obli-

gation and considered the building of Gdynia a matter of its territorial sovereignty. The league council took an intermediary position.

In internal politics Danzig had coalition governments similar to those of the reich. The first one was headed by Heinrich Sahm, later burgomaster of Berlin; the last one of the pre-Hitler era by Dr. Ernst Ziehm, a former president of the supreme court of administration. As a result of general elections to the volkstag held in May 1933, the nazi party acquired a majority of 50.03%. The new government u-as headed by Dr. Hermann Rauschning, who concluded economic agreements with Poland leading to an alleviation of tension.

Under the leadership of the nazi *gauleiter* Albert Forster, a Bavarian, Danzig's nazification was pushed forward with unconstitutional measures. Against these the opposition parties, in particular the Social Democrats, Centrists and Conservatives, appealed to the league council, the Danzig Poles holding themselves aloof. Rauschning resigned in Nov. 1934, in protest against the unconstitutional attitude of his party. He was replaced by Arthur Greiser. In May 1935, terrorized elections were held in which the nazis tried to achieve a two-thirds majority, which, if attained, would have entitled them to amend the constitution. In these elections the nazis drew only 57.3%. The German opposition parties appealed to the league council and demanded annulment of the elections on constitutional grounds. As guarantor of the Danzig constitution the league should have intervened. But the league council, with Anthony Eden as *rapporteur,* postponed all oppositional requests for a restoration of the constitution. In the fall of 1936 Sean Lester resigned as league high commissioner. He was replaced by Professor Burckhardt, who ceased to report on the constitutional position. As a result of the inactivity of the league the opposition parties were dissolved, press freedom finally abolished and many parliamentarians imprisoned. By the end of 1937 the gestapo ruled supreme in the free city.

Shortly after the conclusion of the Munich Pact, Germany demanded from Poland the return of Danzig to the reich and a corridor through the Corridor. Poland refused to acquiesce, and in April 1939 Hitler renounced the German-Polish Non-Aggression Pact of Jan. 1934. During the summer of 1939 followed Danzig's accelerated rearmament. In Aug. 1939 Forster proclaimed himself president of the free state, a measure involving a coup d'état. The first shot of World War II was fired by the German warship "Schleswig Holstein" while paying a courtesy visit to Danzig. Professor Burckhardt was requested by the military authorities of the occupation force to leave Danzig within two hours. After concurring declarations of Hitler and Forster, Danzig was reincorporated in the reich and was made again capital of the province of West Prussia.

Economics.— In 1923 Danzig adopted a new gulden currency to be issued by the Bank of Danzig, 25 gulden equalling one British pound sterling. The Danzig gulden did not follow the devaluation of the pound, but in May 1935 the gulden was depreciated 41% by senatorial decree. After the German occupation the gulden was replaced by the mark. During Danzig's independence German and Polish banks maintained branches in the city. Prominent were the Deutsche bank, Dresdner bank, Bank Zwiansku and the British-Polish Trade bank, a branch of the Bank Gostpodárstwo.

The chief import goods were foodstuffs, fertilizers, chemicals, ore, machines, hardware, building materials, raw cotton and textiles; the principal exports were coal, timber, sugar, grain, cement, naphtha, iron and steel. The Danzig port possesses ample facilities for storage, and timber ponds extend for several miles along the banks of the Tote Weichsel. Modern cranes in the coal basin turn a whole railway car upside down and the cargo is dumped in the hold.

Danzig's shipping increased rapidly during the 'nos. As compared with an average total turnover of about 2,500,000 metric tons prior to 1914 the Danzig harbour attained a turnover of 6,000,000, 1926, and of nearly 8,000,000 in 1927. The peak was reached in 1928 with a turnover of over 8,500,000 tons. Then a gradual decrease set in and in 1932 Danzig lost about 3,000,000 tons, mostly at the expense of Gdynia. In 1938 Danzig had a turnover of nearly 6,000,000 tons, Gdynia one of about 8,750,000 tons. National socialist political measures probably also affected Danzig's trade position. Its overseas trade was to a considerable extent managed by foreign residents of Danzig, in particular by Poles, British and Scandinavians. Most of the cargoes were delivered by way of tramp-shipping. The Norwegian, German, English and Polish flags predominated in the port.

Only sugar, railway cars and machines were produced on a larger scale. The leading industry was shipbuilding. Prominent in this branch were the firms of F. Schichau and the International Shipbuilding and Engineering Co. Ltd. The latter firm had leased the establishments of the former German Imperial Wharft from the governments of Poland and Danzig to which they had been assigned by the conference of ambassadors after World War I. The original capital of the international company amounting to £10,000 had been distributed in Britain, France, Poland and Danzig. British and French citizens each held 30% of the capital, Polish and Danzig citizens each 20%. After Danzig's occupation in 1939, the premises of the international company were taken over by the occupation force.

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DAPHNAE (Tahpanhes, mod. *Defenneh*), an ancient fortress near the Syrian frontier of Egypt, on the Pelusian arm of the Nile. Here King Psammetichus established a garrison of foreign mercenaries, mostly Carians and Ionian Greeks. After the destruction of Jerusalem by Nebuchadrezzar in 588 B.C., the Jewish fugitives, of whom Jeremiah was one, came to Tahpanhes. When Naucratis was given by Amasis II the monopoly of Greek traffic the Greeks were all removed from Daphnae, and the place never recovered its prosperity; in Herodotus' time the deserted remains of the docks and buildings were visible. The site was discovered by Sir Flinders Petrie in 1886; the name "Castle of the Jew's Daughter" seems to preserve the tradition of the Jewish refugees.

DAPHNE (Gr. laurel tree), in Greek mythology, was the daughter of the Arcadian river-god Ladon, or the Thessalian Peneus, or of the Laconian Amyclas. She was beloved by Apollo, and when pursued by him was changed by her mother Ge into a laurel tree (Ovid, *Metam.,* i, 452–567). In the Peloponnesian legends, another suitor of Daphne, Leucippus, son of Oenomaus of Pisa, disguised himself as a girl and joined her companions. His sex was discovered while bathing, and he was slain by the nymphs (Pausanias, viii, 20; Parthenius, *Erotica,* 15).

DAPHNE, a genus of much cultivated, showy, and sometimes evergreen, Eurasian shrubs, belonging to the family Thymelaeaceae, and containing about 40 species. D. *Laureola,* spurge laurel, a small, widely cultivated shrub with green flowers in the leaf axils towards the ends of the branches and ovoid black, very poisonous berries, is found in England. D. *Mezereum,* mezereon, a rather larger shrub, 2 to 4 ft. high, has deciduous leaves, and bears fragrant pink flowers in clusters in the axils of last season's leaves, in early spring before the foliage. The bright red ovoid berries are cathartic, the whole plant is acrid and poisonous. It is a native of Europe and north Asia, and found apparently wild in copses and woods in Britain. It is a well-known garden plant, and several other species of the genus are cultivated in the open air and as greenhouse plants. *D. Cneorum* (garland-flower) is a hardy evergreen trailing shrub, with pink sweet-scented flowers. D. *odora* (China and Japan) is a hardy evergreen with showy, rosy-purple, fragrant flowers.

D. indica (China) and *D. japonica* (Japan) are greenhouse evergreens with respectively red or white and pinkish-purple flowers.

DAPHNEPHORIA, a festival held every ninth year at Thebes in Boeotia in honour of Apollo Ismenius or Galaxius. It consisted of a procession in which the chief figure was a boy, of good family and noble appearance, whose father and mother must be alive. Immediately in front of the boy, who was called *Daphnephoros* ("laurel bearer"), walked one of his nearest relatives, carrying an olive branch hung with laurel and flowers and having on the upper end a bronze ball from which hung several smaller balls. Another smaller ball was placed on the middle of the branch or pole, which was then twined round with ribbons.

These balls were said to indicate the sun, stars and moon, while the ribbons referred to the days of the year, being 365 in number. Then followed a chorus of maidens carrying suppliant branches and singing a hymn to the god. The *Daphnephoros* dedicated a bronze tripod in the temple of Apollo. The festival is described by Proclus (in Photius, *Cod.,* 239).

See also A. Mommsen, *Feste der Stadt Athen* (1898); *L. R.* Farnell, *Cults of the Greek States,* iv, 284–86.

DAPHNIS, the legendary hero of the shepherds of Sicily, and reputed inventor of bucolic poetry. According to his countryman Diodorus (iv, 84), and Aelian (Var. *Hist.,* x, 18), Daphnis was the son of Hermes and a Sicilian nymph, and was found by shepherds in a grove of laurels (whence his name). He won the affection of a nymph, who made him promise to love none but her, threatening that if he proved unfaithful he would lose his eyesight. He failed to keep his promise and was smitten with blindness. Daphnis, who endeavoured to console himself by playing the flute and singing shepherds' songs, soon afterwards died, or was taken up to heaven by his father Hermes, who caused a spring of water to gush out from the spot where his

son had been carried off. Ever afterwards, the Sicilians offered sacrifices at this spring. In Theocritus, Id. I., Daphnis[1] apparently has offended Eros and Aphrodite, and in return has been smitten with unrequited love; he dies, although Aphrodite, moved by compassion, endeavours, but too late, to save him.

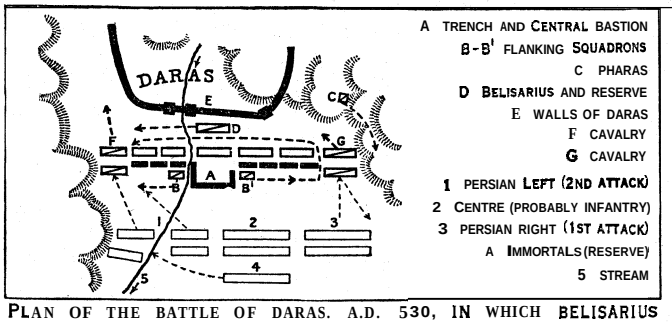
See H. *W.* Stoll in Roscher's *Lexikon;* and G. Knaack in Pauly-Wissowa's *Realencyklopadie.*

DARAB, a town of Fars, in Persia, and headquarters of a district of the same name, situated in 28° 45' N., 54° 37' E., at an elevation of 4,000 ft., on the Shiraz, Fasa, Furg, Bandar Abbas caravan route, about 140 m. from the first-named and 208 m. from the last. It is a straggling place with an estimated population of 12,000. The district around produces oranges and lemons in abundance, and tobacco of good quality is cultivated extensively. In Iranian legend, the foundation of the town, known also as Darab-gird, is attributed to Darab, father of Dara (Darius III.). About 4 m. to the south-west, is a large circular earthwork known as Kalah-i-Darab, described in Sir W. Ouseley's Travels (1819), the history of which is unknown. Another monument in the vicinity is a gigantic bas-relief, carved on the vertical face of a rock, representing the victory of the Sasanian Shapur I. over the Roman emperor Valerian, A.D. 260.

D'ARANYI, JELLY (1895–), Hungarian violinist, grand-niece of Dr. Joachim and one of the most brilliant players of her day, was born at Budapest on May 3, 1895. She studied under Hubay and quickly attracted notice by her exceptional powers, eventually winning world-wide recognition. She resides in London. Her sister, Madame Adila Fachiri, also a violinist, is likewise a player of the first rank.

DARAS, a fortified Roman city on the Mesopotamian frontier about 12 miles N.W. of Nisibis, founded A.D. 504 by Anastasius to replace Nisibis, ceded to the Persians A.D. 363. It was built near the head of, and almost completely blocking, a narrow valley running north-north-east and south-south-west. It flanked the road to Mardin.

Belisarius, aged 24, appointed General of the East by Justinian in 529, was stationed here in June, 530, when Pezozes arrived at Nisibis with a Persian army of 40.000 horse and foot, to invade the Roman empire. Reinforcements from Lebanon raised Belisarius' army to 25,000 undisciplined troops, discouraged by recent defeats. Daras was dominated on three sides by high ground. This, and the low spirits of the troops, made it unwise to stand a siege. Belisarius caused a ditch to be dug across the valley, the flanks protected by the high ground unsuited to cavalry. Openings allowed the Romans to counter-attack. In the centre a rectangular projection, like an entrenched camp, gave flanking fire across the front and protected the front and exposed flanks of



PLAN OF THE BATTLE OF DARAS. A.D. 530, IN WHICH BELISARIUS DEFEATED THE PERSIANS

two bodies of 600 Hunnish light cavalry, placed on either side of this bastion. Infantry manned the centre, and cavalry was posted on the flanks. In concealment, on the high ground beyond the Roman left (east) flank, was posted a squadron of 300 light horse, under Pharas. Belisarius kept a reserve under his own hand. The city walls gave the protection of overhead fire from the bows of the inhabitants of Daras and, probably, artillery engines.

Pezozes arrayed his host in two lines. He kept the "Immortals" in reserve. The first day the Persians looked over the situation and skirmished, but did not attack. Only a short time before, a Persian force had ridden to disaster into a similar ditch dug for them by the Ephthalite Huns. Pezozes did not like the unusual steadiness in the Roman ranks any more than he liked the ditch. Also a stream, whose bed was four feet deep, probably interfered with his power to manoeuvre. The next day reinforcements brought the Persian strength to a total said to be 50,000 men. The Persians advanced about noon. Pezozes relieved the front line with the second to keep up a continuous fire of archery; but the wind favoured the Roman bowmen. Both sides suffered heavy losses in this missile fight. The Persian horse charged the Roman left. The Roman cavalry gave way. Then the squadron of Pharas, moving along the high ground, fell on the Persian rear, and the 600 Hunnish cavalry from the left (east) angle of the central bastion, took the enemy in flank. The Persian horse was routed with heavy loss.

Belisarius noted a movement of the Persians, including the "Immortals," toward his right. He ordered the victorious Huns from the left flank to reinforce the similar detachment on the right, and added troops from his reserve. The Persian attack drove in the Roman cavalry on their front, but the Huns, charging from the west angle of the trench, penetrated between the two Persian lines and created disorder. The reinforcements sent by Belisarius charged also, and the defeated Roman cavalry rallied and counter-attacked. Surprised and almost surrounded, the Persians broke. The Roman lines now advanced across the ditch, and the victorious cavalry rolled up the Persian flank. Belisarius called an early halt to the pursuit lest his undisciplined troops might get out of hand and fall into an ambush.

This victory restored the prestige of Roman arms, raised morale and discipline, and established the reputation of Belisarius. The use of the ditch afforded security to the weakest part of the line. By its location, it protected the front, flanks and rear. It economized force by making use of the walls of Daras and the citizens to cover a possible retirement. It left the cavalry the greatest freedom of manoeuvre. Finally, it permitted a counter-attack.

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2. Primary accounts: Malalas, *Chronographia* (in *Migne. Patr. Gr. V.* 97, 1860); Procopius, *Histories* (1914–1924; Greek and English on opposite pages).

3. For topography and maps: Chapot, *La Frontière de l'Euphrate* (1907); Sachau, *Reise in Syrien und Mesopotamien* (1883).

(J. M. Sc.)

DARBHANGA, a town and district of British India, in the Tirhut division of Behar and Orissa. The town is on the left bank of the Little Baghmati river, and has a railway station. Pop. (1931) 60,676. The town is really a collection of villages round the residence of the Maharaja, a large modern building in extensive grounds. There are a hospital, with a medical college and a Lady Dufferin hospital attached, and a town hall and large tanks extending for over a mile. The district of Darbhanga extends from the Nepal frontier to the Ganges. Area 3,348 sq.m. Pop. (1931) 3,166,094. The district consists entirely of an alluvial plain, in which the principal rivers are the Ganges, Burh Gandak, Baghmati and Little Baghmati, Balan and Little Balan, and Tiljuga. Rice is the staple crop, and the cultivator is especially dependent on the winter harvest. In 1897 a famine affected the whole district except the Samastipur subdivision, and another affected half the district in 1906–07. Indigo manufacture was formerly an important industry but has declined. Sugar cultivation and manufacture have to some extent taken its place. Tobacco is also a valuable crop. The district is traversed by the main line of the Bengal and North-Western railway. Pusa (*q.v.*) in the west of the district is the headquarters of the Imperial Agricultural Department.

The Darbhanga raj, which was founded in the 16th century, is a name applied to a large estate which includes parts of the districts of Darbhanga, Muzaffarpur, Monghyr, Purnea and Bhagal-

[1] It is erroneous to suppose that every shepherd called Daphnis in pastoral poetry and romance is this Daphnis.

pur. It is held by one of the chief noblemen of the province, Sir Rameshwar Singh Bahadur, Maharajadhiraj of Darbhanga, G.C.I.E., K.C.I.E., K.B.E., who was born in 1860, and on attaining his majority in 1878 was appointed to the Indian Statutory Civil Service, which he resigned in 1885 in order to manage his estates. He was created raja bahadur in 1886, maharaja bahadur on his succession to the raj in 1898, and hereditary Maharajadhiraj in 1920: he was a member of the Executive Council of Behar and Orissa from 1912 to 1917. He is the head of the Maithil Brahmans.

D'ARBLAY. FRANCES (1752–1840), English novelist and diarist, better known as FANNY BURNEY, daughter of Dr. Charles Burney (*q.v.*), was born at King's Lynn, Norfolk, on June 13, 1752. Her mother was Esther Sleepe, granddaughter of a French refugee named Dubois. Fanny was the fourth child in a family of six. Of her brothers, James (1750–1821) became an admiral and sailed with Captain Cook on his second and third voyages, and Charles Burney (1757–1817) was a well-known classical scholar. In 1760 the family removed to London, and Dr. Burney, who was now a fashionable music-master, took a house in Poland street. Mrs. Burney died in 1761, when Fanny was only nine years old. Her sisters, Esther (Hetty), afterwards Mrs. Charles Rousseau Burney, and Susanna, afterwards Mrs. Phillips, were sent to school in Paris, but Fanny was left to educate herself. Early in 1766 she paid her first visit to Dr. Burney's friend Samuel Crisp at Chessington Hall, near Epsom. Dr. Burney had first made Samuel Crisp's acquaintance about 1745 at the house of Fulke Greville, grandfather of the diarist, and the two studied music while the rest of the guests hunted. Crisp wrote a play, *Virginia,* which was staged by David Garrick in 1754 at the request of the beautiful countess of Coventry (*née* Maria Gunning). The play had no great success, and in 1764 Crisp established himself in retirement at Chessington Hall, where he frequently entertained his sister, Mrs. Sophia Gast, of Burford, Oxfordshire, and Dr. Burney and his family, to whom he was familiarly known as "daddy" Crisp.[1] It was to her "daddy" Crisp and her sister Susan that Fanny Burney addressed large portions of her diary and many of her letters. After his wife's death in 1767, Dr. Burney married Elizabeth Allen, widow of a King's Lynn wine-merchant.

From her 15th year Fanny lived in the midst of a brilliant social circle, gathered round her father in Poland street, and later in his new home in St. Martin's street, Leicester Fields, London. Garrick was a frequent visitor, and would arrive before eight o'clock in the morning. Of the various "lyons" they entertained she leaves a graphic account, notably of Omai, the Otaheitan native, and of Alexis Orlov, the favourite of Catherine II. of Russia. Dr. Johnson she first met at her father's home in March 1777. Her father's drawing-room, where she met many of the chief musicians, actors and authors of the day, was in fact Fanny's only school. Her reading, however, was by no means limited. Macaulay stated that in the whole of Dr. Burney's library there was but one novel, Fielding's *Amelia;* but Austin Dobson points out that she was acquainted with the abbé Prévost's *Doyen de Killérine,* and with Marivaux's *Vie de Marianne,* besides *Clarissa Harlowe* and the books of Mrs. Elizabeth Griffith and Mrs. Frances Brooke. Her diary also contains the record of much more strenuous reading. Her stepmother, a woman of some cultivation, did not encourage habits of scribbling. Fanny, therefore, made a bonfire of her mss., among them a *History of Caroline Evelyn,* a story containing an account of Evelina's mother. Luckily her journal did not meet with the same fate. The first entry in it was made on May 30, 1768, and it extended over 72 years. The earlier portions of it underwent wholesale editing in later days, and much of it was entirely obliterated. She planned out *Evelina, or A Young Lady's Entrance into the World,* long before it was written down. *Evelina* was published by Thomas Lowndes in the end of Jan. 1778, but it was not until June that Dr. Burney learned its authorship, when the book had been reviewed and praised everywhere. Fanny proudly told Mrs. Thrale the secret. Mrs. Thrale wrote to Dr. Burney on July 22: "Mr. Johnson returned home full of the Prayes of the *Book* I had lent him, and protesting that there were passages in it which might do *honour* to Richardson: we talk of it for ever, and he feels ardent after the denouement; he could not get *rid* of the Rogue, he said." Miss Burney soon visited the Thrales at Streatham, "the most consequential day I have spent since my birth" she calls the occasion. It was the prelude to much longer visits there. Dr. Johnson's best compliments were made for her benefit, and eagerly transcribed in her diary. His affectionate friendship for "little Burney" only ceased with his death.

Evelina was a continued success. Sir Joshua Reynolds sat up all night to read it, as did Edmund Burke, who came next to Johnson in Miss Burney's esteem. She was introduced to Elizabeth Montagu and the other bluestocking ladies, to Richard Brinsley Sheridan, and to the gay Mrs. Mary Cholmondeley, the sister of Peg Woffington, whose manners, as described in the diary, explain much of *Evelina.* At the suggestion of Mrs. Thrale, and with offers of help from Arthur Murphy, and encouragement from Sheridan, Fanny began to write a comedy. Crisp, realizing the limitations of her powers, tried to dissuade her, and the piece, *The Witlings,* was suppressed in deference to what she called a "hissing, groaning, catcalling epistle" from her two "daddies." Meanwhile her intercourse with Mrs. Thrale proved very exacting, and left her little time for writing. She went with her to Bath in 1780, and was at Streatham again in 1781. Her next book was written partly at Chessington and after much discussion with Mr. Crisp. *Cecilia; or Memoirs of an Heiress,* by the author of *Evelina,* was published in 5 vols. in 1782 by Messrs. Payne and Cadell (who paid the author £2,000 as stated by Macaulay).

On April 24, 1783, Fanny Burney's "most judicious adviser and stimulating critic," "daddy" Crisp, died. He was her devoted friend, as she was to him, "the dearest thing on earth." The next year she was to lose two more friends. Mrs. Thrale married Piozzi, and Johnson died. Fanny had met the celebrated Mrs Delany in 1783, and she now attached herself to her. Mrs. Delany, who was living (1785) in a house near Windsor castle, presented to her by George III., was on the friendliest terms with both the king and queen, and Queen Charlotte soon after offered Miss Burney the post of second keeper of the robes, with a salary of £200 a year, which after some hesitation was accepted. Fanny's own misgivings as to her unfitness for court life were quite justified. From Queen Charlotte she received unvarying kindness, though she was not very clever with her waiting-maid's duties. She had to attend the queen's toilet, to take care of her lap-dog and her snuff-box, and to help her senior, Mrs. Schwellenberg, in entertaining the king's equerries and visitors at tea. The constant association with Mrs. Schwellenberg, who has been described as "a peevish old person of uncertain temper and impaired health, swaddled in the buckram of backstairs etiquette," proved to be the worst part of Fanny's duties. The strain told on her health, and after pressure both from Fanny and her numerous friends, Dr. Burney prepared with her a joint memorial asking the queen's leave to resign. She left the royal service in July 1791 with a retiring pension of £100 a year, granted from the queen's private purse, and returned to her father's house at Chelsea.

In 1792 she became acquainted with a group of French exiles, who had taken a house, Juniper Hall, near Mickleham, where Fanny's sister, Mrs. Phillips, lived. On July 31, 1793, she married one of the exiles, Alexandre D'Arblay, an artillery officer, who had been adjutant-general to La Fayette. They took a cottage at Bookham on the strength, it appears, of Miss Burney's pension. In 1793 she produced her *Brief Reflections relative to the Emigrant French Clergy.* Her son Alexandre was born on Dec. 18, 1794. In the following spring Sheridan produced at Drury Lane her *Edwy and Elgiva,* a tragedy which was not saved even by the acting of the Kembles and Mrs. Siddons. The play was never printed. Madame D'Arblay issued her next novel, *Camilla: or A Picture* of *Youth* (5 vols., 1796), by subscription, by which she made over £2,000; Jane Austen was among the subscribers. Unfortunately its literary success was not great. **A**

[1] His letters to Mrs. Gast and another sister, Anne, were edited with the title of *Burford Papers* (1906), *by* W. H. Hutton.

second play, *Love and Fashion*, was actually put in rehearsal in 1799, but was withdrawn in the next year. In 1801 Madame D'Arblay accompanied her husband to Paris, where he eventually obtained a place in the civil service. In 1812 she returned to England, bringing with her her son Alexandre to escape the conscription. In 1814 she published *The Wanderer; or Female Difficulties*. Possibly because readers expected to find a description of her impressions of revolutionary France, it had a large sale, from which the author realized £7,000. Nobody, it has been said, ever read *The Wanderer*. At the end of that year she returned to France. During the Hundred Days of 1815 she was in Belgium, and the vivid account in her *Diary* of Brussels during Waterloo may have been used by Thackeray in *Vanity Fair*. General D'Arblay now received permission to settle in England. After his death at Bath on May 3, 1818, his wife lived in Bolton street, Piccadilly. There she was visited in 1826 by Sir Walter Scott, who describes her (*Journal*, Nov. 18, 1826) as an elderly lady with no remains of personal beauty, but with a gentle manner and a pleasing countenance. The later years of her life were occupied with the editing of the *Mentoirs of Dr. Burney, arranged from his own Manuscripts, from family papers and jrom personal recollections* (3 vols., 1832). Her style had, as time went on, altered for the worse, and this book is full of extraordinary affectations. Madame D'Arblay died in London on Jan. 6, 1840 and was buried at Walcot, Bath, near her son and husband.

Madame D'Arblay's best title to the affections of modern readers is the *Diary and Letters*. Dr. Johnson lives in its pages almost as vividly as in those of Boswell, and King George and his wife in a friendlier light than in most of their contemporary portraits. Croker, in *The Qzrarterly Review*, April 1833 and June 1842, made two attacks on Madame D'Arblay. The first is an unfriendly but largely justifiable criticism on the *Memoirs of Dr. Burney*. In the second, a review of the first three volumes of the *Diary and Letters*, Croker abused the writer's innocent vanity, and declared that, considering their bulk and pretensions, the *Diary and Letters* were "nearly the most worthless we have ever waded through." These pronouncements drew forth the eloquent defence by Lord Macaulay, first printed in *The Edinburgh Review*, Jan. 1843, which perhaps did more than anything else to maintain Madame D'Arblay's constant popularity.

BIBLIOGRAPHY.—The *Diary and Letters of Madame D'Arblay* was edited by her niece, Charlotte Frances Barrett, in 7 vols. (1842–46). The text, covering the years 1778–1840, was edited with preface, notes and reproductions of contemporary portraits and other illustrations, by Mr. Austin Dobson in 6 vols. (1904–05). This *Diary*, which begins with the publication of *Evelina*, was supplemented in 1889 by *The Early Diary of Frances Burney* (1768–78), which in the first instance had been suppressed as being of purely private interest, edited by Mrs. Annie Raine Ellis, with an introduction giving many particulars of the Burney family. Mrs. Ellis also edited *Evelina* for "Bohn's Novelist's Library" in 1881, and *Cecilia* in 1882. *See* also Austin Dobson, *Fanny Burney (Madame D'Arblay)* (1903), in the "English Men of Letters Series"; S. E. Burney, *The Early Diary of Frances Burney*, with a selection from the journals of her sisters Susan and Charlotte Burney (1907); F. F. Moore, *The Keeper of the Robes*, (1911); *C*. B. Tinker, *Dr. Johnson and Fanny Burney* (1912); *T*. B. Macaulay, *Essay on Frances Burney* (1919); *R*. B. Johnson, *Fanny Burney and the Burneys* (1926).

DARBOUX, JEAN GASTON (1842–1917), French mathematician, was born at Nîmes on Aug. 13, 1842. His father died in 1849, and under the guidance of his mother, and with her encouragement, he was educated at the Ecole Normale, Paris. Pasteur became interested in Darboux, and created a teaching post for him at the Ecole Normale. After acting as assistant to Bertrand in the chair of mathematical physics at the Collège de France (1866–67) he became successively professor of mathematics at the lycée Louis le Grand (1867–72), Maître de conférences at the Ecole Normale (1872–73), assistant to the professor of rational mechanics at the Sorbonne (1873–80), professor of higher geometry at the Sorbonne (1880–89), dean of the faculty of science (1889–90) and perpetual secretary of the Academy of Science. Darboux, besides being an excellent teacher and a notable mathematician, was also a very capable organizer and the last two posts he held gave him ample scope in this direction. He died in Paris on Feb. 25, 1917.

Practically all his mathematical work was on geometry, his early papers (1864 and 1866) were on orthogonal surfaces; these were followed by a memoir on partial differential equations of the second order (1870), which embodied a new method of integration. In his treatise *Sur une Classe remarquable des courbes* (1873) Darboux developed the theory of the class of surfaces called cyclides. *Leçons sur la Théorie générale des surfaces et les applications géométriques du calcul infinitésimal* (4 vols., 1887–96) is one of Darboux's most important works; dealing with infinitesimal geometry, it embodies most of his previous research work. In 1898 the publication of *Leçons sur les systèmes orthogonaux et les coordonne'es curvilignes* was commenced. Darboux was the author of a number of papers and memoirs on the approximation to functions of very large numbers, on discontinuous functions and on other subjects.

Darboux held honorary degrees of many foreign universities; he was a foreign member of the Royal Society and in 1916 was awarded the Sylvester Medal.

DARBOY, GEORGES (1813–1871), archbishop of Paris, was born at Fayl-Billot in Haute Marne on Jan. 16, 1813. He was appointed bishop of Nancy in 1859, and in January 1863 was raised to the archbishopric of Paris. The archbishop was a strenuous upholder of episcopal independence in the Gallican sense, and sought to suppress the jurisdiction of the Jesuits and other religious orders within his diocese. At the Vatican council (*q.v.*) he strongly opposed the dogma of papal infallibility, against which he voted as inopportune. When the dogma had been finally adopted, however, he submitted. During the Franco-Prussian War he organized relief for the wounded and remained at his post during the siege of Paris and the brief triumph of the Commune. On April 4, 1871, he was arrested by the Cornmunards as a hostage and confined in the prison at Mazas, from which he was transferred to La Roquette on the advance of the army of Versailles. On May 27 he was shot within the prison along with other hostages. He died in the attitude of blessing and uttering words of forgiveness. His body was recovered with difficulty and received a public funeral (June 7). Darboy was the third archbishop of Paris who perished by violence between 1848 and 1871. He wrote a *Vie de St. Thomas Becket* (1859) and translated the works of St. Denis the Areopagite and the *Imitation of Christ*.

See J. A. Foulon, *Histoire de la vie et des oeuvres de Mgr. Darboy* (1889), and *J*. Guillermin, *Vie de Mgr. Darboy* (1888), biographies written from the clerical standpoint.

DARBY, a borough of Delaware county, Pa., U.S.A., on the south-west border of Philadelphia, near the Delaware river; served by the Baltimore and Ohio, and the Pennsylvania railways. It is largely a residential suburb, with few businesses operating in the town. Its population was 9,899 in 1930 and 10,334 in 1940 by the federal census

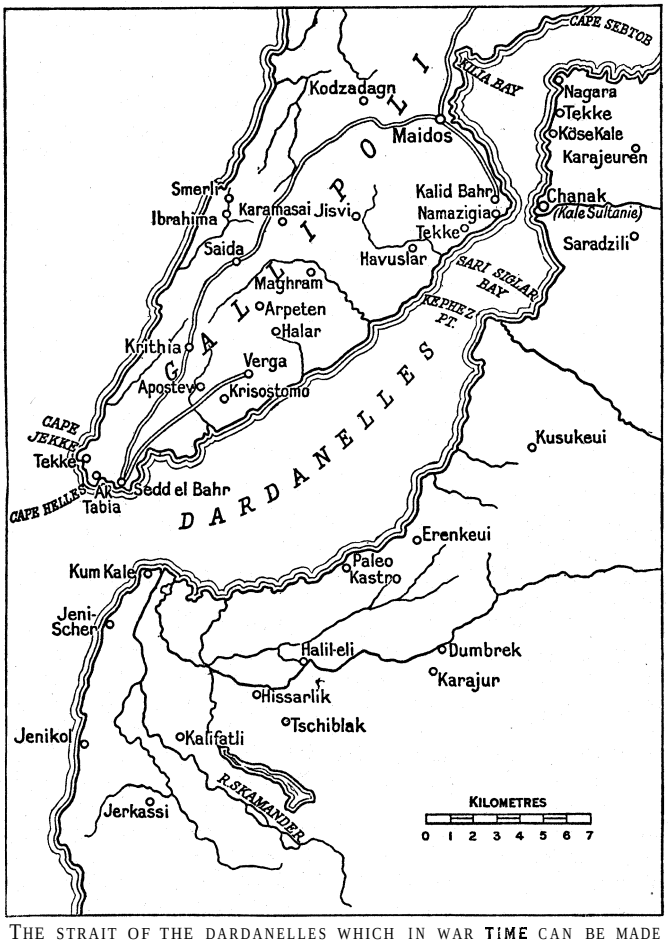
Darby was settled by eight Friends, in 1682. and has one of the oldest libraries in the country. It was incorporated in 1853, but most of its development has taken place since 1900.

DARCY, THOMAS DARCY, BARON (1467–1537), English soldier, was a son of Sir William Darcy (d. 1488). In 1505, having been created Baron Darcy, he was made warden of the east marches towards Scotland. In 1511 Darcy led some troops to Spain to help Ferdinand and Isabella against the Moors, but he returned almost at once to England, and was with Henry VIII. on his French campaign two years later. Darcy, who was one of the most powerful nobles on the border, was also a member of the royal council, dividing his time between state duties in London and a more active life in the north. He brought forward accusations against his former friend, Cardinal Wolsey; however, after the cardinal's fall his words and actions caused him to be suspected by Henry VIII. Disliking the separation from Rome, Darcy asserted that matrimonial cases were matters for the decision of the spiritual power, and he communicated with Eustace Chapuys, the ambassador of the emperor Charles V., about an invasion of England in the interests of the Roman Catholics. Detained in London by the king, he was not allowed to return to Yorkshire until late in 1535, and about a year after his arrival in the north the rising known as the Pilgrimage of Grace broke out. For a short time Darcy defended Pontefract Castle against

the rebels, but soon he surrendered to them this stronghold, which he could certainly have held a little longer, and was with them at Doncaster, being regarded as one of their leaders. Darcy may have assisted to suppress the rising which was renewed under Sir Francis Bigod early in 1537, but the king believed, probably with good reason, that he was guilty of fresh treasons, and he was seized and hurried to London. Tried by his peers, Darcy was found guilty of treason, and was beheaded on June 20, 1537.

DARDANELLES (Turk. *Chanak Kali* or *Çanakkale*), the chief town of a Turkish vilayet which includes the peninsula of Gallipoli, the ancient Troad, and the adjoining islands. Population, 54,476. It is at the mouth of the Rhodius, and at the narrowest part of the strait of the Dardanelles, where its span is but a mile across. The pottery trade, from which the town derived its Turkish name (Chanak means "pot" in Osmanli) has declined in importance; valonia and cereals are the chief products of this section.

DARDANELLES (Turk. *Bahr-Sefed Boghazi*), the strait (anciently called the Hellespont) that unites the Sea of Marmora with the Aegean. The city of Dardanus in the Troad, where Mithridates and Sulla signed a treaty in 84 B.C., gave the strait its name. The shores are formed by the peninsula of Gallipoli on the north-west and by Asia Minor on the south-east; it extends for a distance of about 47m. with an average breadth of 3 or 4 miles. At the Aegean extremity stand the castles of Sedil Bahr and Kum Kaleh respectively in Europe and Asia; and near the Marmora extremity is the town of Gallipoli (Callipolis) on the northern shore, and that of Lamsaki or Lapsaki (Lampsacus) on the southern. The two most famous castles of the Dardanelles



THE STRAIT OF THE DARDANELLES WHICH IN WAR TIME CAN BE MADE ALMOST IMPREGNABLE

are Chanak-Kalehsi, Sultanieh-Kalehsi, or the Old Castle of Anatolia, and Kilid-Bahr, or the Old Castle of Rumelia. The strait has long been famous in history since the passage of Xerxes' army by a bridge of boats. It is the scene of the story of Hero and Leander, and of Byron's successful attempt to rival Leander. The strategic importance of the strait has always been very great, since it is the gateway to Constantinople and the Black Sea from the Mediterranean. Although easily capable of defence, the strait was forced by the English admiral, Sir J. T. Duckworth, in 1807; and during World War I a British submarine under the command of Lieutenant-commander Stoker penetrated through the Turkish minefields and sank a Turkish battleship off the Golden Horn. Its strategic importance has given to it an international political importance that has found expression in what is known as the Straits (Dardanelles and Bosphorus) Question (*q.v.*). (I. F. D. M.)

DARDANELLES CAMPAIGN. This campaign, brought about by a desire on the part of the Allies that communications should be opened up from the Mediterranean into the Black sea with a view to assisting Russia, was begun in Feb. 1915 as a purely naval undertaking. (See WORLD WAR I, Naval.)

But it had been realized from the outset that, even should the warships succeed in attaining their object, land forces would sooner or later be required to aid in the campaign, if only to secure the communications of the fleet after it had passed into the Sea of Marmora. Before the failure of the naval attack of March 18, Allied troops had been set in motion for the Aegean. Some were already in Lemnos, and Sir Ian Hamilton, chosen as commander-in-chief of the military contingents, had arrived in time to witness the fight of the 18th. In view of its result, the Allied Governments decided that from this time onwards the gathering army must assume the principal rôle in the effort to secure possession of the straits. Hamilton was unable to initiate land operations at once. The Turks were making preparations to repel landings on both sides of the straits, while the troops at his disposal were partly in Egypt, partly at Lemnos, and partly on the high seas, en route from their respective bases in England and France.

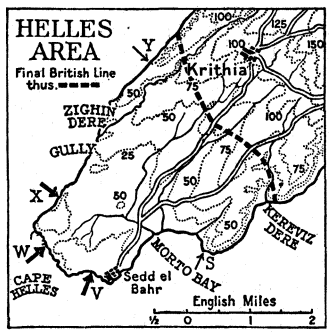
Organization in Egypt.—He decided therefore that his army must in the first place be concentrated in Egypt, to be organized for the hazardous undertaking to which it was about to be committed, and that it must then be disposed in transports in accordance with tactical requirements in anticipation of a landing in face of the enemy. A month was lost in consequence. During that month the Turkish army was formed (March 24) to guard the straits. Marshal Liman von Sanders, head of the German military mission in Turkey, was appointed its commander-in-chief, and under his instructions the defence system, organized in consequence of the warning offered by the naval operations, was overhauled and developed.

The Allied force was composed of five divisions—two (the 29th and the Royal Naval) furnished by the United Kingdom, two formed of Australian and New Zealand troops, and one composed of French colonial troops. Against this force Liman von Sanders could pit six divisions, but these were perforce dispersed; two (3rd and 11th) were watching the coast on the Asiatic side, two (5th and 7th) were near Bulair to guard against a landing at the neck of the Gallipoli peninsula, while the remainder (9th and 19th) were disposed towards its southern end.

I. THE FIRST LANDINGS

The expeditionary force concentrated in Mudros bay, Lemnos, in the third week of April. Hamilton contemplated two distinct major operations to secure a footing on the Gallipoli peninsula. The 29th Div., supported by the Royal Naval Div., was to be put ashore at its extremity, an area which it is convenient to designate as Helles; the Australian and New Zealand Divs. under Sir W. Birdwood (*q.v.*) were to land north of Gaba Tepe, where there are extensive beaches. But part of the one available French division was furthermore to effect a descent at Kum Kale, opposite Helles, as a subsidiary operation, subsequently being transferred to Helles. After a short delay, enforced by bad weather, the armada put to sea during the nights of April 23–24 and 24–25, so that the transports and the covering warships should arrive at their various rendezvous at or before dawn on the 25th, and the day broke calm after a placid night.

Landing at Cape **Helles.**—Five points had been selected in the Helles area for attack. Enumerating from right to left the beaches were "S" in Morto bay, "V" and "W" on either side of Cape Helles, and "X" and "Y" on the outer shore. The attacks at "S" and "Y" were intended to be subsidiary; but great importance was attached to "W" and "V," as those two beaches offered the most suitable landing places from the point of view of subsequent operations. Owing to its vicinity to "W," "X" was calculated to play a very prominent part in the affair as a whole. Covered by the fire of battleships and cruisers, the troops started in flotillas of boats soon after dawn for all points, and, as it turned out, the actual disembarkations at "S," "X" and "Y" were carried out without any great difficulty. But at "W" the troops gained a footing only after incurring heavy loss, while at "V," where a large part of the landing force was carried in the steamer "River Clyde" which was run ashore, the effort nearly failed altogether. After hard fighting all day the position at nightfall was that the troops landed at "W" and "X" beaches had joined hands and that a battalion was established at "S," while the situation at "V" was critical, as also at "Y"; but during the night more troops were got ashore at "V," and those at "Y" were safely withdrawn and re-embarked next morning. Losses had been severe.



MAP SHOWING THE LANDING BEACHES S, V, W, X, Y, AT GALLIPOLI

Landing **at** Kum Kale.—In the meantime a French brigade had, after a tough struggle, effected a lodgement at Kum Kale (Qum Qal'e). The Turks were in strong force here, so that any advance by the French was out of the question, but their presence on the Asiatic side was being indirectly helpful to secure a footing on the further shore. Some little progress was made on the morrow in spite of determined resistance by the enemy, additional troops were landed, and during the night the French were withdrawn from Kum Kale and they were landed at "V" beach on the 27th. On that day the Allies' line was again advanced by a few hundreds of yards; but the Turks had received substantial reinforcements in this quarter, and but little ground was gained when Hamilton ordered a fresh attack on the 28th. The invaders had suffered very heavy losses during the initial landing and the subsequent strenuous encounters, and there were no reserves on the spot to fill the gaps that had been created in the ranks.

Landing **at Anzac.**—Birdwood's divisions had in the meantime effected a lodgement to the north of Gaba Tepe. The actual disembarkation had in this case been started before dawn on the 25th at a point about a mile and a half north of the Gaba Tepe promontory, and at a spot where the hills rose abruptly from the actual beach which came to be known as Anzac. A haphazard line on the heights immediately above the beach had been secured at once, the Turks being in weak force at the moment when the advanced parties of invaders reached the shore; but the defenders were able to hurry reinforcements to the point of danger and the actual area secured was of limited extent. Won practically at the first blow, it provided but a scanty water supply, it presented great inconveniences and its beach was much exposed in the event of bad weather setting in; it was but slightly extended during the following three months, for Liman von Sanders realized that owing to its proximity to the narrows of the Dardanelles, it represented a very serious danger to the Turks, and he took steps accordingly. Although the Ottoman troops delivered vigorous counter-attacks on the 26th, these were beaten off with loss to the assailants, and by the night of April 27–28 the position of which Birdwood had contrived to gain possession had come to be, tactically, fairly secure.

Hamilton thus gained a somewhat precarious footing at two points of the peninsula. But his two forces were some 15m. apart, and what amounted to little more than a patch of ground had been won in either case. His intentions were now completely exposed to the enemy, and the great advantage of surprise had passed away without his force having established itself in a dominating position capable of being turned to satisfactory account in subsequent operations. In both areas the Turks enjoyed the tactical command, they were at least equal in force to the Allies, their guns were able to bear with effect upon the beaches used as landing places and advanced bases, and, although at this time of the year the weather was generally calm, these beaches provided but inadequate facilities for the landing of ammunition, armament or stores.

Reinforcements.— Early in May the Allies' contingents planted in the Helles area were strengthened by the arrival of the British 42nd Div., an Indian brigade, and the French 2nd Division. Some ground was gained on May 6, and during the next day or two determined counter-attacks on the part of the enemy were effectually repulsed. The two French divisions were occupying the right of the line, next to the straits; and that arrangement held good up to the time when the Gallipoli peninsula was finally evacuated early in January in the following year. Both here and facing the Australasian troops at Anzac the Turks had dug themselves in, establishing elaborate defences, and trench warfare was becoming the order of the day.

During the month a state of stalemate set in, and although ground was gained by the Allies in attacks delivered in the Helles area on June 4, 21 and 28 and during the month of July the line was gradually pushed forward near Krithia, the situation was so unpromising that the British Government, decided to send five more divisions (10th, 11th, 13th, 53rd and 54th) to the Aegean. These arrived at the islands of Mytilene and Imbros during the closing days of July and the first days of August. Hamilton's artillery was at the same time strengthened, and his very inadequate ammunition supply somewhat improved. But Liman von Sanders was likewise receiving reinforcements, and, although the Ottoman maritime communications with the Gallipoli peninsula were from time to time imperilled by the submarines of the Allies, the relative strength of the two opposing armies facing each other in the theatre of war was not, as it turned out, greatly affected by the appearance of the fresh troops sent out from England to these waters. The Allies, in view of the coming of reinforcements, treated July as a month of preparation, although a general attack was delivered by them in the Helles area by which a little ground was gained. A few days later the first of the reinforcing divisions, the 13th, arrived and was landed at Helles as a temporary measure.

II. SARI BAIR AND SUVLA BAY

How to employ the fresh divisions coming out from home had to be decided by Hamilton. The French had from the outset favoured operations on the further side of the straits, and there was something to be said for such a plan of campaign. But a descent in that quarter must involve a disembarkation in face of opposition, the perils of which had been made apparent on April 25; moreover, granting the landing to be successful, the forces would start work much farther from the narrows of the Dardanelles, the objective, than were either Helles or Anzac. There were also not wanting inducements for the Allies to attempt a landing at Bulair, seeing that their presence at that point would carry with it the severance of the Turkish land communications with the peninsula. But this would likewise mean a landing in face of opposition; and the distance of Bulair from the Island of Imbros, the nearest base of operations for the peninsula, provided a strong argument, from the point of view of ship transport, against such an undertaking. Moreover, a landing either on the Asiatic side or at Bulair meant a dispersion of the Allies' forces as a whole, unless Helles or Anzac, or both of them, were to be abandoned; and the fact that the Ottoman commander-in-chief had to be prepared for his opponent adopting one of these two plans, offered a strong argument against selecting either of them, apart from any other considerations as to their tactical advantages or disadvantages.

British Plans.—Hamilton decided that his great effort should be made at, and immediately north of, Anzac. The rugged bluffs on which Birdwood's men had taken root since April were spurs of a tangled mountain mass known as Sari Bair, from the topmost ridges of which the narrows were visible four or five miles off; Anzac was, moreover, situated almost at the narrowest point of the peninsula. The plan was to reinforce Birdwood secretly by a division and a half (the 13th and part of the 10th) and that, thus strengthened, he should secure possession of Sari Bair by a night attack. A further force (the 11th Div. and the rest of the 10th) was on that same night to effect a landing at an entirely new point—Suvla bay—a few miles north of Anzac, where the Turks were known to be few. This force was to assist the troops attacking Sari Bair in due course; and the possession of Suvla bay would furnish troops ashore in and about this area with a much more sheltered landing place than the beaches about Anzac offered. The last divisions to arrive, the 53rd and 54th, were to be employed wherever should seem best after the offensive had begun; to land the whole of the reinforcements simultaneously would not have been practicable with the amount of water transport available.

The utmost secrecy was observed by the Allies' staff. Steps were taken to mislead the Ottoman authorities by means of feints and of reconnaissances executed at localities other than those selected for operations. False reports were circulated assiduously by the intelligence department. Liman von Sanders was well aware of the arrival of large bodies of British troops in the islands; but he remained in complete ignorance of his rival's real design until this was actually in course of execution. He had organized his forces as a southern group watching Anzac, while two divisions were retained near Bulair, where he was disposed to anticipate that the blow would fall. There were also large bodies of Turkish troops in reserve about Chanaq, and others about Kum Kale and Besika bay. Numerically the contending armies at this critical juncture were about equal, but the Turks were necessarily much dispersed, so that the result of the impending clash of arms really hinged upon the speed with which the attacking side should gain ground before the defenders had time to concentrate.

The Allies' offensive started on Aug. 6 with two preliminary enterprises. An onset was made upon part of the Turkish lines in the Helles area. Portions of Birdwood's force broke out of the southern end of the Anzac position and gained ground. But the real purpose of the two operations was to occupy the enemy's attention and to conceal a design of much greater moment.

Attack on Sari Bair.—So dexterously had the assembling of the reinforcements in the Anzac area been effected that the Turks were entirely unaware that Birdwood's army had been nearly doubled. The plan for gaining possession of the Sari Bair mountain was that several columns were to move out from the northern end of the Anzac position at nightfall on Aug. 6 and, on reaching their appointed stations, were to wheel to the right and to work their way in the dark up certain steep but well-defined gullies that led up to the summit. But although the Turks were to some extent surprised, and although the outlets of the gullies were in consequence in the assailants' hands by midnight, so stubborn a resistance was offered by the defenders that by daybreak the columns were not much more than half way up, and all attempts to win the upper ridges failed on the 7th in the face of the Turkish reinforcements.

After a rearrangement of the troops during the night the offensive was resumed on Aug. 8; but except at one point very little progress was made. After a fresh reorganization during the dark hours another effort was made on the gth, and on this occasion a small body of British and Indian troops actually fought their way to a commanding summit from which the narrows were seen, but they were driven off again. Next day the Turks, now in great force, counter-attacked and thrust those opposed to them back down the slopes all along the line, whereupon strenuous fighting ceased. Both sides had lost heavily, but victory for all practical purposes rested with the Osmanlis, even if the Anzac position had been extended considerably in a northerly direction as a result of the operations.

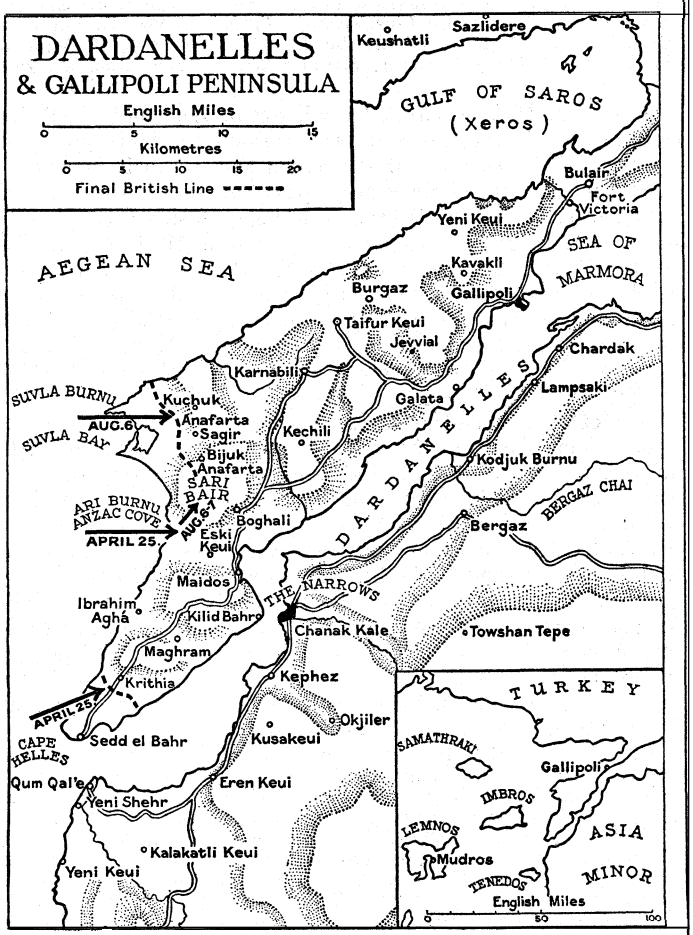
Landing at Suvla Bay.—Stirring events had in the meantime been taking place around Suvla bay. The troops detailed for the landing in this quarter belonged to the British "New Army"; they were not conversant with active service conditions, and they were being highly tried in being called upon to execute a landing in force at night in face of opposition. There was indeed no precedent for an undertaking of this kind under modern tactical conditions, but the Turks were known' not to be in sufficient strength to offer serious resistance. As it was, the whole of the 11th Div. was ashore before dawn; but the urgent need of pressing forward at once was not realized by the local commanders, and some confusion arose when the 10th Div. arrived and began to disembark. No organized advance in force took place until late in the afternoon, and at nightfall the attacking force had only reached the foot of the hills lying to the east of the landing places and captured one advanced spur. The troops had suffered greatly from thirst, the arrangements with regard to water having practically broken down, mainly owing to the inexperience of the troops themselves.

Attack in the Hills.—When Liman von Sanders learned during the night of Aug. 6–7 that the Allies were landing in force at Suvla and were attacking Sari Bair from Anzac, he ordered the two divisions at Bulair to proceed to Suvla with all speed. But this meant a two days' march along indifferent roads. Consequently there was still on Aug. 8 a great opening left for the attacking side to complete the first part of its programme; *i.e.*, to gain possession of the heights to the east of Suvla which dominated the landing places and a considerable area of level ground around Suvla bay. But no organized move took place. The opportunity was allowed to slip by, and that night Turkish reinforcements began to arrive from Bulair and to occupy the all-important high ground. Next morning the 10th and 11th Divs., supported in a measure by the 53rd Div., which had arrived during the night, advanced to the attack. But the effort failed, and when it was renewed on the following day the Turks had been so effectually reinforced. that the offensive enjoyed little chance of achieving success. That day, Aug. 9, was the last on which there remained any hope either of the Sari Bair offensive achieving success or of the Suvla force establishing itself in a satisfactory position. This force, however, made a fresh attempt on the 10th to wrest the heights in front of it out of Osmanli keeping; but this failed completely, and further offensives in this quarter were abandoned for the time being.

Hamilton's carefully devised scheme of offensive operations had in fact come to nought in its most important features. The determined effort to secure possession of Sari Bair had miscarried. A footing had, it is true, been gained at Suvla, giving the Allies control of a fairly well sheltered inlet on the outer coast of the peninsula; but as the high ground within easy artillery range of the landing places, which overlooked the whole occupied area, remained in the hands of the Turks, much of the benefit hoped for from its acquisition was neutralized. Only a restricted patch of Ottoman territory had in fact been occupied, thanks to the new undertaking, and although the position at Anzac had been extended and improved it remained a very bad one. The Allies now occupied many miles of front in the peninsula, but there was scarcely a spot where the enemy did not enjoy the advantage in respect to ground; what the attacking forces needed from the outset was depth rather than breadth, and depth they had failed to secure. They had, moreover, incurred very heavy losses during the succession of combats lasting from Aug. 6 to 10, and, except for a mounted division coming from Egypt to fight on foot, no reinforcements were on the way; the 54th Div. had already been swallowed up at Suvla. The defending side had also, no doubt, suffered heavily in casualties, notably on Sari Bair; but Liman von Sanders could fairly claim that, even if some valuable ground had been lost by the Turks, he had held his own in a contest in which his adversary had enjoyed the initiative and had been in a position to effect a surprise.

An effort was made by the troops on the extreme left of the

Allies' position at Suvla to gain ground along the ridge north of the Suvla plain on Aug. 15, but nothing came of it. Hamilton, however, did not despair of improving the situation in this area, so the mounted division from Egypt and another division from Helles were quietly concentrated there in support of the troops already on the spot, and on the 21st a determined attempt was made to capture some of the high ground which had baffled the



THE THREE THEATRES OF WAR ON THE GALLIPOLI PENINSULA: CAPE HELLES, ANZAC BEACH, AND SUVLA BAY

attempts of the invaders on the 9th and 10th. Large forces were engaged on either side in this battle, and the attack was prepared by a heavy bombardment of the Ottoman trenches, in which warships moored in Suvla bay, where they were secure from submarines, participated. But after a sanguinary encounter the assailants met with a decisive rebuff, and from that date onwards no serious offensive operation was attempted by the Allies in the Dardanelles campaign. The conditions of stalemate which had prevailed before the arrival of the five new divisions from England set in afresh and continued to the end.

As a consequence of the failure at Suvla during the early days of its occupation certain changes in command were carried out, Gen. Byng, especially sent out from home for the purpose, taking over command in this area. Gen. Davies was in command at Helles, and, as the right of the Suvla force was in touch with the left of the Anzac force in the low ground near the shore, Byng and Birdwood now held a continuous front extending from a point on the coast about 3m. N E. of Suvla bay near to Gaba Tepe, overlooked for practically the whole of its length by high ground in occupation of the Turks. Owing to the losses that had been suffered during the August combat and even before the final reverse of Aug. 21, Hamilton had cabled home asking for reinforcements and for the very large drafts needed to bring his depleted units up to their war establishment, amounting to a total of 95,000 men. He had, however, been informed that no large bodies of fresh troops could be spared for the Dardanelles theatre. A temporary change of plan did occur a few days later owing to a French proposal to despatch four divisions to the scene to operate on the Asiatic side of the straits, whereupon the British Government became disposed also to send fresh divisions.

III. EVENTS IN THE BALKANS AND EVACUATION

These projects were dropped early in September, owing very largely to the threatening aspect of affairs in the Balkans. *(See* SALONIKA CAMPAIGNS, SERBIAN CAMPAIGNS.)

The campaign by which the Central Powers and Bulgaria overwhelmed the Serbians for the time being, and by which direct communications were opened through Bulgaria between Austria-Hungary and the Ottoman empire, profoundly influenced the situation in the Gallipoli peninsula to the disadvantage of the Allies. Not only was all idea of reinforcing the Allied army that was planted in this region abandoned, but some of Hamilton's troops had before long been transferred to Salonika. The linking up of Turkey with the Central Powers by railway, moreover, connoted that Liman von Sanders would speedily be furnished with ample munitions of all kinds, which would make the prospect of Anglo-French forces gaining possession of the straits remoter than ever.

Withdrawal Discussed.—By the middle of September the Paris Government had come to the conclusion that there was now no hope of victory in the Dardanelles theatre; but the British cabinet, influenced by anxiety as regards prestige in the East and by disinclination to abandon an enterprise in which great sacrifices had been incurred and from which much had at one time been expected, could not make up its mind to cut losses and to withdraw. On Hamilton being asked to give his views concerning the question of evacuation, he pronounced himself as emphatically opposed to such a step, so Sir C. Monro was sent out from England to take his place. The new commander-in-chief, impressed by the very unsatisfactory positions occupied by the Allied troops, by the impossibility of their making any progress at their existing strength, and by the risks that the army ran by clinging to such a shore without any safe harbour to depend upon for base in stormy weather, declared unhesitatingly in the closing days of October for a complete withdrawal after examining the situation on the spot and consulting with Birdwood, Byng and Davies.

The British cabinet would not accept the recommendation, and sent Lord Kitchener to investigate and report. He had viewed proposals to abandon the campaign with alarm; but after visiting the peninsula he realized that evacuation was the only justifiable course. and reported to that effect. All this time winter was drawing nearer and the need for a prompt decision was becoming more and more urgent, but the authorities in London lost another fortnight before, on Dec. 8, they at last sent instructions to Monro to withdraw from Suvla and Anzac, while retaining Helles.

Evacuation of Suvla Bay and Anzac.—Anticipating orders to this effect, Monro had already made certain preparations for evacuation, and, as he was also responsible for the British forces at Salonika, had placed Birdwood in command, Gen. Godley relieving Birdwood at Anzac. It was recognized that the withdrawal of the vast accumulation of stores about the beaches, and also of the bulk of the actual troops, must be carried out gradually on successive nights, and this process was at once set on foot both at Suvla and at Anzac. The decision come to as to the final stage of the operation was that the front trenches should be held up to the last on the night of definite evacuation, and that the troops manning them should hasten straight to the beaches, everything removable having already been embarked; at a given moment the trenches (which at many points were but a few yards from those occupied by the Turks) would be vacated by detachments which by that hour would have shrunk to mere handfuls of men. The final night was provisionally fixed as that of Dec. 18–19, and, thanks to favourable weather and to the efficiency of the arrangements, the very critical undertaking was carried out with triumphant success just as had been laid down by programme ten days before. Night after night the landing places were scenes of

unceasing activity as war material, food supplies, animals and finally large bodies of troops, were got away. During the daytime reliefs took place as usual, pretences were made of landing stores and animals, and the result was that the Turks remained in complete ignorance of what was passing close to their lines. On Dec. 18 only a meagre force, composed almost entirely of infantry and disposed almost entirely in the front trenches, was holding a front of 10m. face to face with an enemy incomparably stronger in numbers.

At nightfall the very few guns not yet withdrawn were hurried off to the jetties; then the troops along the front were quietly withdrawn by successive detachments; finally the parties still in the trenches slipped away; and when dawn broke the Turks discovered that the invaders were gone. Practically nothing worth mentioning had been left behind at Suvla, and at Anzac, where conditions were more difficult, only a very few worn-out guns had to be abandoned and some valuable war material destroyed. The relaxing by the Allies of their frail hold upon a strip of the outer coast-line of the Gallipoli peninsula had been effected more successfully than the most sanguine amongst them had permitted themselves to hope.

Yet, for a week subsequent to the good news reaching them, the British Government remained irresolute with regard to the policy to be pursued at Helles. Then, however, Monro received the expected sanction for evacuating that area likewise, and Birdwood promptly grappled with this fresh problem, a problem rendered more difficult than the last owing to Liman von Sanders having full warning of what might be expected and, moreover, now enjoying an enormous preponderance ih force. He had 21 divisions available, while there were only four left to oppose him.

Evacuation of Cape Helles.—The same principles as had been adopted by Byng and Godley at Suvla and Anzac were put in practice at Helles, the withdrawal of stores, war material, animals and personnel being carried out on successive nights. While the front trenches were to be held up to the last, the fighting force ashore was to be gradually reduced, and the detachments holding the front trenches were at the given hour on the last night, fixed provisionally for that of Jan. 8–9, to vacate them and hurry straight off to the beaches. But the weather was none too favourable on several of the preliminary nights, and the enemy's guns gave a good deal of trouble on the beaches, causing many casualties. The Turks were aware that a withdrawal was gradually being carried out; but they could not tell which would be the final night, nor could they make sure how far the number of combatants within the British lines had been reduced. So, with the intention of ascertaining the strength of their opponents, on Jan. 7 they delivered a half-hearted attack upon the left of the British position. This was beaten off, and they came to the mistaken conclusion that the final evacuation was not imminent.

Shortly after dark set in on the night of Jan. 8–9 the wind rose ominously. Nevertheless the guns remaining to be embarked were got off, the infantry followed, and the last detachments quitted the front trenches at 11.45 P.M., without the Turks noting their departure. But when they reached the shore it was found, in the case of those detailed for Gully Beach, that embarkation there was impracticable; so these had to march to "W" Beach and they were not afloat till after 4 A.M., only being got off with great difficulty owing to the surf. Several worn-out guns had been intentionally left behind, besides much ordnance material and foodstuff; but practically all of this was rendered unserviceable, for, just as the last boats were lowered off, the masses of stores were set on fire, and only then did the Turks discover that their opponents had evaded them a second time. The withdrawal from Helles had been a masterly military and naval achievement.

IV. CONCLUSIONS

Most authorities on war agree that the failure of the Allies in this memorable campaign was primarily due to the abortive naval effort to force the Dardanelles. This gave the Turk such warning of what was in store that, when Hamilton's army was ready to land, the defenders were in a position to bring it at once to a standstill. The only chance of success after that lay in very substantial reinforcements reaching the scene promptly. But neither the British nor the French would divert the requisite military resources from the main theatre of war at the moment, and when some additional troops were sent later, their numbers were insufficient and it was too late.

BIBLIOGRAPHY.--The Dardanelles Commission, *Final Report* (1919); Sir I. Hamilton, *Gallipoli Diary* (1920); Turkey, Historical Section of Staff, *Campagne de Dardanelles* (1924); Liman von Sanders, *Fünf Jahre Türkei* (Eng. trans. *Five Years in Turkey*, 1928); E. Ashmead-Bartlett, *War Memories of the Dardanelles* (1928); C. P. Aspinall, *British Official History* (1928). *See* also WORLD WAR: BIBLIOGRAPHY.

(C. E. C.)

DARDANUS, in Greek legend, son of Zeus and the Pleiad Electra, mythical founder of Dardanus on the Hellespont and ancestor of the Dardans of the Troad and, through Aeneas, of the Romans. His original home was supposed to have been Arcadia. Having slain his brother Iasius or Iasion (according to some legends, Iasius was struck by lightning), Dardanus fled across the sea. He first stopped at Samothrace, and, when the island was visited by a flood, crossed over to the Troad. Being hospitably received by Teucer, he married his daughter Batea and became the founder of the royal house of Troy.

See articles in Pauly-Wissowa's *Realencyklopadie* and Roscher's *Lexikon der Mythologie.*

DARDIC LANGUAGES, the name of a family of languages spoken immediately to the south of the Hindu Kush, and north of the frontier of British India, includes the group of Kiifir languages spoken in Kafiristiin, Khowar, spoken in the Chitral country, and the group of Shin5 languages, which includes the Shin5 of Gilgit, Kōhistānī, spoken in the Kohistans of the Indus and Swat rivers, and Kashmiri. Of all these Kashmiri is the only one which has received any literary cultivation. The Dardic languages are Aryan by origin, but are neither Iranian nor Indo-Aryan. They have developed phonetic peculiarities, and possess almost unaltered and in common use words which in India are seldom found except in Vedic Sanskrit. In each there is a small but unimportant element of Burushaski (*q.v.*)

BIBLIOGRAPHY.—For the general question of the Dardic languages, *see* G. A. Grierson's *The Piśāca Languages of North-western India* (1906); *Linguistic Survey of India,* vol. viii. pt. ii. For the different languages of this group *see* G. W. Leitner, *Dardistan* (Lahore, 1877); J. Biddulph, *Tribes of the Hindoo Koosh* (Calcutta, 1880); D. J. O'Brien, *Grammar and Vocabulary of the Khowār Dialect* (Lahore, 1895); J. Davidson, *Notes on the Bashgali (Kāfir) Language* (Calcutta, 1901); G. Morgenstierne, *Report on a Linguistic Mission to Afghanistan* (Oslo, 1926). *(See* also INDO-ARYAN LANGUAGES and KASHMIRI.)

DARDISTAN, a conventional name for a tract of country on the north-west frontier of India. It comprises the whole of Chitral, Yasin, Panyal, the Gilgit valley, Hunza and Nagar, the Astor valley, the Indus valley from Bunji to Batera, the Kohistan-Malazai, *i.e.,* the upper reaches of the Panjkora river, and the Kohistan of Swat. The so-called Dard races are referred to by Pliny and Ptolemy, and are supposed to be a people of Aryan origin who ascended the Indus valley from the plains of the Punjab, reaching as far north as Chitral, where they dispossessed the Khos. They have left their traces in the different dialects, Khoswar, Burishki and Shina, spoken in the Gilgit agency.

DARES PHRYGIUS, according to Homer *(Iliad,* v. 9) a Trojan priest of Hephaestus. He was supposed to have been the author of an account of the destruction of Troy, and to have lived before Homer (Aelian, *Var. Hist.* xi. 2). A work in Latin, purporting to be a translation of this and entitled *Daretis Phrygii de excidio Troiae historia,* was much read in the middle ages and was then ascribed to Cornelius Nepos; but the language is corrupt, and the work belongs to a period much later than the time of Nepos (probably the 5th century A.D.). It is doubtful whether the work as we have it is an abridgment of a Latin work or an adaptation of a Greek original. Together with the similar work of Dictys Cretensis (with which it is generally printed) the *De excidio* forms the chief source for the numerous middle age accounts of the Trojan legend. *(See* DICTYS CRETENSIS; and O. S. von Fleschenberg, *Daresstudien,* 1908.)

DAR-ES-SALAAM, a seaport of East Africa, in 6° 50′ S., 39° 20′ E., capital of Tanganyika Territory. Pop. (1927) about

25,000, including some 600 Europeans and 4,500 Asiatics. The harbour is small but perfectly sheltered (hence its name); the entrance to it is through a narrow opening in the palm-covered shore. The depth of water at the entrance is from 20 to 34 ft. according to the tides. Since 1927 a wharf 300 ft. long has been made where ships can berth. A railway (built 1905–1914), starting from the harbour, goes via Tabora to Kigoma-Ujiji on Lake Tanganyika, a distance of 772 miles.

In 1862 Sayyed Majid, sultan of Zanzibar, decided to build a town on the shores of the bay, and began the erection of a palace, which was never finished. In 1871 Majid died, and his scheme was abandoned. In 1876, the construction of a road from the harbour to Victoria Nyanza was begun. The project failed, but in 1928 the port came into railway connection with Victoria Nyanza by the completion of the Tabora-Mwanza line. In 1887 Carl Peters occupied the bay for the German East Africa Company and in 1891 Dar-es-Salaam was made the administrative centre for German East Africa. A town was laid out on an ambitious scale, and it has fine buildings and a good botanical garden; the native quarter is distinct from that of the Europeans. Dar-es-Salaam was occupied by the British forces in 1916; the wireless station was destroyed in 1914.

DARESTE DE LA CHAVANNE, CLEOPHAS (1820–1882), French historian, was born in Paris. Educated at the École des Chartes, he became professor in the faculty of letters at Grenoble in 1844, and in 1849 at Lyons, where he remained nearly 30 years. His works comprise: *Histoire* de *l'administration en* France *depuis Philippe-Auguste* (2 vols., 1848), and a *Histoire* de France (8 vols., 1865–73), completed by a *Histoire* de la Resfauration (2 vols., 1880), and by a *Histoire* du Gouvernement de *Juillet,* a dry enumeration of dates and facts. Before the publication of Lavisse's great work, Dareste's general history of France was the best of its kind.

DARFUR, a semi-independent kingdom of east central Africa. the westernmost province of the Anglo-Egyptian Sudan. It extends from about 10° N. to 16° N. and from 21° E. to 27° 30′ E., has an area of some 150,000 sq.m., and an estimated population of 750,000. It is bounded north by the Libyan desert, west by Wadai (French Congo), south by the Bahr-el-Ghazal and east by Kordofan. The two last-named districts are *mudirias* (provinces) of the Anglo-Egyptian Sudan. The greater part of the country is a plateau from 2,000 to 3,000 ft. above sea-level. A range of mountains of volcanic origin, the Jebel Marra, runs north and south about the line of the 24" E., and forms the watershed between the basins of the Nile and Lake Chad. About 100 m. long and 80 m. thick, its highest points attain from 5,000 to 6,000 ft. Eastward the mountains fall gradually into sandy, bush-covered steppes. North-east of Jebel Marra lies the Jebel Medob (3.500 ft. high), a range much distorted by volcanic action. and Bir-el-Melh, an extinct volcano with a crater 150 ft. deep. South of Jebel Marra are the plains of Dar Dima and Dar Uma; south-west of the Marra the plain is 4,000 ft. above the sea. The mountains are scored by numerous *khors,* whose lower courses across the tableland represent the beds of former rivers, now dry except when scoured by torrents in the rainy season. In the west and south water can always be obtained in the dry season by digging 5 or 6 ft. below the surface of the khors.

The climate, except in the south, where the rains are heavy and the soil is a damp clay, is healthy except after the rains. The rainy season lasts for three months, from the middle of June to the middle of September. In the neighbourhood of the khors the vegetation is fairly rich. The chief trees are the acacias whence gum is obtained, and baobab (Adansonia digitata); while the sycamore and, in the Marra mountains, the *Euphorbia* candelabrum are also found. In the southwest are densely forested regions. Cotton and tobacco are indigenous. The most fertile land is found on the slopes of the mountains, where wheat, durra, *dukhn* (a kind of millet and the staple food of the people) and other grains are grown. Other products are sesame, cotton, cucumbers, water-melons and onions.

Copper is obtained from I-Iofrat-el-Nahas in the south-east, iron is wrought in the south-west; and there are deposits of rock-salt in various places. Camels and cattle are both numerous and of excellent breeds. Horses are comparatively rare; they are a small but sturdy breed. Sheep and goats are numerous. The ostrich, common in the eastern steppes, is bred by various Arab tribes, its feathers forming a valuable article of trade.

Inhabitants. — The population of Darfur consists of negroes and Arabs. The negro For, forming quite half the inhabitants, occupy the central highlands and part of the Dar Dima and Dar Uma districts; they speak a special language, and are subdivided into numerous tribes, of which the most influential are the Masabat, the Kunjara and the Kera. The *Massalit* are a negro tribe which, breaking off from the For some centuries back, have now much Arab blood, and speak Arabic; while the *Tunjur* are an Arab tribe which have incorporated a large For element, and no longer profess Mohammedanism. The Dago (Tago) formerly inhabited Jebel Marra, but they have been driven to the south and west, where they maintain a certain independence in Dar Sula. Genuine Arab tribes, *e.g.,* the Baggara and Homr, are numerous, and they are partly nomadic and partly settled. The Arabs have not, generally speaking, mixed with the negro tribes. They are great hunters, making expeditions into the desert for five or six days at a time in search of ostriches.

Slaves, ostrich feathers, gum and ivory used to be the chief articles of trade, a caravan going annually by the Arbain ("Forty Days") road to Assiut in Egypt and taking back cloth, fire-arms and other articles. The slave trade has ceased, but feathers, gum and ivory still constitute the chief exports of the country. The principal imports are cotton goods, sugar and tea. There is also an active trade in camels and cattle.

The internal administration of the country is in the hands of the sultan, who is officially recognized as the agent of the Sudan government.

The capital and residence of the sultan is El-Fasher (pop. about 10,000), on the western bank of the Wadi Tendelty. There are a few fine buildings, but the town consists mainly of tukls and box-shaped straw sheds. It is 500 m. W.S.W. of Khartum. Dara, a small market town, is 110 m. S. of El-Fasher. Shakka is in the S.E. of the country near the Bahr-el-Homr, and was formerly the headquarters of the slave dealers.

History. — The Dago or Tago negroes, inhabitants of Jebel Marra, appear to have been the dominant race in Darfur in the earliest period to which the history of the country goes back. How long they ruled is uncertain, little being known of them save a list of kings. According to tradition the Tago dynasty was displaced and Mohammedanism introduced, about the 14th century, by Tunjur Arabs, who reached Darfur by way of Bornu and Wadai. The first Tunjur king was Ahmed-el-Makur, who married the daughter cf the last Tago monarch. His great-grandson, the sultan Dali, a celebrated figure in Darfur histories, was on his mother's side a For, and thus was effected a union between the negro and Arab races. Dali divided the country into provinces, and established a penal code, which, under the title of Kitab *Dali* or Dali's Book, is still preserved, and shows principles essentially different from those of the Koran. His grandson Soleiman (usually distinguished by the Forian epithet Solon, the Arab or the Red) reigned from 1596 to 1637, and was a great warrior and a devoted Mohammedan. Soleiman's grandson, Ahmed Bahr (1682–1722), made Islam the religion of the State, and increased the prosperity of the country by encouraging immigration from Bornu and Bagirmi. His rule extended east of the Nile as far as the banks of the Atbara. Under succeeding monarchs the country, involved in wars with Sennar and Wadai, declined in importance.

In 1799 Abd-er-Rahman, the then reigning sultan, wrote to congratulate General Bonaparte on his defeat of the Mamelukes in Egypt. To this Bonaparte replied by asking the sultan to send him by the next caravan 2,000 black slaves upwards of 16 years old, strong and vigorous. To Abd-er-Rahman likewise is due the present situation of the *Fasher,* or royal township. The capital had formerly been at a place called Kobbé. Mohammed-el-Fadhl, his son, whose reign lasted till 1839, devoted himself largely to the subjection of the semi-independent Arab tribes who lived in the country. In 1821 he lost the province of Kordofan to the

Egyptians. Of his 40 sons, the third, Mohammed Hassin, was appointed his successor. In the later part of his reign Hassin became involved in trouble with the Arab slave raiders who had seized the Bahr-el-Ghazal, looked upon by the Darfurians as their especial "slave preserve." The negroes of Bahr-el-Ghazal paid tribute of ivory and slaves to Darfur, and these were the chief objects of merchandise sold by the Darfurians to the Egyptian traders along the Arbain road to Assiut. Hassin died in 1873, blind and advanced in years, and the succession passed to his youngest son Ibrahim, who soon found himself engaged in a conflict with Zobeir (*q.v.*), the chief of the Bahr-el-Ghazal slave traders, and with an Egyptian force from Khartoum. The war resulted in the destruction of the kingdom. Ibrahim was slain in battle in the autumn of 1874, and his uncle Hassab Alla, who sought to maintain the independence of his country, was captured in 1875 by the troops of the khedive, and removed to Cairo with his family. The Darfurians were restive under Egyptian rule. Various revolts were suppressed, and in 1881 Slatin Bey (Sir Rudolf von Slatin) was made governor of the province. Slatin defended the province against the forces of the Mahdi, but was obliged to surrender (Dec. 1883), and Darfur was incorporated in the Mahdi's dominions. Following the overthrow of the khalifa at Omdurman in 1898 the new (Anglo-Egyptian) Sudan government recognized (1899) Ali Dinar, a grandson of Mohammed-el-Fadhl, as sultan of Darfur. A rising attempted by Ali Dinar in 1915 necessitated a punitive expedition in which he was killed (Nov. 1916), and Darfur then became in effect a Sudan province.

The first European traveller known to have visited Darfur was William George Browne (*q.v.*), who spent two years (1793–95) at Kobbé. Gustav Nachtigal in 1873 spent some months in Darfur, and since that time the country has become well known through the journeys of Gordon, Slatin and others.

BIBLIOGRAPHY.—Browne's account of Darfur will be found in his *Travels in Africa, Egypt and Syria* (1799); Nachtigal's *Sahara und Sudan* gives the results of that traveller's observations. The first ten chapters of Slatin Pasha's book *Fire and Sword in the Sudan* (English edition, 1896) should be consulted. *See* also *The Anglo-Egyptian Sudan* (1905), edited by Lord Edward Gleichen, and the bibl. under SUDAN.

DARGAI. (1) Mountain ridge of the Samana range, on the Kohat border, famous for the stand made there by the Afridis and Orakzais in the Tirah Campaign, 1897. (*See* TIRAH CAMPAIGN.) (2) The terminus, on the Peshawar border, of the frontier railway running from Nowshera to the foot of the Malakand pass.

Attack on Dargai (1897).—During the British advance through Tirah in 1897 two attacks were made on the Dargai ridge, the first on Oct. 18, and the second on the 20th. The first failed; the second succeeded through British pluck, in spite of its tactics being of the meanest order.

Dargai is a spur of the Samana range of hills which flanks the Kuram valley, north of Thal, Shinawari and Hangu. It is clearly visible from near Fort Gulistan, whence on the 20th, it was seen that the tribesmen were holding the ridge in strength, and were throwing up sangars (stone breastworks). Major-General Yeatman-Biggs decided to take the position by a frontal attack, and though he had 24 guns at his disposal no attempt was made to concentrate their fire on the tribesmen. The result was that the attack was brought to a standstill by a hail of bullets, and a second one had to be mounted. More wisdom was then displayed, the guns being ordered to bombard the position for three minutes prior to the assault. This bombardment demoralized the tribesmen, and the position was carried. The British losses were 37 officers and other ranks killed, and 156 wounded. The bulk of these losses could have been avoided had it at first been realised that frontal attacks must be prepared by gun-fire.

See C. E. Callwell, *Tirah,* (1897); H. D. Hutchinson, *The Campaign in Tirah 1897–98,* (1898); L. J. Shadwell, *Lockhart's Advance Through Tirah,* (1898).

DARGOMIJSKY, ALEXANDER SERGEIVICH (1813–1869), Russian composer, was born at Tula on Feb. 14, 1813, and educated in St. Petersburg (Leningrad). He was already known as a talented musical amateur when in 1833 he met Glinka and was encouraged to devote himself to composition. His light opera *Esmeralda* was written in 1839, and his *Roussalka* was performed in 1856; but he had small success or recognition either at home or abroad, except in Belgium, till the '60s, when he became one of Balakirev's circle. His opera *The Stone Guest* then became famous among the progressive Russian school, though it was not performed till 1872. Dargomijsky died at St. Petersburg (Leningrad) on Jan. 17, 1869. His compositions include a number of songs and some orchestral pieces.

DARGU: *see* NUBA.

DARIAL, a gorge in the Caucasus, on the east of Mt. Kasbek, pierced by the river Terek for 8 m. between vertical walls of rock (5,900 ft.). It is mentioned in the Georgian annals, by Strabo and by Ptolemy. Being the only available passage across the Caucasus, it has been fortified at least since 150 B.C. In Russian poetry it has been immortalized by Lermontov. The present Russian fort, Darial, which guards this section of the Georgian military road, is at the northern issue of the gorge, at an altitude of 4,746 feet.

DARIEN, a district covering the eastern part of the isthmus joining Central and South America. It is mainly within the republic of Panamá, and gives its name to a gulf of the Caribbean sea. Darién is of great interest in the history of geographical discovery. It was reconnoitred in the first year of the 16th century by Rodrigo Bastidas of Seville; and the first settlement was Santa Maria la Antigua, situated on the small Darién river, northwest of the mouth of the Atrato. In 1513 Vasco Nuñez de Balboa stood "silent upon a peak in Darién," and saw the Pacific at his feet stretching inland in the Gulf of San Miguel; and for long this narrow neck of land seemed alternately to proffer and refuse a means of transit between the two oceans. The first serious attempt to turn the isthmus to permanent account as a trade route dates from the beginning of the 18th century, and forms an interesting chapter in Scottish history. In 1695 an act was passed by the Scottish parliament giving extensive powers to a company trading to Africa and the Indies; and this company, under the advice of one of the most remarkable economists of the period, William Paterson (*q.v.*), determined to establish a colony on the isthmus of Darién midway between Porto Bello and Cartagena, two of Spain's strongholds, and to gain a free trade route to the Pacific "whereby to Britain would be secured the key to the universe, enabling their possessors to give laws to both oceans and to become the arbiters of a commercial world." On July 26, 1698 the pioneers set sail from Leith amid the cheers of an almost envious multitude; and on Nov. 4, with the loss of only 15 out of 1,200 men, they arrived at Darién, and took up their quarters in a well-defended spot, with a good harbour and excellent outlook. The country they named New Caledonia, and two sites selected for future cities were designated respectively New Edinburgh and New St. Andrews. At first all seemed to go well; but by and by lack of provisions, sickness and anarchy reduced the settlers to the most miserable plight; and in June 1699 they re-embarked in three vessels, a weak and hopeless company. Meanwhile, a supplementary expedition had been prepared in Scotland; two vessels were despatched in May, and four others followed in August. But this venture proved even more unfortunate than the former. The last addition to the settlement was the company of Capt. Alexander Campbell of Fonab, who arrived only to learn that a Spanish force of 1,500 or 1,600 men lay encamped at Tubacanti, on the river Santa Maria, waiting for the appearance of a Spanish squadron in order to make a combined attack on the fort. Campbell was at first successful in a surprise attack but after the arrival of the Spanish fleet the garrison was forced to capitulate, and Darién colony was no more. Of those who had taken part in the enterprise only a miserable handful ever reached their native land.

See J. S. Barbour, *A History of William Paterson and the Darien Company* (1907); A. H. Varrill, *Panama, Past and Present* (1921); E. Cullen, *Isthmus of Darien Ship Canal* etc. (2d. ed, 1853); J. H. Burton, *The Darien Papers* (1849); and G. P. Insh, *Papers Relating to the Ships and Voyages of the Company of Scotland Trading to Africa and the Indies* (1924).

DARÍO, RUBEN (1867–1916), South American poet, was born at Metapa (Nicaragua), and came to Madrid in 1892. In

his *Prosas profanas* (1899) he revealed himself a symbolist; then, throwing off every trammel, ardent in the pursuit of all that was rare and new and beautiful, he astonished the Spanish-speaking world by his *Canto a la Argentina y otros Poemas* (1900), *Cantos de Vida y Esperanza* (1905), and *Canto errante* (1907). Heedless of rules and schools, Dario followed his own path, trying the boldest innovations, especially in metre. His experiments were not always successful, nor did he succeed in founding a school, but he has left his mark on Castilian verse, infusing into it new life and enlarging its traditional forms. He writes a nervous prose in such works as *Los Raros* (1893), *Tierras solares* (1904) and *Todo al Vuelo* (1912).

DARIUS, the name of three Persian kings (Pers. *Darayavaush;* Old Test. *Daryavesh).*

1. DARIUS *THE* GREAT, the son of Hystaspes (*q.v.*). The principal source for his history is his own inscriptions, especially the great inscription of Behistun (*q.v.*), in which he relates how he gained the crown and put down the rebellions. In modern times his veracity has often been doubted, but without any sufficient reason; the whole tenor of his words shows that we can rely upon his account. The accounts given by Herodotus and Ctesias of his accession are in many points evidently dependent on this official version with many legendary stories interwoven, *e.g.,* that Darius and his allies left the question as to which of them should become king to the decision of their horses, and that Darius won the crown by a trick of his groom.

Darius belonged to a younger branch of the royal family of the Achaemenidae. When, after the suicide of Cambyses (March 521), the usurper Gaumata ruled undisturbed over the whole empire under the name of Bardiya (Smerdis), son of Cyrus, and no one dared to gainsay him, Darius, "with the help of Ahuramazda," attempted to regain the kingdom for the royal race. His father Hystaspes was then alive but evidently had not the courage to urge his claims. Assisted by six noble Persians, whose names he proclaims at the end of the Behistun inscription, he surprised and killed the usurper in a Median fortress (Oct. 521; for the chronology of these times *cf.* E. Meyer, *Forschungen zur aiten Geschichte,* ii. 472 ff.), and gained the crown. But this sudden change was the signal for an attempt on the part of all the eastern provinces to regain their independence. In Susiana, Babylon, Media, Sagartia, Margiana, usurpers arose, pretending to be of the old royal race, and gathered large armies around them; in Persia itself Vahyazdata imitated the example of Gaumata and was acknowledged by the majority of the people as the true Bardiya. Darius, with only a small army of Persians and Medes and some trustworthy generals, overcame all difficulties, and in 520 and 519 all the rebellions were put down (Babylon rebelled twice, Susiana even three times), and the authority of Darius was established throughout the empire.

Darius in his inscriptions appears as a fervent believer in the true religion of Zoroaster. But he was also a great statesman and organizer. The time of conquests had come to an end; the wars which Darius undertook, like those of Augustus, only served the purpose of gaining strong natural frontiers for the empire and keeping down the barbarous tribes on its borders. Thus Darius subjugated the wild nations of the Pontic and Armenian mountains and extended the Persian dominion to the Caucasus; for the same reasons he fought against the Sacae and other Turanian tribes. But by the organization which he gave to the empire he became the true successor of the great Cyrus. His organization of the provinces and the fixing of the tributes are described by Herodotus iii. 90 ff., evidently from good official sources. He fixed the coinage and introduced the gold coinage of the Daric (which is not named after him, as the Greeks believed, but derived from a Persian word meaning "gold"; in Middle Persian it is called *zarig*). He tried to develop the commerce of the empire and sent an expedition down the Kabul and the Indus, led by the Carian captain Scylax of Caryanda, who explored the Indian Ocean from the mouth of the Indus to Suez. He dug a canal from the Nile to Suez, and, as the fragments of a hieroglyphic inscription found there show, his ships sailed from the Nile through the Red Sea by Saba to Persia. He had connections with Carthage (*i.e.,* the *Karka* of the Nakshi Rustam inscr.), and explored the shores of Sicily and Italy. At the same time he attempted to gain the good will of the subject nations, and for this purpose promoted the aims of their priests. He allowed the Jews to build the Temple of Jerusalem. In Egypt his name appears on the temples which he built in Memphis, Edfu, and the Great Oasis. He called the high-priest of Saïs, Uzahor, to Susa (as we learn from his inscription in the Vatican), and gave him full powers to reorganize the "house of life," the great medical school of the temple of Sais. In the Egyptian traditions he is considered as one of the great benefactors and lawgivers of the country (Herod. ii. 110, Diod. i. 95). He stood in similar relations to the Greek sanctuaries (*cf.* his rescript to "his slave" Godatas, the inspector of a royal park near Magnesia, on the Maeander, in which he grants freedom of taxes and forced labour to the sacred territory of Apollo. *See* Cousin and Deschamps, *Bulletin de corresp. hellén.,* xiii. (1889), 529, and Dittenberger, *Sylloge inscr. graec.,* 2); all the Greek oracles in Asia Minor therefore stood on the side of Persia in the Persian wars and admonished the Greeks to attempt no resistance. Even Delphi was not entirely free from the taint of Medism.

About 512 Darius undertook a war against the Scythians. A great army crossed the Bosporus, subjugated eastern Thrace, and crossed the Danube. The purpose of this war can only have been to attack the nomadic Turanian tribes in the rear and thus to secure peace on the northern frontier of the empire. It was based upon a wrong geographical conception; even Alexander and his Macedonians believed that on the Hindu Kush (which they called Caucasus) and on the shores of the Jaxartes (which they called Tanais, *i.e.,* Don) they were quite near to the Black Sea. Of course the expedition undertaken on these grounds could not but prove a failure; having advanced for some weeks into the Russian steppes, Darius was forced to return. The details given by Herodotus (according to him Darius had reached the Volga!) are quite fantastical; and the account which Darius himself had given on a tablet, which was added to his great inscription in Behistun, is destroyed with the exception of a few words. (*See* R. W. Macan, *Herodotus,* vol. ii. appendix 3; G. B. Grundy, *Great Persian War,* pp. 48–64; J. B. Bury in *Classical Review,* July 1897.)

Although European Greece was intimately connected with the coasts of Asia Minor, and the opposing parties in the Greek towns were continually soliciting his intervention, Darius did not meddle with their affairs. The Persian wars were begun by the Greeks themselves. The support which Athens and Eretria gave to the rebellious Ionians and Carians made an attempt to punish them inevitable as soon as the rebellion had been put down. But the first expedition, that of Mardonius, failed on the cliffs of Mt. Athos (492), and the army which was led into Attica by Datis in 490 was beaten at Marathon. Before Darius had finished his preparations for a third expedition an insurrection broke out in Egypt (486). In the next year Darius died, probably in Oct. 485, after a reign of 36 years. He was one of the greatest rulers the East has produced.

2. DARIUS II., OCHUS. Artaxerxes I., who died in the beginning of 424, was followed by his son Xerxes II. But before two months had elapsed he was murdered by his brother Secydianus, or Sogdianus (the form of the name is uncertain). Against him rose a bastard brother, Ochus, satrap of Hyrcania, who after a short fight killed him and suppressed by treachery the attempt of his own brother Arsites to imitate his example (Ctesias *ap. Phot.* 44; Diod. xii. 71, 108; Pausan. vi. 5, 7). Ochus adopted the name Darius (in the chronicles called *Nothos,* the bastard). Neither Xerxes II. nor Secydianus occurs in the dates of the numerous Babylonian tablets from Nippur; here the dates of Darius II. follow immediately on those of Artaxerxes I. Of Darius II.'s reign we know very little (a rebellion of the Medes in 409 is mentioned in Xenophon, *Hellen* i. 2. 19), except that he was quite dependent on his wife Parysatis. In the excerpts from Ctesias some harem intrigues are recorded, in which he played a disreputable part. As long as the power of Athens remained intact he did not meddle in Greek affairs; even the support which the Athenians in 413 gave to the rebel Amorges in Caria would not have roused him (Andoc. iii. 29; Thuc. viii. 28, 54; Ctesias wrongly names his father Pissuthnes in his stead; an account of these wars is contained in

the great Lycian stele from Xanthus in the British Museum), had not the Athenian power broken down in the same year before Syracuse. He gave orders to his satraps in Asia Minor, Tissaphernes and Pharnabazus, to send in the overdue tribute of the Greek towns and to begin war with Athens; for this purpose they entered into an alliance with Sparta. In 408 he sent his son Cyrus to Asia Minor to carry on the war with greater energy. In 404 he died after a reign of 19 years, and was followed by Artaxerxes II.

3. DARIUS III., CODOMANNUS. The eunuch Bagoas (*q.v.*), having murdered Artaxerxes III. in 338 and his son Arses in 336, raised to the throne a distant relation of the royal house, whose name, according to Justin x. 3, was Codomannus, and who had excelled in a war against the Cadusians (*cf.* Diod. xvii. 5 ff., where his father is called Arsames, son of Ostanes, a brother of Artaxerxes). The new king, who adopted the name of Darius, noted the fate of his predecessors and saved himself from it by forcing Bagoas to drink the contents of the cup himself. In 336 Philip II. of Macedon had sent an army into Asia hfinor and in the spring of 334 the campaign of Alexander began. In the following year Darius himself took the field against the Macedonian king, but was beaten at Issus and in 331 at Arbela. In his flight to the east he was deposed and killed by Bessus (July 330).

The name Darius was also borne by many later dynasts of Persian origin, among them kings of Persis (*q.v.*), Darius of Media Atropatene who was defeated by Pompeius, and Darius, king of Pontus in the time of Antony. (ED. M.)

DARJEELING, a town and district of British India, in the Rajshahi division of Bengal. The town is a hill station and the hot weather headquarters of the Bengal Government. In 1931 it had a population of 19,903. It occupies a long ridge with two projecting spurs, on which are the town proper and the cantonments of Katapahar, Jalapahar and Lebong. The total area is nearly 5 sq.m., and the difference between its highest and lowest points is about 2,000 feet., Katapahar being 7,886 ft. and Lebong 5,970 ft. above sea level. It enjoys a temperate climate, the average maximum and minimum temperatures being only slightly above those of London; but it has a heavy rainfall, over 100 in. falling from June to October; in these months it is often hidden in mist. On the other hand, snow rarely falls in the winter. Darjeeling commands one of the most beautiful views in the world, for the eye goes up from the valleys to a succession of ranges culminating in Kinchinjunga (28,146 ft.), with snow-clad peaks on either side, a glittering white wall of perpetual snow, which fills a great part of the horizon. There are several schools, botanic gardens and sanatoriums for both Europeans and Indians. The buildings and the roads suffered severely from landslips in 1899; protective works have been built to prevent the recurrence of such a disaster.

BY COURTESY OF THE CANADIAN PACIFIC STEAMSHIP CO.

DARJEELING DEVIL DANCER

The district of Darjeeling has an area of 1,164 sq.m., and a population of 319,635. It consists of two well-defined tracts, viz., the lower Himalayas, and the *tarai,* or plains, at their base. The plains from which the hills take their rise are only 300 ft. above sea-level; the mountains ascend abruptly in spurs of 6,000 to 12,000 ft. in height. The scenery is picturesque, and in many parts magnificent. Two of the highest mountains in the world, Kinchinjunga in Sikkirn (28,146 ft.), and Mt. Everest (29,140 ft.), are visible from Mt. Sandakphu (11,929 ft.) on the Singalila ridge. Other high points in the district are Phalut (11,811 ft.), Rishi-la (10,500), Tanglu (10,084) and (6 m. from Darjeeling) Senchal (8,163) and Tiger hill (8,515 ft.). The chief rivers are the Tista, Great Ranjit, Mahananda and Balasan. Bears, leopards and deers are found on the higher hills, and elephants and tigers in the *tarai* and lower hills.

The majority of the inhabitants of the hills are Nepalese by origin, with Bhotias (10,710) of Tibetan extraction and the Lepchas (9,669). In the *tarai* the Bengali Rajbansis (originally Koch) predominate. Over a third of the district is occupied by forests, which cover the hills above 6,000 ft., and below 3,000 ft., these being roughly the limits of cultivation of food crops and of tea. The cultivation of tea is the main industry. There were 168 tea gardens, with an output of 14 million lb. in 1921. Cinchona cultivation was introduced by the Government in 1862; the factory at Mungpo is capable of manufacturing over 50,000 lb. of quinine annually. The Darjeeling Himalayan railway of 2 ft. gauge, connects the town of Darjeeling with the Eastern Bengal State railway at Siliguri, from which a branch line runs up the Tista valley to Kalimpong road.

The British connection with Darjeeling dates from 1816, when, at the close of the war with Nepal, the British made over to the Sikkim rajah the *tarai* tract, which had been wrested from him and annexed by Nepal. In 1835 the nucleus of the present district was created by a cession of a portion of the hills by the rajah of Sikkim to the British as a sanatorium. A military expedition against Sikkim, rendered necessary in 18jo by the imprisonment of Dr. A. Campbell, the superintendent of Darjeeling, and Sir Joseph Hooker, resulted in the annexation of the Sikkim *tarai* at the foot of the hills and of a portion of the hills beyond. The hill territory east of the Tista was acquired as the result of the Bhutan war of 1864, and now forms the Kalimpong sub-division.

DARK AGES, a term formerly used to cover the whole period between the end of classical civilization and the revival of learning in the 15th century. The use of the term implied an exclusive respect for classical standards in literature and art and a corresponding disparagement of all that was achieved between the decline of ancient culture and the work of Renaissance scholars, writers and artists. With the progress of mediaeval studies in the 19th century it became impossible for historians to dismiss one of the great constructive periods in human activity with an epithet implying contempt for its achievements, and the phrase has now become obsolete. It remains, nevertheless, the fact that the six centuries following the collapse of the Roman empire are in an especial sense dark through the insufficiency of historical evidence. Even so, it is necessary to remember that intellectual work of the highest quality was done by exceptional individuals in ages when life was insecure and its environment very discouraging to thought. The ages which form the prelude to mediaeval history are dark when compared with the time which followed them, but the foundations of mediaeval civilization were laid in these obscure and troubled centuries.

(F. M. S.)

DARLEY, GEORGE (1795–1846), Irish poet, was born in Dublin and educated at Trinity college. He settled in London in 1822, where he contributed to *The London Magazine,* and became dramatic and art critic to the *Athenaeum.* His best known works are a fairy opera, *Sylvia* (1827), and a poem "Nepenthe" (1839).

See the *Selections from the Poems of George Darley,* with an introduction by R. A. Streatfeild (1904); Claude Abbott, *Life and Letters of George Darley* (1928).

DARLING, CHARLES JOHN, 1ST BARON (1849–1936), English judge, was born on Dec. 6, 1849. At the age of 24 he was called to the bar; in 1885 he became a Q.C., and soon afterwards entered Parliament as Conservative member for Deptford. He sat in the House of Commons from 1888 until 1897 when he was knighted. His appointment in 1897 to a judgeship was not received with universal approval; but he later justified the choice by proving himself to be a man of acute understanding, with an unusual insight into human nature. In 1923 he retired, and in 1924 was granted a peerage. Among his published works are *Scintillae Juris* (1877); *Meditations in the Tea Room* (1879); *Seria Ludo* (1903); *On the Oxford Circuit* (1909); *Musings on Murder, etc.* (1925). *A Pensioner's Garden and other verses* (1926).

See Evelyn Graham, *Lord Darling and his Famous Trials* (1929).

DARLING, GRACE HORSLEY (1815–1842), British heroine, was born at Bamborough, Northumberland, on Nov. 24, 1815. Her father, William Darling, was the keeper of the Longstone (Farne Islands) lighthouse. On the morning of Sept. 7, 1838, the "Forfarshire," bound from Hull to Dundee, with 63

persons on board, struck on the Farne Islands, 43 being drowned. The wreck was observed from the lighthouse, and Darling and his daughter determined to try to reach the survivors. By a combination of daring, strength and skill, the father and daughter reached the wreck in their coble and brought back four men and a woman to the lighthouse. Darling and two of the rescued men then returned to the wreck and brought off the four remaining survivors Grace Darling and her father received the gold medal of the Humane society, the treasury made a grant, and a public subscription was organized. Grace Darling died of consumption on Oct. 20, 1842.

See *Grace Darling, her true story* (1880); *Grace Darling, The Maid of the Isles* (1839); *E.* Hope, *Grace Darling* (1875); *T.* Arthur, *Grace Darling* (1885).

DARLING, a river of Australia (*q.v.*).

DARLINGTON, market town. county and parliamentary borough, Durham, England, 232 mi. N.W. of London, on the L.N.E. Ry. Pop. (1938) 75,930. Area 10.1 sq.mi. It lies on the river Skerne, a tributary of the Tees, not far from the main river. Its appearance is almost wholly modern, but there is a fine old parish church on the site of an earlier church, dedicated to St. Cuthbert. It is cruciform, and in style mainly transitional Norman, and has a central tower surmounted by a spire of the 14th century. Educational establishments include an Elizabethan grammar school, a training college and a technical school. There is a park of 44 ac. The industries include worsted-spinning, coal and ironstone mining, quarrying and brickmaking, the manufacture of iron and steel into bridge castings, ships' engines, munitions, etc. The large locomotive works of the L.N.E. Ry. were removed there from Gateshead. The town was incorporated in 1867.

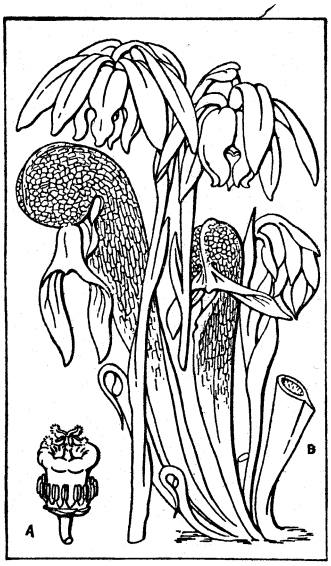
Before the 19th century Darlington was noted for the manufacture of linen, worsted and flax, but it owes its modern importance to the opening of the railway between Darlington and Stockton on September 27, 1825. "Locomotive No. 1," the first that ever ran on a public railway, stands in Bank Top station. Darlington sent no members to parliament until 1862, after which year it returned one member. The fairs and markets in Darlington were formerly held by the bishop and were in existence as early as the 11th century. The markets and fairs were finally in 1854 purchased by the local authority, and now belong to the corporation.

DARLINGTON, a town of northeastern South Carolina, U.S.A., served by the Atlantic Coast Line and the Seaboard Air Line railways; county seat of Darlington county. It is on federal highway 52. Pop. (1940) 6,236. It has a cotton mill of 37,800 spindles, a drinking cup factory, a chair factory, a flour and corn products mill, veneer mills, shingle mills, a cottonseed oil mill. ice and lumber manufacturing plants, tobacco warehouses and a tobacco-stemming plant. It was founded about 1785.

DARLINGTONIA (named after Dr. William Darlington, an American botanist, 1782–1863), the Californian pitcher plant, belonging to the family Sarraceniaceae. There is only one species. D. *californica.* According to Greene, the generic name should be *Chrysamphora.* It grows in sphagnum swamps and springy hillsides in southwestern Oregon and northwestern California from near sea level to an altitude of 6000 ft. in the Sierra Nevada Mts. The tall tubular leaves grow in a cluster arising from a stout horizontal stolon and have two forms. The juvenile leaf has the open top overhung by a tapering lid-like appendage, seen on the left of the illustration. Such leaves are found in seedlings and variously on small shoots. The leaf of maturity may reach a height of 3 ft., gradually expanding its diameter till at the top it expands suddenly into a bent-over hood ending in a downward hanging appendage of the shape of a fishtail. Beneath the hood is a rounded opening, the entrance, guarded on the inside by a low, inturned flange having many nectar glands, which are common also to the fishtail appendage, and to the interior surface of the hood. The roof of the hood is tesselated by white translucent patches, windows mullioned by green, eventually red bands of chlorophyll bearing tissues. To an insect approaching the entrance, attracted by the nectar on the fishtail or elsewhere beneath the hood, the fenestrations doubtless suggest a way of exit. When once inside, the insect feeds on the abundant nectar and gradually, impelled by downward pointing hairs, falls into the hollow tubular leaf. Since digestive glands are absent, the decay of the captured insects takes place through the agency of bacteria, the products of this sort of digestion being absorbed by the walls of the tube, from which cuticle is absent.

An interesting matter in this connection is the invariable presence of living insect larvae in the wet mass of decaying insects which are usually very plentiful. A few of these are obligate commensals, not occurring elsewhere. Among these are two minute gnats, *Metriocnemus Knabi* and *M. Edwardsii.* So abundant is the dead prey that the odour of decay has often been remarked.

(F. E. L.)



DARLINGTONIA. CALIFORNICA. SHOWING TWO OF THE PITCHERS (LEAVES) WITH CURVED TOPS ENDING IN FISHTAIL FLAPS IN FRONT
A. Flower with floral leaves removed
B. Leaf cut across to show hollow interior

DARLY, MATTHIAS or **MATTHEW,** (? –1781?) English caricaturist, designer and engraver. This extremely versatile artist produced social and political caricatures, designed architectural and mobiliary accessories, made many engravings for Thomas Chippendale, and sold his own productions at his print shop in the Strand (and elsewhere) which was one of the first to stock prepared colours and materials for artists. His first known publication is a coloured caricature, "The Cricket Players of Europe" (1741). Darly was in partnership with one Edwards, with whom he published many political prints which were collected annually into volumes under the title of *Political and Satirical History.* He published in 1754 *A New Book of Chinese Designs* and engraved many of the plates for the *Director* of Thomas Chippendale. in 1770–71 appeared Darly's most important work—The *Ornamental Architect or Young Artists' Instructor,* the title of which became in the 1773 edition *A Compleat Body of Architecture, embellished with a great Variety of Ornament.* His last caricature was published in October 1780, and as his shop, No. 39 Strand, was let to a new tenant in 1781, it is presumed that he had by then died or become incapable of further work.

See George Paston, *Social Caricature in the 18th Century* (1905).

DARMESTETER, ARSÈNE (1846–1888), elder brother of James Darmesteter *(see* below), was a distinguished philologist and man of letters. He studied under Gaston Paris at the École des Hautes Études, and became professor of old French language and literature at the Sorbonne. He collaborated with Adolphe Hatzfeld in a *Dictionnaire général de la langue française* (2 vols., 1895–1900). Among his most important work was the elucidation of old French by means of the many glosses in the mediaeval writings of Rashi and other French Jews. His scattered papers on romance and Jewish philology were collected by James Darmesteter as *Arskne Darmesteter, reliques scientifiques* (2 vols., 1890). His *Cours de grammaire historique de la langue française* was edited after his death by E. Muret and L. Sudre (1891–95; English edition, 1902).

DARMESTETER, JAMES (1849–1894), French author and antiquarian, was born of Jewish parents at Château Salins, Alsace. The family name had originated in their earlier home of Darmstadt. He studied in Paris under Michel Bréal and Abel Bergaigne. In 1875 he published a thesis on the mythology of the *Zend Avesta,* and in 1877 became teacher of Zend at the École des Hautes Études. He followed up his researches with his *Études iraniennes* (1883), and ten years later published a complete translation of the *Zend Avesfa,* with historical and philological commentary (3 vols., 1892–93), in the *Annales du musée Guimet.* He

also edited the *Zend Avesta* for Max Muller's *Sacred Books of the East*. Darmesteter regarded the extant texts as far more recent than was commonly believed, placing the earliest in the 1st century B.C., and the bulk in the 3rd century A.D. In 1885 he was appointed professor in the Collège de France, and was sent to India in 1886 on a mission to collect the popular songs of the Afghans, a translation of which, with a valuable essay on the Afghan language and literature, he published on his return. His impressions of English dominion in India were conveyed in *Lettres sur l'Inde* (1888). He married A. Mary F. Robinson (*see* DUCLAUX, AGNES MARY FRANCES). He died on Oct. 19,1894.

There is an *éloge* of James Darmesteter in the *Journal asiatique* (1894, vol. iv. pp. 519–534), and a notice by Henri Cordier, with a list of his writings, in *The Royal Asiatic Society's Journal* (Jail. 1895); *see* also Gaston Paris, "James Darmesteter," in *Penseurs et poètes* (1896, pp. 1-61).

DARMSTADT, a city of Germany, capital of the *Land* of Hesse-Darmstadt, on a plain gently sloping from the Odenwald to the Rhine, 21 mi. by rail S.E. from Mainz and 17 mi. S. from Frankfort-on-Main. Pop. (1939) 115,526.

Darmstadt is mentioned in the 11th century, but in the 14th century it was still a village, held by the counts of Katzenelnbogen. It came by marriage into the possession of the house of Hesse in 1479, the male line of the house of Katzenelnbogen having in that year become extinct. The imperial army took it in the Schmalkaldic War, and destroyed the old castle. In 1567, after the death of Philip the Magnanimous, his youngest son George received Darmstadt and chose it as his residence. He was the founder of the line of Hesse-Darmstadt. Its most brilliant days were those of the reign of Louis X. (1790–1830), the first grand-duke, under whom the new town was built.

Darmstadt consists of an old and a new town, the streets of the former being narrow. In the new town is the stately Luisenplatz, on which are the old house of parliament, the palace and the post office, and, in the centre, a statue of the grand-duke Louis I., the founder of the new town. The ducal palace is a complex of buildings of various centuries. Adjoining the palace gardens, are the theatre and armoury, and a little farther west the museum, a library of 600,000 volumes and 4,000 mss., a museum of Egyptian and German antiquities, a picture gallery with masterpieces of old German and Dutch schools, a natural history collection and the State archives. To the south of the castle lies the old town, with market square, town hall and town church. The town possesses a technical high school, having (after 1900) power to confer the degree of doctor of engineering, and attended by about 2,000 students, two gymnasia, a school of agriculture, an artisans' school and a botanical garden. The chemist, Justus von Liebig, was born in Darmstadt in 1803. The industries are very varied. The city was bombed by the British in World War II.

To the east of the town lies the Mathildenhohe, formerly a park and now converted into villa residences. Here are the Alice hospital and the Russian church, built (1898–99) by the emperor Nicholas II of Russia in memory of his Hessian wife.

See Walther, *Darmstadt wie es war und wie es geworden* (Darms. 1865); and Zernin and Worner, *Darmstadt und seine Umgebung* (Ziirich, 1890).

DARMSTÄDTER UND NATIONALBANK. The Bank is a merger of the Bank fur Handel und Industrie (generally known as the Darmstadter Bank) with the Nationalbank fur Deutschland. The amalgamation took place in 1922.

The Bank fur Handel und Industrie was founded in 1853 in Darmstadt. It was in intimate relationship with the most important firms and possessed a large number of branches.

The Nationalbank fur Deutschland was founded in 1881. In 1920, after having absorbed the Deutsche Nationalbank in Bremen and later the Holsten Bank in Neumünster, it turned its attention to branch banking. The Nationalbank fur Deutschland saw in its relationships with industrial enterprises the main support of its business, and by founding, or collaborating in the founding, of many important German enterprises it established a basis for financial and syndicate investment business.

The capital of the Darmstadter und Nationalbank in 1928 was 60,000,000 Reichsmarks, and the open reserves (which were 40,000,000 Reichsmarks when the gold balance sheet was drawn up in 1924) were increased by 10,000,000 in 1927 and by an additional 5,000,000 in 1928; the reserves amounting to 55,000,000 Reichsmarks.

The Darmstädter und Nationalbank is represented in the management of the most important industrial enterprises in Germany and is on the board of approximately 1,000 companies. The Bank also has a number of foreign investments in other banks abroad. It founded, together with an international group, the "Internationale Bank te Amsterdam" with the object of carrying out international financial transactions.

In 1928 the Darmstadter und Nationalbank owned 143 bank buildings, had branches in approximately 120 towns. (A. SN.)

DARNLEY, HENRY STEWART or **STUART,** LORD (1545–1j67), earl of Ross and duke of Albany, second husband of Mary, queen of Scots, was the eldest son of Matthew Stewart, earl of Lennox (1516–1571), and through his mother Lady Margaret Douglas (1515–1578) was a great-grandson of the English king Henry VII. Born at Temple Newsam in Yorkshire on Dec. 7, 1545, he was educated in England. After the death of Francis II. in 1j60 Darnley was sent to France by his mother, who hoped that he would become king of England on Elizabeth's death, and entertained the idea of his marriage with Mary, queen of Scots, the widow of Francis, as a means to this end. In 1561 both Lady Margaret and her son, who were English subjects, were imprisoned for a short time by Elizabeth; and Darnley spent some time at the English court before going to Scotland in Feb. 1565. The marriage of Mary and Darnley was now definitely proposed, and the queen, having nursed her new suitor through an attack of measles, decided to marry him. Elizabeth had permitted Darnley's journey to Scotland, but she and her council declared their dislike of the proposed marriage, and ordered Darnley and his father to repair to London, a command which was disobeyed. In March 1565 there were rumours that the marriage had already taken place, but the public marriage, at all events, was celebrated at Holyrood on July 29, 1565.

Although Mary had doubtless a short infatuation for Darnley, the union was mainly due to political motives, and trouble soon arose between them. Contrary to his expectations Darnley dia not receive the crown matrimonial. He was on bad terms with the regent Murray and other powerful nobles, who disliked the marriage and were intriguing with Elizabeth. He was in addition soon estranged from his wife. He became jealous of David Rizzio, and was easily persuaded to assent to the murder of the Italian, a crime in which he took part. Immediately afterwards, however, flattered and cajoled by the queen, he betrayed his associates to her, and helped her to escape from Holyrood to Dunbar. Deserted and distrusted by his companions in the murder, he decided to leave Scotland, but a variety of causes prevented his departure; and meanwhile at Craigmillar a band of nobles undertook to free Mary from her husband, who refused to be present at the baptism of his son, James, at Stirling in Dec. 1566. The details of the conspiracy at Craigmillar are not clear, nor is it certain what part, if any, Mary took in these proceedings. The first intention may have been to obtain a divorce for the queen, but it was soon decided that Darnley must be killed. Rumours of the plot came to his ears, and he fled from Stirling to Glasgow, where he fell ill, possibly by poisoning, and where Mary came to visit him. Another reconciliation took place, and Darnley was persuaded to journey with Mary by easy stages to Edinburgh. They stayed for a few days at Kirk o' Field, a house just inside the city walls. On the evening of Feb. 9, 1567 Mary bade her husband farewell, and went to attend some gaieties in Edinburgh. A few hours later, on the morning of the 10th, Kirk o' Field was blown up with gunpowder. Darnley's body was found at some distance from the house, and it is supposed that he was strangled whilst making his escape. The remains were afterwards buried in the chapel at Holyrood.

As the father of King James I., Darnley is the direct ancestor of all the sovereigns of England since 1603.

For further information, and also for a list of the works bearing on his life, *see* the article *MARY,* QUEEN OF SCOTS.

DARRANG, a district of British India, in the province of Assam. It lies between the Bhutan and Dafla hills and the Brahmaputra, including many islands in the river. The administrative headquarters are at Tezpur (pop. 5,047) on the right Sank of the Brahmaputra. Its area is 3,197 sq.mi. Pop. (1931) 584,817. This area was reduced in 1914 by the transfer of 500 sq.m. of almost uninhabited country to the Balipara Frontier Tract formed in that year. It is for the most part a level plain watered by many tributaries of the Brahmaputra. The district contains the two subdivisions of Tezpur and Mangaldai, tea being the principal cultivation in the valley of Tezpur, and rice in Mangaldai. In Tezpur the density has risen to 157 per sqm. from 42 in 1890 owing to large areas of waste land being brought under cultivation. In Mangaldai 800 sq.m. are available. for settlement. There were 58,000 acres under tea with an output of 27½ million lb. in 1921, when the tea-garden population numbered 122,749. There are 568 sq m. of reserved forests, mostly at the foot of the hills along the northern boundary.

DARROW, CLARENCE SEWARD (1857–1938), American lawyer, was born at Kinsman, O., April 15, 1857. He received a public school education and was called to the bar in 1875, afterwards practising in Chicago. He appeared as counsel in a large number of important cases, many of which attracted wide attention, and he became recognized as one of the leading criminal lawyers in the United States. He was retained by the labour organizations in much of their litigation of recent years. Among the celebrated cases in which he appeared were the Debs strike case (1895), anthracite coal strike arbitration (1902), Steunenburg murder (1907), The Los Angeles Times dynamite case (1911) and the Loeb-Leopold case (1924). In July 1925 he defended J. T. Scopes at the Tennessee evolution trial. He wrote Crime, *Its* Cause *and* Treatment (1922); Farmington, *A* Persian Pearl and Other Essays, *An* Eye for an Eye, The *Prohibition Mania,* and many other books and pamphlets on social, literary and economic questions.

For many years he was a well-known platform speaker and debater.

DARTER: see SNAKE-BIRD.

DARTFORD, a market town and municipal borough in the Dartford parliamentary division of Kent, England, 17 mi. E.S.E. of London by the Southern railway. Pop. (1938) 35,680. Area 6.6 sq.mi. Its most noteworthy building is the parish church, restored in 1863, which contains an old fresco and several interesting brasses, and has a Norman tower, restored in 1910. The grammar school dates from 1576.

Dartford was the scene, in 1235, of the marriage, celebrated by proxy, between Isabella, sister of Henry III, and the Emperor Frederick II; and in 1331 a famous tournament was held in the place by Edward III. The same monarch established a Dominican nunnery on West Hill in 1356, of which, however, little remains. After the Dissolution it was used as a private residence by Henry VIII, Anne of Cleves and Elizabeth. The chantry of St. Edmund the Martyr on the opposite side of the town was a part of Edward III's endowment to the priory, and became famous as a place of pilgrimage on the way to Canterbury. The part of Watling street which crossed there towards London was sometimes called "St. Edmund's Way." On Dartford heath is the mental home maintained by the London County council. Greenhithe, on the banks of the Thames, has large chalk quarries in its neighbourhood, from which lime and cement are manufactured. One of the first attempts at the manufacture of paper in England was made here by Sir John Spielman (d. 1607), jeweller to Queen Elizabeth. Papermaking is still important here as well as chemical, metal and leatherworking. From 1894 until 1933, when it was incorporated, Dartford was governed by an urban district council.

DARTMOOR, high plateau, in south-west Devonshire, England. It is 23 mi. from north to south, 20 mi. from east to west, 215 sq.mi. in area with a mean altitude of 1,500 feet. It is the highest and easternmost in a broken chain of granitic elevations which extends to the Scilly isles. The higher parts are open, bleak and wild. Sloping heights rise from the main tableland, crested with broken masses of granite, locally named tors. The highest of these are Yes Tor and High Willhays (2,028 and 2,039 feet). Large parts of the moor are covered with morasses; and head-waters of all the principal streams of Devonshire (*q.v.*) are found here. Only two good roads cross the moor, one between Exeter and Plymouth, and the other between Ashburton and Tavistock, intersecting at Two Bridges. The central part of Dartmoor was a royal forest from a date unknown, probably before the Conquest. Its woods were formerly more extensive than now, but a few small tracts of dwarf oaks remain in the lower parts. Previous to 1337 the forest had been granted to Richard, earl of Cornwall, by Henry III., and from then has belonged to the Duchy of Cornwall. The districts immediately surrounding the moor are called the Venville or Fenfield districts. The holders of land by Venville tenure have rights of pasture, fishing, etc., in the forest. (For antiquarian remains see DEVON.)

Princetown prison was built in 1806 to house French prisoners, and was adapted for use as a convict station in 1850. A tract of moorland adjacent to the prison was brought under cultivation by the inmates.

DARTMOUTH, EARL OF, an English title borne by the family of Legge from 1710 to the present day.

WILLIAM LEGGE (c. 1609–1670), the eldest son of Edward Legge (d. 1616), vice-president of Munster, assisted Charles I. in his war against the Scots in 1638. He was also very useful to the king during the months which preceded the outbreak of the Civil War, although his attempt to seize Hull in Jan. 1642 failed. During the war Legge distinguished himself at Chalgrove and at the first battle of Newbury, and in 1645 he became governor of Oxford. Legge helped Charles to escape from Hampton Court in 1647, and was arrested in May 1648. He was released, but was again captured in 1649, and remained in prison until 1653. He then spent some years abroad, but in 1659 was in England inciting the royalists to rise. The old royalist died on Oct. 13, 1670.

Legge's eldest son, GEORGE, BARON DARTMOUTH (1647–1691), served as a volunteer in the navy during the Dutch war of 1665–1667. He was a member of the household of the duke of York, afterwards James II., was governor of Portsmouth and master-general of the army. In 1678 he commanded as colonel the troop at Nieuport, and in 1682 he was created Baron Dartmouth. In 1683 as "admiral of a fleet" be sailed to Tangiers, dismantled the fortifications and brought back the English troops. Under James II. Dartmouth was master of the horse and governor of the Tower of London; and in 1688 when William of Orange was expected, James II. made him commander-in-chief of his fleet. Although himself loyal to James, the same cannot be said of many of his officers, and an engagement with the Dutch fleet was purposely avoided. Dartmouth, however, refused to assist in getting James Edward, prince of Wales, out of the country, and even reproved the king for attempting this proceeding. He then left the fleet and took the oath of allegiance to William and Mary, but in July 1691 he was arrested for treason, and was charged with offering to hand over Portsmouth to France and to command a French fleet. Dartmouth protested his innocence. He died in the Tower of London on Oct. 25, 1691 before the question was investigated. (See *Dartmouth* Papers [Hist. Mss. Comm. 2nd Report ix. and spp. pp. 9–12, 1870–72].)

Lord Dartmouth's only son. WILLIAM, 1ST EARL OF DARTMOUTH (1672–1750), succeeded to his father's barony in 1691. He became secretary of state for the southern department and joint keeper of the signet for Scotland in 1710. In 1711 he was created viscount Lewisham and earl of Dartmouth; in 1713 he exchanged his offices for that of keeper of the privy seal, which he held until the end of 1714. After a long period of retirement from public life he died on Dec. 15, 1750.

WILLIAM, 2ND EARL OF DARTMOUTH (1731–1801), grandson of the 1st earl, was lord privy seal at the beginning of the dispute with the American colonies. He advised them in 1777 to accept the conciliatory proposals put forward by Lord North, but in 1776 he opposed similar proposals and advocated the employment of force. In March 1782 lie resigned his office, and in 1783 became lord steward of the household; he died on July 15, 1801. Dartmouth's piety and his intimacy with the early Methodists won for

him the epithet of the *Psalnt-singer*. Dartmouth College was named after him, and among his papers preserved at Patshull House, Wolverhampton, are many letters from America relating to the struggle for independence, printed in *Dartmouth Papers* (Hist. Mss. Comm. 11th Rep. pp. 19–23 and spp. v. 1–500, 1887).

DARTMOUTH, a seaport and municipal borough in the Torquary parliamentary division of Devonshire, England, 27 mi. E. of Plymouth. Pop. (1938) 5,966. Area, 3 sq.mi. It is near the mouth of the river Dart, which here forms an almost landlocked estuary, and is connected by ferry steamer with Kingswear on the opposite shore. The houses rise in tiers from the shore, beneath a range of hills. The parish church of St. Saviour is of the 14th and 15th centuries, and retains an oak rood-screen and an ancient stone pulpit. The churches of St. Petrox and St. Clement, both Early English, represent respectively the ancient manors of Clifton and Hardness, which with Dartmouth give the borough its official name of Clifton-Dartmouth-Hardness.

Dartmouth castle, partly Tudor, commands the river; the wooded castle estate was purchased by the corporation in 1904. Portions of the cottage of Thomas Newcomen, one of the inventors of the steam-engine, are preserved. The Royal Naval Cadet college was opened in 1905 to take the place of the Britannia training ship; it occupies the site of a former seat called Mount Boone. Dartmouth is a yachting centre, and shipping and yacht and boat building are the chief industries. Coal is imported, and resold. River steamers ply to Totnes, 10 mi. up the Dart.

Probably owing its origin to Saxon invaders, Dartmouth was a seaport of importance when Earl Beorn was buried in its church in 1049. From its sheltered harbour William II. embarked in 1099 for the relief of Mans and Richard I.'s squadron set sail for the crusades in 1190, while John landed here in 1214. The borough, first claimed as such in the reign of Henry I., was in existence by the middle of the 13th century. In the 13th century Dartmouth was required to furnish ships for the king's service, an obligation maintained throughout the following century. In 1342 the town was incorporated by a charter frequently confirmed by later sovereigns. A French attack on the town was repulsed in 1404, and in 1485 the burgesses received a royal grant of £40 for walling the town and stretching a chain across the river mouth. Dartmouth fitted out two ships against the Armada, and was captured by both the Royalists and Parliamentarians in the Civil War. Manorial markets were granted for Dartmouth in 1231 and 1301. These were important, since as early as 1225 the fleet provisioned there. During the 14th and 15th centuries there was a regular trade with Bordeaux and Brittany, and complaints of piracies by Dartmouth men were frequent.

DARTMOUTH, a town in Halifax county, Nova Scotia, Canada, on the north-eastern side of Halifax-harbour, connected by a steam ferry with Halifax. Pop. (1941) 10,847. It contains a large sugar refinery, foundries, machine shops, saw mills, skate, rope, nail, soap and sash factories and also the Imperial Oil works. Though now practically a suburb of Halifax, Dartmouth was separately founded in 1750; was the first town incorporated in Nova Scotia.

DARTMOUTH COLLEGE, an American institution of higher education for men, in Hanover, New Hampshire. It is Congregational by origin but actually non-sectarian. Dartmouth embraces the original college, incorporated in 1769, a medical school, dating from 1798; the Thayer School of Civil Engineering, established in 1867 by the bequest of General Sylvanus Thayer; and the Amos Tuck School of Administration and Finance, established in 1900 by Edward Tuck—the first, and until the establishment at Harvard of a similar graduate school, the only commercial school in the country whose work is largely postgraduate. The Chandler School of Sciences and the Arts was founded by Abiel Chandler in 1851 in connection with Dartinouth and incorporated in the collegiate department in 1893 as the Chandler scientific course in the college. From 1866 to 1893 the New Hampshire College of Agriculture and the Mechanic Arts, now at Durham, was connected with Dartmouth. The medical school granted the degree of M. D. until 1914, when the last two clinical years were discontinued. The Thayer school and the Tuck school maintain each a two years' course, the first year of which may, under certain conditions, be counted as the senior year of the undergraduate college.

The college has a beautiful campus; 15 instruction halls; 22 residence halls, with accommodation for 1,650 students; a large gymnasium, built in 1911 by alumni, with the Spaulding swimming pool (1919), the Davis field house (1927) and the Davis Hockey Rink (1929) attached, and large athletic fields; an auditorium, Webster hall (1901); College hall (1901), a social headquarters; Rollins chapel (1885); an astronomical and meteorological observatory (Shattuck observatory, 1854). The Fisher Ames Baker Memorial Library (completed 1928) replaces Wilson hall (1885) and contains 420,000 volumes. This library, the gift of George F. Baker, cost $1,000,000. With it are associated the Carpenter Fine Arts Building (1929) and the Sanborn English House (1929). The physical laboratory is housed in Wilder hall (1899). Instruction in chemistry is given in the Steele Chemistry Laboratory (1921), the natural sciences in Silsby hall (1928) where geological and ethnological collections are also maintained, while botany is taught in the Clement greenhouse (1928). Parkhurst hall (1911) contains the administrative offices, and Robinson hall (1914) is the home of all college organizations other than athletic. The Mary Hitchcock Memorial Hospital (1893) is associated with the Medical School, and Dick Hall's house (1927), adjoining the hospital, is a completely equipped infirmary for 50 students. The college owns the Hanover Inn with accommodation for 150 guests and maintains single or apartment houses for 50 faculty families. A new upper-class dining hall, seating some 500 students, was completed in 1937.

Dartmouth is the outgrowth of Moor's Indian Charity School, founded by Eleazar Wheelock (1711–79) about 1750 at Lebanon, Connecticut. This school was named in 1755 in honour of Joshua Moor, who in this year gave to it lands and buildings. In 1765 Samson Occum (c. 1723–92), an Indian preacher and former student of the school, visited England and Scotland in its behalf and raised £10,000, whereupon plans were made for enlargement and for a change of site to Hanover. In 1769 the school was incorporated by a charter granted by George III. as Dartmouth College, being named after the earl of Dartmouth, president of the trustees of the funds raised in Great Britain. The first college building, Dartmouth hall, was built between 1784 and 1791. This building was twice destroyed by fire, in 1904 and 1935, and reproduced in its original external form, the second time with fireproof materials. During the War of Independence the support from Great Britain was mostly withdrawn. In 1815 President John Wheelock (1754–1817), who succeeded his father in 1779, and was a Presbyterian and a Republican, was removed by the majority of the board of trustees, who were Congregationalists and Federalists, and Francis Brown was chosen in his place. Wheelock, upon his appeal to the legislature, was reinstated at the head of a new corporation, called Dartmouth University. The State courts upheld the legislature and the "university," but in 1819 after a famous argument of Daniel Webster (*q.v.*) in behalf of the "college" board of trustees as against the "university" board before the U. S. Supreme Court, that body decided that the private trust created by the charter of 1769 was inviolable, and Dr. Francis Brown and the old "college" board took possession of the institution's property. At the Webster centennial, celebrated in 1901, it was stated that the Dartinouth College Case had at that time been cited in judicial opinions more frequently than any other in the American reports—about 970 times.

The annals of the college have been tranquil with the exception of the disturbed years of the "university" controversy. During the Civil War Dartmouth College contributed 652 alumni and undergraduates to the Union armies. In World War I 3,319 graduates, undergraduates and faculty served in the military forces of the United States. Those dying in active service numbered 112. During most of the 19th century there was little variation in the numbers attending the college. With the administration of President William Jewett Tucker (1893–1909), however, a great expansion of equipment, endowment and enrolment took place which has continued during the present administration

of Ernest Martin Hopkins, the 11th president. The enrolment increased from 256 students and 19 members of the faculty in 1890 to 2,400 students and more than 250 members of the faculty in 1936. In 1890 91% of the students came from New England. Tne constituency of the college gradually changed, until in 1936 less than 40% of the men came from homes within those States. The productive investment assets of the college also increased from approximately $1,000,000 in 1890 to $17,000,000 in 1936. The tuition cost in 1937 will be $450 a year; provision is made through scholarships for assisting deserving students unable to pay this sum. The government is entrusted to a hoard of 12 trustees, five of whom are elected upon the nomination of the alumni. Applicants for the entering class are selected on a basis of character, scholarship and general promise of profiting by a college course. Out of more than 2,000 applicants who apply each year, an entering class of approximately 650 is selected.

During President Hopkins' administration several important features were introduced. A personnel department for advice on the curriculum and later occupation was organized. Outdoor recreation was made coinpulsory in the two lower classes. Experts in psychiatry and in nutrition were added to the college staff. In June 1925 certain major changes were made in the liberal arts curriculum providing inter alia for special treatment for students of higher grade and for the granting of but one degree, Bachelor of Arts. In 1929 senior fellowships were introduced, and more recently complete medical and surgical care without charge was adopted, and the curriculum was revised so as to insure greater study of modern social problems. One of the interesting influences of the college is promoted by the Dartmouth Outing Club, which maintains a chain of 23 cabins and shelters between Hanover and the White mountains and promotes winter sports.

See Frederick Chase, *A History of Dartmouth College and the Town of Hanover* (Cambridge, 1891); John K. Lord, *History of Dartmouth College 1815–1909* (Concord, 1913); Leon B. Richardson, *History of Dartmouth College* (Hanover, 1932); Wilder D. Quint, *The Story of Dartmouth* (Boston, 1916); *The Proceedings of the Webster Centennial of Dartmouth College* (1901); *150 Years of Dartmouth College* (1919). For the Dartmouth College Case *see* Timothy Farrar, *Report of the Case of the Trustees of Dartmouth College against William H. Woodward* (Portsmouth, 1819); Shirley, *The Dartmouth College Causes (St.* Louis, Mo., 1879); Kent, *Commentaries on American Law* (vol. i., Boston, 1884). (E. F. C.)

DARU, PIERRE ANTOINE, COUNT (1767–1829), French soldier, was born at Montpellier on Jan. 12, 1767. He was a great army administrator, and served as commissary to the army of defence of the Breton coast (1793), in Masséna's army in Switzerland (1799), in Berthier's army in Italy (1799), and again on the Breton coast (1803). He enjoyed the complete confidence of Napoleon, who employed him as chief commissary of the Grand Army in 1805, and made him intendant of his military household. In the campaigns of 1806–07 he served, in his usual capacity, in the army which overthrew the forces of Russia and Prussia; and he had a share in drawing up the treaty of Tilsit (July 7, 1807). After this he supervised the administrative and financial duties in connection with the French army which occupied the principal fortresses of Prussia. At the congress of Erfurt, Daru was present at the interview between Goethe and Napoleon, and interposed tactful references to the works of the great poet. Daru served again as commissary in the campaign of 1809 against Austria, and late in the year 1813 he took up the portfolio of military affairs. After the first abdication of Napoleon in 1814, Daru retired into private life, but aided Napoleon during the Hundred Days. After the second Restoration he became a member of the Chamber of Peers, in which he defended the cause of popular liberty against the ultra-royalists. He died at Meulan on Sept. 5, 1829.

Few men of the Napoleonic empire have been more generally admired and respected than Daru. On one occasion when he expressed a fear that he lacked all the gifts of a courtier, Napoleon replied, "Courtiers! They are common enough about me; I shall never be in want of them. What I want is an enlightened. firm and vigilant administrator; and that is why I have chosen you" At another time Napoleon said, "Daru is good on all sides; he has good judgment, a good intellect, a great power for work, and a body and mind of iron."

Among Daru's literary works are his *Histoire* de *Venise* (7 vols., 1819); *Histoire* de Bretagne (3 vols., 1826); a poetical translation of Horace; *Discours* en *vers* sur les *facultés* de *l'homme* (1825), and *Astronomie,* a didactic poem in six cantos (1820).

See the "Notice" by, Viennet prefixed to the fourth edition of Daru's *Histoire de la republique* de *Venise* (9 vols., 1853) and three articles by Sainte-Beuve in *Causeries du lundi,* vol. ix. For the many letters of Napoleon to Daru *see* the *Correspondance de Napoléon Ier* (32 vols., 1858–70).

His son, NAPOLÉON DARU (1807–1890), created count in 1832, was a liberal member of the National Assembly in 1848, and of the Legislative Assembly (1869) and foreign minister in 18 jo. He sat as a conservative in the National Assembly (1871–76), and in the senate from 1876 to 1879.

DARWEN, municipal borough, Darwen parliamentary division, Lancashire, England, 20 mi. N.W. from Manchester by the L.M.S.R. Pop. (1938) 31,850. Area 9.2 sq.mi. It lies on the river Darwen, which traverses a densely populated manufacturing district. In the neighbourhood are collieries and stone quarries. Darwen manufactures cotton goods, paper, and has blast furnaces and fire-clay works. It has a market hall, technical schools, a free library, and two public parks. A grammar school was opened in 1938. Darwen was incorporated in 1788.

DARWIN, CHARLES ROBERT (1809–1882), English naturalist, author of the Origin of Species, was born at Shrewsbury on Feb. 12, 1809, the grandson of Dr. Erasmus Darwin (*q.v.*). His mother, a daughter of Josiah Wedgwood (1730–1795), died in 1817. Charles's elder brother, Erasmus Alvey (1804–81), was interested in literature and art rather than science: on the subject of the wide difference between the brothers Charles wrote that he was "inclined to agree with Francis Galton in believing that education and environment produce only a small effect on the mind of anyone, and that most of our qualities are innate" (Life and Letters, London, 1887). Darwin considered that his own success was chiefly due to "the love of science, unbounded patience in long reflecting over any subject, industry in observing and collecting facts, and a fair share of invention as well as of common sense" (ibid.). He also says: "I have steadily endeavoured to keep my mind free so as to give up any hypothesis, however much beloved (and I cannot resist forming one on every subject), as soon as facts are shown to be opposed to it" (ibid.). The essential causes of his success are to be found in this latter sentence, the creative genius ever inspired by existing knowledge to build hypotheses by whose aid further knowledge could be won, the calm unbiassed mind, the love of truth which enabled him to abandon or to modify his own creations when they ceased to be supported by observation. The great naturalist appeared in the ripeness of time, when the world was ready for his splendid generalizations. In the preparation for Darwin Sir Charles Lyell's *Principles* of Geology played an important part, accustoming men's minds to the vast changes brought about by natural processes, and leading them, by its lucid and temperate discussion of Lamarck's and other views, to reflect upon evolution.

Darwin studied at Shrewsbury School under Dr. Samuel Butler (1774–1839), and in 1825 went to Edinburgh to prepare for the medical profession, for which he was unfitted by nature. In 1828 his father sent him to Christ's College, Cambridge with the idea that he should become a clergyman. He took his degree in 1831, tenth in the list of those who do not seek honours. Both at Edinburgh and at Cambridge he gained the friendship of older scientific men — Robert Edmond Grant and William Macgillivray at the former, John Stevens Henslow and Adam Sedgwick at the latter. From Dec. 1831 to Oct. 1836, Darwin was on the "Beagle" as naturalist for the surveying expedition. After visiting the Cape de Verde and other Atlantic islands, the expedition surveyed on the South American coasts and adjacent islands (including the Galapagos), afterwards visiting Tahiti, New Zealand, Australia, Tasmania, Keeling Island, Maldives, Mauritius, St. Helena, Ascension, and Brazil, de Verdes and

Azores on the way home. His work on the geology of these countries and that on coral islands became the subject of volumes which he published after his return, as well as his *Journal of a Naturalist*, and his other contributions to the official narrative. The voyage was the real preparation for his life-work. His observations on the relation between animals in islands and those of the nearest continent and between living animals and those most recently extinct and found fossil in the same country, related but not the same, led him to reflect upon the modification of species. He had also been much impressed by "the manner in which closely allied animals replace one another in proceeding southwards" in South America. His pocket-book for 1837 contains the words: "In July opened first note-book on Transmutation of Species. Had been greatly struck from about the month of previous March [while still on the voyage and just over twenty-eight years old] on character of South American fossils, and species on Galapagos Archipelago. These facts (especially latter) origin of all my views" From 1838 to 1841 he was secretary of the Geological society, and saw a great deal of Sir Charles Lyell, to whom he dedicated the second edition of his *Journal.* In Jan. 1839 he married his cousin, Emma Wedgwood. They lived in London until 1842, when they moved to Down, which was Darwin's home for the rest of his life. From 1846 to 1854 he was chiefly engaged upon four monographs on the recent and fossil cirripede Crustacea *(Ray Soc.,* 1851 and 1854; *Palaeontograph. Soc.,* 1851 and 1854).

Soon after opening his note-book in 1837 be began to collect facts bearing upon the formation of the breeds of domestic animals and plants, and quickly saw "that selection was the keystone of man's success. But how selection could be applied to organisms living in a state of nature remained for some time a mystery to me." Various ideas as to the causes of evolution had to be successively abandoned. He had the idea of "laws of change" which affected species and finally led to their extinction, to some extent analogous to the causes which bring about the development, maturity and finally death of an individual. He also had the conception that species must give rise to other species or else die out, just as an individual dies unrepresented if it bears no offspring. In Oct. 1838 he read *Malthus on Population,* and his observations having long since convinced him of the struggle for existence, it at once struck him "that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here, then, I had *a* theory by which to work." In June 1842 he wrote out a sketch, which in 1844 he expanded to an essay of 231 pages folio. The idea of progressive divergence as an advantage in itself, because the competition is most severe between organisms most closely related, did not occur to him until long after. In Jan. 1844 he wrote to his friend, Sir Joseph Hooker: "At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable" *(ibid.,* ii. 13). In 1857 he explained his views to the great American botanist Asa Gray in a letter which afterwards became classical. He had completed about half of a third and far more expanded treatise, when, in June 1858, he received a manuscript from A. R. Wallace, who was then at Ternate in the Moluccas. Wallace wanted Darwin's opinion on the manuscript, which he asked should be forwarded to Lyell. Darwin was much startled to find in the essay a complete abstract of his own theory of natural selection. He wrote to Lyell, "your words have come true with a vengeance—that I should be forestalled." He placed himself in the hands of Lyell and Hooker, who decided to send Wallace's essay to the Linnean society, together with an abstract of Darwin's work, which they asked him to prepare, the joint essay being accompanied by an explanatory letter to the secretary. The title of the joint communication was "On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection." It was read on July 1, 1858, and appears in the *Linn. Soc. Journal* (Zoology) for that year. In this statement of the theory of natural selection, Darwin's part consisted of two sections, the first being extracts from his 1844 essay, including a brief account of sexual selection, and the second an abstract of his letter to Asa Gray dated Sept. 5, 1857. Canon H. B. Tristram was the first to apply the new theory, explaining by its aid the colours of desert birds, etc. *(Ibis,* Oct. 1859).

Acting under the advice of Lyell and Hooker, Darwin published on Nov. 24, 1859, his great work, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life.* The whole edition of 1,250 copies was exhausted on the day of issue. The first four chapters explain the operation of artificial selection by man and of natural selection in consequence of the struggle for existence. The fifth chapter deals with the laws of variation and causes of modification other than natural selection. The five succeeding chapters consider difficulties in the way of a belief in evolution generally as well as in natural selection. The three remaining chapters (omitting the final recapitulation), deal with the evidence for evolution. The theory which suggested a cause of evolution is thus given the foremost place and the evidence for the existence of evolution considered last. This evidence had never been thought out and marshalled in a manner which bears any comparison with that of Darwin, and the work would have been epoch-making had it consisted of the later chapters alone. A storm of controversy arose over the book, reaching its height at the British Association at Oxford in 1860, when the celebrated duel between T. H. Huxley and Bishop Wilberforce of Oxford took place. Throughout these struggles Huxley was the foremost champion for evolution and for fair play to natural selection, although he never entirely accepted the latter theory, holding that until man by his selection had made his domestic breeds sterile *inter se,* there was no sufficient evidence that selection accounts for natural species which are thus separated by the barrier of sterility.

The Variation of Animals and Plants under Domestication.—Probably the second in importance of Darwin's works was published in 1868, and may be looked upon as a complete account of the material condensed in the first chapter of the *Origin.* He finally brought together an immense number of apparently disconnected sets of observations under his "provisional hypothesis of pangenesis," which assumes that every cell in the body, at every stage of growth and in maturity, is represented in each germ-cell by *a* gcmmule. The germ-cell is only the meeting-place of gemmules, and the true reproductive power lies in the whole of the body-cells which despatch their representatives, hence "pangenesis." There are reasons for believing that this infinitely complex conception, in which, as his letters show, he had great confidence, was forced upon Darwin in order to explain the hereditary transmission of acquired characters involved in the small proportion of Lamarckian doctrine which he incorporated. If such transmission does not occur, a simpler hypothesis based on the lines of Weismann's "continuity of the germ-plasm" is sufficient to account for the facts *(see* HEREDITY; LAMARCKISM).

The *Descent of Man and Selection in Relation to Sex* (1871), both fulfilled his statement in the *Origin* that "light would be thrown on the origin of man and his history," and collected the evidence in support of his hypothesis of sexual selection which he had briefly described in the 1858 essay. The *Expression of the Emotions* (1872) offered a natural explanation of phenomena which appeared to be a difficulty in the way of the acceptance of evolution. In 1876 Darwin brought out his two previously published geological works on *Volcanic Islands* and *South America* as a single volume. The widely read *Formation of Vegetable Mould through the Action of Worms* appeared in 1881; and the *Fertilization of Orchids* in 1862. *The Effects of Cross- and Self-Fertilization in the Vegetable Kingdom* (1876) proved that the offspring of cross-fertilized individuals are more vigorous, as well as more numerous, than those produced by *a* self-fertilized parent. *Different Forms of Flowers on Plants of the Same Species* (1877) demonstrates that each different form, although possessing both kinds of sexual organs, is specially adapted to be fertilized by the pollen of another form, and that when artificially fertilized by pollen from a plant of its own form, less vigorous offspring are produced. *Climbing Plants* and *Insectivorous Plants* were pub-

lished in 1875, and *The Power of Movement in Plants* in 1880.

Darwin died on April 19, 1882, and was buried in Westminster Abbey on the 26th.

Two daughters and five sons survived him, four of the latter becoming prominent in the scientific world,—Sir George Howard (1845–1912), who became professor of astronomy and experimental philosophy at Csmbridge; Sir Francis (1848–1925), distinguished botanist; Leonard (1850–1943), a major in the royal engineers, and afterwards well known as an economist and eugenist; and Sir Horace (1851–1928), civil engineer.

See *Life and Letters of Darwin, including an autobiographical chapter,* ed. by his son Francis Darwin (3 vols., 1887) and *More Letters* (2 vols., 1903); E. B. Poulton, *Darwin and the Theory of Natural Selection* (1896) and *Darwin and tlze Origin of Species* (1909); *L.* Huxley, *Life and Letters of T. H. Huxley* (2 vols., 1900) and *Charles Darwin* (1921); *V.* L. Kellog, *Darwinism To-day* (1907); *J.* Marchant, *A. R. Wallace, Letters,* etc. (2 vols., 1916) and H. Ward, C. *Darwin* (1927). *See* also HUXLCY, *T.* H., WALLACE, A. R. and HOOKER, SIR JOSEPH. (E. B. PO.)

DARWIN, ERASMUS (1731–1802), English man of science and poet, was born at Elton, Nottinghamshire. Educated at Cambridge and Edinburgh, he settled in 1756 as a physician at Nottingham, but moved in 1757 to Lichfield, and in 1781 to Derby, where he died suddenly on April 18, 1802. His fame as a poet rests upon his *Botanic Garden,* though he also wrote *The Temple of Nature, or the Origin of Society* (1803), and *The Shrine of Nature* (posthumously published). The *Botanic Garden* (1792, the part entitled *The Loves of the Plants* was published anonymously in 1789) shows a genuine scientific enthusiasm and interest in nature, but has little other poetic quality. The artificial character of the diction renders it in emotional passages stilted, and the personification is carried to excess. Botanical notes are added to the poem, and its eulogies of scientific men are frequent. Darwin's most important scientific work is his *Zoonomia* (1794–96), which contains a system of pathology, and a treatise on generation, in which he, in the words of his famous grandson, Charles Darwin, "anticipated the views and erroneous grounds of opinions of Lamarck." The essence of his views is contained in the hypothesis that through millions of ages all warm-blooded animals may have arisen from one living filament which the First Cause endowed with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions and associations.

His *Phytologia, or the Philosophy of Agriculture and Gardening* (1799) claims that plants have sensation and volition. A paper on *Female Education in Boarding Schools* (1797) completes the list of his works.

ROBERT WARING DARWIN (1766–1848), his third son by his first marriage, a doctor at Shrewsbury, was the father of the famous Charles Darwin; and VIOLETTA, his eldest daughter by his second marriage, was the mother of Francis Galton.

See A. Seward, *Memoirs of the Life of Dr. Darwin* (1804); Charles Darwin, *Life of Erasmus Darwin, an introduction to an essay on his works by Ernst Krause* (1879); *L.* Brandl, "E. Darwin's Botanic Garden" in *Wiener Beiiriige zur englischen Philologie* (1909).

DARWIN, SIR GEORGE HOWARD (1845–1912), British astronomer, was born at Down, Kent, on July 9, 1845, and was the second son of Charles Darwin (q v). He was educated at Trinity college, Cambridge (second wrangler and Smith's prizeman), of which he was elected a fellow in 1868, and where he became Plumian professor of astronomy and experimental philosophy in 1883. His work on the application of harmonic analysis and prediction to oceanic tides is monumental, as is his discussion of the influence of tidal friction in determining the evolution of binary systems, with special reference to the earth and moon. In an early paper he discussed the possibility of geological changes having altered considerably the inclination of the earth's axis to the plane of its orbit, and came to a negative conclusion. These works constituted the first attempt to apply thorough dynamical analysis to cosmogony and the major problems of geological evolution. He also carried out important work on periodic orbits in the problem of three bodies, figures of equilibrium of rotating masses of fluid and the stresses in the earth's crust produced by continents and mountains. He was awarded the gold medal of the Royal Astronomical Society in 1892 and the Copley Medal of the Royal Society in 1911. In 1899 Darwin was made president of the Royal Astronomical Society, and of the British Association in 1905. He was made K.C.B. in 1905, and he died in Cambridge on Dec. 7, 1912.

Among his works are *The Tides and Kindred Phenomena in the Solar System* (1898; 3rd ed., 1911) and *Scientific Papers* (5 vols., Cambridge University Press, 1907–16), which has a supplementary volume edited by F. J. M. Stratton and J. Jackson, containing biographical memoirs.

DARWIN GLASS: *see* TEKTITE.

DAS, CHITTA RANJAN (1870–1925), Indian politician and leader of the Swaraj party in Bengal, was born at Calcutta on Nov. 5, 1870 His father, Bhuban Mohan Das, an attorney of the Calcutta High Court, joined the Brahmo Samaj, and edited the *Brahmo* (afterwards the *Bengal) Public Opinion.* Chitta Ranjan was educated at the London Missionary college, Bhowanipore, and at the Presidency college, Calcutta. He was called to the bar at the Middle Temple on June 26, 1894. Joining the Calcutta bar, he won his reputation by his successful defence of Arabinda Ghosh in the Manicktollah bomb conspiracy case. He defended relays of young political offenders, and assisted in keeping extremist papers, such as *Bande Mataram,* going, until they were checked by the Press Act, 1910.

In 1895 Das had published a volume of Bengali lyrics, *Malancha,* and two volumes of verse were issued during the World War. In 1915 Das started the Bengali monthly *Narayana,* but his chief journalistic work was the founding and conduct of the aggressive Swarajist daily, *Forward.* "His dominating note was hatred—and dread—of everything that savoured of the West. . . . It was the pursuit of these false gods that had converted Bengal from a smiling land of happiness and plenty into a salt waste over which brooded stagnation and death" (Lord Ronaldshay's *Heart of Âryâvarta* [1925]). Yet he was sufficiently interested in the shaping of political reforms on western lines to participate in discussions leading to a joint address of Europeans and Indians to the Secretary of State and the Viceroy in Nov. 1917 *(see* Lionel Curtis, *Diarchy,* 1920).

Das became an influential though not always tractable supporter of M. K. Gandhi in the non-cooperation movement launched in the autumn of 1918. He abandoned general practice, though he continued to defend political offenders, took to the wearing of *khadar* (homespun cloth) and lived in the utmost simplicity. Late in 1921 the "volunteer" movement was proscribed in Bengal, as in other provinces. On Dec. 10. some days before Das was due to preside at the Indian National Congress at Ahmadābād he was arrested for issuing a public appeal for the proscribed organization, and was sentenced to six months' imprisonment. Mrs. Das, who was in thorough sympathy with her husband's views, was arrested, but by order of the governor, Lord Ronaldshay, was speedily released. Das presided at the National Congress at Gaya in Dec. 1922, and endeavoured to secure revocation of previous resolutions against entering the Legislatures, suggesting obstructive tactics in place of boycott. The controversy sharply divided the non-cooperationists, but with the decline of Gandhi's influence the Das policy gained ground, and influenced the second general election (1923) under the Reforms; Das was elected to the Bengal Council by more than one constituency. In the following April Das was elected the first mayor of Calcutta.

In the Bengal Legislature Das did not command a clear majority, but he was able to bring pressure both on the Independents and the Mohammedans, to whom he suggested a pact by which a substantial proportion of elective seats and public appointments would be reserved for them in the event of Swarajist success. He secured a bare majority on March 24, 1924, for refusal of the salaries of Ministers appointed provisionally by Lord Lytton. Lord Lytton's offer of a ministership to Das was refused after some hesitation. Das offered vehement opposition to the Bengal Criminal Law Amendment Ordinance (Oct. 25,1924) subsequently embodied in a certified Act under which 110 persons, some of them associates of Das, were kept in imprisonment for terrorist conspiracy. His refusal of office and command of votes in the Legis-

lature led to the suspension of the diarchical system in Bengal, all transferred subjects being taken over by the executive government.

At the Bengal Provincial conference at Faridpur, early in May 1925, Das modified his position, and a resolution was passed condemning revolutionary tactics. There can be no doubt that the connection between the Terrorists and the Swarajists under Das was more than mere sympathy of the latter for the former. While each party had its own separate aims, each was working to use and assist the other in so far as it was useful for the attainment of its own ends.

The secretary for India in the first Labour government, Lord Olivier, stated in debate (July 21, 1924) that he was informed by a high authority in Indian politics that Das had "the reputation of being a particularly upright and scrupulous politician second only to Gandhi himself in saintliness of character." Undoubtedly, the Indian mind was impressed by the great personal sacrifices of Das for the Swaraj cause, and by his courage in act and utterance. In resource and driving power he stood high above his associates. He was skilful in swaying Bengali audiences and individuals, being capable both of playing upon their weaknesses and appealing to what was best in them. But his vision of India under Sm-araj as a conglomeration of semi-autonomous villages had no relation to the hard facts that make centralization inevitable.

There is reason to believe that Das was gaining a fresh outlook, more tolerant of western ideas, in the closing months of his life. He was at Darjeeling in search of health when he died from heart failure followuing diabetes, on June 16, 1925.

Das' book, India for *Indians* (1918), gives extracts from speeches. A substantial volume of Speeches (some translated from Bengali) was published in Calcutta, 1918. The Way to *Swaraj* (1923) gives the speeches made during a tour in southern India, and expounding, according to the prefatory note, "the whole of Desabandhu's philosophy of Indian Nationalism." This philosophy is discussed with penetrating insight in Lord Ronaldshay's hooks: India: *A* Bird's-eye View (1924) and *The Heart* of *Âryâvarta* (1925). See also Life and *Times* of C. R. Das by P. C. Ray, 1928.

DASEWRA (DUSSERA), the "ten days" (or nine nights) festival of the modern Hindus; also called in Bengal the Durga-puja. It celebrated the close of the rainy season and the opening of the season for warlike activities; but is now observed merely as a festival.

DASWKOV, CATHERINA ROMANOVNA VORONTSOV, PRINCESS (1744–1810), Russian *littérateur,* was the third daughter of Count Roman Vorontsov. (For the family see VORONTSOV.) She studied mathematics at the University of Moscow, and became one of the leaders of the party that attached itself to the grand duchess (afterwards empress) Catherine. Before she was 16 she married Prince Mikhail Dashkov and went to reside with him at Moscow. In 1j62 she was at St. Petersburg (Leningrad) and took a leading part, according to her own account the leading part, in the coup d'e'tat by which Catherine was raised to the throne. (See CATHERINE II.) Another course of events would probably have resulted in the elevation of the Princess Dashkov's elder sister, Elizabeth, who was the emperor's mistress, and in whose favour he made no secret of his intention to depose Catherine. Her relations with the new empress were not cordial and she set out in 1j68 on an extended tour through Europe. In Paris she secured the warm friendship and admiration of Diderot and Voltaire. She corresponded with Garrick, Dr. Blair and Principal Robertson In 1782 she returned to the Russian capital, where she was appointed *directeur* of the Academy of Arts and Sciences, and in 1784 the first president of the Russian academy founded at her suggestion She projected the Russian dictionary of the academy, arranged its plan, and executed a part of the work herself. She edited a monthly magazine; and wrote at least two dramatic works, The *Marriage* of Fabian, and a comedy entitled Toissiokoff. Shortly before Catherine's death she retired from court.

On the accession of the emperor Paul in 1796 she was deprived of all her offices. and ordered to retire to a village in the government of Novgorod, "to meditate on the events of 1762." But she pnssed the closing years of her life on her estate near Moscow, where she died on Jan. 4, 1810.

The *Memoirs* of the Princess *Dashkoff* Written by Herself were composed in English and published in London (2 vols., 1840). They were edited by Mrs. W. Bradford, who, as Miss Wilmot, had resided with the princess between 1803 and 1808, and had suggested their preparation.

DASS, PETTER (1647–1708), the "father" of modern Norwegian poetry, was the son of a Scottish merchant, Peter Dundas, settled in Bergen. He was born on the island of Nord Hero, on the north coast of Norway, studied at Copenhagen, and was ordained priest in 1672. In 1689 be received the important living of Alstahoug in the north of Norway, with jurisdiction over the neighbouring districts. His writings passed in ms. from hand to hand, and few of them were printed in his lifetime. *Nordlands* Trompet (The Trumpet of Nordland), his greatest and most famous poem, was not published till 1739; Den norska Dale-Vise (The Norwegian Song of the Valley) appeared in 1696; the *Aandelig* Tidsfordriv (Spiritual Pastime), a volume of sacred poetry, was published in 1711.

The *Trumpet* of Nordland remains as fresh as ever in the memories of the inhabitants of the north of Norway; boatmen, peasants, priests will alike repeat long extracts from it at the slightest notice, and its popularity is unbounded. It is a rhyming description of the province of Nordland, its natural features, its trades, its advantages and its drawbacks, given in dancing verse of the most breathless kind, and full of humour, fancy, wit and quaint learning.

The collected writings of Dass were edited (3 vols., Christiania, 1873–77) by Dr. A. E. Eriksen.

DASYURE, a name for any member of the family *Dasyuridae* (see MARSCPIALIA). The name is better restricted to animals of the typical genus Dasyurus. These are mostly inhabitants of the Australian continent and Tasmania. They hide themselves in the daytime in holes among rocks or in hollow trees, but prowl about at night in search of the small mammals and birds which constitute their prey. In arboreal species there are transversely striated pads on the feet; these are absent in terrestrial forms such as the common dasyure (D. *viverrinus*). The ursine dasyure (*Sarcophilus* ursinus), often called the "Tasmanian Devil," constitutes a distinct genus. In size it may be compared to an English badger. The general colour of the fur is black tinged with brown, with white patches on the neck, shoulders, rump and chest.

It is a burrowing animal, nocturnal and carnivorous, and commits great depredations on the sheepyards and poultry-lofts of the inhabitants.

DATE LINE: see INTERNATIONAL DATE LINE.

DATE PALM. The dates of commerce are the fruit of a species of palm, Phoenix *dactylifera,* a tree which ranges from the Canary Islands through northern Africa and the southeast of Asia to India. For an illustration of this tree see PALM. It has been cultivated and much prized as the staple food and chief source of wealth in the irrigable desert portions of most of these regions from the remotest antiquity. Iraq (Mesopotamia) is the leading date growing country in the world and supplies most of the fruit exported to Europe and America. Although high summer temperatures and low humidity during the ripening season are required for successful fruit production, the palm itself wiil grow in any tropical or subtropical region where prolonged temperatures below 20° F. are not of frequent occurrence. Along the Mediterranean shores of Europe the date palm is grown as an ornamental and used to supply leaves for the festival of Palm Sunday among Christians, and for the celebration of the Feast of Tabernacles by Jews. It was carried to the new world by Spanish missionaries in the 18th and early 19th centuries and a few seedling plantings of date palms in the dry districts of Mexico date back to that period. Early in the 20th century some of the better varieties of the old world were introduced into the southwestern United States and are being cultivated on a commercial scale. In 1941 there were approximately 500 ac. of dates in Arizona and 3300 ac. in southern California, of which 3000 were in Coachella valley, 140 mi. S.E. of Los Angeles. The leading varieties grown in the United States are Deglet Noor from

Algeria, Saidy from Egypt, and Khadrawy, Zahidi and Halawy from Iraq.

The date palm is a beautiful tree, growing to a height of from 60 ft. to 80 ft. and its stem, which is strongly marked with the pruned stubs of old leaf bases, terminates in a crown of graceful, shining, pinnate leaves, 10 ft. to 20 ft. long. The flowers are of separate sexes borne on different palms in branching spadices from the axils of leaves which emerged the previous year. Under cultivation it is necessary to pollinate the female flowers by artificial means. The fruit is a one-seeded berry, usually more or less oblong, but varying much in shape, size, colour, quality and consistency of flesh according to variety and cultural conditions. A single large bunch may carry over 1000 fruits weighing 20 lbs. or more. The dried fruit so widely exported contains more than half its weight of sugar and about 2% each of protein, fat and mineral matter.

Propagation is either from seeds or from suckers or offshoots which arise chiefly near the base of the stem in the early years of the palm's life.

Palms grown from seed are a source of new varieties but extremely variable and about equally divided as to number of males and females.

Offshoots reproduce the sex and character of the parent palm and are used for commercial plantings. When offshoots are 3–6 yrs. old and have formed roots of their own they are removed and planted. Palms are spaced about 30 x 30 ft.; they begin to bear in 5 or 6 yrs. and reach full bearing at 10 to 15 yrs., yielding 100 to 200 lbs. or more each. Although palms are known to live as long as 150 yrs., fruit production declines, and in commercial culture palms are replaced at a much earlier age.

All parts of the date palm yield products of economic value to the old world areas where it is grown. Its trunk furnishes timber for house-building; the midribs of the leaves supply material for crates and furniture; the leaflets for basketry; the leaf bases for fuel; the fruit stalks for rope and fuel; the fibre for cordage and packing material; the seeds are sometimes ground and used for stock feed; vinegar and a strong liquor are made from the fermented fruit.

Date sugar is a valuable commercial product of India, obtained from the sap or toddy of *Phoenix sylvestris,* another species very closely related to the date palm. The juice, when not boiled down to form sugar, is either drunk fresh, or fermented and distilled to form an alcoholic drink. *Date palm meal* is obtained from the stem of a small species, *Phoenix farinifera,* growing in the hill country of southern India.

For further details *see* Sir *G.* Watt, *Dictionary of the Economic Products of India* (1892); *The Date Palm,* U.S. Department of Agriculture, Bureau of Plant Industry, Bulletin No. 53 (W. T. Swingle), 1904; and Reports of the Annual Date Growers' Institutes, Indio, Calif., yearly since 1924. (R. W. N.)

DATIA, an Indian state in the Bundelkhand agency. It lies in the extreme northwest of Bundelkhand, near Gwalior, and is surrounded on all sides by other states of central India, except on the east where it meets the United Provinces. The state came under the British government after the treaty of Bassein in 1802, and was settled with the present family by treaties in 1804, and 1818. Area, 911 sq.mi.; pop. (1931) 158,834. The chief, whose title is maharaja, is a rajput of the Bundela clan, being descended from a younger son of a former chief of Orchha; his salute is 11 guns. The town of Datia (pop. 18,292 in 1931) is surrounded by a stone wall, enclosing handsome palaces, with gardens; the palace of Bir Singh Deo, of the 17th century, is "one of the finest examples of Hindu domestic architecture in India" and is now untenanted.

DATIVE, the name, in grammar, of the case of the "indirect object," the person or thing to or for whom or which anything is given or done (Lat. *dativus,* giving or given, from *dare,* to give). In law, the word signifies something, such as an office, which may be disposed of at will. In Scots law the term signifies "appointed or granted by a court." In Roman law, a *tutor* was either *dativus,* if expressly nominated in a testament, or *optivus,* if a power of selection was given.

DATO, EDUARDO (1856–1921), Spanish politician, was born at Corunna on Aug. 12, 1856. He graduated in law at Madrid university and was elected deputy in 1884. Under-secretary for the home department in 1892, he became minister for the department in 1899, and promoted bills regarding accidents, insurance and women's labour. In Dec. 1902 he became minister of justice, in 1907 mayor of Madrid and then president of the chamber. He belonged to the "liberal-conservative" variety of the conservative party, which his friend and political chief Silvela had represented, and after Silvela's death continued to maintain this attitude. When in 1913 Señor Maura refused to take power, Señor Dato dissented from his chief, carrying with him the majority of his party, which elected him as its leader. When World War I broke out, he was responsible for Spain's declaration of neutrality. Becoming prime minister again in June 1917, he faced with determination the revolutionary outbreaks and disturbances of that summer. He resigned in October, but in 1920 resumed office, and while prime minister was murdered in Madrid on March 8, 1921.

DATOLITE, a mineral species consisting of basic calcium and boron orthosilicate, $Ca(BOH)SiO_4$. It is white or colourless. often with a greenish tinge, and may be either transparent or opaque; it usually occurs as well-developed monoclinic crystals bounded by numerous bright faces, many of which often have a more or less pentagonal outline, but also as masses with a granular to compact texture, the fractured surfaces having the appearance of porcelain when the mineral is compact. Hardness $5–5\frac{1}{2}$; specific gravity 3.0.

Datolite is a mineral of secondary origin, and in its mode of occurrence it resembles the zeolites, being found with them in the amygdaloidal cavities of basic igneous rocks such as basalt; it is also found in gneiss and serpentine, and in metalliferous veins and in beds of iron ore. At Arendal in Norway, the original locality for both the crystallized and botryoidal, or fibrous variety (known also as botryolite), it is found in a bed of magnetite. In amygdaloidal basaltic rocks it is found at Bishopton in Renfrewshire and near Edinburgh; and as excellent crystallized specimens at several localities in the United States.

DATURA: *see* STRAMONIUM.

DAUB, KARL (1765–1836), German Protestant theologian. was born at Cassel on March 20, 1765. He studied at Marburg, and in 1795 became professor ordinarius of theology at Heidelberg, where he died on Nov. 22, 1836. Daub sought to bring about a speculative reconstruction of orthodox dogma, but he unfortunately ignored historical criticism. His *Lehrbuch der Katechetik* (1801) was written under the spell of Kant, his *Theologumena* (1806), his *Einleitung* in *das Studium der christl. Dogmatik* (1810), and his *Judas Iscarioth* (2 vols., 1816), in the spirit of Schelling, while *Die dogmatische Theologie jetziger Zeit* (1833), and *Vorlesungen über die Prolegomena zur Dogmatik* (1839) are Hegelian in principle.

See Rosenkranz, *Erinnerungen an Karl Daub* (1837); F. Lichtenberger, *History of German Theology* (1889); *O.* Pfleiderer, *Development of Theology* (1890).

DAUBENTON, LOUIS-JEAN-MARIE (1716–1800), French naturalist, was born at Montbar (Côte d'Or). In 1741 he graduated in medicine at Reims, and returned to his native town with the intention of practising, but Buffon invited him to provide the anatomical descriptions for his treatise on natural history. His details of the dissection of 182 species of quadrupeds in Buffon's work brought him great reputation; but a feeling of jealousy induced Buffon to dispense with his services in the remainder of the treatise. Daubenton now occupied himself with zoological descriptions and dissections, the comparative anatomy of recent and fossil animals, vegetable physiology, mineralogy, experiments in agriculture, and the introduction of the merino sheep into France. In 1744 he was appointed keeper and demonstrator of the cabinet of natural history in Paris, and from 1775 lectured on natural history in the college of medicine, and in 1783 on rural economy at the Alfort school. He was also professor of mineralogy at the Jardin du Roi. In Dec. 1799 he was appointed a member of the senate.

Daubenton died in Paris on Jan. 1, 1800.

DAUBENY, CHARLES GILES (1795–1867), English scientist born at Stratton, Gloucestershire, on Feb. 11, 1795, studied medicine. He was professor of chemistry (1823–j's), and of botany (1834–67) at Oxford, and carried out numerous experiments on the effect of changes in soil, light, etc., on plants. He also made an extensive survey of the volcanoes of Europe, the results of which are embodied in his Description of Active and *Extinct Volcanoes* (1826; 2nd ed., 1848). He died at Oxford on Dec. 12, 1867.

DAUBIGNY, CHARLES FRANÇOIS (1817–1878), French landscape painter, allied in several ways with the Barbizon school, was born in Paris, on Feb. 15, 1817, but spent much time as a child at Valmondois, a village on the Oise to the north-west of Paris. Daubigny was the son of an artist, and most of his family were painters. He studied in Italy and painted for nearly two years; he then returned to Paris, not to leave it again until, in 1860, he took a house at Auvers on the Oise. By 1837 Daubigny had become famous as a river and landscape painter, althcugh he had been devoting himself as well to drawing in black-and-white, to etching, wood engraving and lithography. In 1855 his picture, "Lock at Optevoz," in the Louvre, was purchased by the State. He visited London more than once, and spent some time in Holland. He died in Paris on Feb. 19, 1878. Daubigny is chiefly preferred in his riverside pictures, of which he painted a great number, but although there are two landscapes by Daubigny in the Louvre, neither is a river view. They are for that reason not so typical as many of his smaller Oise and Seine pictures. Among his most ambitious canvases are: "Springtime" (1857), in the Louvre; "Borde de la Cure, Morvan" (1864); "Villerville sur Mer" (1864); "Moonlight" (1865); "Andrésy sur Oise" (1868); and "Return of the Flock—Moonlight" (1878).

His followers and pupils included his son Karl (who painted so well that his works are occasionally mistaken for those of his father, though in few cases do they equal his father's mastery), Oudinot, Delpy and Damoye. The works of Daubigny are, like Corot's, to be found in many modern collections.

See Fred Henriet, C. Daubigny et son oeuvre (1878); Albert Wolff, La *Capitale* de *l'art*: Ch. *François Daubigny* (1881); J. Claretie, Peintres et *sculpteurs* contemporains: Daubigny (1882); D. Croal Thomson, The *Barbizon* School of Painters (1890); J. W. Mollett, Daubigny (1890).

DAUBLER, THEODORE (1876–1934), German writer, was born in Trieste on Aug. 17, 1876, son of a merchant family. With the appearance of Das Nordlicht (1910) Daubler took his place at the head of the German expressionist movement. Das Nordlicht is a massive religious allegory showing the author's own path from agnosticism to mystic religion, under an epic-heroic disguise. Other characteristic poetical works are Der *Sternhelle* Weg (1913), Das Sternenkind (1916) and Die *Treppe zum* Nordlicht (1920), Attische Sonette (1924); prose works, *Mit silberner* Sichel (1921); *Wir wollen* nicht verweilen (autobiographical fragment, 1916); Der neue *Standpunkt* (artistic criticism, 1916); *Lucidarium* in arte *musica* (musical criticism, 1917); Ein *Kampf um* die *moderne Kunst.* Daubler was remarkably successful in giving his thought clear and often melodious expression, but his original work, possibly owing to its Latin forms, was slow in achieving wide popularity in Germany. His influence as a critic of expressionist music and poetry was, however, very great. In 1928 he was elected a member of the German Academy of Letters.

DAUDET, ALPHONSE (1840–1897), French novelist, was born at Nimes on May 13, 1840, the son of a silk manufacturer. The lad, amid much truancy, had but a depressing boyhood. In 1856 he left Lyons, where his schooldays had been mainly spent, and began life as an usher at Alais, in the south. The position proved to be intolerable. On Nov. 1, 1857, he abandoned teaching, and took refuge with his brother Ernest in Paris. Alphonse wrote poems, shortly collected into a small volume Les *Amoureuses* (1858), which met with a fair reception, obtained employment on the Figaro, and wrote two or three plays. The duc de Morny appointed him to be one of his secretaries—a post which he held till Morny's death in 1865.

In 1866 appeared Lettres de mon *moulin.* The first of his longer books, Le petit chose (1868), the pathetic story of his own earlier years, is told with much grace and pathos. The year 1872 produced the famous *Aventures prodigieuses* de *Tartarin* de *Tarascon,* and the three-act piece *L'Arlésienne. Fromont jeune et Risler aîné* (1874) struck a note, not new certainly in English literature, but comparatively new in French. Here was a writer who possessed the gift of laughter and tears, a writer not only sensible to pathos and sorrow, but also to moral beauty. Jack, the story of an illegitimate child, a martyr to his mother's selfishness, followed in 1876. Other novels followed: Le Nabab (1877), Les *Rois en exil* (1879), *Numa* Roumestan (1881), Sapho (1884) and *L'Immortel* (1888). Daudet then wrote his own reminiscences in Trente *ans* de Paris (1887) and Souvenirs d'un *homme* de leftres (1888). These, with the three Tartarins—Tartarin the mighty hunter, Tartarin the mountaineer, Tartarin the colonist—and the admirable short stories, written for the most part before he had acquired fame and fortune, constitute his life work.

Though Daudet defended himself from the charge of imitating Dickens, it is difficult altogether to believe that so many similarities of spirit and manner were quite unsought. What, however, was purely his own was his style. It is a style that may rightly be called "impressionist," full of light and colour, not descriptive after the old fashion, but flashing its intended effect by a masterly juxtaposition of words that are like pigments. Nor does it convey, like the style of the Goncourts, to whose work it owed something, a constant feeling of effort. It is full of felicity and charm—*un charmeur* Zola has called him. An intimate friend of Edmond de Goncourt (who died in his house), of Flaubert, of Zola, Daudet belonged essentially to the naturalist school of fiction. His own experiences, his surroundings, the men with whom he had been brought into contact, various persons who had played a part, more or less public, in Paris life—all passed into his art. But he vivified the material supplied by his memory. His world has the great gift of life. *L'Immortel* is a bitter attack on the French Academy, to which august body Daudet never belonged.

Daudet wrote some charming stories for children, among which may be mentioned La Belle Nivernaise, the story of an old boat and her crew. His married life—he married in 1867 Julia Allard—seems to have been singularly happy. There was perfect intellectual harmony, and Madame Daudet herself is known by her Impressions de *nature* et *d'art* (1879), *L'Enfance d'une* Parisienne (1883), and by some literary studies written under the pseudonym of Karl Steen. In his later years Daudet suffered from insomnia, failure of health and consequent use of chloral. He died in Paris on Dec. 17, 1897.

The story of Daudet's earlier years is told in his brother Ernest Daudet's *Mon frère* et moi. There is a good deal of autobiographical detail in Daudet's *Trente ans* de Paris and Souvenirs d'un *homme* de *lettres,* and also scattered in his other books. The references to him in the Journal des *Goncourt* are numerous. See also L. A. Daudet, Alphonse Daudet (1898), and biographical and critical essays by R. H. Sherard (1894); by A. Gerstmann (1883); by B. Diederich (1900); by A. Hermant (1903), and a bibliography by J. Brivois (1895); also The Works of *Alphonse* Daudet, translated by L. Ensor, H. Frith, E. Bartow (1902, etc.). Criticism of Daudet is also to be found in F. Brunetière, Le Roman naturaliste (new ed., 1897); J. Lemaitre, Les *Contemporains* (vols. ii. and iv.); G. Pellissier, Le Mouvement *littéraire* au *XIXe siècle* (1890); A. Symons, Studies in Prose and Verse (1904).

DAUDET, LÉON (1867–1942), French man of letters and politician, born in Paris Nov. 16, 1867, son of Alphonse Daudet (*q.v.*) He married a granddaughter of Victor Hugo, whom he subsequently divorced. His violent opposition to the Government permitted him to display his talents as a controversialist. He wrote for Le *Gaulois* and Le Figaro, and also for La *Libre* Parole, a violently anti-semitic paper, in the columns of which he was able to give full vent to his fiery temperament. Influenced by the writer, Charles Maurras, he adopted the doctrines of neo-royalism. At the time of the Dreyfus case, through the generosity of Madame de Loynes, the royalist paper, Action *Française,* was founded in 1899, afterwards appearing as a daily newspaper in 1908. The lucidity and force of his literary style, the wealth of his invective, often highly-coloured, combined to make him read and

feared for 20 years. He was elected to the Chamber as a deputy for Paris in 1919, but was defeated in 1924. With the establishment of peace his influence declined. In the summer of 1925 the death of his young son, Philippe, caused a great sensation. The finding of the judicial enquiry was that he had committed suicide, but Leon Daudet conducted a long and violent campaign to prove that he had, in fact, been murdered. He accused the chauffeur, in whose taxi his son had been found dead from a bullet wound, of complicity. The chauffeur prosecuted him, and Daudet was condemned to prison and ordered to pay heavy compensation. He was imprisoned in the *Santé* at Paris, from which he was rescued in 1927 by a ruse of royalists, who made the governor of the prison believe he had been pardoned; Daudet fled to Belgium.

The best of Daudet's novels are: *L'astre noir* (1893); *Les Morticoles* (1894); *Le voyage de Shakespeare* and *Sylla et son destin* (1922). Among his philosophical and controversial works may be mentioned *L'Hérédo* (1916); *Le monde des images* (1919); *L'avant-guerre* (1913); *Le stupide XIXe siècle* (1922); and *Souvenirs* (1914). Daudet died July 1, 1942.

DAUGAVPILS (Dvinsk), a town of Latvia in 55° 53' N., 26° 32' E. on the Daugava (Western Dvina). Pop. (1939) 41,160. Formerly a Russian fortress, it was later the training centre for the Lettish army. The Livonian Knights of the Sword founded a fort 12 mi. farther up the river, which was removed to its present site by Stephen Bathori, King of Poland, in 1582. Poland, Sweden and Russia alternately occupied this strategic border fort until the partition of Poland gave it to Russia in 1772. The French occupied it in 1812 and it was a centre of strife in both World Wars I and II. The population and industry (particularly timber) were diminished as a result of war and political shifts. (*See* LATVIA.)

DAULATABAD, hill-fortress, Hyderabad State, India, about 10 m. N.W. of the city of Aurangabad. The former city of Daulatabad (Deogiri) has shrunk to a village though its magnificent fortress and remains of public buildings survive. The fortress, on a conical rock, crowns a hill rising steeply from the plain to a height of some 600 ft. The outer wall, $2\frac{3}{4}$ m. in circumference, once ecclosed the ancient city of Deogiri (Devagiri), and between this and the base of the upper fort are three lines of defences. The only access to the summit is by a narrow bridge, with passage for two men abreast, and a long gallery, excavated in the rock, with a steep stair midway, the top of which is covered by a grating destined in time of war to form the hearth of a huge fire kept burning by the garrison above. The remarkable Chand Minar in Daulatabad, a tower 210 ft. high and originally covered with Persian glazed tiles, was erected in 1445 by Ala-ud-din Bahmani to commemorate his capture of the fort. The Chini Mahal, or China Palace, is the ruin of a building in which Abul Hasan, the last of the Kutb Shahi kings of Golconda, was imprisoned by Aurangzeb in 1687.

Deogiri is said to have been founded *c.* A.D. 1187 by Bhillama I. who renounced his allegiance to the Chalukyas and established the power of the Yadava dynasty in the west. In 1294 the fort was captured by Ala-ud-din Khilji, and the rajas were reduced to pay tribute. The tribute fslling into arrear, Deogiri was again occupied by the Mohammedans, and in 1318 the last raja, Harpal, was flayed alive. Deogiri now became an important base for Muslim expeditions southwards, and in 1339 Mohammed ben Tughlak Shah made it his capital as Daulatabad ("Abode of Prosperity"), and made arrangements for transferring to it the population of Delhi, but troubles summoned him north; during his absence the Muslim governors of the Deccan revolted, and Daulatabad itself was taken by Zafar Khan, governor of Gulbarga. Later it fell into the hands successively of the Nizam Shahis, the emperor Akbar, the Shah of Ahmednagar, the Nizam Shahi usurper, Malik Amber, Shah Jehan, the Mogul emperor and the Nizam of Hyderabad, who took it after the death of Aurangzeb. Its glory, however, had already decayed owing to the removal of the seat of government by the emperors to Aurangabad.

DAUMER, GEORG FRIEDRICH (1800–1875), German writer on religion, was born on March 5, 1800, at Nuremberg arid died on Dec. 13, 1875, at Wurzburg. He was educated at Erlangen and Leipzig, and, forsaking his early pietism, violently opposed Christianity, especially in his *Die Geheimnisse des christlichen Altertums* (1847). After the publication of *Religion des neuen Weltalters,* 3 vols. (1850), Daumer approached Mohammedanism in his poems, *Mahomet* (1848) and *Liederblüten der Hafis* (1846–51). He became a Catholic in 1859, and wrote Das *Wunder* (1874) and *Kaspar Hauser, sein Wesen, seine Unschuld* (1873).

DAUMET, PIERRE JEROME HONORÉ (1826–1911), French architect, member of the Académie des Beaux-Arts, was born on Oct. 23, 1826, in Paris. He entered the École des Beaux-Arts in 1846, and in 1855 was awarded the Prix de Rome. In 1861 he was sent on an archaeological expedition to Macedonia, and published, in collaboration with Léon Henzey, an important work on the researches in Thessaly, Thrace and Illyria. He was entrusted with the restoration of many monuments of French architecture, in particular the castle of Chantilly, the Palais de Justice, Paris, and the theatre at Orange. In Nov. 1884 Daumet undertook the construction of the Église du Sacré-Coeur on Montmartre, which had already been begun by the architect Abbadie; but the following year he abandoned the task, after a dispute with the ecclesiastical authorities. He died in Paris on Dec. 15, 1911.

DAUMIER, HONORÉ (1808–1879), French caricaturist and painter, was born at hfarseilles on Feb. 20, 1808, and died at Valmondois on Feb. 11, 1879. Daumier started his artistic career by producing plates for music publishers and illustrations for advertisements; these were followed by anonymous work for publishers, in which he followed the style of Charlet and displayed considerable enthusiasm for the Napoleonic legend. When, in the reign of Louis Philippe, Philipon launched the comic journal, La *Caricature,* Daumier joined its staff, which included Devéria, Raffetand Grandville, and started upon his pictorial campaign of scathing satire upon the foibles of the bourgeoisie, the corruption of the law and the incompetence of a blundering Government. His caricature of the king as "Gargantua" led to imprisonment for six months at Ste. Pélagie in 1832. The publication of *La Caricature* was discontinued soon after, but Philipon provided a new field for Daumier's activity when he founded the *Charivari.* For this journal Daumier produced his famous social caricatures in which bourgeois society is held up to ridicule in the figure of Robert Macaire, the hero of a then popular melodrama. Another series, "L'histoire ancienne," was directed against the pseudo-classicism which held the art of the period in fetters. In 1848 Daumier embarked again on his political campaign still in the service of *Charivari,* which he left in 1860 and rejoined in 1864. In spite of his prodigious activity in the field of caricature — the list of Daumier's lithographed plates compiled in 1904 numbers no fewer than 3,958 — he found time for flight in the higher sphere of painting. Except for the searching truthfulness of his vision and the powerful directness of his brushwork, it would be difficult to recognize the creator of "Robert Macaire," of "Les Bas bleus," "Les Bohémiens de Paris," and the "Masques," in the paintings of "Christ and His Apostles" at the Ryks Museum in Amsterdam, or in his "Good Samaritan," "Don Quixote and Sancho Panza," "Christ Mocked," or even in the sketches in the Ionides Collection at South Kensington. But as a painter, Daumier, one of the pioneers of naturalism, was before his time, and had little success until in 1878, a year before his death, when M. Durand-Ruel collected his works for exhibition at his galleries and demonstrated the full range of the genius of the man who has been well called the Michelangelo of caricature. At the time of this exhibition Daumier, totally blind, was living in a cottage at Valmondois which was placed at his disposal by Corot, and where he breathed his last in 1879. An important exhibition of his works was held at the École des Beaux-Arts in 1900.

BIBLIOGRAPHY.—*See* Arséne Alexandre, *Honoré Daumier, l'homme et son oeuvre* (1890); Gustave Geffroy, *Daumier;* Henri Frantz and Octave Uzanne, *Daumier and Gavarni (The Studio,* 1904); *H.* Marcel, *Honoré Daumier* (1907); *A.* Ruemann, *Daumier als Illustrator* (Munich, 1919), and M. T. Sadler, *Daumier, the Man and the Artist* (1924).

DAUN (DHAUN), LEOPOLD JOSEF, COUNT VON (1705–1766), prince of Thiano, Austrian field marshal, was born at Vienna on Sept. 24, 1705. He served in Sicily (1718), in Italy and on the Rhine in the War of the Polish Succession (1734–35), against the Turks (1737–39), and in the War of the Austrian Succession (1740–42). He was present at Chotusitz and Prague, and led the advanced guard of Khevenhuller's army in the victorious Danube campaign of 1743. Field Marshal Traun, who succeeded Khevenhiiller in 1744, thought equally highly of Daun, and entrusted him with the rearguard of the Austrian army when it escaped from the French to attack Frederick the Great. He held important commands in the battles of Hohenfriedberg and Soor, and in the same year (1745) was promoted to the rank of *Feldzeugmeister*. After this he served in the Low Countries, and was present at the battle of Val. Maria Theresa made him commandant of Vienna and a knight of the Golden Fleece, and in 1754 he was elevated to the rank of field marshal.

During the interval of peace that preceded the Seven Years' War he began the reorganization of the Austrian army. He was not actively employed in the first campaigns of the war, but in 1757 he commanded the army raised to relieve Prague. On June 18, 1757, Daun defeated Frederick for the first time in his career in the desperately fought battle of Kolin (*q.v.*). The union of the relieving army with the forces of Prince Charles at Prague reduced Daun to the position of second in command, and as such he took part in the pursuit of the Prussians and the victory of Breslau. Frederick now reappeared and won the most brilliant victory of the age at Leuthen. Daun was not held accountable for the disaster, and when Prince Charles resigned his command, Daun was appointed in his place. With the campaign of 1758 began the war of manoeuvre in which Daun, if he missed, through over-caution, many opportunities of crushing the Prussians, at least maintained a steady and cool resistance to the fiery strategy of Frederick. In 1758 Major-General Loudon, acting under Daun's instructions, forced the king to raise the siege of Olmutz, and later in the same year Daun himself surprised Frederick at Hochkirch and inflicted a severe defeat upon him (Oct. 14). On Nov. 20–21, 1759, he surrounded the entire corps of General Finck at Maxen, forcing the Prussians to surrender. These successes were counterbalanced in the following year by the defeat of Loudon at Liegnitz, which was attributed to the dilatoriness of Daun, and Daun's own defeat in the great battle of Torgau (*q.v.*). In this engagement Daun was severely wounded.

He continued to command until the end of the war, and afterwards worked with the greatest energy at the reorganization of the imperial forces. In 1762 he had been appointed president of the *Hofkriegsrat*. He died on Feb. 5, 1766.

See *Der deutsche Fabius Cunctator, oder Leben u. Thaten S. E. des H. Leopold Reichsgrafen v. Dhaun K.K.F.M.* (Frankfort and Leipzig, 1759–60), and works dealing with the wars of the period.

DAUNOU, PIERRE CLAUDE FRANÇOIS (1761–1840), French statesman and historian, born at Boulogne-sur-Mer on Aug. 18, 1761, was educated in the school of the Oratorians there and joined the order in Paris in 1777. He was professor in various seminaries from 1780 till 1787, when he was ordained priest. Elected to the Convention by Pas-de-Calais, he associated himself with the Girondists, but strongly opposed the death sentence on the king. He took little part in the struggle against the Mountain, but was involved in the overthrow of his friends, and was imprisoned for a year. In December 1794 he returned to the Convention, and was the principal author of the Constitution of the year III. It seems to have been due to his Girondist ideas that the Ancients were given the right of convoking the *corps législatif* outside Paris, an expedient which made possible Napoleon's *coup d'état* of the 18th and 19th Brumaire. The creation of the Institute was also due to Daunou, who drew up the plan for its organization. His energy was largely responsible for the suppression of the royalist insurrection of the 13th Vendémiaire, and the important place he occupied at the beginning of the Directory is indicated by the fact that he was elected by twenty-seven departments as member of the Council of Five Hundred, and became its first president. He had himself set the age qualification of the directors at forty, and thus debarred himself as candidate, as he was only thirty-four. The direction of affairs having passed into the hands of Talleyrand and his associates, Daunou turned once more to literature, but in 1798 he was sent to Rome to organize the republic there, and again, almost against his will, he lent his aid to Napoleon in the preparation of the Constitution of the year VIII. He supported Napoleon's policy in the controversy with the Vatican in his *Sur la puissance temporelle du Pape* (1809). Still, he took little part in the new régime, with which at heart he had no sympathy, and turned more and more to literature. At the Restoration he was deprived of the post of archivist of the Empire, which he had held from 1807, but from 1819 to 1830 (when he again became archivist of the kingdom) he held the chair of history and ethics at the Collkge de France. In 1839 he was made a peer. He died in 1840.

Daunou's lectures at the Collkge de France, collected and published after his death, fill twenty volumes *(Cours d'études historiques,* 1842–1846). They treat principally of the criticism of sources and the proper method of writing history, and occupy an important place in the evolution of the scientific study of history in France. Personally Daunou was reserved and somewhat austere, preserving in his habits a strange mixture of bourgeois and monk. His indefatigable work as archivist in the time when Napoleon was transferring so many treasures to Paris is not his least claim to the gratitude of scholars.

See Mignet, *Notice historique sur la vie et les travaux de Daunou (1843)*; Taillandier, *Docztments biographiques sur Daunou* (1847), including a full list of his works; Sainte-Beuve, *Daunou* in his *Portraits Contemporains,* t. iii. (unfavourable and somewhat unfair).

DAUPHIN, an ancient feudal title in France, borne only by the counts and dauphins of Vienne, the dauphins of Auvergne, and from 1364 by the eldest son of the king of France. The origin of this curious title is obscure; but it now seems clear that it was in the first instance a proper name. It was borne by Guigo, or Guigue IV. (d. 1142), count of Albon and Grenoble, as an additional name, during the lifetime of his father, and was also adopted by his son Guigue V. Beatrice, daughter and heiress of Guigue V., whose second husband was Hugh III., duke of Burgundy, bestowed the name on their son André, to recall his descent from the ancient counts of Albon. His successors Guigue VI. (d. 1270) and John I. (d. 1282) call themselves sometimes Delphinus, sometimes Delphini, the name being obviously treated as a patronymic, and in the latter form it was borne by the sons of the reigning "dauphin." But even under Guigue VI. foreigners had begun to confuse the name with a title of dignity, an imperial diploma of 1248 describing Guigue as "Guigo Dalphinus Viennensis."

It was not until the marriage of Anne, heiress of John I., with Humbert, Lord of La Tour du Pin, that "dauphin" became definitely established as a title. Humbert not only assumed the name of Delphinus, but styled himself regularly Dauphin of the Viennois (Dalphinus Viennensis), and in a treaty concluded in 1285 between Humbert and Robert, duke of Burgundy, the word *delphinatus* (Dauphiné) appears for the first time as a synonym for *comitatus* (county). In 1349 Humbert II., the last of his race, sold Dauphiné to Charles of Valois, who, when he became king of France in 1364, transferred it to his eldest son. From that time the eldest sons of the kings of France were always either actual or titular dauphins of the Viennois.

The eldest son of the French king was sometimes called "the king dauphin" (*le roy daulphin*), to distinguish him from the dauphin of Auvergne, who was known, since Auvergne became an appanage of the royal house, as "the prince dauphin." The dauphinate of Auvergne, which is to be distinguished from the county, dates from 1155, when William VII., count of Auvergne, was deposed by his uncle William VIII. William VII. had married *a* daughter of Guigue IV. Dauphin, after whom their son was named Dauphin (Delphinus). The name continued, as in Viennois, as a patronymic, and was not used as a title until 1281, when Robert II., count of Clermont, in his will, styles himself for the first time Dauphin of Auvergne for the portion of the county of Auvergne left to his house. In 1428 Jeanne, heiress of the dauphin Béraud

III., married Louis de Bourbon, count of Montpensier (d. 1486), thus bringing the dauphinate into the royal house of France. It was annexed to the Crown in 1693.

See A. Prudhomme, "De l'origine et du sens des mots dauphin et dauphine" in *Bibliothdque de l'École des Chartes,* liv. *an.* 1893.

DAUPHINE, one of the old provinces (the name being still in current use in the country) of pre-Revolutionary France, in the south-east portion of France, between Provence and Savoy; since 1790 it forms the departments of the Isère, the Drôme and the Hautes Alpes.

After the death of the last king of Burgundy, Rudolf III., in 1032, the territories known later as Dauphin6 (as part of his realm) reverted to the far-distant emperor. Much confusion followed, out of which the counts of Albon (between Valence and Vienne) gradually came to the front. The first dynasty ended in 1162 with Guigue V., whose daughter and heiress, Beatrice, carried the possessions of her house to her husband, Hugh III., duke of Burgundy. Their son, André, continued the race, this second dynasty making many territorial acquisitions, among them (by marriage) the Embrunais and the Gapençais in 1232. In 1282 the second dynasty ended in another heiress, Anna, who carried all to her husband, Humbert, lord of La Tour du Pin (between Lyons and Grenoble). The title of the chief of the house was Count (later Dauphin) of the Viennois, *not* of Dauphiné. (For the origin of the terms Dauphin and Dauphin6 *see* DAUPHIN.) Humbert II. (1333–49), grandson of the heiress Anna, was the last independent Dauphin, selling his dominions in 1349 to Charles of Valois, who on his accession to the throne of France as Charles V. bestowed Dauphin6 on his eldest son, and the title was borne by all succeeding eldest sons of the kings of France. In 1422 the Diois and the Valentinois, by the will of the last count, passed to the eldest son of Charles VI., and in 1424 were annexed to the Dauphiné. Louis (1440–61), later Louis XI. of France, was the last Dauphin who occupied a semi-independent position, Dauphin6 being annexed to the crown in 1456. The suzerainty of the emperor (who in 1378 had named the Dauphin "Imperial Vicar" within Dauphin6 and Provence) gradually died out. In the 16th century the names of the reformer Guillaume Farel (1489–1565) and of the duke of Lesdiguières (1543–1626) are prominent in Dauphin6 history. The "States" of Dauphin6 (dating from about the middle of the 14th century) were suspended by Louis XIII. in 1628, but their unauthorized meeting (on July 21, 1788) in the tennis court *(Salle du Jeu de Paume)* of the castle of Vizille, near Grenoble, was one of the earliest premonitory signs of the great French Revolution of 1789. It was at Laffrey, near Grenoble, that Napoleon (March 7, 1815) was first acclaimed by his old soldiers sent to arrest him.

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DAURAT or **DORAT, JEAN** (in Lat. AURATUS) (1508–1588), French poet and scholar, and member of the Pléiade, was born at Limoges. His name was originally Dinemand. He belonged to a noble family, and, after studying at the college of Limoges, came up to Paris to be presented to Francis I., who made him tutor to his pages. As a private tutor in the house of Lazare de Baïf, he had J. A. de Baïf for his pupil. His son, Louis, showed great precocity, and at the age of ten translated into French verse one of his father's Latin pieces; his poems were published with his father's. After the death of Lazare de Baïf in 1547 Jean Daurat became the director of the Collège de Coqueret, where he had among his pupils, besides Baïf, Ronsard, Remy Belleau and Pontus de Tyard. Joachim du Bellay was added by Ronsard to this group; and these five young poets, under the direction of Daurat, formed a society for the reformation of the French language and literature. They increased their number to seven by the initiation of the dramatist Etienne Jodelle, and thereupon they named themselves La Pléiade, in emulation of the seven Greek poets of Alexandria. The election of Daurat as their president proved the weight of his personal influence, and the value his pupils set on the learning to which he introduced them, but as a writer of French verse he is the least important of the seven. Meanwhile he collected around him a sort of academy, and stimulated the students on all sides to a passionate study of Greek and Latin poetry. He himself wrote incessantly in both those languages, and was styled the Modern Pindar. His influence extended beyond the bounds of his own country, and he was famous as a scholar in England, Italy and Germany. In 1556 he was appointed professor of Greek at the Collkge Royale, a post which he continued to hold until, in 1567, he resigned it in favour of his nephew, Nicolas Goulu. Charles IX. gave him the title of *poeta regius.* His flow of language was the wonder of his time; he is said to have composed more than 15,000 Greek and Latin verses. The best of these he published at Paris in 1586 as *J. Aurati Lemovicis poëtae et interpretis regii poëmata.* He died in Paris on Nov. 1, 1588, having survived all his illustrious pupils of the Pléiade, except Pontus de Tyard. He was a little, restless man, of untiring energy, rustic in manner and appearance. His unequalled personal influence over the poets of his age gives him an importance for which his own writings do not fully account.

The *Oeuvres poétiques* in the vernacular of Jean Daurat were edited (1875) with biographical notice and bibliography by Ch. Marty-Laveaux in his *Ple'iade française.*

DAVAO, a well laid out chartered city (with administrative centre and 7 *barrios* or districts), and capital of the Province of Dávao, Mindanao, Philippine Islands, located on the Gulf of Dávao, at the mouth of the Dávao river, about 800 mi. from Manila. Pop. (1939), 95.546, of whom 170 were whites, 14,181 Japanese and 2,234 Chinese. An unusually high grade of abacá (Manila hemp) is produced and exported from the surrounding country, as well as copra; but it was the former which attracted the Japanese when its price rose to new levels during World War I. Concentrating there and then, they were by 1939 dominating the city, the hemp market, pearl fishing and other industries. It was quite natural, therefore, for the Japanese to make Dávao one of their landing places in their invasion of December 1941. The native population consists of Bisayans, Mandayas, Bagobos and Moros. Of those aged 6 to 19. 32·1% in 1939 attended school and of those ten years old and over 55·8% were literate.

DAVENANT, CHARLES (1656–1714), English economist, eldest son of Sir William Davenant, the poet, was born in London, and educated at Cheam grammar school and Balliol college, Oxford. He was member of parliament successively for St. Ives, Cornwall, and for Great Bedwyn. He held the post of commissioner of excise from 1683 to 1689, and that of inspector-general of exports and imports from 1705 till his death in 1714. He was also secretary to the commission appointed to treat for the union with Scotland. His most important works were: *Ways and Means of supplying the War* (169j); *An Essay on the East India Trade* (1697); *Two Discourses on the Public Revenues and Trade of England* (1698); *An Essay on the probable means of making the people gainers in the balance of Trade* (1699); *A Discourse on Grants and Resumptions* and *Essays on the Balance of Power* (1701).

See his *Works* edit. by C. Whitworth (1771).

DAVENANT or D'AVENANT, **SIR WILLIAM** (1606–1668), English poet and dramatist, was baptized on March 3, 1606; he was born at the Crown Inn, Oxford, of which his father, a wealthy vintner, was proprietor. It was stated that Shakespeare always stopped at this house in passing through the city of Oxford, and out of his known or rumoured admiration of the hostess, a

very fine woman, there sprang a story which attributed Davenant's paternity to Shakespeare, a legend which there is reason to believe Davenant himself encouraged. After a brief stay at Lincoln college, Oxford, Davenant became a page to the duchess of Richmond, and then entered the household of Fulke Greville, Lord Brooke. After Brooke's death he turned to the stage, his first play, *Albovine, King of the Lombards*, being produced in 1629. Other plays and masques followed, the most important of which was *The Wits*, licensed in 1633 and published in 1636. Davenant was high in favour at court, and succeeded Ben Jonson as poet laureate. Throughout the civil war Davenant supported the king. He joined Henrietta Maria in France, and was sent by her on more than one mission to England. He fought at the siege of Gloucester (1643), after which he was knighted, and returned to Paris after the battle of Naseby. He was captured by the Parliamentarians more than once. In 1650 he was at the head of a colonizing expedition to Virginia which was intercepted in the Channel. He was interned at Cowes until 1651 and was sent to the Tower to await trial for high treason. He solaced his imprisonment by the composition of his epic poem, *Gondibert*, and was released, it is said, on the personal intercession of Milton, for whom he interceded in his turn after the Restoration.

Davenant had been manager of the Drury Lane theatre when the Puritan régime put an end to dramatic performances. In 1656 he contrived to evade the law by giving semi-private representations in private houses. The first of these productions was *The First Day's Entertainment at Rutland House* (May 21, 1656), speeches for and against the drama with declamation and music. The famous *Siege of Rhodes* (Xug. 1656) followed. This was not, as sometimes stated, the first occasion in which changes of scenery were employed and women appeared on the stage, but it does mark the beginning of the change from the ancient simplicity of the English stage. To this performance was given the name "opera." In 1658 Davenant was permitted to open the Cockpit theatre in Drury Lane for historical drama, though not without some protest from Puritan sources. In 1659 he was imprisoned for complicity in the rising of Sir George Booth. At the Restoration Davenant and Killigrew received a patent to set up two companies of players, and Davenant's company became known as the duke of York's players, housed at first in Lincoln's Inn Fields. There were performed many "musical plays," and the theatre became known as the "opera."

The duke of York's players produced some of Davenant's pre-Commonwealth plays in a revised form, notably *Love and Honour* (1649), *The Wits* and *The Platonic Lovers* (1636), but many plays of Shakespeare, Jonson and Fletcher were "adapted," with considerable freedom, by Davenant for the Restoration stage. He also produced versions of various French plays.

Davenant died on April 7, 1668, and was buried in Westminster Abbey.

His works were collected in folio in 1672. *See* the edition of his *Dramatic Works*, with prefatory memoir and notes, by J. Maidment and Logan (1872–74).

DAVENBORT, CHARLES BENEDICT (1866–), American zoologist, was born at Stamford, Conn., on June 1, 1866. He graduated in 1886 at Brooklyn Polytechnic institute and, in 1889, at Harvard, from which in 1892 he received the degree of doctor of philosophy. After serving as assistant and instructor in zoology at Harvard in 1888–99, he was assistant and associate professor of zoology and embryology in the University of Chicago from 1899 to 1904 when he was made director of the station (at Cold Spring Harbor, L.I., N.Y.) for experimental evolution of the Carnegie Institution of Washington, in which he became the director of the eugenics record office and of the department of genetics (1904–34). He made valuable investigations in the breeding of animals, and in the heredity of eye. hair, and skin color, and of temperament, stature, and build in man. Among his published works are *Experimental Morphology* (1897–99), *Statistical Methods in Biological Variations* (2nd cd. 1904), *Inheritance in Poultry* (1906), *Eugenics* (1910), *Heredity in Relation to Eugenics* (1911), *Heredity of Skin Color in Negro-White Crosses* (1913), *The Feebly-Inhibited—Nomadism and Temperament* (1915), *Defects Found in Drafted Men* (1920), *Body Build and Its Inheritance* (1923), and *How We Came by Our Bodies* (1936).

DAVENPORT, EDWARD LOOMIS (1816–1877), American actor, born in Boston, made his first appearance on the stage in Providence in support of Junius Brutus Booth. Afterwards he went to England, where he supported Mrs. Anna Cora Mowatt (Ritchie) (1819–70), Macready and others. In 1854 he was again in the United States, appearing in Shakespearian plays and in dramatizations of Dickens's novels. As Bill Sikes he was especially successful and his Sir Giles Overreach and Brutus were also greatly admired. He died at Canton, Pa., on Sept. 1, 1877. In 1849 he had married Fanny Vining (Mrs. Charles Gill) (d. 1891), an English actress also in Mrs. Mowatt's company.

Their daughter FANNY (LILY GIPSY) DAVENPORT (1850–1898) appeared in America at the age of 12 as the king of Spain in *Faint Heart Never Won Fair Lady*. Later (1869) she was a member of Daly's company; and afterwards, with a company of her own, acted with especial success in Sardou's *Fédora* (1883), *Cleopatra* (1890) and similar plays. Her last appearance was on March 25, 1898, shortly before her death.

DAVENPORT, ROBERT (fl. 1623–1639), English dramatist, of whose life nothing is known. Three plays of his have survived, *King John and Matilda* (printed 1655); and two comedies, *The City-Nightcap*, (licensed in 1624, but not printed until 1661), and *A New Tricke to Cheat the Divell* (printed 1639). Other plays entered in the Stationers' Register as Davenport's are lost, including one called *Henry I. and Henry II.* (1653), the second part of which was said to be the work of Davenport and Shakespeare.

Davenport's plays were reprinted by A. H. Bullen in *Old English Plays* (new series, 1890). The volume includes two didactic poems, which first saw the light in 1623.

DAVENPORT, the third largest city of Iowa, U S A , on the Mississippi river, opposite Rock Island and Moline, Ill ; the county seat of Scott county. It is on federal highways 6, 61 and 67, and is served by the Chicago, Burlington and Quincy; the Chicago, Milwaukee, St. Paul and Pacific; the Chicago, Rock Island and Pacific, and the Davenport. Rock Island and Northwestern railways; and by bus lines and barges. Land area 18.1 sq.mi. Pop. (1940) 66.039. Davenport has a beautiful location on the slope of a bluff, rising to an altitude of 561 ft. above sea level, and commanding extensive views of landscape and river scenery. There are 12 parks (one along the river front), covering 710 ac., and including two municipal golf courses, a bathing beach, tennis courts, baseball diamonds and a zoological garden. The assessed valuation of property in 1940 was $58,233,071. Davenport has ten public grade schools, three junior high, one senior high and 11 parochial schools; St. Ambrose college for young men, Marycrest college for young women, the American Institute of Commerce and the Palmer School of Chiropractic. Davenport is an Episcopal see of the Roman Catholic and the Protestant Episcopal churches. It has a large commerce, by rail and by water, shipping especially great quantities of grain and oil; and has important manufactures, including freight cars, gondolas, ready-cut houses, flour, cereal products, candy, bakery goods, cement, washing machines and agricultural implements. The output of its factories in 1940 was more than $38,000,000. Bank clearings in 1940 amounted to $315,041,297. On an island in the Mississippi opposite the city, Rock Island arsenal is the largest government arsenal in the world, with 1,000 ac Davenport was founded in 1835, under the leadership of Col. George Davenport. It was incorporated as a town in 1839 and as a city in 1851 The first bridge across the Mississippi was built at this point in 1853.

DAVENTRY (pronounced dān'trĭ or dăv'ĕn-trĭ), a market town and municipal borough in the Daventry parliamentary division of Northamptonshire, England, 73¾ mi. N.W. from London on a branch of the L.M S.R. from Weedon. Population (1938) 3,703. Area 5 sq mi. Daventry is situated on a sloping site in a rich undulating country. The parish church of Holy Cross was rebuilt in 1752 Borough hill, adjoining Daventry, is the site of a vast ancient earthwork, more than two miles in circumference and en-

closing a superficial area of 150 ac. Other remains have been found at Burnt Walls in the vicinity; Watling street passes close by. Daventry grammar school (1576), enlarged and modernized, is a mixed secondary school under the county council. The chief industry of the town is the manufacture of boots and shoes. The making of whips is an extinct craft. Daventry became an important wireless centre after 1925, when the British Broadcasting corporation established on Borough hill a high-power station (5 XX) which assumed the functions formerly performed through Chelmsford. In 1927 a second station (5 GB), largely for experimental purposes, was installed, but it also took the place of an earlier Birmingham station (IT) for the broadcasting of alternative programs. These two stations were superseded by others, including a high-power short-wave station for overseas broadcasts. The outbreak of World War II, with a consequent increase in the amount of overseas broadcasts, accelerated the steady development of this wireless centre. Power is derived from Northampton through an electricity substation built in 1925 to supply Daventry.

The large commercial post office station at Hillmorton, near Rugby, is visible from Borough hill. The borough of Daventry is under a mayor, 4 aldermen, 12 councillors, and has a court of summary jurisdiction.

Nothing is known of Daventry itself until the time of the Domesday Survey, when the manor consisting of eight hides was held by the countess Judith, the Conqueror's niece, as the widow of Waltheof, the last native earl of Northumbria, who at the Conquest held the great midland earldom of Huntingdonshire and Northamptonshire. Before the end of the century it had passed to Simon de St. Liz, whose grandson, Walter Fitz-Robert, held "of the fee of the king of Scotland," who had become possessed of the earldom of Huntingdon (*see* HUNTINGDONSHIRE and NORTHAMPTONSHIRE). Daventry was created a borough by King John, who granted to Simon, son of Walter, a market on Wednesday and a fair on St. Augustine's day. But there is no extant charter before that of Elizabeth in 1576, by which the town was incorporated under the name of the bailiff, burgesses and commonalty of the borough of Daventry. James I confirmed this charter in 1605–06, and Charles II in 1674–75 granted a new charter. The corporation was reconstituted in 1835. During the civil wars Daventry was the headquarters of Charles I immediately before the battle of Naseby. He is supposed to have slept at the Wheat Sheaf inn. The last remains of the Cluniac priory endowed by Simon de St. Liz were removed during the 19th century.

The pronunciation of Daventry as "Dane-tree," which is sanctioned by ancient local usage (*cf.* Shakespeare's "Daintry," Henry *VI.*, pt. iii., act V.), is referred by tradition to the building of the town by the Danes. Though the written element affords no definite proof of early pronunciation, the spelling "Daventrei" in Domesday is explicit, and in the legend of a seal of the Prior Nicholas (1231–64) reads "Davintre" (*Victoria County History, Northampton,* vol. ii.).

DAVEY OF **FERNHURST, HORACE DAVEY,** BARON (1833–1907), English judge, son of Peter Davey, of Horton, Bucks, was born on Aug. 30, 1833, and educated at Rugby and University college, Oxford. In 1861 he was called to the bar, and in 1875 became a Q.C. In 1880 he was returned to parliament as a Liberal, but lost his seat in 1885. On Gladstone's return to power in 1886 he was appointed solicitor general and was knighted, but had no seat in the House, being defeated at both Ipswich and Stockport in 1886; in 1888 he found a seat at Stockton-on-Tees, but lost it in 1892. As an equity lawyer Sir Horace Davey ranked among the finest intellects and the most subtle pleaders ever known at the English bar. He was standing counsel to the University of Oxford, and senior counsel to the Charity Commissioners. Among the cases in which he was engaged were the Mogul Steamship Case (1892), the trial of the bishop of Lincoln, and the Berkeley Peerage case. In 1862 he married Miss Louisa Donkin, who, with two sons and four daughters, survived him. In 1893 he was raised to the bench as a lord justice of appeal, and in the next year was made a lord of appeal in ordinary and a life peer. He died in London on Feb. 20, 1907.

DAVID, ST., the patron saint of Wales, whose feast falls on March 1. Few historical facts are known regarding the saint, although there is reason to suppose he was born c. 500 and died *c.* 600. According to his various biographers he was the son of Sandde, a prince of the line of Cunedda, his mother being Non, who ranks as a Cymric saint. He seems to have taken a prominent part in the celebrated synod of Llanddewi-Brefi (see CARDIGANSHIRE); and to have presided at the so-called "Synod of Victory" held later at Caerleon-on-Usk. At some date unknown, St. David, as *pen-escoli,* or primate of South Wales, moved the seat of ecclesiastical government from Caerleon to the remote headland of Mynyw or Menevia, which is still under the name of St. David's (*Ty-Dewi*) the cathedral city of the western see. St. David founded numerous churches throughout South Wales (53 still recall his name) but apparently he never penetrated farther north than the region of Powys, although he seems to have visited Cornwall. His shrine at St. David's became a notable place of pilgrimage, and at Henry I.'s request he was formally canonized by Calixtus II. about 1120.

The earliest known biography is that of Rhygyvarch (d. 1099), one of the last British bishops of St. David's, from whose work Giraldus Cambrensis (*q.v.*) chiefly compiled an extravagant life. Rhygyvarch's Life has been edited with a translation by A. W. Wade-Evans (1914). *See* also *Catalogue of mss., books,* etc., *relating to St. David, the cathedral Church* of *St. David's,* etc. (Cardiff, 1927).

DAVID, king of Judah and Israel, was the founder of the Judaean dynasty at Jerusalem. The exact date of his reign is uncertain. It used to be reckoned from 1055–1015 B.C., but is now generally fixed at about 1010–970 B.C. Our principal source for his history is 1 Sam. xvi.–1 Kings ii. Its very extent shows how deep was the impression he made upon the mind of his people; indeed, his popularity as a national hero is one cause of the difficulty we find in reconstructing his history. Stories of exploits and incidents in his career were repeated with delight from generation to generation. Groups of these stories were collected together, and from several such sources the history of his doings was compiled. The editors have pieced their material so well together, however, that it is impossible for us to separate it with accuracy into its constituent sources. But the harmonizing has not been perfectly carried out, and the inconsistencies and duplications have enabled the critics to separate more or less clearly at least two main sources. The Greek text, again, varies very considerably from the Hebrew, offering a different collection of the narratives. For detailed discussion of these problems the commentaries on Samuel, and SAMUEL (BOOKS OF) should be consulted. Another history of David is to be found in 1 Chron. xi.–xxix., which is to some extent parallel to that in Samuel but omits many of the narratives. On the other hand it contains much additional material, which is, however, of inferior historical value. It is much fuller on subjects which were the special concern of the editor of Chronicles, such as details of temple arrangements and lists of officers. It is particularly interesting because of its obvious tendency to idealize the character of David, and in this respect was the late stage of a process which must have begun soon after the death of the national hero, and of which we find traces even in Samuel.

The history in Samuel opens with an account of the anointing of David by Samuel as successor to Saul, whom Yahweh had rejected from the throne of Israel (1 Sam. xvi. 1–13). Samuel is instructed that the new king is to be found among the sons of Jesse, who dwells at Bethlehem, 5m. south of Jerusalem. A sacrifice is celebrated there, to which, beside Jesse and his sons, the elders of the town are invited. David, busy in tending the sheep, is apparently too young to be summoned with his older brothers. But when the oracle rejects each of the seven elder brothers Samuel asks whether there is no other son, and David is summoned. It is made clear that he is the chosen one, and Samuel anoints him. This narrative, which is seemingly rather the conclusion of Samuel's history than the beginning of David's, raises suspicions. It will be noted that in 1 Sam. xvii. 13 seq. the brothers of David are three in number (v. 12 is harmonistic), not seven, and in I Chron. ii. 13–15, six. It is highly improbable that the ceremony could have been performed without some news of it getting to the ears of Saul, and the later narratives seem to ignore it.

Introduction to Saul.—I Sam. xvi. 14–23 gives an account of David's introduction to the court of Saul. One of the king's attendants, when a man is sought who can play the harp to charm the moods of melancholy which have fallen upon Saul, recommends David, whom he describes not merely as a good harpist, but as "a mighty man of valour, and a man of war"—a description difficult to reconcile with the preceding narrative unless a considerable number of years be supposed to intervene. David is summoned, and his manly beauty appeals to Saul, who makes him not only court harpist but also his own armour-bearer.

The next section of the history in Samuel (xvii. 1–xviii. 5) records the most famous exploit of David, his victory in single combat over the Philistine giant Goliath, and its consequences. This account, however, raises several serious difficulties. First of all there is the fact that in 2 Sam. xxi. 19 the slaying of Goliath is attributed to Elhanan, one of David's heroes. An attempt to reconcile these contradictory statements is found in 1 Chron. xx. 5, where the victim of Elhanan's valour is described as "Lahmi, the brother of Goliath." David's exploit is not referred to in 1 Sam. xxi. 10–15, or in xxix., where some reference to it would have been expected, and on these and other grounds the simpler tradition of 2 Samuel is usually preferred. On the other hand, it may well have been some such valiant deed that first attracted Saul's attention to David (cf. xiv. 52), and accounted for the popularity of the latter which made him an object of jealousy to Saul. Hence the narrative of 1 Sam. xvii., though legendary, may be the expanded version of some historic combat in which David's opponent was not Goliath. Much more serious is the impossibility of reconciling the narrative with what precedes. Although according to xvi. Saul has already appointed David to be his musician and armour-bearer, now David appears as an untried shepherd lad, sent by his father with provisions for his brothers in the Israelite camp. His brothers treat him with a petulance hardly conceivable if he already stood well at court, and vv. 55–58 show that neither Saul nor his captain Abner had ever heard of David before. Some light is thrown upon this difficult problem by a study of the Greek versions, in one group of which, represented by the Vatican text, xvii. 12–31, 41, 50, and xvii. 55–xviii. 5 are missing. This shorter form of the tradition is much more intelligible, and more easy to reconcile with xvi. It will be seen at once that xvii. 32 follows xvii. 11 much more naturally than does v. 12. Whether the Greek or the Hebrew text is original is a much-debated problem, but on the whole it is more likely that the additional verses in the latter are expansions, taken from another biography of David, than that the Greek is an abbreviated form of the Hebrew. In xviii. 1–4 we have the first notice of the friendship that grew up between Jonathan, Saul's son, and David. The investment of David in the apparel of Jonathan may be an alternative to the exchange of blood as a symbol of brotherhood, for the clothes of a man were regarded as in a sense part of his personality. Otto Eissfeldt, however, has argued plausibly (*Theologische Blätter,* Oct. 1927) that this is part of a parallel tradition according to which David was armour-bearer and favourite, not of Saul, but of Jonathan, a theory which would explain some difficulties in the later narratives.

Conflicts with Saul.—But now Saul becomes jealous of David, because he is the popular idol and his exploits are extolled beyond those of the king. The development of this jealousy is described naturally in the shorter Greek version of xviii., according to which Saul removes David from personal attendance at the court and makes him captain of a thousand soldiers. In his new position David is very successful and his popularity increases, so that Saul becomes more alarmed than ever. Michal, Saul's daughter, falls in love with David, and Saul promises him her hand if he will attempt an almost impossible task of valour, hoping that he may be killed in the endeavour. David succeeds brilliantly and claims the king's daughter. Saul's anger now becomes a fierce hatred, and he proposes to Jonathan and the court the assassination of David (xix. 1). The additional matter in the Hebrew, which includes the incident—a double of xix. 9 *seq.*—of Saul's attempt to murder David, and his unfulfilled promise to give his daughter Merab to him, destroys the psychological truth of the narrative. The breach between Saul and David was made up, for a time, by Jonathan (xix. 2–7); but further successes of David in war reawaken the dormant hatred of Saul, who hurls a spear at David, which the latter evades. The story of Saul's attempt to have David assassinated in the house where he dwelt with Michal (xix. 11–17), which bears all the marks of truth, is out of place here, when David has already fled (v. 10), and may possibly be connected with xviii. 27 (see H. P. Smith in the *International* Critical *Commentary*).

Chapter xx., which records the covenant made by Jonathan with David and prepares the way for the story of David's kindness to Jonathan's son Meribaal, seems to be independent of the traditions in which it is embedded, and has been expanded by the additional interview between the two friends, vv. 40–42. It certainly cannot follow on xix. 18–24, the story of David's attempt to find sanctuary with Samuel at Ramah, for it supposes David to be still at court and Jonathan to be unaware that David stands in peril. This flight of David's may possibly be fitted in after xxi. 9; xx. 1 is an ineffective attempt to remove the difficulty. Next David goes to the sanctuary at Nob, where he had been wont to consult the priestly oracle (xxv. 15), and, pretending that he is engaged on a secret expedition in Saul's behalf, obtains of Ahimelech the priest bread from the sacred table and the sword of Goliath. This narrative may well follow xix. 10, the incident of David's escape from the spear hurled at him by Saul. The story goes on to relate the flight of David to the court of the Philistine king of Gath, Achish, where he escapes from the revenge which might otherwise have been taken upon him by feigning madness (xxi. 10–15). This anticipates xxvii., and is out of place at this point of the history; surely David would not go to the very city of Goliath flaunting the sword of the giant!

Outlaw Life.—For years after his escape David lived the life of an outlaw. He made his headquarters first at the stronghold—the traditional "cave" is a mistake—of Adullam, a Canaanite town said to have been captured by Joshua (Josh. xii. 15), probably on the western border of Judah, and about 12 miles from Bethlehem. Here he was joined by his clansmen and by others who were in a desperate position, such as those who feared to be sold into slavery for failure to pay their debts, until his band numbered 400 men. A probably secondary tradition xxii. 3 seq., relates that he placed his father and mother under the protection of the king of Moab. The following verse, which speaks of the seer Gad as in the company of David, is also probably a later tradition. Saul was disconcerted at this new development. His hated rival had escaped his clutches, largely through the connivance of his son. An Edomite, Doeg, who had been a concealed witness of the interview at Nob between Ahimelech and David, reported what had happened there, and Saul sent for Ahimelech. In spite of Ahimelech's protest that he had acted in all good faith with Saul, the king commanded that he and all the other priests of the sanctuary should be slaughtered. His bodyguard refusing to carry out this command, he ordered the informer to act as executioner, and Doeg slew 85 priests of Nob—a suspiciously large number. All living creatures in that town were also put to death, save Abiathar, one of Ahimelech's sons, who escaped and took refuge with David.

Presently word was brought to David that the Philistines were raiding Keilah, south of Adullam; and, despite the reluctance of his followers to undertake so desperate an enterprise, the outlaw chief, encouraged by a priestly oracle. defeated the Philistines and delivered Keilah. Probably he maintained his band by acting, at aprice, as protector of the district against such marauding attempts on the part of the Philistines and Bedouins. Saul saw an opportunity of capturing David while he was away from the protection of his stronghold and prepared to besiege him in Keilah; but David, warned by the oracle that the inhabitants of Keilah would deliver him up to Saul if he remained within their walls, dispersed his band, which had now grown to 600 men. David lived now the life of the hunted outlaw, wandering from stronghold to stronghold in the border country. Popular tradition tells in xxiii., xxiv., xxvi., of a visit of consolation from Jonathan, the attempt of the men of Ziph to betray David to Saul, and of David's magnanimity in sparing Saul's life when it was in his power to kill him, the two latter incidents appearing in duplicate. The incident of David's marriage to Abigail, the wife of a rich farmer who died a few days after he

had churlishly refused to pay David the levy for protection afforded him (xxv.), is important as showing how David maintained his band, and how he strengthened his position by matrimonial alliances (cf. xxv. 43).

Wearying at last of his precarious life he decided to place himself under the protection of Achish, the Philistine ruler of Gath, from whom he obtained permission to establish himself and his band at Ziklag, which probably lay to the south of Judah. Here for more than a year he maintained his troop by raids upon the Amalekites and other marauding Bedouins. According to the rather improbable story of xxvii. 10–12 he represented these to Achish as raids upon Judah, as though to give proof of his permanent alienation from his own people. In any case Achish was convinced of David's loyalty and took him and his band as part of the army which he led in an important campaign against Saul. But on the eve of battle the Philistine captains, more distrustful than their leader, persuaded Achish to order David's return to Ziklag. David reached Ziklag to find that in his absence the Amalekites had raided and burned the town, carrying off with other booty David's wives. Pursuing the marauders he inflicted upon them a signal defeat, recovering all that had been carried off and much spoil in addition. By distributing a part of his spoil among the rulers of the various towns in the south country and of the old haunts of his freebooting days he strengthened his hold upon the affections of that countryside. In the meantime the Philistine campaign against Israel had been successful, and Saul and his sons, including Jonathan, lay dead upon the slopes of Mt. Gilboa. The fertile lowlands of Jezreel and the Jordan fell into the possession of the victors, and Saul's son Ishbaal, who had escaped the fate of his brothers, maintained a shadowy sovereignty in the remote city of Mahanaim, the force behind his throne being Abner, Saul's commander-in-chief. The news of Israel's defeat and Saul's death is brought (2 Sam. i.) to Ziklag by an Amalekite, who claims—in contradiction to the account in 1 Sam. xxxi. 4—to have slain the wounded king, and offers to David the crown and bracelet which he had taken from the corpse. Instead of receiving the reward which he doubtless looked for the messenger is slain at the command of David, who utters the noble dirge on Saul and Jonathan, 2 Sam. i. 19–27. The compiler avowedly takes the poem from the "Book of Jashar," but there appears to be no cogent reason for denying that David is its author.

King at **Hebron.**—David now takes a further step in his advance towards the throne, for, in response to a Divine oracle, he establishes his household and his band in Hebron, where, at the age of 30 (if 2 Sam. v. 4 may be trusted), he is anointed king by the Judaean clans: there he reigned, according to the statement of ii. 11, seven and a half years. His position as established ruler of an important town, on friendly terms with the neighbouring sheikhs, and allied by marriage with the families of Caleb and Jezreel (in Judah), was well secured. Further such marriages are recorded in iii. 3–5. It is quite in keeping with the constant tradition of David's chivalrous treatment of Saul that he should have sent a message of appreciation to the men of Jabesh-Gilead for their pious act in burying the bodies of Saul and his sons, ii. 46 seq.; and with his skilful diplomacy that the messengers should hint that Jabesh-Gilead might do well to transfer its allegiance to himself—a hint which was for the time being ignored.

A conflict between the forces of Ishbaal, under Abner, and those of David, under Joab, which developed out of a contest between 12 picked men on either side, ended greatly to the advantage of David's men. In the course of the struggle Abner slew Asahel, Joab's brother, thus creating a blood-feud which had serious consequences in the subsequent history. Abner, recognizing that the cause of Ishbaal was hopeless, took to himself one of Saul's concubines, an infringement of Ishbaal's prerogative as Saul's successor, with deliberate intent to raise a quarrel with his lord which might provide him with a pretext for transferring his allegiance to David. When Ishbaal protested Abner sent an embassy to David offering to bring the northern clans over to him. According to one story (iii. 12–16), David demanded the return of Michal to him, as an evidence of good faith, but this story is consistent neither with itself nor with its context. In any case Abner, returning from Hebron after arranging terms with David, was summoned back by Joab and treacherously slain in pursuance of the blood-feud. David was indignant, and showed his indignation by according burial to Abner and proclaiming a fast. Apparently Joab was both too strong and too useful for the king to punish him, so David handed over that task to his God. The position of Ishbaal, deprived of Abner's help, went from bad to worse, and he was eventually assassinated by two of his own followers. They brought his head to David, but received the same reward as the Amalekite who thought to have found favour with David by his claim to have killed Saul. Following this the northern tribes swore allegiance to David at Hebron, and he became king of the united peoples. Here we may place the two successes over the Philistines narrated in v. 17–25.

Capture of Jerusalem.—Another important stage in David's career was marked by the capture of Jerusalem, an ancient Jebusite stronghold which had never been in Hebrew hands. Regarded as impregnable by its inhabitants, who treated David's threat with derision, it was captured by the ascent of a shaft which had been pierced through the rock to aiford the city a water supply. The stronghold was further fortified by David, who built himself a cedarwood palace, the materials and artificers for which were furnished by Hiram, king of Tyre—another indication of David's growing importance. David also enlarged his harem.

The king now turned his attention to the ark of Yahweh, which had remained in obscurity since its return from the Philistines in the early youth of Samuel. It was brought up from Baal of Judah, and, after having been temporarily housed with Obed-Edom owing to an untoward incident during its progress, was placed in a specially prepared pavilion in the citadel, amid great rejoicings. That the king should have proposed to build a temple worthy to stand beside his palace is quite natural, and ch. vii., which relates how Nathan the prophet, after first sanctioning the project, forbade it in the name of Yahweh, may, though comparatively late, be based on a historical foundation. There follows in viii. a summary of military successes achieved by David and Joab, his commander-in-chief. The concluding verses show that the court had been properly organized and a bodyguard of mercenaries provided for the king. The lame Mephibosheth (-Meribaal), Jonathan's son, was admitted to the royal table as the king's pensioner, and his family estates were restored to his use.

A friendly embassy from David to the newly crowned king of Ammon was treated with insult, and a war ensued, in which the Ammonites, who succeeded in gaining considerable Aramean support, were completely defeated, and their chief city was captured by David after a siege. It was during this campaign that David, in order to obtain for himself the beautiful Bathsheba, caused Joab deliberately to abandon her husband, Uriah the Hittite mercenary, to an Ammonite assault. Not only were the Syrian allies of Ammon reduced to submission, but Edom was completely subjugated by Joab.

Internal Troubles.—From this time on David's reign was undisturbed by foreign attack, but, in the absence of necessity for standing together against a common foe, internal troubles developed. In part these proceeded from the king's own household. Absalom, his third son, having contrived the murder of Amnon, the eldest, in revenge for an assault upon Absalom's sister Tamar, fled the country and took refuge with his mother's father, Talmai, king of Geshur. After three years Joab satisfied the unexpressed longing of David for his son's return, for which he secured permission by a stratagem. Absalom was excluded from the court for two years, and when David was fully reconciled to receive him began to plot against his father. He succeeded in creating a party for himself, and after some four (so read in xiv. 7) years raised the standard of revolt in Hebron. David was compelled to flee in haste to Gilead, abandoning Jerusalem to Absalom. The first battle between the forces resulted in the total defeat of Absalom, who was slain. against the express command of David, by Joab. David was welcomed back by the people, but the northern tribes resented the precedence which was claimed by Judah on the ground of kinship to the king. This discontent manifested itself in a rebellion headed by Sheba, a Benjamite, who eventually threw him-

self into the walled city of Abel of Beth-Maacah. There he was besieged by David's army under Joab. To avoid the disastrous consequences of a prolonged siege the inhabitants slew Sheba and threw out his head to Joab, who had agreed to draw off his forces on that condition. It should be said that some scholars, *e.g.*, Winckler and S. A. Cook *(Notes on* Old Testament History, pp. 3–17), have argued forcibly that the revolts of Absalom and Sheba should be dated in a much earlier period of David's reign. The remaining chapters of 2 Samuel interrupt the history of David, which is resumed in 1 Kings i. They contain fragments relative to David which have been inserted here by different editors. The two poetical pieces, 2 Sam. xxii. 1–xxiii. 7, are not Davidic: it will be recognized at once that they interrupt the catalogue of David's heroes and their exploits, which xxiii. 8 resumes from xxi. 22. The story of xxi. 1–14, relating how David delivered over to the men of Gibeon seven of Saul's descendants to be impaled, and how, moved by the pathetic fidelity of Rizpah, he gathered the bones of these men and of Saul and Jonathan to be decently interred, is probably historic, though not in its proper chronological order. The story of the census and its disastrous results, xxiv., may possibly come from the same source, though some parts of it may be later insertions.

The closing scenes of David's life, 1 Kings i.–ii. 11, show the old warrior enfeebled by age, and the succession to his throne the subject of intrigue. His eldest surviving son, Adonijah, regarded himself as the heir. Like Absalom, he was of great personal charm and a favourite with numbers of the people, his outstanding supporters being Joab and Abiathar. Like Absalom, too, he sought to make his position secure by assuming the state suitable to the heir-apparent. He made a great feast for the men of Judah, inviting the king's sons but deliberately ignoring Solomon, Bathsheba's son, the prophet Nathan, and David's "mighty men," who evidently constituted a party in favour of Solomon's succession. Bathsheba and Nathan contrived to secure from David the ratification of an old promise that Solomon should succeed to the throne, and the aged king roused himself to make arrangements for the formal proclamation of Bathsheba's son. Adonijah's followers were seized with panic, and he himself sought sanctuary by taking hold of the horns of the altar, whence he suffered himself to be removed upon a rather equivocal promise by Solomon that his life should be spared. The remainder of the story records, with some later expansion by a Deuteronomic editor, how David left instructions to Solomon that Joab and Shimei should be put to death, but kindness shown to the family of Barzillai. This ungenerous treatment of Joab, to whom more than to any man he owed the success of his career, and the virtual recantation of his promise to spare Shimei strike an unpleasant note in our ears. Nor does the consideration of the king's failing powers and of his possible fear that Solomon's position might be endangered by adversaries whom he himself had felt free to spare completely mellow its harshness. And so, after a reign of 40 years, David slept with his fathers.

David's Character and Work.—Rightly to estimate the character and work of David we must judge him by the standards of his own day. His military capacity is proved by the uniform success he achieved as commander. Even though the story of his conflict with Goliath may be legendary it undoubtedly gives us the measure of his reputation for personal bravery. To these qualities he added astute diplomacy and far-seeing statesmanship. That at times he resorted to deceit—as, for example, in the employment of Hushai to spy upon the movements of Absalom—is true, but this would be commended by his own age and is reputable even to-day. He knew well how to wait his opportunity, and instead of snatching at the kingship in haste allowed the fruit to ripen until it fell into his hands, all the while strengthening his hold upon his fellow countrymen. His choice of Jerusalem as capital is an excellent example of his wisdom. In seizing it he furnished himself not only with a secure citadel, whose natural strength was shown later by its desperate resistance to Babylonians and Romans, but also with a centre of government not so closely associated with his own tribe of Judah as was Hebron, and one therefore less likely to cause jealousy on the part of northern Israel. His real monument was the united kingdom which he established, its influence stretching right up into Syria; it was the most powerful empire that ever Palestine produced. True, his opportunity was exceptional, because neither Egypt, Assyria, nor Babylon was at the time in a position to challenge his progress; but to have achieved it at all was wonderful. We can readily understand that the Jews of later days looked back to David as the ideal king and pictured the ruler of the happy day for which they hoped as a second David.

David may be charged with harshness in the treatment of conquered peoples—though the true meaning of 2 Sam. xii. 31 is that he set the people of Rabbah to menial labour, not that he tortured them; but in this respect he compares favourably with his contemporaries. His delivery of Saul's descendants to be impaled was but obedience to the will of Yahweh as he understood it. And on the other hand his record is marked by chivalrous treatment of his foes on several occasions. Even his outstanding faults, the murder of Uriah that he might obtain Bathsheba, and his weakness in dealing with his sons, though we need not palliate them, were less heinous a thousand years before Christ than they would be to-day. He was a sincerely religious man, a devout worshipper of Yahweh, as may be seen from his care for the Ark. Though his relationships with the prophets Gad and Nathan may have been idealized by later editors he certainly was more amenable to prophetic guidance than was Saul. He was assuredly not the soldier-saint of Chronicles, or the Psalmist of profound religious experience. But while it is improbable that he was the author of any of the Hebrew hymns he was undoubtedly a musician and a poet. The dancer of 2 Sam. vi. would naturally be the singer, too, and there is good reason for believing the elegy on Saul and Jonathan and the little dirge on Abner, 2 Sam. iii, *seq.* 33, are of David's composition. Moreover, the attribution of Psalms to David, though mistaken, is most easily understood if he was really a minstrel (cf. also Amos vi. 5).

Greatly loved in his day, deeply revered by those who came after him, David was perhaps the most winsome character in Hebrew story, lovable, because so human, even in his faults. A great warrior and a great statesman, his importance as the real constructor of the Hebrew kingdom can hardly be overestimated.

BIBLIOGRAPHY.—See the articles DAVID in Hastings' *Dict. Bible* and the *Ency. Bib.*; the Commentaries on Samuel by H. P. Smith, Dhorme and Caspari; S. A. Cook, *Critical Notes on Old Testament History;* R. Kittel, *Geschichte des Volkes Israels,* ii. pp. 108–187; *Gestalten und Gedanken in Israel,* pp. 120–157. (W. R. S.; W. L. W.)

DAVID I. (1084–1153), king of Scotland, the youngest son of Malcolm Canmore and (Saint) Margaret, sister of Edgar Aetheling, married in 1113 Matilda, daughter and heiress of Waltheof, earl of Northumbria, and thus became possessed of the earldom of Huntingdon. On the death of Edgar, king of Scotland, in 1107, the territories of the Scottish crown were divided in accordance with the terms of his will between his two brothers, Alexander and David. Alexander, together with the crown, received Scotland north of the Forth of Clyde, David the southern district with the title of earl of Cumbria. The death of Alexander I, in 1124 gave David possession of the whole. In 1127, in the character of an English baron, he swore fealty to Matilda as heiress to her father Henry I., and when the usurper Stephen ousted her in 1135 David vindicated her cause in arms and invaded England. But Stephen marched north with a great army, whereupon David made peace. The peace, however, was not kept. After threatening an invasion in 1137, David marched into England in 1138, but sustained a crushing defeat on Cutton Moor in the engagement known as the battle of the Standard. He returned to Carlisle, and soon afterwards concluded peace. In 1141 he joined Matilda in London and accompanied her to Winchester, but after a narrow escape from capture he returned to Scotland. Henceforth he remained in his own kingdom and devoted himself to its political and ecclesiastical reorganization. A devoted son of the church, he founded five bishoprics and many monasteries. In secular politics he energetically forwarded the process of feudalization which had been initiated by his immediate predecessors. He died at Carlisle on May 24, 1153.

DAVID II. (1324–1371), king of Scotland, son of King Robert the Bruce by his second wife, Elizabeth de Burgh (d. 1327), was born at Dunfermline on March 5, 1324. In accordance with

the terms of the treaty of Northampton he was married in July 1328 to Joanna (d. 1362), daughter of the English king, Edward II., and became king of Scotland on his father's death in June 1329, being crowned at Scone in November 1331. Owing to the victory of Edward III. of England and his protégé, Edward Baliol, at Halidon Hill in July 1333, David and his queen were sent for safety into France, reaching Boulogne in May 1334, and being received very graciously by the French king, Philip VI. Little is known about the life of the Scottish king in France, except that Chbteau Gaillard was given to him for a residence, and that he was present at the bloodless meeting of the English and French armies at Vironfosse in October 1339. Meanwhile his representatives had obtained the upper hand in Scotland, and David was thus enabled to return to his kingdom in June 1341, when he took the reins of government into his own hands. In 1346 he invaded England in the interests of France, but was defeated and taken prisoner at the battle of Neville's Cross in October of this year, and remained in England for eleven years, living principally in London and at Odiham in Hampshire. His imprisonment was not a rigorous one, and negotiations for his release were soon begun. Eventually, in October 1357, after several interruptions, a treaty was signed at Berwick by which the Scottish estates undertook to pay 100,000 marks as a ransom for their king. David, who had probably recognized Edward III. as his feudal superior, returned at once to Scotland; but owing to the poverty of the kingdom it was found impossible to raise the ransom. A few instalments were paid, but the king sought to get rid of the liability by offering to make Edward III., or one of his sons, his successor in Scotland. In 1364 the Scottish parliament indignantly rejected a proposal to make Lionel, duke of Clarence, the next king; but David treated secretly with Edward III. over this matter, after he had suppressed a rising of some of his unruly nobles. The king died in Edinburgh Castle on Feb. 22, 1371. His second wife was Margaret, widow of Sir John Logie, whom he divorced in 1369; but he left no children, and was succeeded by his nephew, Robert II. David was a weak and incapable ruler without his father's patriotic spirit. (See SCOTLAND, History.)

DAVID, the name of three Welsh princes.

DAVID I. (d. 1203), a son of Prince Owen Gwynedd (d. 1169), came into prominence as a leader of the Welsh during the expedition of Henry II. in 1157. In 1170 he became lord of Gwynedd (*i.e.*, the district around Snowdon), but some regarded him as a bastard, and Gwynedd was also claimed by other members of his family. After fighting with varying fortunes he sought an ally in the English king, whom he supported during the baronial rising in 1173; after this event he married Henry's half-sister Emma. But his enemies increased in power, and about 1194 he was driven from Wales by the partisans of his half-brother Llewelyn ap Iorwerth. The chronicler Benedictus Abbas calls David rex, and Rhuddlan castle was probably the centre of his vague authority.

DAVID II. (c. 1208–1246) was a son of the great Welsh prince, Llewelyn ap Iorwerth, and through his mother Joanna was a grandson of King John. He married an English lady, Isabella de Braose, and, having been recognized as his father's heir both by Henry III. and by the Welsh lords, he had to face the hostility of his half-brother Gruffydd, whom he seized and imprisoned in 1239. When Llewelyn died in April 1240, David, who had already taken some part in the duties of government, was acknowledged as a prince of North Wales, doing homage to Henry III. at Gloucester. He was soon at variance with the English king, who appears to have espoused the cause of the captive Gruffydd. Henry's Welsh campaign in 1241 was bloodless but decisive. Gruffydd was surrendered to him; David went to London and made a full submission, but two or three years later he was warring against some English barons on the borders. To check the English king he opened negotiations with Innocent IV., doubtless hoping that the pope would recognize Wales as an independent state, but here, as on the field of battle, Henry III. was too strong for him. Just after Henry's second campaign in Wales the prince died in March 1246.

DAVID III. (d. 1283) was a son of Gruffyddand thus a nephew of David II. His life was mainly spent in fighting against his brother, the reigning prince, Llewelyn ap Gruffydd. His first revolt took place in 1254 or 1255, and after a second about eight years later he took refuge in England, returning to Wales when Henry III. made peace with Llewelyn in 1267. Then about 1274 the same process was repeated. David attended Edward I. during the Welsh expedition of 1277, receiving from the English Iring lands in North Wales; but in 1282 he made peace with Llewelyn and suddenly attacked the English garrisons, a proceeding which led to Edward's final conquest of Wales. After Llewelyn's death in December 1282 David maintained the last struggle of the Welsh for independence. All his efforts, however, were vain; in June 1283 he was betrayed to Edward, was tried by a special court and sentenced to death, and was executed with great barbarity at Shrewsbury in October 1283. As the last native prince of Wales, David's praises have been sung by the Welsh bards, but his character was not attractive, and a Welsh historian says "his life was the bane of Wales." (See WALES, History.)

DAVID, FÉLICIEN (1810–1876), French composer, was born on April 13, 1810, at Cadenet (Vaucluse). He was a precocious child, and composed a string quartet at the age of 12. He was educated at the Jesuit college at Aix, and became choirmaster at St. Sauveur at Aix for a year. He then studied for a while at the Paris Conservatoire. In 1831 he joined the sect of Saint Simonians, and in 1833 travelled in the Near East in order to preach the new doctrine. After three years' absence he returned to France and published a collection of Oriental Melodies for the pianoforte. For several years he worked in retirement, and wrote two symphonies, some chamber music and songs. On Dec. 8, 1844, he suddenly leapt into fame with his symphonic ode *Le* De'sert, produced at the Conservatoire. In this work David attempted in simple strains to evoke the majestic stillness of the desert. Notwithstanding its title of "symphonic ode," Le De'sert, has little in common with the symphonic style. What distinguishes it is a certain naïveté of expression and an effective oriental colouring. His succeeding works, *Moïse* au *Sinai* (1846), *Christophe* Colomb (1847), *L'Éden* (1848), scarcely bore out the promise shown in Le De'sert. David produced several operas: La Perle *du Brésil* (1851), *Herculanum* (1859), Lalla-Roukh (1862), Le *Saphir* (1865). He died at Saint-Germain-en-Laye on Aug. 29, 1876. At a time when the works of Berlioz were still unappreciated by the majority of people, David succeeded in making the public take interest in music of a picturesque and descriptive kind. Thus he may be considered as one of the pioneers of modern French musical art.

See R. Brancour, *Félicien* David (1911), with full bibliography.

DAVID, GERARD [GHEERAERT DAVIT] (?–1523), Netherlands painter, born at Oudewater, in Holland, was the last great master of the Bruges school. He was only rescued from complete oblivion in 1860–63 by W. J. H. Weale, whose researches in the archives of Bruges brought to light the main facts of the master's life. David came to Bruges in 1483, presumably from Haarlem, where he had formed his early style under the tuition of Ouwater; he joined the gild of St. Luke at Bruges in 1484, and became dean of the gild in 1501; he married, in 1496, Cornelia Cnoop, daughter of the dean of the Goldsmiths' gild; became one of the leading citizens of the town; died on Aug. 13, 1523, and was buried in the Church of Our Lady at Bruges.

In his early work he had followed the Haarlem tradition as represented by Dirck Bouts, Ouwater and Geertgen of Haarlem, but already gave evidence of his superior power as colourist. To this early period belong the "St. John" of the Kaufmann collection in Berlin, and "St. Jerome" in the Salting collection (National Gallery, London). In Bruges he studied and copied masterpieces by the Van Eycks, Van der Weyden, and Van der Goes, and came under the direct influence of Hans Memlinc. From him he acquired the intensity of expression, the increased realism in the rendering of the human form and the orderly architectonic arrangement of the figures. In 1515 he visited Antwerp, and became impressed with the life and movement in the work of Quentin Matsys, who had introduced a more intimate and more human conception of sacred themes. David's "Pietà" in the National Gallery, and the "Descent from the Cross," in the

Cavallo collection, Paris, were painted under this influence and are remarkable for their dramatic movement. But the works on which David's fame rests most securely are the great altar-pieces executed by him before his visit to Antwerp—the "Marriage of St. Catherine," at the National Gallery; the triptych of the "Madonna Enthroned, and Saints" of the Brignole-Sale collection in Genoa; the "Annunciation" of the Sigmaringen collection; and, above all, the "Madonna with Angels and Saints" at Rouen. Of David's pupils in Bruges, only Isenbrandt, A. Cornelis and Ambrosius Benson achieved importance. Among other Flemish painters, Joachim Patinir and Mabuse were to some degree influenced by him.

Eberhard Freiherr von Bodenhausen published in 1905 a very comprehensive monograph on *Gerard David and his School* (Munich, F. Bruckmann), together with *a catalogue raisonné* of his works, which, after careful sifting, are reduced to 43.

DAVID, JACQUES LOUIS (1748–1825), French painter, was born in Paris on April 30, 1748. His father was killed in a duel, when the boy was but nine years old. His education was begun at the Collège des Quatre Nations, but he was soon placed by his guardian in the studio of François Boucher. Boucher recommended him to J. M. Vien, the pioneer of the classical reaction in painting. Under him David studied for some years; and, after several attempts to win the *prix de Rome*, at last succeeded. in 1775, with his "Loves of Antiochus and Stratonice." He then accompanied Vien, who had just been appointed director of the French academy at Rome. The classical reaction was now in full tide; Winckelmann was writing, Raphael Mengs painting; and the treasures of the Vatican galleries helped to confirm David in a taste already moulded by so many kindred influences. This severely classical spirit inspired his first important painting, *"Date obolum Belisario,"* exhibited at Paris in 1780. The picture exactly suited the temper of the times, and was an immense success. It was followed by "The Grief of Andromache" (1783), "The Oath of the Horatii" (Salon, 1785), "The Death of Socrates," "Love of Paris and Helen" (1788), "Brutus" (1789). In the first years of the revolutionary movement the fashion of imitating the ancients even in dress and manners went to the most extravagant length and it was at this time that David returned to Paris.

The success of his sketch for the picture of the "Oath of the Tennis Court," and his pronounced republicanism, secured David's election to the Convention in Sept. 1792, by the *Section du Muséum*, and in the January following his election into the Convention his vote was given for the king's death. David's revolutionary ideas, which led to his election to the presidency of the Convention and to the committee of general security, inspired his pictures "Last Moments of Lepelletier de Saint-Fargeau" and "Marat Assassinated." He also arranged the programme of the principal republican festivals. When Napoleon rose to power David became his enthusiastic admirer. His picture of Napoleon on horseback pointing the way to Italy is now in Berlin. During this period he also painted the "Rape of the Sabines," and "Leonidas at Thermopylae." Appointed painter to the emperor, David produced the two notable pictures "The Coronation" (of Josephine), and the "Distribution of the Eagles."

On the return of the Bourbons the painter was exiled with other regicides, and retired to Brussels, where he again returned to classical subjects: "Amor quitting Psyche," "Mars disarmed by Venus," etc. He rejected the offer, made through Baron Humboldt, of the office of minister of fine arts at Berlin, and remained at Brussels till his death on Dec. 29, 1825.

It is difficult for a generation which has witnessed another complete revolution in the standards of artistic taste to realize the secret of David's immense popularity in his own day. Yet he exercised in his time and generation a great influence. His pictures are magnificent in their composition and draughtsmanship; and his keen observation and insight into character are evident, especially in his portraits, notably of Madame Récamier, of the Conventional Gérard and of Boissy d'Anglas.

See E. J. Delécluze, *Louis David, son école et son temps* (1855), and *Le Peintre Louis David. Souvenirs et documents inédits, by* J. L. Jules David, the painter's grandson **(1880)**; L. Rosenthal, *David* (1904).

DAVID, PIERRE JEAN (1789–1856), usually called David d'Angers, French sculptor, was born at Angers on March 12, 1789, and died in Paris on Jan. 4, 1856. The son of a carver, he went to Paris at 17 with 11 francs in his pocket to study under Roland. After a year and a half's struggle he received a small annuity from the municipality of Angers, and in 1811 won the *prix de Rome*, and was sent to Italy, where he worked for some time in Canova's studio. Returning to Paris in 1816, after a short visit to London, he received many important commissions. He was in revolt against the prevailing classical style, and one of his first works in Paris, the "Condé" at Versailles, shows the new tendency towards a more realistic method. In 1827 he visited England, and m 1828 and 1834, Germany. Always a Radical in politics, he had to leave France for a short period after the *Coup d'état* of Dec. 1851. Many of the most famous men and women of his time sat to David for busts or medallions. A nearly complete collection, originals or copies, is to be seen in the Musée David at Angers. Among David's most important works are: the sculptures on the pediment of the Panthéon, showing the principal personages in France since the Revolution grouped round a figure of "La Patrie"; the Gutenberg monument at Strasbourg; the monument to General Gobert in Père Lachaise, the "Philopoemen" in the Louvre, and the bust of Goethe, presented by him to the poet in 1831, in the public library at Weimar.

See H. Jouin, *David d'Angers et ses relations littéraires* (1890); *Lettres de P. J. David d'Angers à Louis Dupré* **(1891)**; *Collection de portraits des contemporains d'après les médaillons de P. J. David* (1838).

DAVIDISTS, a fancy name rather than a recognized designation for three religious sects. It has been applied (1) to the followers (if he had any) of David of Dinant, in Belgium, the teacher or pupil of Amalric (Amaury) of Bena, both of whom taught apparently a species of pantheism. David's *Quaterni*, or *Quaternuli*, condemned and burnt at Paris (1209), is a lost hook, known only by references in Albertus Magnus and Thomas Aquinas; its author would have been burnt had he not fled. (2) To the followers of David George or Joris (*q.v.*). (3) To the followers of Francis David (1510–79), the apostle of Transylvanian unitarianism *(see* SOCINUS; UNITARIANISM).

DAVIDQVIC, LJUBOMIR (1863–1940), Yugoslav politician, was born at Vlaška in Serbia. In 1901 he entered parliament and, the next year, with Ljubomir Stojanović, founded the Independent Radical party. In 1904 he became Minister of Education, in 1905 President of the Skupština and in 1909 mayor of Belgrade. In that year he was one of the Serbian witnesses at the Friedjung trial in Vienna, and soon afterwards Prof. Masaryk laid before the Austrian delegation the papers on which the forgers had practised Davidovic's signature. In the Serbian Coalition cabinet, formed during the Austrian invasion in Nov. 1914, Davidovic again became Minister of Education, but in 1917 he resigned office and remained in active opposition to Pašić throughout the remainder of the World War. In 1919 he was elected chief of the newly formed Democratic party and was Yugoslav premier from August of that year until Feb. 1920. In July 1924 he again became Prime Minister at the head of a coalition of Democrats, Slovene Clericals and Bosnian Moslems, supported by the Croat peasants. He was, however, replaced, in 1924, by a purely Radical Government under Pašić. Not active in the succeeding governments, Davidovic, however, led the democratic party against the Government party in the elections of 1935 and 1938.

DAVIDSON, ANDREW BRUCE (1831–1902), Scottish divine, was born in 1831 at Kirkhill, Aberdeenshire, where his father, Andrew Davidson, had a farm. During his four years at Aberdeen university his mother supplied him fortnightly with provisions from the farm and sometimes walked the whole 20 miles from Kirkhill, handing the coach fee to her son. He graduated in 1849. In 1852, after three years as a schoolmaster, he entered New college, Edinburgh, and was licensed to preach in 1856. For two years he preached occasionally and took vacancies. In 1858 he became assistant professor of Hebrew at New college. He taught during the winter, and in the long vacation continued his

preparation for his life work. One year he worked in Germany under Ewald, another year he went to Syria to study Arabic. In 1862 he published the first part of a commentary on Job. It was never finished and deals only with one-third of the book, but it is recognized as the first really scientific commentary on the Old Testament in the English language. In 1863 he was appointed by the General Assembly professor of oriental languages at New college. He was junior colleague of Dr. John Duncan (Rabbi Duncan) till 1870, and then for 30 years sole professor. He was a member of the Old Testament revision committee. He died on Jan. 26, 1902.

Besides the commentary on Job he published a book on the *Hebrew Accents,* the only Scottish performance of the kind since the days of Thomas Boston. His *Introductory Hebrew Grammar* has been widely adopted as a class-book in theological colleges. His *Hebrew Syntax* has the same admirable clearness, precision and teaching quality. His *Commentary on the Epistle to the Hebrews* is one of a series of handbooks for Bible classes. These were followed by commentaries on Job, Ezekiel, Nahum, Habakkuk and Zephaniah, in the Cambridge series; and a Bible-class primer on *The Exile and Restoration.* His lectures on *Old Testament Prophecy* were published after his death by Prof. J. *A.* Paterson, The *Theology of the Old Testament* in the "International Theological Library" is a posthumous volume edited by Prof. Salmond. "Isaiah" in the *Temple Bible* was finished, but not revised, when he died; and he also had in hand the volume on Isaiah for the *International Critical Commentary;* to which must be added a mass of articles contributed to the *Imperial Bible Dictionary,* the *Encyclopædia Britannica,* and the chief religious reviews. Various articles in Dr. Hastings' *Bible Dictionary* were by Davidson, including the article "God." Two volumes of sermons, *The Called of God* (with biographical introduction), and *Waiting upon God,* were published after his death.

DAVIDSON, JOHN (1857–1909), British poet, playwright and novelist, son of the Rev. Alexander Davidson, a minister of the Evangelical Union, was born at Barrhead, Renfrewshire, Scotland, on April 11, 1857. In 1876 he studied for a session at Edinburgh university, and then went as a master to various Scottish schools till 1890, varying his experiences in 1884 by being a clerk in a Glasgow thread firm. He had married in 1885, and meanwhile he had published his poetical and fantastic plays, *Bruce* (1886), *Smith; a tragic farce* (1888) and *Scaramouch in Naxos* (1889). Determining at all costs to follow his literary vocation, he went to London in 1890. *Fleet Street Eclogues* (1893) at, once established Davidson's position among the younger generation of British poets. He produced other books in prose, but his most important work is found in his *Ballads and Songs* (1894), *Second Series of Fleet Street Eclogues* (1895), *New Ballads* (1896), *The Last Ballad, etc.* (1898), all full of remarkably fresh and unconventional beauty. Meanwhile, in 1896, he produced an English verse adaptation in *For the Crown* (acted by Forbes Robertson and Mrs. Patrick Campbell), of François Coppée's drama *Pour* la *couronne,* and he wrote several other literary plays. In later years he lived at Penzance, provided with a small Civil List pension, but otherwise badly off, for his writings brought in very little money. On March 23, 1909, he disappeared, in circumstances pointing to suicide, and six months later his body was found in the sea.

DAVIDSON OF LAMBETH, RANDALL THOMAS DAVIDSON, 1ST BARON (1848–1930), English divine, archbishop of Canterbury, 1903–28, was with King Edward VII. at his death in 1910, and he crowned King George V. in 1911 He was one of the four counsellors of State who acted as His Majesty's Commission when the King went to India in 1911, and again in 1925 when the King went to the Mediterranean after illness. During the whole of this period he took a leading part as spokesman of the national Church in the House of Lords. Lord Morley bore public witness to the effectiveness of his intervention in the critical debate on the Parliament Act in 1914. He made important contributions in debates on temperance, divorce and various social and moral questions. His influence was also constantly and successfully exerted in matters affecting the welfare of native races; *e.g.,* in Kenya, and he made notable appeals on behalf of Christian minorities in the East. In his educational policy he has steadily supported definite religious instruction in all schools, by teachers willing to give it.

Trusted by Englishmen of all classes for his wisdom and goodness, the archbishop commanded the confidence of Free Churchmen to a greater degree than any of his predecessors. He had a peculiarly anxious task during the World War. On more than one occasion he lifted up his voice against reprisals which had "as a deliberate object the killing and wounding of non-combatants." Twice he visited the troops in France. In 1916 he placed himself at the head of a national mission, which aimed at the deepening of religious life at home. At an early date he gave public support to the proposals for a League of Nations, and it was recognized as specially fitting that he should preach the sermon at the opening of the third Assembly in Geneva, 1922. In 1922 Dr. Davidson took the lead in issuing a vigorous protest, signed by the leaders of the Anglican, Roman, Free Church and Jewish Communions, against religious persecution in Russia. In 1923 he made a successful public appeal for the retention of the Oecumenical patriarchate at Constantinople.

The archbishop also took a deep interest in the work of the Church overseas. He presided over the sixth Lambeth Conference in 1920, attended by 252 out of the 368 bishops of the Anglican Communion, and throughout the deliberations adopted a strong forward-looking attitude. After the issue of the appeal to all Christian people by that conference he took a prominent part in securing widespread consideration of the proposals for the reunion of Christendom which it contained. He actively forwarded conferences with the Free Church representatives in England, a series of important meetings being held at Lambeth Palace. He further expounded the appeal to the General Assemblies of the Church of Scotland, and the United Free Church of Scotland in 1921. In addition, the archbishop markedly developed friendly relations between the Anglican and Orthodox Churches, and it was to him that the Patriarch (Meletios IV.) of Constantinople communicated his Synod's acceptance of the validity of Anglican ordinations in 1922. He also took "cognizance" of the conversations between Anglican and Roman Catholic theologians held at Malines (1921–25), under the presidency of Cardinal Mercier; Pope Pius XI. taking a similar "cognizance."

He was mainly instrumental in securing the passage into law of the Church Assembly (Powers) Act, 1919, and from 1920–28 presided over the Church Assembly with wisdom and courage. During this period a large number of measures were passed. But the principal measure, dealing with Prayer Book revision, was rejected by the House of Commons on Dec. 15, 1927. This situation, however, afforded an opportunity for an extraordinary outburst of admiration for the archbishop personally in all sections of the community. In Feb. 1928 he completed the 25th year of his primacy—a primacy longer than any since Archbishop Warham. He displayed a remarkable combination of sincere piety, common sense, loyalty to truth and sympathy with modern movements. He resigned Nov. 1928, was succeeded by Dr. Lang, and was created a baron. He died May 25, 1930. (G. K. A. B.)

DAVIDSON, SAMUEL (1807–1898), Irish biblical scholar, was born near Ballymena. He became in 1842 professor of biblical criticism, literature and oriental languages at the Lancashire Independent college, Manchester, but was obliged to resign in 1857, on account of *The Text of the Old Testament, and the Interpretation of the Bible,* written for a new edition of Horne's *Introduction to the Sacred Scripture.* In 1862 he removed to London to become scripture examiner in London university, and he spent the rest of his life in literary work. He died on April 1, 1898. Davidson was a member of the Old Testament Revision Committee.

Among Davidson's principal works *are:—The Hebrew Text of the Old Testament Revised* (1855), *Introduction to the Old Testament* (1862), *On, a Fresh Revision of the Old Testament* (1873), *The Doctrine of Last Things in the New Testament* (1883), besides translations of the New Testament from Tischendorf's text, Gieseler's *Ecclesiastical History* (1846) and Fiirst's *Hebrew and Chaldee Lexicon.*

DAVIDSON, THOMAS (1817–1885), British palaeontologist, born in Edinburgh on May 17, 1817, was educated partly in the University of Edinburgh and partly in France, Italy and Switzerland. His *Monograph of British Fossil Brachiopoda* was published by the Palaeontographical Society (1850–86, 6 vols. with zoo plates). He also prepared an exhaustive memoir on "Recent

Brachiopoda," published by the Linnean Society. He was elected F.R.S. in 1857. He died at Brighton on Oct. 14, 1885.

See biography with portrait and list of papers in *Geol. Mag.* for 1871, p. 145.

DAVIES, ARTHUR B. (1862–1928), American painter, was born at Utica, N.Y., on Sept. 26, 1862. He was a pupil of Dwight Williams at Utica, afterwards studying in New York and Chicago. He became an adherent of the Romantic school of painting and made notable contributions in the fields of etching and colour-lithography. Among his more important works are "Dream" and "The Girdle of Ares," in the Metropolitan Museum, New York city; "Maya, Mirror of Illusions," in the Art Institute, Chicago; "Spring in a Valley" and "Night Overture," in the Minneapolis Institute of Art; and "The Place of the Mother" and "Children of Yesterday," in the Brooklyn museum. In 1923 his picture, "After-Thoughts of Earth," procured for him from the Carnegie Trust a medal of the first class and $1,500. He died in Italy on Oct. 24, 1928.

DAVIES, SIR HENRY WALFORD (1869–1941), knighted 1922, English organist and composer, was born at Oswestry, Salop, on Sept. 6, 1869, and educated privately. In 1882 he became a chorister at St. George's chapel, Windsor, and in 1885 assistant organist to Sir Walter Parratt there. From 1890–94 he was pupil and scholar at the Royal College of Music, where, in 1895, he became a teacher of counterpoint. In 1898 he was appointed organist to the Temple church, a post which he held until 1923. From 1903–07 he was conductor of the London Bach choir in succession to Stanford; and from 1919–26 professor of music in the University college of Wales, at Aberystwith. During the World War, with the rank of major, he worked for the organization of music among the troops, and in 1918 was made director of music to the R.A.F. In 1919 he was appointed director of music and chairman of the National Council of Music, University of Wales; in 1924, Gresham professor of music. He was organist of St. George's chapel, Windsor, 1927–32.

His compositions include two symphonies; and in the way of choral works, *Everyman,* a felicitous setting for chorus and orchestra of the old morality play, which enjoyed nide favour; "Ode on Time" (1908); *The Sayings of Jesus* (1911); "Dante Fantasy" (1914); and *Heaven's Gate;* in addition to a quantity of church music, chamber music, part songs, etc. Over and above his creative work, Walford Davies mas for many years one of the most potent and stimulating forces (not least by means of his immensely popular radio talks) in musical education in England. He wrote *Music and Worship* (1935), with Harvey Grace, and *The Pursuit of Music* (1936), and edited several song books. In 1937 he was created K.C.V.O.

DAVIES, HUBERT HENRY (1869–1917), English playwright, was born in Cheshire on March 17, 1876. After some years of journalism in San Francisco, where he also produced a few vaudevilles, he returned to England and made a success in London with *Cousin Kate* and *Mrs. Gorringe's Necklace.* Among his other comedies were *The Mollusc* (1907) and *Doormats* (1912). He produced *The Outcast* (1914). His health broke down as the result of overwork in France as a hospital orderly during the World War, and he was found dead at Robin Hood's bay, Yorks, on Aug. 17, 1917.

DAVIES, SIR JOHN (1569–1626), English poet, was baptized on April 16, 1569, at Tisbury, Wiltshire. He was educated at Winchester college, and became a commoner of Queen's college, Oxford, in 1585. In 1588 he entered the Middle Temple, and was called to the bar in 1595. In his general onslaught on literature in 1599 the archbishop of Canterbury ordered to be burnt his volume, *All Ovid's Elegies, 3 Bookes, by C. M. Epigrams, by J. D.* (Middleburgh, 1598?), which contained posthumous work by Marlowe. The epigrams were probably earlier in date of composition than the charming fragment entitled *Orchestra* (1596), written in praise of dancing, and dedicated to the author's "very friend, Master Richard Martin," but in the next year the friends quarrelled, and Davies was expelled from the society for having struck Martin with a cudgel in the hall of the Middle Temple. He spent the year after his expulsion at Oxford in the composition of his philosophical poem on the nature of the soul and its immortality—Nosce *teipsum* (1599). Its force, eloquence and ingenuity, the orderly and lucid arrangement of its matter, place it among the finest of English philosophical poems. In 1599 Davies published a volume of 26 acrostics on the words *Elisabetha Regina,* entitled *Hymns to Astraea.* He produced no more poetry except two dialogues contributed to Francis Davison's *Poetical Rhapsody* (1608). In 1601 Davies was restored to his position at the bar, after making his apologies to Martin, and in the same year he sat for Corfe Castle in parliament. James I. received the author of *Nosce teipsum* with great favour, and sent him (1603) to Ireland as solicitor-general; he was knighted in the same year. In 1606 he was promoted to be attorney-general for Ireland, and created serjeant-at-arms. One of his chief aims was to establish the Protestant religion firmly in Ireland, and he took an active part in the "plantation" of Ulster. In 1612 he published his prose *Discoverie of the true causes why Ireland was never entirely subdued untill the beginning of his Majestie's happie raigne* (ed. H. Morley in his *Ireland under Elizabeth and James I.* [1890]). In the same year he entered the Irish parliament as member for Fermanagh, and was elected speaker after a scene of disorder in which the Catholic nominee, Sir John Everard, who had been installed, was forcibly ejected. In the capacity of speaker he delivered an excellent address reviewing previous Irish parliaments. He resigned his Irish officesin 1619, and sat in the English parliament of 1621 for Newcastle-under-Lyme. With Sir Robert Cotton he was one of the founders of the Society of Antiquaries He was appointed lord chief justice in 1626, but died suddenly before he could enter on the office. He had married (1609) Eleanor Touchet, daughter of George, Baron Audley. She developed eccentricity verging on madness, and wrote several fanatical books on prophecy.

BIBLIOGRAPHY.—In 1615 Davies published at Dublin *Le Primer Discours des Cases et Matters in Ley resolues et adjudges en les Courts del Roy en cest Realme* (reprinted 1628). He issued an edition of his poems in 1622. His prose publications were mainly posthumous. The *Question concerning Impositions, Tonnage, Poundage . . .* was printed in 1656, and four of the tracts relating to Ireland, with an account of Davies and his services to that country, were edited by G. Chalmers in 1786. His works were edited by Dr. A. B. Grosart (1869–76), with a full biography, for the Fuller Worthies Library; also by H. Morley for the "Carisbrooke Library" (vol. x. 1889). *Nosce teipsum* is printed in Arber's *English Garner* (vol. v. 1882).

DAVIES, JOHN, of Hereford (1565?–1618), English poet, was born at Hereford, and settled in Oxford as a writing master. His principal work is the *Microcosmus* (1603), modelled largely on Joshua Sylvester's translation of the *Semaines* of Du Bartas.

Among other works *are:—Mirum in modum* (1602), *The Holy Roode* (1609), *Wittes Pilgrimage* (*c.* 1610), *The Scourge of Folly* (*c.* 1611), *The Muses Sacrifice* (1612), and *Wittes Bedlam* (1607). His *Scourge of Folly* contains verses addressed to many of his contemporaries, to Shakespeare among others. He also wrote 4 *Select Second Husband for Sir Thomas Overbury's Wife* (1616), and *The Writing Schoolmaster* (earliest known edition, 1633). His works were collected by Dr. A. B. Grosart (1873) for the Chertsey Worthies Library.

DAVIES (DAVISIUS), **JOHN** (1679–1732), English classical scholar and critic, was born in London. He was president of Queen's college, Cambridge, and was considered one of the best commentators on Cicero. He edited the *Tusculanae disputationes* (1709), *De natura deorum* (1718), *De divinatione* and *De fato* (1725), *Academica* (1725), *De legibus* (1727), *De finibus* (1728) and other works. Davies's editions, which were intended to supplement those of Graevius, show a great knowledge of history and philosophy, but are too free in emendation.

DAVIES, JOHN LLEWELLYN (1826–1916), English divine and educationalist, was born at Chichester on Feb. 26, 1826. He was educated at Repton and Trinity College, Cambridge, where he was made a fellow in 1851. He was ordained in the same year, and held successively several London livings. He was given the crown living of Christ church, Marylebone in 1856, and in 1889 became vicar of Kirkby Lonsdale, Westmorland, where he remained until 1908. Davies was closely associated with John Frederick Denison Maurice in the foundation of the Working Men's College (1854), where he taught for many years. He was elected to the first London school board in succession to Huxley,

and from 1873–74 and 1878–86 was principal of Queen's College, Harley street, founded by Maurice in 1848 for the advancement of women's education. Davies was an advocate of the higher education of women, a cause in which his sister, Sarah Emily Davies (*q.v.*), was also prominent, and favoured the granting to women of university degrees and the Parliamentary franchise. He died at Hampstead on May 17, 1916. With Vaughan he produced the well-known translation of Plato's *Republic*.

DAVIES, SIR LOUIS HENRY (1845–1924), Canadian politician and jurist, was born in Prince Edward Island in 1845, of Huguenot descent. In 1882 he entered the Canadian parliament as a Liberal, and from 1896 to 1901 was minister of marine and fisheries. In the latter year he became one of the judges of the supreme court of Canada. In 1877 he was counsel for Great Britain before the Anglo-American fisheries arbitration at Halifax; in 1897 he was a joint delegate to Washington with Sir Wilfred Laurier on the Bering sea seal question; and in 1898–99 a member of the Anglo-American joint high commission at Quebec. In 1918 he became chief justice and a member of the privy council. He died at Ottawa on May 1, 1924.

DAVIES, RICHARD (*c.* 1501–1581), Welsh bishop and scholar, was born in north Wales and educated at New Inn Hall, Oxford, becoming vicar of Burnham, Bucks., in 1550. He took refuge at Geneva during the reign of Mary. In Jan. 1560 he was consecrated bishop of St. Asaph, whence he was translated, early in 1561, to the bishopric of St. Davids. Davies was a member of the council of Wales, was very friendly with Matthew Parker, archbishop of Canterbury, and was consulted both by him and by Burghley, on Welsh concerns. He took part in translating the New Testament into Welsh, and assisted with the Welsh translation of the Book of Common Prayer. He helped to revise the "Bishops' Bible" of 1568, being responsible for Deuteronomy and 2 Samuel. He died on Nov. 7, 1581.

DAVIES, SARAH EMILY (1830–1921), British educationalist, sister of John Llewellyn Davies (*q.v.*), was born at Southampton on April 22, 1830. She was educated at home, and later identified herself with the movement for the higher education of women, being also one of a group of women who, about 1858, were discussing the question of women's suffrage at the Kensington Society. In 1862 she became secretary to the committee which was formed to procure the admission of women to university examinations. In 1867, Miss Davies, with the help of Mme. Bodichon (Barbara Leigh Smith) and others, organized a women's college at Hitchin, which was subsequently transferred to Cambridge as Girton college in 1873. From 1870 to 1873 she was a member of the London School Board, and withdrew to become mistress of Girton college, Cambridge, a post which she held for two years. In 1873 she was elected a life governor of University college, London, and in 1882 became honorary secretary of Girton college, retiring in 1904. She died in London on July 13, 1921. She published *The Higher Education of Women* (1886), and *Thoughts on Some Questions Relating to Women 1860–1908* (1910).

See B. Stephen, *Emily Davies and Girton College* (1927).

DAVIES, WILLIAM HENRY (1871–1940), British poet, born at Newport, Monmouth, April 20, 1871. After serving as apprentice to a picture-frame maker he tramped through America, crossed the Atlantic many times on cattle boats, became a pedlar and street singer in England, and after eight years of this life published his first volume of poems, *The Soul's Destroyer*, from the Marshalsea prison. Next year appeared in prose *The Autobiography of a Super-Tramp* (1908) with a preface by G. Bernard Shaw, and also *Nature Poems and Others*. Collected editions of his poems appeared in 1916, 1924, 1928. His poetry includes: *Forty New Poems* (1918); *The Hour of Magic, and Other Poems* (1922); *A Poet's Alphabet* (1925); *The Song of Love* (1926); *Poems* (1930–31, 1932); *The Loneliest Mountain* (1939). He published a novel, *A Weak Woman* (1911), and volumes of nature studies, including *A Poet's Pilgrimage* (1918), *Later Days* (1925), *The Adventures of Johnny Walker Tramp* (1926).

DAVILA, ENRICO CATERINO (1576–1631), Italian historian, was descended from a Spanish noble family His immediate ancestors had been constables of the kingdom of Cyprus for the Venetian republic since 1464. But in 1570 the island was taken by the Turks; and Antonio Davila, the father of the historian, had to leave it, despoiled of all he possessed. He travelled into Spain and France, and finally returned to Padua, and at Sacco on Oct. 30, 1576, his youngest son, Enrico Caterino, was born. About 1583 Antonio took this son to France, where he became a page in the service of Catherine de' Medici, wife of King Henry II. In due time he entered the military service, and fought through the civil wars until the peace in 1598. He then returned to Padua, where, and subsequently at Parma, he led a studious life until, when war broke out, he entered the service of the republic of Venice. During the whole of this active life he never lost sight of his early design of writing the history of those civil wars in France in which he had borne a part. The success of the *Istoria delle guerre civili di Francia* was immediate and enormous. Over 200 editions followed, of which perhaps the best is the one published in Paris in 1644 Davila was murdered, while on his way to take over Cremona for Venice in July 1631.

The *Istoria* mas translated into French by G. Baudouin (1642); into Spanish by Varen de Soto (Madrid, 1651, and Antwerp, 1686); into English by W. Aylesbury (1647), and by Charles Cotterel (1666), and into Latin by Pietro Francesco Cornazzano (1745). The best account of the life of Davila is that by Apostolo Zeno, prefixed to an edition of the history printed at Venice in 2 vols. in 1733.

DAVIS, CHARLES HAROLD (1857–1933), American landscape painter, was born at East Cambridge (Mass.), Feb. 2, 1857. A pupil of the schools of the Boston Museum of Fine Arts, he was sent to Paris in 1880. Having studied at the Academy Julian under Lefebvre and Boulanger, he went to Barbizon and painted much in the forest of Fontainebleau under the traditions of the "men of thirty." He became a full member of the National Academy of Design in 1906, and received many awards, including a silver medal at the Paris Exhibition of 1889. He is represented by important works in the Bletropolitan Museum of Art, New York; the Corcoran Art Gallery, Washington; the Pennsylvania Academy, Philadelphia, and the Boston Museum of Fine Arts. The Union League club in New York had an exhibition of his works in Feb. 1927.

DAVIS, CUSHMAN KELLOGG (1838–1900), American political leader and lawyer, was born in Henderson, N.Y., on June 16, 1838. He was taken by his parents to Wisconsin Territory in the year of his birth, and was educated at Carroll college, Waukesha, Wis., and at the University of Michigan, where he graduated in 1857. After studying law he was admitted to the bar in 1860. During the Civil War he served as a first lieutenant in 1862–63 and in 1864 was an aide to Gen. Willis A. Gorman (1814–76). Resigning his commission in 1864, he settled in St. Paul, Minn., where he soon became prominent both at the bar and, as a Republican, in politics. He served in the State house of representatives in 1867, and was U.S. district attorney for Minnesota (1868–73). In 1874–76 he was governor of the State, and from 1887 until his death at St. Paul, Nov. 27, 1900, was a member of the U.S. Senate, where he was one of the acknowledged leaders of his party, an able and frequent speaker, and a committee worker of great industry. He was one of the peace commissioners who negotiated and signed the treaty of Paris by which the Spanish-American War was terminated. In addition to various speeches and public addresses, he published an essay entitled *The Law of Shakespeare* (1899).

See sketch by W. B. Chamberlain in *Michigan Alumnus*, vol. vii., pp. 133–139 (1901).

DAVIS, HENRY WILLIAM CARLESS, C.B.E. (1874–1928), British historian, a son of H. F. A. Davis of Stroud, Gloucestershire, was born on Jan. 13, 1874 and educated at Weymouth college and Balliol college, Oxford. He was a fellow of All Souls (1895–1902), and of Balliol (1902–21). During the World War he served in the War Trade Intelligence Department, and after attending the Peace Conference, directed the Overseas Trade Department. In 1921 Davis was appointed professor of modern history at Manchester and in 1925 he returned to Oxford as regius professor of modern history. He became, in addition, curator of the Bodleian Library in 1926. He was made

director of the *Dictionary of National Biography*, when, in 1902, the copyright of that work passed to the Clarendon Press. Davis's historical work was chiefly done in the mediaeval field and found expression in his *England under the Normans and Angevins* (1905), *Mediaeval Europe* (1911), a revised edition of the *Select Charters* of William Stubbs (1913) and *Mediaeval England* (1924). The calendar of Anglo-Norman Royal Charters, 1066–1154, was not completed, owing to the difficulty of obtaining literary assistance during the World War. Davis was able to finish only the first volume (1913).

The considered judgment, exact scholarship and constructive imagination shown in his *England under the Normans and Angevins* brought him into prominence as an authority on mediaeval history. This work was remarkable for its appreciation of the true position held by England in the period dealt with, and marks a definite advance in historical scholarship. His *Mediaeval Europe*, though showing a masterly knowledge of the period, was written rather for the general public than for the serious student. After the outbreak of war, Davis's writings on subjects connected with modern political thought *(The Political Thought of Treitschke* [1914], and various articles) demonstrated his skill in the delineation of character and the exposition of policy, and he brought to this work in a very different field the same characteristic ability and thoroughness which had made his mediaeval studies famous. He was exceptionally gifted as a tutor, particularly for those who, themselves, intended to become teachers. Davis died of pneumonia on June 28, 1928, in Edinburgh, where he had gone to conduct an examination.

He contributed several articles to this *Encyclopædia.*

DAVIS, HENRY WINTER (1817–1865), American political leader, was born at Annapolis (Md.), U.S.A., on Aug. 16, 1817. He graduated from the law department of the University of Virginia in 1841, and began to practice law in Alexandria (Va.), but in 1850 removed to Baltimore (Md.). Early imbued with strong anti-slavery views, he began political life as a Whig, but when the Whig party disintegrated, became an "American" or "Know-Nothing," and as such served in the national House of Representatives from 1855 to 1861. In 1860, not ready to ally himself wholly with the Republican party, he declined to be a candidate for the Republican nomination for the vice-presidency. After Lincoln's election, he became a Republican, and was re-elected in 1862 to the National House of Representatives, in which his radical views commanded especial attention owing to his being one of the few representatives from a slave state. From Dec. 1863 to March 1865 he was chairman of the committee on foreign affairs. With other radical Republicans Davis was a bitter opponent of Lincoln's reconstruction plan of the Southern States. On Feb. 15, 1864, he reported a bill placing reconstruction under the control of Congress. The bill finally passed both houses but failed to receive the approval of the president, who on July 8 issued a proclamation defining his position. On Aug. 5, 1864, Davis joined Benjamin F. Wade of Ohio, in issuing the so-called "Wade-Davis Manifesto," which violently denounced President Lincoln for encroaching on the domain of Congress. He was one of the radical leaders who preferred Frémont to Lincoln in 1864, but subsequently supported the President. In July 1865, he publicly advocated the extension of the suffrage to negroes. He died in Baltimore (Md.), on Dec. 30, 1865.

See *The Speeches* of *Henry Winter* **Davis** (1867), *to* which is prefixed an oration on his life and character delivered in the House of Representatives by Senator J. A. J. Creswell of Maryland.

DAVIS, JEFFERSON (1808–1889), American statesman, president of the Confederate States of America, was born on June 3, 1808 on a farm on the present site of Fairview, Todd county, Ky. He was the tenth and youngest child of Samuel Davis (1755–1824), a descendant of a Welsh family that had settled originally in New Jersey, and he probably was a cousin of Samuel Davies (1724–1761), president of Princeton. Samuel Davis was born in Georgia, was a captain of infantry in the American revolution and subsequently was a planter. He married Jane Cook (1759–1844) of Scotch-Irish stock. They moved to south-western Kentucky in 1796, thence to Louisiana about 1810 and still again to Wilkinson county, Miss.

Schooled in Kentucky and in Mississippi, Davis attended Transylvania college, Ky., in 1821–24, entered the U.S. Military Academy in Sept. 1824, and graduated no. 23 in a class of 33, in July 1828. Albert Sidney Johnston was in a higher class during Davis' cadetship, and Robert E. Lee and Joseph E. Johnston belonged to the next junior class. Davis remained in the army seven years, and served chiefly in Wisconsin, where a severe attack of pneumonia left him with a facial neuralgia that often incapacitated and sometimes blinded him. After 1831 he was never a man of robust health or of a normal nervous system.

Finding in 1835 that army life had become a routine, Davis resigned his commission as lieutenant and after marrying Sarah Knox Taylor, daughter of Col. Zachary Taylor, started as a cotton-planter in Mississippi. His young bride died within three months of their marriage, and he spent the next ten years of his life on his plantation with his leisure devoted to hard reading. He soon developed a system that was almost a model in the relations of master and slaves. He gave the servant community a large measure of self-government and left in its hands, through an interesting jury system, the trial of all petty offenders. His own experience shaped his views: knowing that his negroes were well-fed, happy and advancing, he could not believe the evil alleged against slavery.

An unsuccessful candidate of the legislature in 1843 and a Democratic presidential elector in 1844, Davis was elected to the U.S. House of Representatives in 1845. He was married that same year to Varina Howell (1828–1907), granddaughter of Gov. Richard Howell of New Jersey. His service in Washington had hardly begun when the war with Mexico broke out and he was named colonel of the First Mississippi Infantry. He resigned from Congress in June 1846, and speedily had his troops well drilled and ready to join in the advance of the army under Gen. Zachary Taylor. Davis and his regiment acquitted themselves well in the battle of Monterey, Sept. 21–23, 1846, and when Taylor's reduced force was attacked at Buena Vista on Feb. 22, 1847, a stand by the Mississippians saved the day for the American forces and made Davis something of a national figure. He was wounded in this battle and was forced to return to Mississippi, in the company of his troops, whose term of enlistment had expired. He declined President Polk's complimentary commission as brigadier-general of volunteers, on the ground that officers of volunteers should be named by the States, but in Aug. 1847 he accepted appointment to the United States Senate and soon was named chairman of its committee on military affairs. In 1851 the Democrats of Mississippi prevailed upon him, in the party's interest, to become a candidate for governor. He was defeated by a narrow vote, and was again in retirement for 18 months, but upon the inauguration of Franklin Pierce in 1853, he became secretary of war and served for four years. During this time he strengthened the coast-defences, enlarged the army, directed valuable surveys for a railroad to the Pacific, introduced various betterments at West Point, and experimented with the use of camels as draft animals in the West. Expansionist plots in Cuba and in Nicaragua were supposed to have his support President Pierce's endorsement of the repeal of the Missouri compromise was probably the result of Davis' influence with him.

Davis re-entered the United States Senate on March 4, 1857, but an affection of the eyes limited his activities for nearly two years. In 1859–60 he was one of the foremost leaders of Southern Democrats in opposition to Stephen A. Douglas. During his first term in the senate (1847–51) he had argued that all the territories should be opened to slavery, but he had been willing to accept an extension of the line of the Missouri compromise to the Pacific. After the verdict of the Supreme Court in the Dred Scott case, he became more aggressive in his views of Southern rights and repudiated Stephen A. Douglas' doctrine of squatter sovereignty. He asserted that Congress had no right to deny admission to the Union to any territory because of the existence or non-existence of slavery, which he now frankly defended. His opinions were fully set forth in a series of resolutions offered on Feb. 2, 1860, and subsequently adopted. He did his utmost to

prevent the nomination of Douglas for the presidency, and after the split in the Democratic convention at Charleston, he supported Breckinridge and Lane, though he did not canvass for them.

Always a believer in the right of secession, Davis had favoured a convention of the Southern States in 1851, to consider what action they should take on the compromise of 1850, but until after the election of Lincoln in Nov. 1860 he never felt that circumstances justified a withdrawal from the Union. The victory of the party opposed to slavery, the uncompromising attitude of the Republican senators, and the unwillingness of President Buchanan to concede the right of a State peaceably to leave the Union, combined in the early winter of 1860–61 to convince Davis that the South in self-protection should exercise its right of secession and should form a separate confederation. He united with six other senators from the cotton States in an historic declaration to this effect. At the instance of his colleagues he consented to serve on the "committee of thirteen" that sought a last-minute settlement of slavery, but when he found that the Republican members would accept no compromise, he voted against the committee's report. Although he believed further efforts at accommodation were futile, he intervened in South Carolina's behalf in an attempt to have the Federal garrison withdrawn from Charleston harbour. Then, following the secession of his own State, he bade farewell to the senate on Jan. 21, 1861, in a moving address.

CIVIL WAR CAREER

Designated commander of his own State's troops, Davis hoped for a military career in case of war. Instead, to his surprise and regret, he was unanimously chosen by Congress provisional president of the Confederate States Feb. 9, 1861. He was inaugurated at Montgomery, Ala., on Feb. 18, 1861, mas formally elected by the people on Oct. 16, 1861, was again inaugurated, this time at Richmond, Va., under the "permanent constitution" on Feb. 22, 1862, and was holding the office of president when the Confederacy collapsed.

Selecting a cabinet of moderate views and of no more than moderate ability, Davis sought to negotiate for a withdrawal of the Union troops from military posts in the South, and he did not order military operations to be opened at Charleston, S.C., in April 1861, until he was convinced that the Lincoln administration had sent an armed expedition to revictual and reinforce the garrison of Ft. Sumter.

The easy victory of the Confederates at Bull Run, on July 21, 1861, misled the South into believing that its independence would be won without great effort. Even Davis himself, who had warned the Confederacy of the magnitude of its task, seems to have been so deluded in the summer of 1861 by the hope of speedy foreign intervention that he did not capitalize the war ardour of the first months of the struggle. Events of the winter of 1861–62, however, spurred him to a vigorous policy. He procured the passage of a conscription law, and although the South had only one rolling-mill of any consequence, he contrived to manufacture cannon in sufficient numbers. Side-arms, powder, uniforms and quarter-masters stores were obtained in a country that had few facilities for making them. A navy was constructed in improvised yards and by secret, adroit purchase abroad. The war was financed on fiat money. The feeble, disjointed transport system of the South was welded together and was made to serve.

The results of hard effort, coupled with the fortunate choice of good commanders, showed during 1862 in a series of brilliant victories in Virginia. It was otherwise on the Mississippi. Friction among rival generals and a lack of co-ordination led from disappointment to disaster. A visit of Davis to the threatened front in Dec. 1862 failed to change the situation. The next year he decided on an offensive in the East in preference to reinforcement of the army on the Mississippi. It was his most momentous decision and perhaps his greatest blunder, because the Eastern offensive failed at Gettysburg and the very next day, by the fall of Vicksburg, the Confederacy was cut in half.

In 1864, Lee maintained a successful defensive in Virginia, but in Tennessee and Georgia conditions went from bad to worse. Davis had delayed too long in removing the unsuccessful Braxton Bragg and after he at last relieved Bragg of command of the Army of Tennessee, he offended public opinion by making him his chief military adviser. On July 17, 1864, when Sherman was close to Atlanta, Davis supplanted Joseph E. Johnston by John B. Hood. This most ruinous change led to the speedy break-up of the only army that stood in the way of Sherman's march to join Grant, who by this time had pinned Lee to the Richmond defences. The reaction against Davis, who was blamed for all this, was immediate and severe. Congress no longer sustained him, the governors of North Carolina and of Georgia were openly antagonistic, the press denounced him, and Robert E. Lee would probably have been named dictator in Davis' place if Lee had been willing to countenance a revolution within the Confederacy. The failure of the Hampton Roads conference, on Feb. 3, 1865, to find any basis of peace, filled out the measure of Davis' unpopularity.

Davis was perhaps too harshly judged by his contemporaries. He never had a general military policy. He was too prone to 'take the course of immediate safety. After the removal of the Confederate capital to Richmond, in May 1861, he laid too much emphasis on the defence of Virginia to the neglect of other parts of the Confederacy. He acted on occasion as his own chief of staff, and then, with no apparent reason for change, he left his field commanders entirely to their own discretion. He became so absorbed in operations that he neglected the commissary and transport. Above all, he was not a good judge of men when his affection, his pride or his prejudice were involved, though it must be remembered to his credit that he kept his faith in Robert E. Lee at a time when the press and the country decreed Lee a failure because of his unsuccessful campaign in Western Virginia. Criticism sometimes aroused in Davis a dangerous obstinacy. He could not brook open opposition and he was singularly sensitive. This last-named bad quality, his coldness and his personal dignity kept him from making an effective appeal to the emotions of his people. He was unhappy in his dealings with a short-sighted, contentious congress, and he was maladroit in his foreign relations, particularly with France. His loyalty to his friends was so extreme as to be a positive vice. But against all his failings is to be set the fact that the agricultural South, with resources vastly inferior to those of the North, kept up the struggle for four years. Perhaps the strongest single force in that defence, when all is said, was Jefferson Davis.

On the evacuation of Richmond, April 2–3, 1865, Davis removed the executive offices to Danville, Va., and thence to Greensboro, N.C. Journeying southward in the hope of reaching the Trans-Mississippi department, he was captured near Irwinville, Ga., on May 10, 1865, and was transported to Ft. Monroe, Va. He was confined there, under threat of a trial for treason, until May 4, 1867, when he was admitted to bail and was allowed to go to Canada. During the early part of his imprisonment he was manacled and subjected to severities that impaired his health. This maltreatment, and the effort of the North to make him a scapegoat, won for him the sympathy of the South and restored him to his former place in its affection. Although he was twice indicted for treason, the proceedings were dropped after the general amnesty proclamation of Dec. 25, 1868. He subsequently visited Europe, served for a time as president of an insurance company and then retired to Beauvoir, the home of an admiring friend in Mississippi, where he wrote his *Rise and Fall of the Confederate Government* in two volumes (1881). This is an excellent review of the constitutional questions underlying secession but is in many respects a singularly reticent account of his administration. He later composed *A Short History of the Confederate States of America,* issued posthumously in 1890. He declined to take any part in politics on his return to the United States, and he was cheerfully engaged in his correspondence and in interviews with frequent visitors when a brief illness from a bronchial complaint terminated fatally on Dec. 6, 1889, in New Orleans, La. He was buried there, but in 1893 his body was taken to Richmond and on May 31 was reinterred in Hollywood cemetery.

In person, Jefferson Davis was imposing, over 6 ft. in height, erect, thin and graceful in his movements. His jaw was strong, his eyes were grey-blue, his nose was slightly aquiline and his features were sharply cut. He had much dignity of manner and a fine voice, combined with unfailing personal courtesy.

All four of Davis' sons predeceased him. Besides his widow by his second marriage, he left two daughters, Margaret Davis (1857–1909), who married J. Addison Hayes, and Varina ("Winnie") Davis (1864–1898), known as the "daughter of the Confederacy," born in the confederate executive mansion. She wrote several books that enjoyed some popularity. Mrs. Jefferson Davis lived until 1907, chiefly in New York. Her biography of her husband in two volumes, *Jefferson Davis . . . A Memoir* (1890) is a detailed and persuasive picture of Davis.

BIBLIOGRAPHY.—F. H. Alfriend and E. A. Pollard soon after the war wrote partizan lives that are now supplanted by Mrs. Davis' *Memoir (see* above), by *W*. E. Dodd's *Jefferson Davis* (1907), by A. C. Gordon's biography of the same title (1918) and by H. J. Eckenrode's *Jefferson Davis, President of the South* (1923), an exacting critique of Davis' military policy. Dunbar Row-land in 1923 issued in ten volumes *Jefferson Davis, Constitutionalzst, His Letters, Papers and Speeches.* Mrs. Dunbar Rowland (Eron Rowland) publisned (1928) a biography *Varina Howell, Wife of Jefferson Davis. W. H.* Whitsitt published a tentative *Genealogy* in 1910. *See* also Allen Tate, *Jefferson Davis, His Rise and Fall* (1929). (D. S. F.)

DAVIS or **DAVYS, JOHN** (1550?–160j), one of the chief English navigators and explorers under Elizabeth, was born at Sandridge near Dartmouth about 1550. He early made several voyages with Adrian Gilbert. In Jan. 1583 he appears to have broached his design of a north-west passage to Walsingham and John Dee, and in 1585 he started on his first north-western expedition. He began by striking the ice-bound east shore of Greenland, which he followed south to Cape Farewell; thence he turned north, and coasted the west Greenland littoral, and shaped a "course for China" by the north-west. In 66° N., however, he fell in with Baffin Land, and though he pushed some way up Cumberland sound, he turned back (end of August). He tried again in 1 j86 and 1587; in the last voyage he pushed through the straits still named after him into Baffin's bay, coasting west Greenland to 73° N., almost to Upernavik. Many points in Arctic latitudes (Cumberland sound, Cape Walsingham, Exeter sound, etc.) retain names given them by Davis, who ranks with Baffin and Hudson as the greatest of early Arctic explorers and, like Frobisher, narrowly missed the discovery of Hudson's bay via Hudson's straits.

In 1588 he seems to have commanded the "Black Dog" against the Spanish Armada, and in 1591 he accompanied Thomas Cavendish on his last voyage, with the object of searching "that northwest discovery upon the back parts of America." After the rest of Cavendish's expedition returned unsuccessful, he continued to attempt on his own account the passage of the Strait of Magellan, and discovered the Falkland islands. After his return in 1593 he published a valuable treatise on practical navigation in *The Seaman's Secrets* (1594), and a more theoretical work in *The World's Hydrographical Description* (159j). His invention of back-staff and double quadrant (called a "Davis Quadrant") held the field long after Hadley's reflecting quadrant had been introduced. In 1596–97 Davis sailed with Raleigh (as master of Sir Walter's own ship) to Cadiz and the Azores; and in 1598–1600 he accompanied a Dutch expedition to the East Indies as pilot. In 1601–03 he accompanied Sir James Lancaster as first pilot on his voyage in the service of the East India Company; and in Dec. 1604 he sailed again for the same destination as pilot to Sir Edward Michelborne (or Michelbourn). On this journey he was killed by Japanese pirates off Bintang near Sumatra.

A Traverse Book made by John Davis in 1587, an *Account of his Second Voyage in 1586* and *a Report of Master John Davis of his three voyages made for the Discovery of the North West Passage* were printed in Hakluyt's collection. Davis himself published *The Seaman's Secrets, divided into two Parts* (1594), *The World's Hydrographical Description . . . whereby appears that there is a short and speedy Passage into the South Seas, to China, Molucca, Philippina, and India, by Northerly Navigation* (1595). Various references to Davis are in the *Calendars of State Papers, Domestic* (1591–94), and *East Indies* (1513–1616). *See* also *Voyages and Works of John Davis,* ed. *A. H.* Markham (Hakluyt Society, 1880), and the article "John Davys" by Sir J. Laughton in the *Dict. Nat. Biog.* (C. R. B.)

DAVIS, JOHN WILLIAM (1873–), American lawyer, was born at Clarksburg (W. Va.), April 13, 1873, where he received his early education. He graduated at Washington and Lee university in 1892, and from the law school there in 1895, being admitted to the bar in the same year. After a year as assistant professor of law at his alma mater, he returned in 1897 to Clarksburg, where he entered into an informal partnership with his father, also a lawyer, which continued until 1913. In 1899 he was elected a member of the West Virginia house of delegates, and in 1904 was a delegate to the Democratic national convention at St. Louis. He was elected to the 62nd (1911) and 63rd (1913) congresses for the first West Virginia district. During his period of service he was one of the managers on the part of the House in the successful impeachment of Judge Archbald.

In Aug. 1913, he was appointed solicitor-general of the United States, an office which he held until 1918. In this position he conducted many important cases, among them the Midwest Oil case, involving the right of the President to withdraw from entry public lands thought to contain mineral deposits. From 1913 to 1918 he was counsel for the American Red Cross. In 1918 he was appointed American delegate to a conference with Germany at Bern on the treatment and exchange of prisoners of war, and in the same year succeeded Walter Hines Page as American ambassador to Great Britain, retaining this post until 1921. Among the honours conferred upon him was that of election as a bencher of the Middle Temple.

During the Peace Conference John W. Davis was one of President Wilson's advisers, and was the American representative on the joint committee which drafted the form of Allied control and government in the occupied Rhineland territory. In 1921 he returned from England and accepted a partnership in the New York law firm of Stetson, Jennings and Russell, which had many distinguished clients, among them J. P. Morgan and Co., and the Guaranty Trust Company. Davis was nominated on the 103rd ballot as Democratic candidate for the presidency at the Democratic national convention held in New York city, July 1924. The ensuing election resulted in an overwhelming victory for Calvin Coolidge, the Republican candidate, the electoral vote being 382 for the latter, 136 for Davis and 13 for La Follette, the Progressive candidate, while the popular vote was 15,748,356 for Coolidge, 8,617,454 for Davis and 4,686,681 for La Follette.

DAVIS, RICHARD HARDING (1864–1916), American writer, was born in Philadelphia, April 1S, 1864. He studied at Lehigh and Johns Hopkins universities, and in 1886 became a reporter on the Philadelphia *Record.* After working on several newspapers, at the same time writing short stories, he was managing editor of *Harper's Weekly.* In Dec. 1890 he arranged to travel and write for *Harper's Monthly,* the first book thus resulting being *The West from a Car-Window* (1892). He became widely known as a war correspondent, reporting every war from the Greco-Turkish War (1897) to the World War. Of his numerous works of fiction, the earliest are the best, especially *Gallegher and Other Stories* (1891), and *Van Bibber and Others* (1892). His other books include *Soldiers of Fortune* (1897), *A Year from a Reporter's Note-Book* (1898), *Real Soldiers of Fortune* (1906), *Farces* (1906), *The White Mice* (1909), *Notes of a War Correspondent* (1910), and *Somewhere in France* (191j) He died near Mt. Kisco, N.Y., April 11 1916.

There have been several collective editions, the principal one being *The Novels and Stories of Richard Harding Davis* (1916). A collection of the best of his short stories, *From Gallegher to the Deserter,* was edited by Roger Burlingame in 1927. *See* also *Adventures and Letters of Richard Harding Davis* (1917), edited by his brother Charles B. Davis and *Richard Harding Davis; a Bibliography* (1924), by *H.* C. Quinby.

DAVIS, THOMAS OSBORNE (1814–1845), Irish poet and politician, was born at Mallow, co. Cork. He graduated at Trinity college, Dublin, in 1836, and was called to the bar in 1838. Adopting nationalist views he joined John Blake Dillon in editing the *Dublin Morning Register* (1841), and worked, as a follower of Daniel O'Connell, on the committee of the repeal association He helped Dillon and Charles Gavan Duffy to found the weekly newspaper, *The Nation,* in 1842, to which he contributed a series

of lyrics, "The Lament of Owen Roe O'Neill," "The Battle of Fontenoy," "The Geraldines," "Máire Bhan a Stoir," and many others. Differences arose between O'Connell and the young writers of *The Nation,* and Davis was one of the leaders of the extremist party, "Young Ireland," till his premature death.

See his *Poems* and his *Literary and Historical Essays* collected in 1846 (new ed. 1915). There is an edition of his prose writings (1889) in the *Camelot Classics. See* the monograph on *Thomas Davis* by Sir Charles Gavan Duffy (1890, abridged ed. 1896), and the same writer's *Young Ireland* (revised ed. 1896).

DAVIS, WILLIAM MORRIS (1850–1934), American geographer and geologist, was born in Philadelphia, Pa, on Feb. 12, 1850. After graduating from the Lawrence scientific school, Harvard university in 1870, he was assistant astronomer at the Argentine Kational observatory, Cordoba, Argentina, in 1870–73. In **1877** he made a tour of the world. He was instructor and professor of physical geography and geology at Harvard from **1877** until **1912** when he was made professor emeritus. In 1903 he went to Turkistan as a physiographer of Pumpelly's Carnegie institution expedition. He visited South Africa in 1905 and Australia in 1914 as guest of the British Association for the Advancement of Science. He was visiting professor at the University of Berlin in 1908–09, and at the University of Paris in 1911–12. In **1914** he crossecl the Pacific on a Shaler memorial study of coral reefs. He was founder and for three terms president of the Association of American Geographers; founder and president (1902–11) of the Harvard Travellers' club, and president **(1911)** of the Geological Society of America. By his lectures and writings on the development of the physical features of the earth he won high rank among modern physiographers.

Among his published works are *Elementary Meteorology* **(1894)** ; *The Triassic Formation of Connecticut* (U.S. Geological Survey, **1896);** *Physical Geography* **(1898)**; *Practical Exercises in Physical Geography* (1908); *Geographical Essays* (1909); *Physiogeographie* (with G. Braun, 1911); *Erkl. Beschreibung der Landformen* (lectures in Berlin, 1912); *The Coral Reef Problem* **(1928);** and numerous scientific essays. In **1895** he was made a member of the editorial committee of *Science* and in 1909 he became associate editor of the *American Journal* of *Science.*

DAVISON, WILLIAM (*c.* 1541–1608), secretary to Queen Elizabeth, was of Scottish descent. In 1566 he acted as secretary to Henry Killegrew (d. 1603), when he was sent into Scotland by Elizabeth on a mission to Mary, queen of Scots. Remaining in that country for about 10 years, Davison then went twice to the Netherlands on diplomatic business, returning to England in **1586** to defend the hasty conduct of his friend, Robert Dudley, earl of Leicester, who had assumed the office of Governor of the Low Countries without Elizabeth's instructions. In the same year he became member of parliament for Knaresborough, a privy councillor, and assistant to Elizabeth's secretary, Thomas Walsingham; but he soon appears to have acted rather as the colleague than the subordinate of Walsingham. He was a member of the commission appointed to try Mary, queen of Scots, although he took no part in its proceedings, was never at Fotheringay, and was not present at Westminster when the sentence of death was passed. The warrant for Mary's execution was entrusted to Davison. On this occasion, and also in subsequent interviews with her secretary, Elizabeth suggested that she would be glad to avoid the responsibility of the execution, but Mary's gaolers, Paulet and Drury, refused to take the hints thrown out to them. Meanwhile, the privy council having been summoned by Lord Burghley, it was decided to carry out the sentence at once, and Mary mas beheaded on Feb. **8,** 1587. When the news of the execution reached Elizabeth she was extremely indignant, and her wrath was chiefly directed against Davison, who, she asserted, had disobeyed her instructions not to part with the warrant. The secretary was arrested and thrown into prison, but, although he defended himself when interrogated in the Tower, he did not say anything about the queen's wish to get rid of Mary by assassination. Charged before the Star Chamber (March **28,** 1587) with misprision and contempt, he was acquitted by many of the commissioners of evil intention, but was sentenced to pay a fine of 10,000 marks, and to imprisonment during the queen's pleasure; but he was released in 1589. He retired to Stepney, where he died. He was buried on Dec. 4, **1608.** Davison was undoubtedly made the scapegoat for the queen's pusillanimous conduct.

His eldest son FRANCIS DAVISON (*c.* **157j-c** 1619), and his fourth son WALTER (1581–1608?) both contributed poems to the *Poetical Rhapsody* **(1602)** ; notices of them are given in Sir N. H. Nicolas's edition **(1826)** of that miscellany. Francis Davison also wrote a metrical translation of the Psalms, which remained in ms. until they were edited by Sir E. Brydges and by Nicolas in the 19th century.

Many state papers written by him, and many of his letters, are extant in various collections of manuscripts. *See* Sir N. *H.* Nicolas, *Life of* W. *Davison* (1823); *J.* A. Froude, *History of England* (1881 fol.); *Calendar of State Papers 1580–1609;* and *Correspondence of Leicester during his Government of the Low Countries,* edited by *J.* Bruce (1844).

DAVIS STRAIT, the broad strait which separates Greenland from North America, and connects Baffin bay with the open Atlantic. At its narrowest point, which occurs just where the Arctic Circle crosses it, it is nearly 200 m. wide. This part is also the shallowest, a sounding of 112 fathoms being found in the centre, whereas the depth increases rapidly both to north and to south. Along the western shore (Baffin Land) a cold current passes southward; but along the east there is a warm northward stream. There are a few Danish settlements on the Greenland coast. The strait takes its name from the explorer John Davis.

DAVITT, MICHAEL (1846–1906), Irish Nationalist politician, son of a peasant farmer, was born at Straide, Co. Mayo, on March **25, 1846.** His father was evicted for non-payment of rent in 1852, and migrated to Lancashire, where at the age of ten the boy began work in a cotton mill at Haslingden. In **1857** he lost his right arm by a machinery accident; he was sent to school, and at 15 became a newsboy and printer's "devil." He drifted into the ranks of the Fenian brotherhood in **1865,** and on May 14, 1870, he was arrested at Paddington for treason-felony in arranging to send firearms into Ireland, and was sentenced to **15** years penal servitude. After seven years, spent chiefly at Dartmoor, he was released on ticket-of-leave. He at once rejoined the "Irish Republican Brotherhood," and went to the United States, where his mother, herself of American birth, had settled with the rest of the family, with the idea of grafting constitutional methods on the revolutionary movement on lines which he had thought out in prison. He proposed to link up the campaign for independence with the agrarian question. Returning to Ireland he seems to have persuaded Parnell of the importance of the agrarian element, and helped him to start the Land League in 1879, and his violent speeches resulted in his re-arrest and consignment to Portland by Sir William Harcourt, then home secretary. He was released in **1882,** but was again prosecuted for seditious speeches, and imprisoned for three months in **1883.** Before this his support of Parnell had led to his expulsion from the supreme council of the I.R B., though he remained a member of the organization until **1882.** Between **1882** and **188j** he conducted a campaign on land nationalization. which Parnell repudiated. He had been elected to parliament for Meath as a Nationalist in **1882,** but, being a convict, was disqualified to sit. He was included as one of the respondents before the Parnell Commission (1888–1889), and spoke for fire days in his own defence. That he had brought the Irish Party into contact with the Fenians in America was undoubted. *(See* PARNELL **)** He took the anti-Parnellite side in 1890, and in **1892** was elected to parliament for North Meath, but was unseated on petition. He was then returned for North-East Cork, but had to vacate his seat through bankruptcy, caused by the costs in the North Meath petition. In **189j** he was elected for West Mayo. In **1898** he helped William O'Brien to found the United Irish League to reconcile the Parnellite and anti-Parnellite factions. He retired from the House of Commons to express his disapproval of the Boer War. He fiercely opposed the Wyndham Land Purchase Act and William O'Brien's conciliatory policy. He died on May 31, 1906, in Dublin. A sincere but embittered Nationalist, anti-English, anti-clerical and sceptical as to the value of the purely parliamentary agitation

for Home Rule, Davitt was often in conflict with his fellow Home Rulers. In later years his socialistic radicalism connected him closely with the Labour Party. His force of character earned him the respect of many, even of those who thought his doctrine pernicious. The chief original authority is to be found in his own works, notably in his speech before the Parnell Commission, separately published as The *Defence* of tlze Land *League* (1891).

See also F. Sheehy Skeffington, *Michael* Davitt, etc. (1908).

DAVOS, a mountain valley in the Swiss canton of the Grisons (Romansch Tavau), lying east of Coire (40 m. distant by rail), and north-west of the Lower Engadine (18 m. by road from Süs). It contains two main villages, 2 m. from each other, Dorfli and Platz (the chief hamlet), which are 5,015 ft. above sea-level, and had a population in 1930 of 11,164, a figure exceeded in the Grisons only by Coire. Of the population in 1920 5,885 were Protestants, 3,309 Romanists and 163 Jews; while 7,776 were German-speaking and 430 Romansch-speaking. Tavaus or Tavauns is mentioned in 1160 and 1213, as a mountain pasture or "alp." It was then in the hands of a Romansch-speaking population, as is shown by many surviving field names. But between 1260 and 1282, German-speaking colonists from the Upper Valais were planted there, so that it has long been a Teutonic island in the midst of a Romansch-speaking population. Historically it is associated with the Prattigau or Landquart valley to the north, and in 1436 became the capital of the League of the Ten Jurisdictions. (See GRISONS.) It formerly contained many iron mines, and belonged from 1477 to 1649 to the Austrian Habsburgs.

In 1860 the population was only 1,705; the increase being due to the fact that the region is much frequented as a winter resort and has many sanatoria, etc. At the north end of the valley is lake Davos, while from Platz the Landwasserstrasse leads (20 m) down to the Alvaneubad station.

DAVOUT, LOUIS NICOLAS, duke of Auerstadt and prince of Eckmühl (1770–1823), marshal of France, was born at Annoux (Yonne) on May 10, 1770. His name is also, less correctly, spelt Davoût and Davoust. He entered the French army as a sub-lieutenant in 1788, and was *chef* de bataillon in a volunteer corps in the campaign of 1792, and distinguished himself at Neerwinden in the following spring. He had just been promoted general of brigade when he was removed from the active list as being of noble birth. He served, however, in the campaigns of 1794–97 on the Rhine, and accompanied Desaix in the Egyptian expedition of Bonaparte. On his return he fought in the campaign of Marengo under Napoleon, who made him a general of division, and in 1801 gave him a command in the consular guard. Davout was created a marshal of France when Napoleon became emperor. As commander of the III. corps of the *Grande Armée* Davout rendered the greatest services. At Austerlitz, after a forced march of 48 hours, the III. corps bore the brunt of the allies' attack. In the Jena campaign Davout with a single corps fought and won the brilliant victory of Auerstadt against the main Prussian army. (See NAPOLEONIC CAMPAIGNS.) He took part in the campaign of Eylau and Friedland. Napoleon left him as governor general in the grand-duchy of Warsaw when the treaty of Tilsit put an end to the war (1807), and in 1808 created him duke of Auerstadt. In the war of 1809 Davout took a brilliant part in the actions which culminated in the victory of Eckmuhl, and had an important share in the battle of Wagram (*q.v.*). He was created prince of Eckmiihl about this time. It was Davout who was entrusted by Napoleon with the task of organizing the "corps of observation of the Elbe," which was in reality the army with which the emperor invaded Russia in 1812. In this Davout commanded the I. corps, over 70,000 strong, and defeated the Russians at Mohilev before he joined the main army, with which he continued throughout the campaign and the retreat from Moscow. In 1813 he defended Hamburg, a city ill fortified and provisioned, and full of disaffection, through a long siege, only surrendering the place on the direct order of Louis XVIII. after the fall of Napoleon in 1814.

Davout was a stern disciplinarian, almost the only one of the marshals who exacted rigid and precise obedience from his troops. Thus, in the earlier days of the Grande *Armée,* it was always the III. corps which was entrusted with the most difficult part of the work in hand. His rapacity in the conduct of civil affairs was in reality Napoleon's, for he gave the same undeviating obedience to superior orders which he enforced on his own subordinates. He was admitted by his contemporaries and by later judgment to be one of the ablest, perhaps the ablest, of all Napoleon's marshals. On the first restoration he retired into private life, and at once joined Napoleon on his return from Elba. Appointed minister of war, he was so far indispensable to the war department that Napoleon kept him at Paris during the Waterloo campaign. Napoleon has been criticised for not availing himself in the field of the services of the best general he then possessed. Davout directed the defence of Paris after Waterloo, and was deprived of his marshalate and his titles at the second restoration. When some of his subordinate generals were proscribed, he demanded to be held responsible for their acts, as executed under his orders, and he endeavoured to prevent the condemnation of Ney. After a time the hostility of the Bourbons towards Davout died away, and he was reconciled to the monarchy. In 1817 his rank and titles were restored, and in 1819 he became a member of the chamber of peers. He died in Paris June 1, 1823.

See Ch. de Mazade, Corr. du mar. Davout (1885); the marquise de Blockqueville, Le *Maréchal* Davout *raconté* par *les siens* et *lui-même* (Paris, 1870–80, 1887); Chenier, Davout, *duc d'Auerstädt* (Paris, 1866).

DAVY, SIR HUMPHRY, BART. (1778–1829), English chemist, was born on Dec. 17, 1778, at Penzance, Cornwall. In his school days at the grammar schools of Penzance and Truro he showed few signs of a taste for scientific pursuits. During his apprenticeship to a surgeon-apothecary at Penzance he studied metaphysics, ethics and mathematics. He turned to chemistry at the end of 1797, and, after reading Nicholson's and Lavoisier's treatises he began a series of chemical experiments with any apparatus and materials he could obtain. About this time he made the acquaintance of Davies Giddy, afterwards Gilbert (1767–1839), who was president of the Royal Society (1827–31). Giddy recommended him to Dr. Thomas Beddoes, who was in 1798 establishing his Medical Pneumatic Institution at Bristol for investigating the medicinal properties of various gases. Here Davy, released from his indentures, was installed as superintendent towards the end of 1798. Early next year two papers by him were published by Beddoes; these contained the results of Davy's crude experiments and theories hastily formed on insufficient evidence.

One of his first discoveries at the Pneumatic Institution on April g, 1799, was that pure nitrous oxide is perfectly respirable, and he narrates that on the next day he became "absolutely intoxicated" through breathing 16 quarts of it for "near seven minutes." This discovery brought both him and the Pneumatic Institution into prominence, and Count Rumford, requiring a lecturer on chemistry for the recently established Royal Institution in London, engaged him in 1801 as assistant lecturer in chemistry and director of the laboratory. He was almost at once appointed lecturer, and his promotion to be professor followed on May 31, 1803. One of his first tasks was the delivery of a course of lectures on the chemical principles of tanning. The main facts he discovered from his experiments in this connection were described before the Royal Society in 1802–3. In 1802 the board of agriculture requested him to direct his attention to agricultural subjects; and in 1803, with the acquiescence of the Royal Institution, he gave his first course of lectures on agricultural chemistry and continued them for ten successive years, ultimately publishing their substance as Elements of Agricultural Chemistry in 1813. Although Davy had taken up the subject by order, this book remained for nearly 50 years the standard work on the subject.

But his chief interest at the Royal Institution was with electrochemistry. His early work on this subject is summed up in his first Bakerian lecture "On some Chemical Agencies of Electricity." This paper gained him from the French Institute the medal offered by Napoleon for the best experiment made each year on "galvanism." The discovery of potassium and sodium, and their preparation by an electrolytic method effected in Oct. 1807 was of great

importance. According to his cousin, Edmund Davy, then his laboratory assistant, he was so delighted with this achievement that he danced about the room in ecstasy.

Four days after reading his second Bakerian lecture his health broke down, and he was unable to resume work until March 1808. He continued to research on the alkalis and earths and his results were communicated in successive Bakerian lectures (1807–10). Another important discovery due to Davy was that oxymuriatic acid was a simple substance; he proposed the name "chlorine" for it. He succeeded in preparing boron, for which at first he proposed the name boracium, under the impression that it was a metal. Davy also discovered hydrogen telluride, hydrogen phosphide and a number of other compounds. On April 9, 1812, he gave his farewell lecture as professor of chemistry at the Royal Institution, though he continued his connection as an honorary professor. In that month he was knighted, and married to Mrs. Apreece, daughter and heiress of Charles Kerr of Kelso. A few months after his marriage he published the first and only volume of his *Elements of Chemical Philosophy*.

In Oct. 1813 he started with his wife for a continental tour, and with them, as "assistant in experiments and writing," went Michael Faraday, his assistant in the Royal Institution laboratory. In spite of the fact that England and France were at war Davy was welcomed in Paris, where he was made a corresponding member of the first class of the Institute. From Paris he went to Genoa where he investigated the electricity of the torpedo-fish, and at Florence, by the aid of the great burning-glass in the Accademia del Cimento, he effected the combustion of the diamond in oxygen and decided that, beyond containing a little hydrogen, it consisted of pure carbon.

A few months after his return, through Germany, to London in 1815, he considered the construction of a miner's safety lamp. His lamps were brought into use in the mines in 1816. A large collection of the different models made by Davy in the course of his inquiries is in the possession of the Royal Institution. He took out no patent for his invention, and in recognition of his disinterestedness the Newcastle coal-owners in Sept. 1817 presented him with a dinner-service of silver plate. Davy's will directed that this service should pass to his brother, Dr. John Davy, on whose decease, if he had no heirs who could make use of it, it was to be melted and sold, the proceeds going to the Royal Society "to found a medal to be given annually for the most important discovery in chemistry anywhere made in Europe or Anglo-America." The silver produced £736, and the interest on that sum is expended on the Davy medal, which was awarded for the first time in 1877, to Bunsen and Kirchhoff for their discovery of spectrum analysis.

In 1818 he received a baronetcy for this signal service to industry. In that year also he was commissioned by the British government to examine the papyri of Herculaneum in the Neapolitan museum. He had been secretary of the Royal Society from 1807 to 1812, and on his return from Italy in 1820 became president, but his personal qualities did not make for success in that office, especially in comparison with the tact and firmness of his predecessor, Sir Joseph Banks. He directed his attention to various subjects, chiefly electromagnetism, but his researches were less successful than his earlier experiments. In 1823 the admiralty consulted the Royal Society as to a means of preserving the copper sheathing of ships from corrosion and keeping it smooth, and he suggested that the copper would be preserved if it were rendered negatively electrical, as would be done by fixing "protectors" of zinc to the sheeting. This method was tried on several ships, but it was found that the bottoms became extremely foul from accumulations of seaweed and shellfish. For this reason the admiralty decided against the plan. In 1826 Davy's health, which showed signs of failure in 1823, made rest necessary. The following years were spent chiefly abroad. and he died at Geneva on May 29, 1829. On this journey he wrote his *Consolations* in *Travel* (1830).

Of a sanguine, somewhat irritable temperament, Davy displayed characteristic enthusiasm and energy in all his pursuits. As is shown by his verses (all his life he found solace in writing verse) and sometimes by his prose, his mind was highly imaginative; the poet Coleridge declared that if he "had not been the first chemist, he would have been the first poet of his age," and Southey said that "he had all the elements of a poet; he only wanted the art." In spite of his ungainly exterior and peculiar manner, his happy gifts of exposition and illustration won him extraordinary popularity as a lecturer, his experiments were ingenious and rapidly performed, and Coleridge went to hear him "to increase his stock of metaphors." Though his ambition sometimes betrayed him into petty jealousy, it did not leave him insensible to the claims on his knowledge of the "cause of humanity," to use a phrase often employed by him in connection with his invention of the miners' lamp.

See J. A. Paris, *The Life of Sir Humphry Davy* (1831); John Davy, *Memoirs of Sir Humphry Davy* (1836); *Collected Works* (with shorter memoir, 1839); *Fragmentary Remains, Literary and Scientific* (1858); T. E. Thorpe, *Humphry Davy, Poet and Philosopher* (1896).

DAVY LAMP. If a piece of metal gauze is interposed between a flame and an explosive gaseous mixture, the heat of the flame is absorbed and conducted away by the metal gauze so that the gaseous mixture does not explode. That is the principle of the Davy lamp, which was invented by Sir Humphry Davy in 1816. The Davy lamp consisted of a small cylindrical oil lamp, covered with a cylinder of wire gauze about 6in. long and 1½in. in diameter, with a flat gauze top. The upper part of the gauze was doubled to prevent it from being worn into holes by the products of combustion. The gauze was mounted in a frame of upright wires screwed into a brass ring at each end. The upper ring carried the handle, and the lower one was screwed to a collar on the oil vessel at the bottom of the lamp. Thus encircled with a case of metal gauze, the flame or gases could not pass out at a temperature high enough to fire an explosive mixture in the mine. For the subsequent developments of this invention, *see* SAFETY LAMP.

DAWARI or **DAURI,** a Pathan tribe on the Waziri border of the North-West Frontier Province of India. The Dawaris inhabit the Tochi Valley (q *v.*), otherwise known as Dawar or Daur, and are a homogeneous tribe of considerable size.

DAWES, CHARLES GATES (1865–), American statesman and financier, was born in Marietta, O., on Aug. 27, 1865, the son of Gen. Rufus R. Dawes. He was educated in his home town, graduating at Marietta college in 1884 at the early age of 19. He then attended the Cincinnati law school and in order to defray his expenses obtained employment during his vacation on the Marietta, Columbus, and Northern Ohio railway. Before finishing his two-years law course he was made chief engineer in charge of construction on this railway—a fact eloquent of the energy and versatility which were to distinguish his whole career. He graduated in 1886, before he was old enough to practise. Admitted to the bar several months later, he commenced practice at Lincoln, Neb., in 1887.

Dawes' reputation as a lawyer was established by his part in the Nebraska rate case, in which he appeared successfully as counsel for the Lincoln board of trade in an effort to obtain a reduction in railway rates in Nebraska. In 1894 he became extensively interested in the gas business at Evanston, Ill., and at other western points, and removed to Evanston in that year. In 1896 he organized the movement in Illinois to nominate William McKinley as Republican candidate for the presidency. He was active in securing McKinley's nomination and election and was chosen a member of the executive committee of the Republican national committee. He was appointed comptroller of the currency by President McKinley on Jan. 1, 1898. His tenure of office was conspicuous for efficiency of administration and disregard of "red-tape" methods, especially in the conduct of the many receiverships and trusts created by the financial disorders following 1893. Retiring from this office in 1902, he organized the Central Trust Co. of Illinois, which, under his presidency, became one of the strongest financial institutions in Chicago.

On the declaration of war against Germany by the United States (April 6, 1917) Dawes volunteered for service and was given a commission as major and later as lieut.-col. of the 17th

Engineers (Railway), his well-known ability and early experience in railway construction outweighing the fact that he was over age. He landed in France July 17, and was placed on the head-quarters staff of the A.E.F. by General Pershing as chairman of the general purchasing board and chief of supply procurement, charged with the duty of collecting supplies in Europe and of co-ordinating their purchase in such a way as to guard against inflated prices and duplication of orders. His conspicuous success in directing these transactions, which secured for the American army 10,000,000 ship tons of supplies in Europe as against 7,000,000 shipped to it from the United States, led to his promotion to the rank of brigadier-general in 1918. On the unification of command of the Allied forces under Foch, General Dawes was appointed as U.S. member of the Military Board of Allied Supply, the organization of which had been largely due to his efforts. This board for the last four months of the War co-ordinated the movement of supplies for the Allied Armies in the zone of the advance.

After the conclusion of the Armistice, Dawes became a member of the liquidation committee of the A.E.F., charged with the task of disposing of the huge accumulations of American property in France and of settling outstanding claims against the army. This engaged his efforts until Aug. 1919, when he resigned his commission and returned to the United States. Upon the creation of a budget bureau by Congress, April 1921, the directorship of it was offered to General Dawes by President Harding and was accepted on condition that the bureau should be non-political, that in gathering information the director should be assumed to be acting for the President and his calls for consultation or information should take precedence of all others. His work in organizing this bureau and creating under executive order the existing system of co-ordinating boards now operating in Government business was carried through with characteristic vigour and directness and resulted in savings estimated officially at $250,000,000 in the first year. Having completed the task of placing the budget on a satisfactory and permanent basis, he resigned his position on June 30, 1922.

In the meantime the collapse of the German financial structure and international reactions resulting therefrom had precipitated a crisis in European affairs, the outcome of which appeared ominous. At this juncture, the Allied Reparations Commission, in 1923, appointed General Dawes and Owen D. Young as U.S. members of the committee of experts to report upon means of balancing Germany's budget and stabilizing its currency. Dawes was selected as chairman, and the committee's report, known as the "Dawes Plan," was accepted by all the Powers concerned. By making the actual transfer of reparation payments conditional on the stability of the German exchange, this plan provided a non-political and automatic means for determining Germany's ability to pay and so withdrew this vexed question from international controversy and paved the way for the later agreements entered into at Locarno. (*See* REPARATIONS AND THE DAWES PLAN.)

At the Republican National Convention held at Cleveland, O., June 10–12, 1924, following the nomination of President Coolidge for re-election, General Dawes was nominated for vice-president on the third ballot by a vote of 682½ against 334½ for Herbert Hoover and 75 for Judge Kenyon. Following the overwhelming triumph of the Republican ticket at the ensuing election, General Dawes assumed office on March 4, 1925. In his inaugural speech he called for a revision of the rules of procedure in the Senate so that a majority vote could apply the closure to debate. He later carried his proposals for senatorial reform before the people in a series of public meetings in various parts of the country.

Another aspect of General Dawes's character is revealed by two acts of philanthropy. In memory of his son, Rufus Fearing, who was accidentally drowned (Sept. 5, 1912) he established the Rufus F. Dawes hotels in Chicago and Boston, at which impoverished men could obtain food and accommodation at nominal rates. As a memorial to his mother he established the Mary Gates Dawes memorial hotel, where women might live cheaply and retain the physical comforts and social opportunities compatible with self-respect. In the course of his varied and successful career as engineer, lawyer, politician, comptroller of the currency, public utility operator, banker, philanthropist, soldier, organizer of the Government budget, leading spirit in the settlement of German reparations, and vice-president of the United States, General Dawes found time also to become an accomplished musician on the piano and flute. In March and April, 1929, he headed a financial commission to the Dominican Republic. In April he was appointed ambassador to Great Britain.

Dawes wrote *The Banking System of the United States and its Relation to the Money and Business of the Country* (1894); *Essays and Speeches* (1915); *A Journal of the Great War* (1921); and *The First Year of the Budget of the United States of America* (1923).

(O. D. Y.)

DAWES, RICHARD (1708–1766), English classical scholar, was born in or near Market Bosworth. He was elected fellow of Emmanuel college, Cambridge, in 1731. From 1738 to 1749 he was master of the Newcastle grammar school. The book on which his fame rests is his *Miscellanea critica* (1745), which gained the commendation of such distinguished Continental scholars as L. C. Valckenaer and J. J. Reiske. The *Miscellanea*, which was re-edited by T. Burgess (1781), G. C. Harles (1800) and T. Kidd (1817), will remain an enduring monument of English scholarship, although some of the "canons" have been proved untenable.

See J. Hodgson, *An Account of the Life and Writings of Richard Dawes* (1828); H. R. Luard in *Dict. of Nat. Biog.*; J. E. Sandys, *Hist. of Classical Scholarship*, ii. 415.

DAWES PLAN: *see* REPARATIONS AND THE DAWES PLAN.

DAWISON, BOGUMIL (1818–1872), German actor, was born at Warsaw, of Jewish parents, and at the age of 19 went on the stage. In 1839 he received an appointment to the theatre at Lemberg in Galicia. In 1847 he played at Hamburg with marked success, was from 1849 to 1854 a member of the Burg theatre in Vienna, and then of the Dresden court theatre. He died in Dresden on Feb. 1, 1872. Dawison was considered in Germany an actor of a new type; a leading critic wrote that he and Marie Seebach "swept like fresh gales over dusty tradition." His chief parts were Mephistopheles, Franz Moor, Mark Anthony, Hamlet, Charles V., Richard III. and King Lear.

DAWKINS, SIR WILLIAM BOYD (1837–1929), English geologist and archaeologist, was born at Buttington vicarage near Welshpool. Educated at Rossall school and Oxford, he joined the Geological Survey in 1862, and in 1870 became curator of the Manchester museum, a post which he retained till 1890. He was appointed professor of geology and palaeontology in Owens college, Manchester, in 1872. He paid special attention to the question of the existence of coal in Kent, and in 1882 was selected by the Channel tunnel committee to make a survey of the French and English coasts. He was also employed in the scheme of a tunnel beneath the Humber. His chief distinctions, however, were won by his researches into the lives of the prehistoric cave-dwellers described in *Cave-hunting* (1874); *Early Man in Britain* (1880); *British Pleistocene Mammalia* (1866–87). He was knighted in 1919, and died on Jan. 15, 1929.

DAWLISH, urban district and seaside resort, Tiverton parliamentary division. Devon, England, on the English channel at the mouth of Dawlish brook, 12 mi. S. from Exeter by G.W. railway. Population (1938) 5,455. Area, 9·5 sq.mi. It lies on a cove sheltered by two headlands, and both sides of the Dawlish brook are lined by pleasure grounds. The warm climate and excellent bathing attract many visitors in spring and early summer. It holds an annual fair on Easter Monday and a regatta in August or September. Until its sale, in the 19th century, the site of Dawlish belonged to Exeter cathedral from 1050.

DAWN, the time when light appears (*daws*) in the sky. The dawn colours appear in the reverse order from those of the sunset. When the sun is lowest in both cases the colour is deep red; this gradually changes through orange to gold and yellow as the sun nears the horizon. This is their order of refrangibility, in the spectrum; the blue rays usually are scattered in the sky. The colours of the dawn are purer and colder than the sunset colours as the reduced dust content of the atmosphere causes less sifting of the light rays.

DAWSON OF PENN, BERTRAND EDWARD DAWSON, 1st VISCOUNT, British physician, studied medicine at Univer-

sity college and the London hospital, where in 1896 he became an assistant physician and in 1906 physician. By his extensive researches on gastric affections he became one of the authorities on this subject. He was appointed physician extraordinary to Edward VII in 1907, and later physician in ordinary to George V and in 1923 to the prince of Wales. During World War I he worked on war diseases, publishing various papers on paratyphoid and infective jaundice. He was made G.C.V.O. in 1917, K.C.M.G. in 1919 and in 1920 was raised to the peerage. Dawson has published *The Diagnosis and Operative Treatment of Diseases of the Stomach* (1908) and other similar works. He was made a privy councillor in June 1929 and a viscount in 1936.

DAWSON, GEORGE GEOFFREY (1874–), editor of the *Times*, 1912–19, and from 1923 until his retirement in 1941. He was educated at Eton and Magdalen college, Oxford, and was elected a fellow of All Souls college in 1900. Passing into the civil service, he was appointed to the colonial office, and in 1901 he went to South Africa as private secretary to Lord Milner, then high commissioner. On Lord Milner's retirement from the high commissionership in 1905 he accepted the editorship of the Johannesburg *Star*, which he held for the next four years. Returning to London in 1910, he was appointed a director of the *Times*, which was then in the early days of Lord Northcliffe's direction, and in 1912 succeeded G. E. Buckle as editor. The conspicuous success which the *Times* attained during the difficult years of World War I was largely due to Dawson's sound judgment and knowledge of affairs, which formed an admirable and often very necessary complement to Lord Northcliffe's imagination and genius. In 1919, however, Dawson found himself unable to carry out Lord Northclifie's policy for the *Times* and resigned. He was succeeded by Henry Wickham Steed (*q.v.*). When in consequence of Lord Northcliffe's death in 1923 the *Times* was reconstructed, Steed retired and Dawson was recalled to the editorship. He had been estates bursar of All Souls college (1919–23) and secretary to the Rhodes Trust (1921–22). In 1917 he changed his name by royal licence from Robinson to Dawson.

DAWSON, SIR JOHN WILLIAM (1820–1899), Canadian geologist, was born at Pictou, Nova Scotia, on Oct. 30, 1820. He was educated at Edinburgh, Scotland, and on his return to Nova Scotia in 1842 he accompanied Sir Charles Lyell on his first visit to that territory. He was superintendent of education (1850–53); at the same time he studied the geology of the country, making a special investigation of the fossil forests of the coal-measures. From these strata, in company with Lyell (during his second visit) in 1852, he obtained the first remains of an "air-breathing reptile" named *Dendrerpeton*. He also described the fossil plants of the Silurian, Devonian and Carboniferous rocks of Canada for the geological survey of that country (1871–73). From 1855 to 1893 he was professor of geology and principal of McGill university, Montreal. He was elected F R.S. in 1862 and knighted in 1884. Dawson published, besides other works, *Acadian Geology: The Geological Structure, Organic Remains and Mineral Resources of Nova Scotia, New Brunswick and Prince Edward Island* (1855; ed. 3, 1878); *Air-Breathers of the Coal Period* (1863). He died on Nov. 20, 1899.

His son, GEORGE MERCER DAWSON (1849–1901), was born at Pictou on Aug. 1, 1849, and received his education at McGill university and the Royal School of Mines, London. In 1873 he was appointed geologist and naturalist to the North American boundary commission, and two years later he joined the staff of the geological survey of Canada, of which he became assistant director in 1883 and director in 1895. He was in charge of the Canadian government's Yukon expedition in 1887, and his name is commemorated in Dawson City, of gold-bearing fame. He was one of the Bering Sea commissioners in 1891. He was elected F.R S. in 1891, and was president of the Royal Society of Canada in 1893. He died on March 2, 1901. He was the author of many scientific papers and reports on the surface geology and glacial phenomena of the northern and western parts of Canada.

DAWSON or DAWSON CITY, capital of the Yukon territory, Canada, on the bank of the Yukon river, and in the middle of the Klondike gold region, of which it is the distributing centre. It is in beautiful mountainous country, 1,049 ft. above the sea and 1.500 mi. from the mouth of the Yukon river, and is reached by river steamer from White Horse (460 mi.) in summer, and by tractors and aeroplanes in winter. There are metal-works and sawmills.

Order is kept by the Northwest mounted police. Founded in 1896, its population soon reached over 30,000 at the height of the gold rush; in 1901 it was 9,142; in 1931, 819; and in 1941, 1,043 The record of temperature varies from 83° F. in summer to −60° in winter. (*See* YUKON AND NORTHWEST TERRITORIES.)

Dawson was named for George M. Dawson, director of the Canadian geological survey. In 1898 the town became the administrative centre of Yukon territory. Jack London, Robert Service and Rex Beach were among the inhabitants of the town in its "boom" days and later wrote of the robustious period of the gold rush. The town was severely damaged by fire in 1898 and 1899.

See Merle Colby, *A* ***Guide*** to *Alaska, Last American Frontier* (Federal Writers' Project, 1939).

DAWSON-WATSON, DAWSON (1864–1939), U.S. artist, was born at London, England, July 21, 1864. He studied art under Mark Fisher and others in England and moved in 1893 to the United States to become art director of the Hartford (Conn.) Art society. Later he taught at the Byrdcliffe colony, Woodstock, N.Y., and from 1904 to 1915 at the St. Louis (Mo.) School of Fine Arts; he also was art director of the St. Louis Industrial exhibition in 1914 and the St. Louis centennial exhibition in 1918.

Aside from his paintings in oil and water colour, he designed textiles and costumes and was a wood carver and mezzotint engraver. He died at San Antonio, Tex., Sept. 3, 1939.

DAX, a town of southwestern France, capital of an arrondissement in the department of Landes, 92 mi. S.S.W. of Bordeaux, on the Southern railway between that city and Bayonne. Pop. (1936) 10,168. It lies on the left bank of the Adour, and its suburb, Le Sablar, on the right. Its ancient Gallo-Roman fortifications are now a promenade. Dax (*Aquae Tarbellicae, Aquae Augustae,* later *D'Acqs*) was the capital of the Tarbelli in Roman times, when its waters were already famous. In the 11th century its viscounty passed to the viscounts of Béarn and in 1177 was annexed by Richard Coeur de Lion to Gascony. The bishopric, founded in the 3rd century, was in 1801 attached to that of Aire. The church of Notre Dame, once a cathedral, was rebuilt from 1656 to 1719, but still preserves a sacristy, a porch and a fine sculptured doorway of the 13th century. The church of St. Paul-lès-Dax, mainly 15th century, has a Romanesque apse with curious bas-reliefs. Dax, well known as a winter resort, has thermal waters and mud baths (the deposit of the Adour). The principal of numerous bathing establishments are the Grands Thermes, the Bains Salés, adjoining a casino, and the Baignots, which fringe the Adour and are surrounded by gardens. Dax has a subprefecture and tribunals of first instance and of commerce Commerce is chiefly in the pine wood, resin and cork of the Landes, in mules, cattle and horses, hosiery and ceramics. Dax was occupied by Germany in June 1940.

DAY, JOHN (1574–1640?), English dramatist, was born at Cawston, Norfolk. in 1574, and educated at Ely. He became a sizar of Caius College, Cambridge, in 1592 but was expelled in the next year for stealing a book. As early as 1598 he became one of Henslowe's playwrights, collaborating with Henry Chettle, William Haughton, Thomas Dekker, Richard Hathway, and Wentworth Smith, but his almost incessant activity seems to have left him poor enough, to judge by the small loans, of five shillings and even two shillings, that he obtained from Henslowe. The first play in which Day appears as part author is *The Conquest of Brute, with the Finding of the Bath* (1598), which, with most of his journeyman's work, is lost. *The Ile* of *Guls* (printed 1606), a prose comedy founded upon Sir Philip Sidney's *Arcadia,* contains in its light dialogue much satire to which the key is now lost. In 1607 Day produced, with William Rowley and George Wilkins. *The Travailes of the Three English Brothers,* which detailed the adventures of Sir Thomas, Sir Anthony and Robert Shirley. The work on which Day's reputation chiefly

rests is the *Parliament of Bees*. This exquisite masque, or rather series of pastoral eclogues, is entirely occupied with "the doings, the births, the wars, the wooings" of bees. The bees hold a parliament under Prorex, the Master Bee, and various complaints are preferred against the humble-bee, the wasp, the drone, and other offenders. This satirical allegory of affairs ends with a royal progress of Oberon, who distributes justice to all. There is no earlier edition of *The Parliament of Bees* than that in 1641, but a persistent tradition has assigned the piece to 1607. In 1608 Day published two comedies, *Law Trickes;* or, *Who Would have Thought it?* and *Humour out of Breatlz.* The date of his death is unknown, but an elegy on him by John Tatham, the city poet, was published in 1640. The six dramas by John Day which we possess show a delicate fancy and dainty inventiveness all his own. The beauty and ingenuity of *The Parliament of Bees* were noted and warmly extolled by Charles Lamb; and Day's work has since found many admirers.

His works, edited by A. H. Bullen, were printed at the Chiswick Press in 1881. The same editor included *The Maydes Metamorphosis* in vol. i. of his *Collection of Old Plays. The Parliament of Bees* and *Humour out of Breath* were printed in *Nero and other Plays* (Mermaid Series, 1888), with an introduction by Arthur Symons. An appreciation by Mr. A. C. Swinburne appeared in *The Nineteenth Century* (Oct. 1897).

DAY, THOMAS (1748–1789), British author, was born in London, and is famous as the writer of *Sandford and Merton* (1783–89), a book for the young. Day mas educated at the Charterhouse and at Corpus Christi college, Oxford, and became a great admirer of J. J. Rousseau and his doctrine of the ideal state of nature. Having independent means he devoted himself to a life of study and philanthropy. He brought up two foundlings, one of whom he hoped eventually to marry, on the severest principles, but neither acquired the high quality of stoicism which he had looked for, and ultimately he married an heiress who agreed with his ascetic programme of life. He settled in 1781 at Ottershaw, in Surrey, and took to farming on philanthropic principles. His poem "The Dying Negro" (1773) struck the keynote of the anti-slavery movement.

DAY, in astronomy, the interval of time in which a revolution of the earth on its axis is performed. Days are distinguished as solar, sidereal or lunar, according as the revolution is taken relatively to the sun, the stars or the moon. The solar day is the fundamental unit of time in daily life and in astronomical practice. In the latter case, being determined by observations of the sun, it is taken to begin with the passage of the mean sun over the meridian of the place, or at mean noon, while the civil day begins at midnight.

The question of a possible variability in the length of the day is one of fundamental importance. One necessary effect of the tidal retardation of the earth's rotation is gradually to increase this length. It is remarkable that the discussion of ancient eclipses of the moon, and their comparison with modern observations, show only a small and rather doubtful change, amounting perhaps to less than one-hundredth of a second per century. As this amount seems to be less than that which would be expected from the cause in question, it is probable that some other cause tends to accelerate the earth's rotation and so to shorten the day. (*See* MOON and TIDES.)

Legal Aspects.—In law, a day may be either a *dies naturalis* or natural day, or a *dies artificialis* or civil day. A natural day includes all the 24 hours from midnight to midnight. Fractions of the day are disregarded to avoid dispute, though sometimes the law will consider fractions, as where it is necessary to show the first of two acts or events. In cases where action must be taken for preserving or asserting a right, a day means the whole natural day of 24 hours.

When a statute directs any act to be done within so many days, these words mean *clear days, i.e.,* a number of perfect intervening days, not counting the terminal days: if the statute says nothing about Sunday, the days mentioned mean consecutive days and include Sundays. Under some statutes Sundays and holidays are excluded in reckoning days, and consequently all the Sundays, etc., of a prescribed sequence of days would be eliminated. By custom, the word "day" may be understood in some special sense.

Lay Days, which are days given to the charterer in a charter party, either to load or unload without paying for the use of the ship, are days of the week, not periods of 24 hours. As to lay days, running days, working days and weather working days, *see* AFFREIGHTMENT. For days of grace *see* BILL OF EXCHANGE.

Civil Days.—An artificial or civil day is difficult to define; it is a convenient term to signify the various kinds of "day" known in legal proceedings other than the natural day. In England, the United States and most of the countries of Europe the Roman civil day still prevails, the day commencing at 12 P.M.

In England the period of the civil day may and does vary under different statutes. Daytime, within which distress for rent must be made, is from sunrise to sunset. An obligation to pay money on a certain day is discharged if the money is paid before midnight of the day on which it falls due, but the law requires reasonable hours to be observed. If, for instance, payment has to be made at a bank or place of business, it must be within business hours.

When an act of parliament is expressed to come into operation on a certain day, it is to be construed as coming into operation on the expiration of the previous day. (Interpretation Act 1889, § 36; Statutes [Definition of Time] Act 1880.)

Under the orders of the supreme court the word "day" has two meanings. For purposes of personal service of writs, it means any time of the day or night on week-days, but excludes the time from 12 midnight on Saturday till 12 midnight on Sunday. For purposes of service not required to be personal, it means before six o'clock on any week-day except Saturday, and before 2 P.M. on Saturday.

Closed Days, *i.e.,* Sunday, Christmas day and Good Friday, are excluded from all fixtures of time less than six days: otherwise they are included, unless the last day of the time fixed falls on one of those days (R.S.C., O. lxiv.).

See ENGLISH LAW.

DAY-BED, a small type of French couch bed, intended to serve as a bed at night and as a sofa during the day. The standard day-bed is narrow, with foot and head pieces identical in size and appearance. Because of the convenience of its size the day-bed has come into wide use in small apartments where every effort must be made to conserve space. It is especially popular in the large cities of the United States. The low and symmetrical head and foot pieces give it the appearance of a divan, thus serving to conceal to some degree the fact that the living-room in which it appears is converted at night into a bedroom.

DAY BOOK: *see* BOOKKEEPING.

DAYE, STEPHEN (c. 1594–1668), first printer in the Anglo-American colonies, was born in London. Although it has been stated that he served an apprenticeship as a printer there, the records extant indicate that he was a locksmith. In the summer of 1638, however, he came to America with the Rev. José Glover, a dissenting minister of some means, with whom he made a contract to set up the first printing press in the English colonies. This he did in the autumn of 1638 at Cambridge, Mass. The first issue from his press was the *Freeman's Oath,* Jan. 1639; the second, an *Alnzanack* by William Pierce, mariner, 1639; the third, the *Psalms,* now known as the *Bay Psalm Book,* 1640. According to the records of the general court of Cambridge, Dec. 10, 1641, he was granted 300 ac. of land for "being the first that sett upon printing." His name is not found in connection with the imprint of any of his publications, but that of his son, Matthew, who seems to have been next in charge of the press, appears on the title-page of the *Almanack,* 1647. The extant issues from his press are: *The Whole Booke of Psalms, faithfully translated into English Metre* (1640); *A list of Theses at the Harvard Commencement in 1643* (1643); *A Declaration of Fornzer Passages and Proceedings betwixt the English and the Narrowgansetts, with their confederates, Wherein the grounds and justice of the ensuing warre are opened and cleared* (1645). He died at Cambridge, Mass., on Dec. 22, 1668.

DAY-FLOWER, rather weedy, quick-wilting, plants of the genus *Commelina* of the spiderwort family (Commelinaceae).

There are about 11j species, chiefly natives of tropical and subtropical regions, 8 of which are found in the southern United States. They are usually ascending or reclining, somewhat fleshy, branching herbs, with short-stalked leaves, and irregular, usually blue ephemeral flowers, in small clusters more or less enfolded in two spathelike bracts. The Virginia day-flower (C. *virginica*), found in moist places from southern New York to Illinois southward to Florida and Texas and thence to Paraguay, has diffusely branching stems, 1½ ft. to 3 ft. high, lance-shaped leaves, and showy blue flowers an inch broad. The creeping day-flower (C. *nudiflora*), with reclining stems 1 ft. to 23 ft. long, rooting at the joints, and small blue flowers, about ½ in. broad, found from New Jersey to Missouri and southward, is extensively distributed also in South America, Asia and Africa. The Asiatic day-flower (*C. communis*), with small, very deep blue flowers, has become widely naturalized in the eastern and southern States.

DAYLESFORD, a town of Talbot county, Victoria, Australia. Pop. *c.* 5,000. It lies on the flank of the Great Dividing range, at an elevation of 2,030 ft. Much wheat is grown in the district; gold-mining, both quartz and alluvial, is carried on, and there is a mining school. Near the town are the Hepburn mineral springs.

DAYLIGHT, ARTIFICIAL. The wide use of artificial light in civilization has created a demand for lamps which show coloured objects truthfully; *i.e.,* which do not change colours from their hues as seen by daylight. The problem is thus one of producing an artificial light whose spectrum *(see* LIGHT) closely resembles that of sunlight. Artificial light always contains too high a proportion of red, orange and yellow rays.

A gas-filled electric lamp is employed, as its filament temperature is high and its form the most economical. The spectrum obtained from a black body, heated to 5,000° C., is found to be approximately that of average diffused daylight. According to the temperature at which the filament of an incandescent electric lamp burns the amount of red and orange contained in the spectrum of its light varies, becoming greater as the temperature is lowered; a metal filament bulb burns at 2,200° and has more red and orange in it than the gas-filled bulb, which burns at approximately 3,000°. Therefore, the gas-filled bulb is used in artificial daylight devices, but its light has to be subjected to special treatment to correct its undue yellowness and redness.

Various means are employed for this purpose, such as filtering the light through a coloured transparent medium; *i.e.,* glass, talc or varnish, or by the use of a coloured reflector, or by a series of coloured mirrors fixed in a reflector. Coloured reflectors with certain pigmentations have proved successful, and by this means it is possible to match practically any type of daylight, but this method absorbs a very large quantity of the initial illumination. By the use of tinted or coloured glasses, one or more different colours being placed one behind the other, the same effect can be obtained; the loss of light by this method, however, is not so high as in the former.

Artificial daylight was at first mainly used for the purpose of matching colours. It has come into use for general illumination, however, as the value of artificial daylight in resting the eyes has become appreciated. Hospital staffs, dentists, physicians and surgeons find artificial daylight of great value. The method is also employed in dye and colour works. *See* LIGHTING.

DAYLIGHT SAVING. In the second year of the World War nearly every country in Europe adopted the device of putting the clock forward an hour during the spring, summer and autumn months. The motive was to get people to bed an hour earlier and out of bed an hour earlier, to save fuel for lighting and heating.

Great Britain.— In Great Britain, the idea itself did not arise out of the war. About 1907 it occurred to William Willett, a Chelsea builder, that civilization got up an hour or two too late in the summer months, and had a short evening for outdoor recreation, when it might have a long one. He devoted himself to a campaign for putting the clock on by 80 min. in the spring and summer months. He ran the campaign at his own expense, and succeeded so far that in 1908 Mr. (afterwards Sir Robert) Pearce introduced a bill in the House of Commons to put the clock on by law. The bill was sent to a select committee the following year. In 1916, the expert committee set up by the British Government to study the question of fuel economy advised that the measure should be adopted. The scheme was simplified. Willett had proposed that the clock should be put on 80 minutes in four moves of 20 minutes each. The first select committee in 1908 had advocated one movement of the clock of one hour in the spring. This was the method adopted by the act which was passed on May 17, 1916, and put into operation the following Sunday, May 21. There was a good deal of opposition. Farmers objected to it because milkers would have to get up an hour earlier to do their work, which meant getting up in the dark during the greater part of the year. Hay and corn harvests could not be carried until the dew was dried off, which meant an hour during which labourers could do nothing. When put to the test of practice these difficulties proved to have been much exaggerated.

Summer time was introduced on Sunday, May 21, 1916. The president of the Royal Meteorological Society sent out a letter stating that Greenwich mean time would continue to be used for all meteorological observations and publications, but asked that regular observers for this society should state in their reports whether they were recording Greenwich or summer time. The Port of London Authority announced that the tide tables in the almanacs would remain Greenwich time. The Royal and L.C.C. parks decided to close at dusk by the sun, but Kew Gardens decided to follow the clock and closed an hour earlier by the sun. At Edinburgh the Castle gun continued to be fired at 1 P.M. summer time, but the ball on the top of the Nelson monument on Calton hill was dropped at 1 o'clock, Greenwich mean time, for the benefit of mariners who watched it from the Firth of Forth. The legal change of the clock was fixed for 2 A.M.

In Great Britain summer time was renewed after the World War by a series of acts of Parliament. The final and permanent Act of 1925 provided that summer time should begin on the day next following the third Saturday in April, or if that day is Easter day the day next following the second Saturday in April. Summer time closes on the first Saturday in October. The official time for altering the clock is 2 A.M., Sunday.

United States.—No public interest was developed in the project in the United States till after the outbreak of the World War, and it was not until 1916 that a nation-wide campaign was initiated in its support. Opinion was divided, but in 1917 Congress passed an act, to take effect in 1918, whereby the standard time of the United States would be advanced one hour on the last Sunday in March and set back one hour on the last Sunday in October. The act was effective from March 31 till Oct. 27, 1918, and again on March 30, 1919. Strenuous opposition developed, however, from the farmers and the law was repealed on Aug. 20, 1919, over the President's veto. Since then daylight legislation has been sporadic and intermittent. Daylight saving is observed (1928) in the States of Massachusetts and Rhode Island by virtue of State laws, and by municipal ordinance in the New York Metropolitan district, Philadelphia, Chicago and a number of other cities and towns, but the movement as a whole has lost ground. Chicago is the most westerly city using the summer system. In Seattle the banks alone have adopted it. But west of the Mississippi and in the South daylight saving is practically unknown. While the system is widely used only in the North-east, it has, even there, found opposition, as in Connecticut, where it is a State offence to show any but Eastern standard time publicly. However, a number of the principal towns in this State observe daylight saving. An analogous State law is in force in Maine; yet in the city of Portland daylight saving is observed by general consent.

Other Countries.— The daylight saving bills adopted during the World War in Germany, Austria, Italy and Scandinavia have not been revived. A permanent "summer time" bill was adopted in France, in 1923, and in 1928 summer time was being observed, April 14–15 to Oct. 6–7. Summer time bills were approved in Canada in 1924, in Holland and Belgium in 1925, in Spain and Portugal in 1926 and in New Zealand in 1927. Mexico observes "summer time" all the year round.

DAY NURSERIES. These institutions, of a semi-philanthropic nature, formerly known as "crêches" (from the Fr. *crêche* —crib) but now as "day nurseries," form an integral part of the public health work of Great Britain, the United States, and other industrial countries.

Their original intention was to assist widows, and other women whose circumstances obliged them to go out to work, by caring for their young children, under school age, during the day. During the 19th century France and Belgium had many "crêches," but they were on a very simple scale: a "motherly" woman was put in charge of two or three rooms and for very small fees the working mothers couldleave their children to be fed and cared for during the day. This system proved unsatisfactory; want of technical knowledge and insufficient sanitary precautions led to the spread of infection and the "crêche" soon got a bad name. But with the increase in the knowledge and study of "mothercraft" and infant welfare, which coincided roughly with the early years of the 20th century, day-nurseries were brought to England, and to the United States, and organized on modern and hygienic methods, very different from those of the old "crêches." The value of fresh air and "moving" air was increasingly appreciated and open-air nurseries were built in London, Manchester and elsewhere.

In Great Britain the movement is largely associated with the names of Mrs. Arthur Percival and Muriel, Viscountess Helmsley, who founded the National Society of Day-Nurseries with the objects of starting nurseries, raising the standard of existing "crêches," putting them in close touch with the Government departments, and "standardizing" the training of staffs.

The movement, like many other branches of the infant welfare movement, originated in private enterprise and the day-nursery was generally started by a voluntary committee. From the year 1915 a grant in aid was given by the Board of Education. When, in 1918, the Local Government Board was merged in the Ministry of Health, day-nurseries were placed under their maternity and child welfare department.

The ministry inspect the nurseries at regular intervals and give a grant proportionate to the expenses incurred; in certain cases grants are also made towards capital expenditure, such as the purchase of premises, etc. The cost of upkeep is met by the parents' payments (1s. a day is a common charge), the Government grant, private subscriptions and, in some cases, a municipal grant. Local authorities have the power to provide day-nurseries

Children are received from the age of one month, until they attain school-age. The mother brings the child in the early morning on her way to work and calls for it on her return in the evening. The child is inspected on arrival by the "crêche-trained" matron, and, if found to be free from any signs of infection, is bathed, dressed in the nursery clothes, and cared for during the day in accordance with the requirements of its age. The infants have cots, and the necessary food and sleep; the older children or "toddlers" have three good meals and plenty of opportunity for fresh air, rest and exercise. The mental development of the toddlers is assisted by "nursery school classes," under the supervision of a specially trained member of the staff. The furnishing of the nursery is of great importance, small tables and chairs are provided for meals, etc., and stretchers for rest. The staff generally consists of a matron and sister, with "nursery" training and some hospital experience, a toddlers' nurse, young probationers and a cook.

The health of the children is under the daily care of the matron, who weighs the children weekly or fortnightly; accurate records are kept and are seen by the visiting doctor at the fortnightly medical inspection. The previous medical history of the child, if it has attended the infant welfare centre, is used for reference and the nursery record is available for the school doctor when the child leaves the nursery. In this way a complete record can, in some cases, be obtained of the child's medical history. A great point is made of the clothing and feeding of the children in the nursery; it is held that the nurseries are in this way of great educational value to the mothers.

Probationers in day-nurseries are trained on a syllabus prepared by the National Society of Day-Nurseries in conjunction with the National League for Health, Maternity and Child Welfare. They attend certain lectures and then sit for a series of examinations. The successful candidates who can show evidence of satisfactory practical work then obtain a certificate of proficiency in the care of children. These girls are then fitted to become "nursery nurses" in private posts or public institutions, and the scheme of training is approved by the Ministry of Health.

Since 1919 the headquarters of the National Society of Day-Nurseries have been under the same roof as many other organizations for infant and child welfare at Carnegie house, 117, Piccadilly, London. The Society publishes a monthly magazine, *Crêche News*. (N. *L.* H.)

United States.—The day-nursery movement in America has followed rather different lines, but there, even more than in England, its value is recognized as an essential part of child welfare. Inspection varies and may be under the control of State, county, or city departments of health or welfare, but no Government grant is given and the nurseries are supported by voluntary subscription, supplemented by parents' fees. Some States license the day nurseries, inspect periodically, and require minimum standards. Progressive nurseries include programs of family case work, health, and education The first day nursery in America opened in New York in 1854, but the actual movement dates from conferences held 1892–1898. The National Federation of Day Nurseries, organized in 1898, was superseded in 1938 by the National Association of Day Nurseries, a consolidation of the Federation and the New York Association of Day Nurseries. The National Association serves as a co-ordinating body for day nurseries, raises standards, provides field service and information, and issues publications including a bulletin *The* Day *Nursery*. Headquarters: 122 East 22nd street, New York.

As regards other countries the tendency of the present day is to establish day-nurseries in connection with infant welfare work and nursery schools. In France the "Crêches d'Arrondissements" of 19th century Paris have been largely superseded by nurseries connected with large factories and shops, or department stores. These are frequently used for infants, and give special facilities to nursing mothers for the breast-feeding of their own babies.

Belgium, Holland, Switzerland, Germany, India and Japan encourage the provision of day-nurseries, and Poland, Serbia and Spain have followed their example.

See the publications of National Society of Day-Nurseries, 117, Piccadilly, London, and of the National Association of Day-Nurseries, New York. *Maternity and Child Welfare Act* (1918). (A. E. BE.)

DAYS OF GRACE. The extra time allowed to meet the payment of a bill of exchange after its due date. In English law, three days grace are thus allowed. No extra time is allowed, however, for a bill payable at sight. In the case of insurance premiums, also, days of grace are allowed before the policy actually expires. In the United States days of grace in all bills of exchange have been abolished by the Negotiable Instruments Law, except in a very few States, as to sight drafts. *(See* BILL OF EXCHANGE; INSURANCE.)

DAYTON, a city of Campbell county, Kentucky, U S.A., on the Ohio river, opposite Cincinnati; served by the Chesapeake and Ohio railway. The population was 7,646 in 1920 (95% native white) and was 8,379 in 1940 by the federal census. There is a watchcase factory, but the city is primarily a residential suburb of Cincinnati. It was settled and incorporated in 1849.

DAYTON, a city of southwestern Ohio, U.S.A., on the Great Miami river, 55 mi. N.N.E. of Cincinnati; a port of entry, the county seat of Montgomery county, and a leading centre of aviation research. It is served by the Baltimore and Ohio, the Big Four, the Erie and the Pennsylvania railways, by a number of air lines and by 10 motorbus and 52 motor truck lines operating over the hard-surfaced roads which radiate in every direction. There are three commercial and two government airports and numerous emergency landing fields. The population was 152,559 in 1920, of whom 9,025 were Negroes (an increase of 86% in ten years), and 13,111 were foreign-born white (nearly a third from Germany); and was 210,718 in 1940 by the federal census. About 70% are natives of Ohio

The city covers 24·24 sq.mi. of level ground 740 ft. above sea level, in a wide river trough, where three rapid streams (Wolf creek, Stillwater river and Mad river) flow into the Miami. It is completely protected (since 1921) from all danger from floods. Boulevards and streets are wide and in the residential districts are lined with trees. The dwellings (56% of which were owned by the occupants in 1940) are for the most part small private houses, each with its own garden. Many of the factories are surrounded by attractive grounds. The public parks and playgrounds comprise 1,100 ac. (including a 23-ac. island in the Miami), and just south of the city there is a municipal country club (294 ac. of natural forest), with golf courses and tennis courts. The elimination of grade crossings ivithin the city and the construction of a boulevard on the bed of the abandoned Miami and Erie canal were begun in 1927. A comprehensive city plan (adopted in 1925) was in 1941 in process of development.

Dayton has had a commission-manager form of government since 1914. The water supply comes from driven wells 50–100 ft. deep. Natural gas is used, and it is estimated that the supply will last until 1970 or 1980. Electric current, steam-generated, is provided by a super power system, and the local power and light company furnishes steam heat to a considerable area in the central part of the city. The city has one of the few financially successful municipal garbage-reduction plants. Both the death rate and the cost of living are relatively low.

The manufactures are many and varied, with an aggregate output in 1939 valued at $400,000,000. Dayton has long been known as the home of the National Cash Register company. In recent years it has become the leading producer, also, of electric motors, water plants for home use, electric refrigeration equipment, fare registers, computing scales, water softeners, fan belts, automobile parts, aeroplane parts, golf clubs and ice-cream cones; and it makes all the government stamped envelopes "Precision industries" predominate, in which labour is more important than material, and skilled labour more important than unskilled. The percentage of women in industry is relatively low, and there is little child labour. Except in the building trades the "open shop" prevails. The making of aeroplanes at Dayton began with the experiments of Orville and Wilbur Wright (*qq.v.*) who in 1903 flew successfully the first heavier-than-air machine. During the World War of 1914–18 the U.S. government located its aviation experiment laboratories at McCook field, on the northern boundary of the city. When this became too small, the people of Dayton raised $400,000 in four days to buy a tract of 5.000 ac. northeast of the city (including the Wrights' original flying field), which they presented to the war department, to be a permanent home for the experimental and research division of the army air corps.

The annual volume of Dayton's wholesale business is estimated at $115,000,000; its retail trade at $106,000,000. In 1940 bank debits amounted to $890,152,056; post-office receipts were $2,-871,098; and the assessed valuation of property was $308,556,000.

The city has 82 public schools. including a normal college, and 20 parochial schools; 152 churches; and 4 daily newspapers, one of which is in German. It is the seat of the University of Dayton, a Roman Catholic institution (formerly St. Mary's college, founded in 1850); Bonebrake Theological seminary (United Brethren); and the Central Theological seminary of the German Reformed Church; also of an art institute (established 1919). The Engineers' club and the Foremen's club are distinctive organizations. The National Association of Foremen was founded in Dayton and its official organ is published there. The first house built in Dayton, a log cabin on the bank of the Miami, is preserved as a historic museum. There is a state hospital for the insane; and a branch of the National Home for Disabled Volunteer Soldiers.

History. — The site of Dayton was bought in 1795 from John Cleves Symmes by a party of Revolutionary soldiers. It was laid out as a town in 1796 by Israel Ludlow, one of the owners. and named after Jonathan Dayton (1760–1824), who had fought in the Revolution and was at the time a representative of New Jersey in congress In 1803 it was made the county seat and in 1805 the town was incorporated. Growth was rapid after the opening of the Miami and Erie canal in 1828, and in 1841 it was chartered as a city. By 1860 the population had reached 20,081, increasing to 38,678 in 1880, 85.333 in 1900 and 116,577 in 1910. In March 1913, the Miami valley was swept for five days by a steady downfall of rain, resulting in a great flood. Over 400 lives were lost in the valley, and damage to property was estimated at $100,000,000. When the waters receded, Dayton was left covered with mud and debris. A pestilence was averted only by prompt and energetic measures. Martial law was declared; food was distributed, and tents were put up for the homeless. A relief fund of $750,000 was disbursed by the American Red Cross and the Citizens' Relief committee. Steps were taken to prevent the recurrence of such a disaster. On June 28, 1913, the Miami conservancy district, a political subdivision of the state, was established under a new law, for the purpose of building and maintaining flood-control works in the Miami valley. The plan finally adopted combined channel improvement with the construction of five great retarding basins. Five dams (from 1,200 to 6,400 ft. long; from 75 to 125 ft. high; and from 380 to 785 ft. thick at the base) were built across the upper valleys of the Miami and four of its tributaries. Construction work began in 1918 and was completed in 1922. The cost was $32,000,000. Protection has been provided against a flood 40% greater than that of 1913, and 20% greater than the maximum estimated to be possible. Following the flood Dayton adopted a commission-manager form of government, which came into effect on Jan. 1, 1914. It was the first large city to install a manager and there has been no disposition to return to the mayoralty system.

For an account of the flood of 1913 and the construction of the flood-control works see **Technical** Reports (10 vols) by various authors, published by the Miami conservancy district, Dayton, O.

DAYTON, a city of southeastern Tennessee, U.S.A., 38 mi. N.N.E. of Chattanooga, at the foot of the Cumberland escarpment; the county seat of Rhea county. It is served by the Southern railway. The population in 1940 was 1,870. In July 1925 the little country town was the scene of the famous "anti-evolution" trial, in which John T. Scopes, a teacher of science in the high school, was found guilty of having violated a state law prohibiting the teaching. in the schools supported by the state, of any theories to the effect "that man is descended from the lower animals." Counsel for the defence included Clarence Darrow and Dudley Field Malone. The prosecution had the support of William Jennings Bryan, who died in Dayton a few days after the close of the trial. Mr. Scopes was fined $100, but the penalty was set aside by the state supreme court on a technicality, without any expression of opinion as to the constitutionality of the law. A Fundamentalist university on a hill at the back of the town is projected by Bryan's admirers as a memorial.

DAYTONA BEACH, a city of Volusia county, Fla., U.S.A., on the Halifax river, 50 mi. below St. Augustine; on federal highways 1 and 92 and state highway 140, and is served by the Florida East Coast railway, air lines and buses. It was formed in 192; by the consolidation of the city of Daytona (pop., 1925, 9,592) and the towns of Daytona Beach (pop., 1925, 2.129) and Seabreeze (1,792), and its population in 1940 was 22.584 by the federal census. Daytona Beach is a popular all-year resort, with many hotels and private winter homes. The Spanish style of architecture prevails, and the assessed valuation of property in 1940 was $32 000,000. Along the hard, white beach, which adjoins that of Ormond, is a fine automobile racing course, where many speed records have been made.

DEACON, a minister or officer of the Christian Church. The status and functions of the office have varied in different ages and churches, and the name is the Gr. διάκονος, minister, servant.

(*a*) The Ancient Church. — The office of deacon is almost as old as Christianity itself. Tradition connects its origin with the appointment of "the Seven" recorded in Acts 6:1–6. This connection, however, is questioned on the ground that "the Seven" are not called deacons in the New Testament and do not seem to have been identified with them till the time of Irenaeus (c. 180). The officers of the church are described in Philipp. 1:1 as "bishops and deacons"; and in 1 Tim. 3:8–13 the office of

deacon has evidently become a permanent institution of the Church. By the time of Ignatius (c. 110) the "three orders" of the ministry were definitely established, the deacon being the lowest and subordinate to the bishop and the presbyters. In the apostolic age the duties of deacons were naturally vague and undefined; with the growth of the episcopate, however, they became the immediate ministers of the bishop. Their duties included the management of Church property and finances, distribution of alms and care of the sick and of widows and orphans. They were also required to seek out and reprove offenders (*Apostolical Constitutions,* 4th cent.). With the growth of hospitals and other charitable institutions, however, the social work of the Church was transferred to others, and the diaconate came by degrees to be regarded (as in the Roman Catholic and Anglican Churches to-day) merely as a step towards the priesthood, and the deacon's duties were practically restricted to ritual acts, such as reading the Gospel, censing the priest, etc., at High Mass.

(h) The Church of England.—The diaconate is recognized as one of the "three orders," and is conferred by episcopal ordination. Candidates must be 23 years old and must satisfy the bishop as to their intellectual, moral and spiritual fitness. Deacons may perform any sacred office except that of consecrating the elements and pronouncing absolution.

(*c*) Churches of the Congregational Order.—In these (which include Baptists) the deacons are laymen appointed by the members of the Church to superintend the financial affairs of the Church, co-operate with the minister in the various branches of his work, assist in the visitation of the sick, attend to the Church property and generally supervise its activities.

See Thomassinus, *Vetus ac nova disciplina,* pars i. lib. i. c. 51 f. and lib. ii. c. 29 f. (Lugdunurn, 1706); J. N. Seidl, *Der Diakonat in der katholischen Kirche* (Regensburg, 1884); R. Sohm, *Kirchenrecht,* i. 121–137 (Leipzig, 1892); F. J. A. Hort, *The Christian Ecclesia* (London, 1897).

DEACONESS, a woman set apart for special service in the Christian Church. The origin and early history of the office are obscure. The arguments for its existence in apostolic times, based on Rom. xvi. 1 (where Phoebe is called διάκονος) and 1 Tim. iii. 11, and on Pliny's mention of two ancillae *quae ministrae dicebantur,* are hardly conclusive. But it is certain that before the middle of the 4th century there existed in the Eastern Church an order of deaconesses, of higher rank than the somewhat similar orders of "virgins" and "widows." The order is recognized in the canons of the councils of Nicaea (325) and Chalcedon (451), and many of Chrysostom's letters are addressed to deaconesses at Constantinople. The ordination of deaconesses resembled that of deacons, but conveyed no sacerdotal powers or authority (for specimens of the ordination service see Cecilia Robinson, *The Ministry* of Deaconesses, 2nd ed., 1914, pp. 219–229). Their mission was to perform certain offices in connection with the care of women. The functions of the deaconess, according to the apostolical Constitutions, were as follows: (1) To assist at the baptism of women; (2) to visit and minister to the needs of sick and afflicted women; (3) to act as door-keepers in the church, and conduct the women to their seats. In the Western church an attempt seems to have been made in the 4th century to introduce the order into Gaul. The movement, however, was strongly opposed, and was condemned by the councils of Orange (441) and Epaone (517). Despite the prohibition the institution made some headway, and traces of it are found later in Italy, but it never became popular in the West. In the middle ages the order fell into abeyance in both East and West.

In modern times several attempts have been made to revive the order. In 1833 Pastor Fliedner founded "an order of deaconesses for the Rhenish provinces of Westphalia" at Kaiserswerth. The original aim of the institution was to train nurses for hospital work, but afterwards it trained its members for teaching and parish work as well. Kaiserswerth became the parent of many similar institutions. The revival of the order in the Church of England dates from 1862, when Miss Elizabeth Ferard was set apart by the Bishop of London. Other dioceses gradually adopted the innovation. It has been sanctioned by Convocation, and the Lambeth Conference in 1897 "recognized with thankfulness the revival of the office of deaconess," but insisted that the name must be restricted to women set apart by the bishop and working under the control of the parochial clergy.

In addition to Miss Robinson's book cited above, see *Church Quarterly Review,* xlvii. 302 ff., art. "On the Early History and Modern Revival of Deaconesses" (London, 1899), and the works there referred to; D. Latas, Χριστιανική Ἀρχαιολογία i. 163–171 (Athens, 1883); *Testamentum Domini,* ed. Rahmani (Mainz, 1899); L. Zscharnack, *Der Dienst der Frau in den ersten Jahrhunderten der chr. Kirche* (1902).

DEAD, DISPOSAL OF THE. Monuments and buildings set up by man for the use of the living were seldom preserved by him beyond their period of usefulness and seldom remain intact; but his arrangements for the dead were usually made with permanency in view and are frequently discovered undisturbed. From these records of the past knowledge is yielded of man's physical characteristics, circumstances, material achievements, customs and beliefs. Inscriptions are rarely present to give a date to graves; but the method of disposal, the type of grave, the objects deposited with the dead, their relative positions, the posture and orientation of the body, and, in the older periods, the geological stratification and contemporary fauna, provide knowledge of the period and race to which the remains may be assigned.

PALAEOLITHIC PERIOD

The earliest human remains as yet discovered—at Trinil (*pithecanthropus*), Heidelberg and Piltdown—were river-borne fragments; whether originally buried is unknown, but the earlier part of the last ice age supplies in several instances evidence of the disposal of its dead by the Neanderthal race in Europe. Thus the bodies of the La Ferrassie man and child were protected by stones; a pillow of flint-chippings was gathered together for the Le Moustier youth, and graves were dug for the La Chapelle man and La Ferrassie infant. Belief that the dead lived on and had the same needs as the living is shown in the stone implements placed with the Le Moustier, Spy I, and La Chapelle burials, and in the ochre and food supplied for La Chapelle; and in each case the home of the dead is, as in life, the rock-shelter or cave.

Finds from the Upper Palaeolithic period are more numerous, and here again almost all burials are in caves or by rock-shelters, including probably the remarkable oval grave fenced round with mammoth shoulder-blades at Pfedmost (Moravia): this enclosed 20 burials in squatting position, and was dug in loess close to a limestone outcrop which once probably formed a rock-shelter. The chief exception is the richly furnished single burial in level ground at Briinn. The same kind of provision continues to be made for the dead during this epoch, but its developed culture provides finer implements and a wealth of personal ornament: necklaces, armlets, anklets, aprons, caps, of threaded shells and animals' teeth; carved bone amulets, ivory figurines. Instead of the small lumps of red ochre at La Chapelle, many of these later graves are liberally bestrewn with the substance. The cave-hearth is now frequently chosen as burial-site (Solutré, Grimaldi), and here occasional charred bones are more probably due to incompletely extinguished fires than to deliberate cremation.

Though no invariable position characterizes palaeolithic burials, an attitude of sleep—knees bent, arm under head—is the most frequent in Europe; while in Africa contracted posture obtained in the palaeolithic cave-burials discovered in 1927 near Lake Nakuru (Kenya), and with the skeleton of the same type and period from Oldoway (1913) further north. In Lower Palaeolithic burials at La Ferrassie and an Upper Palaeolithic at Grimaldi, however, were skeletons whose sharply-bent knees and arms were pressed close against the chest. So lie the dead of many primitive peoples: bound tightly lest they walk, or use their hands for mischief on the living

Already in Upper Palaeolithic Spain and France there are some indications of a cult of the skull in calvaria prepared as "bowls," and in occasional burial of the head alone. But with its closing phase (Azilian) comes the remarkable cave-burial at Ofnet (Bavaria) where the severed heads of the dead were deposited one by one into two scooped-out "nests," six into one, 27 into the other. They wore rich ornaments of shells and stags' teeth, were ceremonially besprinkled with red ochre; and all faced west. Charcoal

and charred remains near by suggested that the bodies were cremated. From the same period date the human bones in Mas d'Azil (France), scraped clean of flesh and painted red before interment.

POST-PALAEOLITHIC

As mankind passes through stages marked by his discoveries of the crafts of stone-polishing, copper-, bronze- and iron-working, we find an immense variety of funerary custom, conditioned partly by natural and cultural resources, largely by belief as to the kind of life after death, and the relationship between dead and living.

Cremation and Inhumation.— In Europe total cremation is found associated with the Late Neolithic banded-pottery and painted-pottery cultures, from Belgium to southern Russia. Inhumation was general over Europe in the earlier part of the bronze age, but gradually in the later part it was largely replaced by cremation, and from then on the two methods competed and alternated in different countries until the spread of Christianity banished cremation from European civilization down to its modern revival. This practice has a long and varied history in other continents also. A mid-4th-millennium cemetery rich in gold and copper objects was discovered at Ur (Mesopotamia) in 1927, and contained partial cremations which argued total cremations at an earlier epoch; by the end of that millennium inhumation prevailed alone at Ur. Cremation has been the usual Hindu method; frequent also among Buddhists; rare in China. It was general among the Aztecs of Mexico, reserved only for people of rank in the Maya civilization of Yucatan, and for occasional criminals among the Jews. In Egypt it is unknown.

Other Methods.—These include (1) the preservation of the body by smoke-drying, embalming, etc. (see MUMMY); (2) exposure to birds of prey (as by the ancient Scythians, the Zoroastrians, the poorer Siamese), river-committal, or other methods little likely to help in identifying the remains; (3) disposal in two stages—first, of the corpse by burial, exposure, etc., until the soft tissues disappear; second, of the bones: either individually as in eastern South America (in jars), or collectively, as in neolithic British barrows, in the great neolithic hypogeum at Hal Saflieni (Malta), or in vaults of mediaeval English churches such as Hythe.

Posture and Orientation.— In many cultures and religions a definite position is given to the dead. The posture usually ranges from tightly contracted to fully extended, the former tending to be associated with more primitive, the latter with higher civilizations; the body usually lies on side or back, or is seated, and it is frequently orientated in a given direction. Thus in Egypt the tightly contracted pre-dynastic posture gradually loosens as the dynasties pass until full extension is reached in the Middle Kingdom. From the Old Kingdom onwards the body usually lies with head north, face to the sunrise. In England bodies lay contracted till shortly before our era; but orientation varied until Christianity taught that the feet of the dead should be towards the east, whither they must hasten at the last trump. The custom mainly holds in England still, but Norway and Holland have long abandoned it, except in country districts. Buddhist tradition—where Buddhists bury—dictates head north, face upward, as Buddha died. The Mohammedan must lie on his right side, facing Mecca; but the Japanese in his tub-shaped coffin sits upright, like some among our ancestors in chambered barrows.

Tomb-furniture.— Burials bare of all else but (originally) a garment or shroud are not infrequent, and betoken sometimes poverty, sometimes high beliefs: strict Jews must bury thus. But further protection is usually afforded. The pre-dynastic Egyptian and early Sumerian were often wrapped in matting, though pan-shaped and bucket-shaped pottery coffins were already in use. Slipper-shaped pottery coffins were common among the Chorotegans (Nicaragua) and Parthians; large jars, in Greece at the end of the 2nd millennium, in prehistoric southern India, in the Americas. Wicker-work, wood, stone, marble—all have played their part in coffining the dead. As to possessions: sometimes the latter have none; sometimes a sophisticated civilization cheats them with useless imitations; but mostly the objects are real, valued in life and retained in death.

Type of Tomb.—The use of caves as sepulchres continued in the Neolithic period—usually as sepulchres alone; and in the Late Neolithic were excavated the first artificial burial-caves. In Mediterranean lands the single "cave" entered direct from cliff-face then added an entrance-passage, as the trench in level ground gained a side-chamber; then both gradually developed extra chambers and niches. These elaborations culminated in catacombs such as those of Panticapoeum (Crimea) and—most elaborate of all—of Rome. Megalithic tomb-architecture sprang up in Neolithic, flowered and died in Bronze (see MEGALITHS). In Neolithic times the first barrows also were piled up as burial-places and memorials. But as mankind elaborates—plays out—these various ideas conceived in his imaginative adolescence, he reverts ever and again to the simple grave as standard; while, throughout, we find the simple grave persists for simple folk.

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In the early times of Neanderthal man the bodies of the dead were buried with some ceremony, and, with the apparent exception of one or two very primitive tribes, there is no known people to-day which does not dispose of its dead in some well-defined, traditional manner. The treatment of the corpse, however, is not as a rite complete in itself; it is but an incident in a series of rites. When a community loses one of its members, especially anyone of importance, it suffers a shock, and the rites connected with the dead are to be regarded as the stereotyped behaviour of society by which it readjusts itself during such a period of strain and emotional disintegration. For this reason their correct performance is important to society. The more serious the loss, that is, the greater the value of the deceased to the community, the more elaborate will these rites be and the greater the number of people which they concern. The very aged, on the other hand, and those who have long been ill and who, therefore, have for some time taken little part in the life of the community, often receive scant attention at death and may even be buried alive, since, socially, they are in a sense already dead.

There are many variations in the ceremonies connected with death, and in the treatment of the corpse, but each has its recognized procedure from which deviations are rare, and in all there seem to be three distinct phases. The first lasts from the time of death, or when all hope of the sick person's recovery is abandoned, until the beginning of the rites directly connected with the disposal of the body; the second is during the performance of these rites; the third is covered by the period from the disposal of the body till the cessation of mourning.

When the individual is dead, or regarded as dead, the corpse is usually washed and decorated and a ceremony of leave-taking may be gone through, often accompanied by the presentation of gifts. The duration of this period varies considerably according to the importance of the deceased or to the affection felt for him. For a commoner a day or two may suffice but for a chief it may occupy many weeks and the body is sometimes partially embalmed to prevent decomposition from setting in during this time. If it is suspected that death was due to foul play, especially sorcery, omens are now carefully observed or the body is asked to indicate in some recognized manner the guilty person or village. Friends and relatives having now said farewell, the body is laid to rest.

The number of ways in which a body can be disposed, are six: inhumation or burial, cremation, preservation, exposure, water-burial and hastening decomposition by artificial means. Occasionally the bodies are exposed for destruction by wild animals. Many or all of these methods are sometimes found in use among a single people. Where this is so, the mode of disposal of the body is usually determined by his social status, by membership of some social group, his achievements in life or the cause of his death. In general, such methods as preservation and the artificial hastening of decomposition are reserved mainly for those who have been important in life. Those who are unimportant to society are usually given a form of disposal which entails little trouble or expense. The cause of a person's death often affects profoundly the fate both of the body and soul. A person who has died by

falling from a tree, or by violence in peace or war, is usually treated differently from his fellows, and special treatment is almost always allotted to suicides and women who have died in childbed. The reasons for such distinctions are not always clear but, in general, these unfortunates are considered to be undesirable. Those who are earth-bound are usually feared and measures are taken to prevent their souls from troubling the living, such as putting thorns into the feet of the corpse so that the spirit may not walk, placing stones or briars over the grave that it may not escape thence, or burning the body and so destroying the soul.

Inhumation. — Where inhumation is practised there is often a cemetery, usually situated at a little distance from the village, where all of that community are buried; or there may be separate ones for the different kindreds which compose it; occasionally one is reserved for men, and another for women. These are often carefully tended and are sometimes used for the meetings of the village council. Frequently, however, cemeteries are absent and the site of a man's grave is either fixed by tradition, as, for instance, in his garden or before the threshold of his house, or selected by himself or his heirs. The most usual form of grave is a trench, sometimes shallow, occasionally of considerable depth, but some are more elaborate. A common form is a pit at the bottom of which a horizontal recess is excavated and in this the corpse is laid, the pit being usually but not always filled in afterwards. In some areas the grave is an underground chamber approached by a subterranean passage. To prevent the soil touching the corpse the sides of the grave are sometimes lined with wood, stone, leaves or mats, or the body itself is carefully wrapped up. Wooden coffins are used by some tribes, or, among sea-faring peoples, the deceased is buried in his canoe. The superstructure of the grave may be only a low hummock of earth, but, over the remains of important people, large mounds are often erected. A small hut is often set up over or beside the grave, to protect the soul (which usually lingers near the body until decomposition is complete) from the inclemencies of the weather. Grave-stones are also erected as memorials and as temporary abodes for the spirits when they desire to visit the living.

Cremation. — The destruction of the corpse by fire has a world-wide distribution. Often it is restricted to a certain class of people, notably chiefs, but sometimes, where other methods are normal, it is used for lunatics, workers of black magic and other dangerous members of society. When such people are burnt the remains are generally thrown away. In other cases they are buried, cast ceremonially into water or placed in ossuaries belonging to a kindred or village group. Sometimes some member of the deceased's family keeps them, or certain of them, and treasures them as a link with the soul of the departed. The construction of the pyre and the kind of timber used are generally decreed by custom, since any deviation brings misfortune on the soul of the deceased.

Preservation. — The practice of preserving the bodies of the dead is not restricted to ancient Egypt. It is found to-day among tribes scattered throughout the world and even among such primitive ones as those of Torres straits. Generally it is reserved for chiefs or priests. The methods used vary considerably. Preservatives, such as alcohol, honey, salt, butter or the shavings of certain woods are common; sometimes the body is dried by smoking, usually preceded by evisceration or massage to extract the juices; and sometimes it is placed in a sealed wooden effigy or coffin. In one tribe in East Africa, a fire is lit on the top of the grave with the intention of baking the body.

Exposure. — More common than preservation is the custom of exposing the dead on trees, rocks or on platforms erected in the gardens or the bush. Where the atmosphere is hot and dry this may result in desiccation which possibly is intended. Elsewhere the corpse is left to decompose and the bones are collected and kept as relics or placed in an ossuary. During the period of decomposition the living often visit the body and sometimes rub themselves with its juices probably in order to link themselves more closely to the deceased or to absorb his virtues. Exposure may, in some places, be closely allied to burial, for where there is not sufficient depth of soil to dig a grave (as in islands of coralline and volcanic formation), the obvious alternative is to lay the body on the ground.

Artificial Decomposition. — Artificial means to hasten decomposition are often reserved for important men. It is sometimes effected by warming the body over a slow fire or by washing it regularly and scraping away the putrifying flesh. If only a portion of the body is to be cleaned, such as the head, which is treasured by many who have an ancestor cult, this may be wrenched off and placed in a termites' nest to be eaten clean, while the rest of the body is disposed elsewhere.

Water Burial. — To fling a corpse into the water is an easy mode of disposal and is, therefore, often the fate of slaves, foreigners or people of no account. But there are tribes among whom it is not considered an undistinguished end, and some individuals may even request to be buried at sea, because they "like wash all time 'long salt water." Certain parts of the coast are in some islands set aside as water cemeteries where, after being wrapped up to protect them from the fish, and weighted to prevent them from being washed on shore, the bodies are sunk. In the Solomon islands, however, where sharks are regarded with veneration, the dead are laid on the reef for these creatures to complete the burial. A method (not strictly "water-burial") is that of placing the deceased in a canoe and pushing it out to sea. This was formerly practised in many parts of Polynesia, and is recorded from the Cameroons, where the coastal inhabitants set the figure of a bird on the prow of a funeral canoe to guide it on its way because those for whom it is done are descendants of an immigrant people who, at death, must return across the sea to the land of their origin. This may also explain the other forms of sea-burial and likewise the use of a canoe as a coffin; certainly the latter is sometimes definitely connected with an after world which must be reached by boat.

Orientation. — Wherever inhumation, cremation or exposure are the custom, the position in which the body is placed and the orientation in the grave or on pyre or platform, are important. Even so insignificant a point as whether the body is laid on its right or left side may affect the fate of the soul in the land of the dead. The corpse may lie extended on its back or front; or be seated upright or recline with flexed knees. Sometimes if buried on land or in the sea it may be fixed as though standing, the erect position in the water being obtained by weighting the feet. A very common position for burial is lying on one side with knees drawn up and the hands raised to the face as in sleep, though it has also been suggested that this is in imitation of an infant before birth.

Often there is no definite orientation. Even in one cemetery the bodies may be facing in many different directions. But it is frequently the custom for the head to point or the face to look towards that point of the compass where lies the other world or the land whence the people have migrated.

Secondary Disposal. — The disposal of the remains after cremation and exposure is a necessary part of the funeral rites. But even where inhumation is practised the bones are sometimes exhumed and laid in a special spot, often as a regular part of the ritual which may take place at a definite time after the burial or on a great annual ceremony when the bones of all who have died within the year are finally laid to rest. Among people who have a cult of the dead the skull is often kept by the living to be an abode for the soul if it wishes to visit this world. Other bones are also sometimes kept, not as shrines, but for use in magical ceremonies or for the making of weapons. This secondary disposal often marks the close of the period of mourning and may be for the deceased the last act in the *passage* rite *(see* PASSAGE RITES), as a ceremony whereby the soul is finally despatched to the other world of which community it is henceforth a full member. Sometimes, however, exhumation and secondary disposal are only performed under exceptional circumstances. If a soul troubles the living, the body may be dug up and either removed elsewhere or destroyed by fire or water. Often the soul itself indicates that it desires such a removal, and it may demand several changes of abode before it finds one to its liking. It expresses its wishes

either to a relative in dreams, or by causing sickness and misfortune.

Grave-goods.—To the savage the dead closely resemble the living in both psychological and physical make-up. It often seems that at death the soul is conceived as being weak, just as its body was. To give it increased vitality the mourners cut themselves and allow the blood to drip on to the corpse, for blood is the elixir of life. The laying of food on the grave and the lighting of fires are plainly the result of this material conception of the soul, but the reasons given for the practice vary. Sometimes the journey to the other world is long and the food is for the support of the traveller on his way. In other places it is intended for the comfort of the disembodied creature during the time that it hangs about its home, before departing to join its ancestors. The grave-goods destroyed or buried with the body are definitely for use in the land of the dead, which in physical and social formation is very like that of the living. In it a man will need those things which were valuable in life—weapons, tools, wealth. They are therefore buried or burnt with him; if buried they are often broken in order that their non-material essence may be released. Pots have been found specially made as grave-goods, with holes in the bottom or with uncompleted designs, through which this spiritual part can escape. The killing of a man's favourite wife or slaves is a further logical result of this conception of life after death, for he will continue to need them to minister to his wants. To avoid the actual destruction of the property cheap imitations may be buried or burnt as in China to-day, or the objects may be laid on the corpse while it lies in state and removed before disposal: in this way the dead man retains the use of them in the other world and his heirs have the use of them in this.

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(C. H. W.)

DEAD RECKONING, the computation of a ship's position derived from the latitude and longitude last determined, from the direction of the compass and rate and time of sailing according to the log, reference also being made to astronomical observation for correction and comparison of this method. See NAVIGATION, and AERIAL NAVIGATION.

DEAD RENT. The fixed rent payable under the leases of mines or quarries and paid in addition to the stipulated royalties. This payment secures to the owner of the mineral a certain income, and ensures that the mine or quarry is worked in his interest, since if the property lies idle the dead rent must be paid. *(See* RENT.)

DEAD SEA, the lake in southern Palestine in which the river Jordan terminates. It is bounded on the north by the Jordan valley—at that point broad, arid and forbidding, on the east by the escarpment of the Moabite plateau, on the south by the desert of the Arabah, and on the west by the mountains of Judaea. It has a length of 47 m. and a breadth of 10 m., a superficial area of 360 sqm. and a mean depth of 1,080 feet. Its surface level, which has a seasonal variation of 10 to 1j ft., lies about 1,300 ft. below that of the Mediterranean, and is the lowest sheet of water on the earth's crust. The Jordan alone pours into the Dead sea on a daily average a volume of water estimated at 6 million tons, and in the winter season torrents—very few of which are perennial—from the hills to the east and west add their contribution. The rainfall in the Dead sea valley seldom exceeds j in. in the year. There is, of course, no effluent. The heavy inflow is carried off by evaporation (estimated at 13½ mm. per day), visible in strange looking blue-white clouds which float half-formed and ethereal above the waters. An interesting feature is the peninsula, called from its shape the *Lisān* (tongue) which projects from the east shore. The sea to the south of this peninsula is shallow, showing a depth of from 3 to 30 ft., whilst north of it, towards the eastern shore, is the point of greatest depth (1,310 feet).

Geology.—The Dead sea occupies the lowest point of the Jordan rift-valley or trough-fault, caused by the slipping down of the strip of earth's crust confined by the two parallel fractures visible in the rock walls on either side of the valley. In the Jurassic and Cretaceous periods an extended Mediterranean covered Syria and Palestine, but during the Tertiary period an extensive upheaval of the sea-bed produced land. The earth movement was uneven, creating wrinkles (the Lebanons and the hills of western Palestine) and causing the fractures which resulted in the Jordan-Dead sea depression. There seems reason to suppose that prior to the Pluvial period, which later followed, the climate of this region was similar to that now prevailing, and that the Dead sea was approximately the same size as at present. During the Pluvial period the surface of the Dead sea gradually rose until it reached a height of 1,400 ft. above present level, and consequently higher than the Mediterranean. At this stage it was a vast inland sea stretching 200 m. from Huleh in the north to a point 40 m. beyond its present southern limit. Its waters were capable of supporting life, and remains of its fauna have been found in its marginal deposits.

A dry period supervened during which evaporation prevailed over precipitation causing a gradual shrinkage, until after a long interval only a remnant of the great sea remained, leaving in its wake deposits of marl, gypsum and salt, and clearly-defined beaches to bear silent witness to the uneven course of desiccation. The formation of the Lisān and of Jebel Usdum, a hill on the south-west shore, must have occurred subsequent to this period of contraction, since both are composed entirely of these lacustrine deposits. The strata of the Lisān dip to the east showing that there has been an upheaval of the floor of the Ghōr. It is permissible to conjecture that the crustal movements, due probably to continued faulting, which forced up the Lisān and Jebel Usdum, forming a southern escarpment of varying elevation and irregular base line, depressed at the same time the sea-bed to the north of the Lisān, where its deepest part is known to be. With the sea confined to the north of this barrier, what is now the shallow end of the Dead sea would be dry land. At no very distant date the sea broke this barrier at its western side, aided, it may be, by another tremor, or by merely overflowing, as its level rose, at a point where the barrier was low. That the level of the Dead sea is now rising, and has seemingly been rising for centuries, is well established. Since Kitchener's survey in 1883–84 it has risen nearly 20 feet. Since 1900 it has not risen more than 6 to 8 ft., however. The chief contributing factors to this rise of level are the encroachment on the sea of the Jordan delta, the gradual raising of the sea-bed through fresh layers of precipitate and climate that seems to be growing more moist.

Salinity.—The water of the Dead sea is intensely saline. Whilst ocean water has a salinity of 4–6%, Dead sea water contains 23–25% of salts. Exhaustive analyses of water taken from different parts and at different depths have been made The following selection from the analyses made by Terreil will suffice. A is surface water at the north end, B 120 metres deep 5 m. E. of Kās el-Feshkha, C 300 metres deep at the same point. T = Trace.

	A	B	C
Chlorine	65·81	67·66	67·30
Bromine	2·37	1·98	2·72
Sulphate	0·31	0·22	0·24
Carbonate.	T	T	T
Sodium	11·65	10·20	5·50
Potassium	1·85	1·60	1·68
Calcium	4·73	1·51	6·64
Magnesium	13·20	16·80	15·99
Silica	T	T	T
	100·00	100·00	100·00
Total solids in grams for 100 grams of liquid	19·2	24·5	25·9

Magnesium, sodium, calcium and potassium are present as chlorides, The chloride of magnesium, largely held in solution,

gives the water its nauseous taste, and chloride of calcium its smooth, oily feeling. The brine, as can be seen, is a commodity of great economic and commercial value, and applications have recently (1926) been invited by the Government of Palestine for the monopoly right for developing the mineral resources of the Dead sea. The density of the water is roughly 1.160, increasing from north to south and with the depth. At the southern end the density is 1·253. In consequence the wader in the Dead sea finds that when the water reaches his armpits he is swept off his feet, and in swimming the shoulders are all the time out of the water. When the water is permitted to dry on hands or clothing the resulting stickiness is distinctly disagreeable. No animal life can exist in its waters. Fish brought down by the Jordan die and furnish food for the sea-birds. From the salt pools on the north shore and from the Jebel Usdum the Badouin have been in the habit of retrieving salt to smuggle. Salt was a Government monopoly under the Turks and continues to be so under the new Palestine régime.

Recent investigation has shown that the river Jordan carries an unusually high percentage of salts, especially sodium chloride and magnesium chloride. In the Dead sea the sodium chloride crystallizes out, but the magnesium chloride remains in solution. With magnesium as a permanent and increasing element in Dead sea water, its rate of entry and the cubical content of the sea calculable, the age of the Dead sea becomes a matter of simple arithmetic. From the data available to him Irwin puts the figure at 50,000 years—obviously much too low.

Bitumen, or more exactly, asphalt, floats ashore on occasion. It is collected and used as a protection against worms and grubs in vineyards. According to Arab writers, it had many medicinal virtues. Search is now being made for petroleum in the Dead sea area.

History.—No other sea has had such a variety of names. The term "dead sea" was first introduced by late Greek writers, and is used by Pausanias, Galen, Justin and Eusebius. To the Hebrews it was "the sea," "the salt sea," "the sea of the Arabah," "the eastern sea." To Josephus it was "the asphalt sea," "the Sodomitish sea," whilst to Arab writers it was "the sea of Za'rah (Zoar)," "the stinking sea," "the sea of overwhelming," "the dead sea" and "the sea of Lot." This last is its modern designation. Historically, interest in the Dead sea centres in the biblical narratives of Abraham and Lot, and the destruction of Sodom and Gomorrah. At En-Gedi, on its western shore, David took refuge. To the south of En Gedi lies the fortress of Masada *(Sebbah)*, built by Jonathan Maccabeus, the refuge of Herod and Mariamne when the Parthians took Jerusalem (42 B.C.), and the scene of the last stand and self-destruction of Eleazor and his devoted band of zealots after the fall of Jerusalem (A.D. 70)—this last a grim tale of Roman determination and Jewish heroism.

In early times the sea was navigated, as Tacitus and Josephus bear witness, and under the crusaders the new navigation dues formed part of the revenues of the lords of Kerak. The Turkish sultans of more recent times regarded the sea as their private possession, and sold to individuals the exclusive right of putting boats on it. The Turks, with German assistance, put a flotilla of motor boats on the sea during the World War, and in 1922 one steamer, three motor boats and 14 sailing vessels were plying on its waters.

The tradition that the Dead sea covers Sodom and Gomorrah dates from Josephus. The site of the overwhelmed cities, whether under the waters of the sea at its north end, or its south end, or on its eastern or western shores, continues to occupy the minds and excite the ingenuity of investigators. Although the question is not fully resolved—if, indeed, it ever can be—the evidence seems to favour the south end, where, as we have seen, there was almost certainly dry land within historic times. That in this bituminous region a violent earth tremor—to which, indeed, the Ghor and its borders are peculiarly liable—should have brought into play eruptive forces whose catastrophic effects are indicated in the Bible narrative, is more than probable. The recent (1924) joint expedition of the Xenia seminary and the American School of Oriental Research sent out to locate the Cities of the Plain are convinced that three of them, Sodom, Gomorrah and Zoar, stood in the south-east corner of the Dead sea, on the lower courses of the only perennial streams in that region, the Numeirah, the 'Esāl and the Kurāhī respectively, but now of course beneath the sea. Kyle and Albright would assign but one town to each watercourse, and think that Admah and Zeboim must be sought elsewhere. Yet if they would but think of these perennial streams meandering over the plain to meet the sea west of the Lisān, the vision pictured is of an oasis like Damascus, a veritable "garden of the Lord," where there would be room for Admah and Zeboim and, indeed, many others.

The dismal associations of its name are not borne out by the sea itself. The wild tales of mediaeval travellers that in its poisonous air no plant could live, that over its dread waters no bird could fly and that no waves ever disturbed its gloomy ,surface, are figments of the imagination. The doom of Sodom and Gomorrah must needs be writ large on the waters that hid them. "To think of this lake as sombre is quite an illusion; its intense colouring, its varied effects of light, its scarped overhanging slopes, broken by deep gorges, produce a picture of wild and sublime beauty." Its winter climate, with a temperature of 75° F by day and 60 to 65° by night, is probably the finest in the world. The possibility of the development of some oases on its south-east shore as winter resorts has been suggested. Here is the testimony of the Xenia seminary expedition, which spent part of the winter there in 1924: "With proper irrigation three large oases, totalling perhaps 10,000 ac., could be made into a veritable tropical garden. The atmosphere was pure and refreshing and there was as little swamp smell as may be found anywhere along the shores of salt water. The scenery is beautiful, sublime and romantic far beyond that of many of the winter resorts of the world. Under proper irrigation, with the establishment of a motor boat and automobile line to Jericho and Jerusalem, this plain may soon vie with Luxor as a winter health resort."

The future of this, the most interesting of all seas, will be watched with interest whilst modern enterprise takes a hesitating step towards the fulfilment of Ezekiel's prophetic vision.

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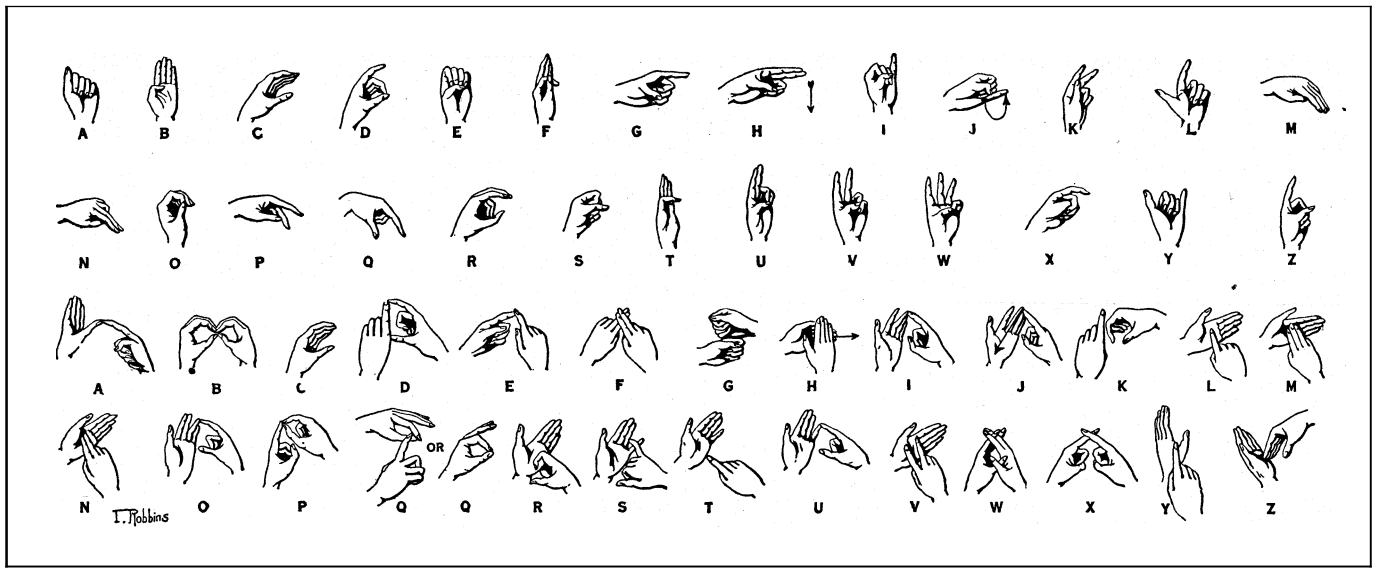
DEADWOOD, a city in the Black hills of western South Dakota, U.S.A., 2m. N.E. of Lead, the county seat of Lawrence county. It lies in a narrow canyon 4,530ft. above the sea, on federal highways 14 and 85, and is served by the Burlington and the Chicago and North Western railways, air and bus lines. Pop. (1940) was 4,100. Deadwood is a headquarters for tourists, and the commercial centre of a cattle-raising and gold-mining region. It has stamp mills, smelters and cyanide mills. In 1875 the discovery of gold in this region was made public. The United States bought the land from the Sioux, and in 1877 opened it to settlement. Deadwood Gulch was the centre of the rush that followed, and its colourful history is commemorated by an annual pageant held in a natural amphitheatre rimmed by steep hills. At the celebration of 1927, President Coolidge was inducted into full tribal membership by the Oglala Sioux, and Deadwood Dick, a national hero among the boys of his generation (one of the shot-gun guard that protected the early shipments of gold by stage-coach), rode in the parade. Ft. Meade, headquarters of the Black Horse cavalry, is 10m. N.E. of Deadwood.



HAND ALPHABETS: TOR ONE HAND (ABOVE) AND FOR TWO HANDS (BELOW). THE ONE-HANDED METHOD IS USED IN AMERICA, IRELAND AND, WITH VARIATIONS AND ADDITIONS. EUROPEAN CONTINENT. WHILE THE TWO-HANDED IS IN USE IN GREAT BRITAIN AND AUSTRALIA

DEAF AND DUMB, EDUCATION AND WELFARE OF THE. The term "deaf" is frequently applied to those who are deficient in hearing power in any degree, however slight, as well as to people who are unable to detect the loudest sounds. The reference here is to those who are so far handicapped as to be incapable of instruction by means of the ear. Deafness, then, is the incapacity to be instructed by means of the ear, and dumbness is ignorance of how to speak as an effect of deafness.

Of such deaf people many can hear sounds to some extent. D. Kerr Love quotes several authorities (Deaf Mutism, p. 58) to show that 50% or 60% are absolutely deaf, while 25% can detect loud sounds, and the rest can distinguish vowels or even words. He thinks that the ability to hear speech exists in about one in four, while ten or fifteen in each hundred are only semi-deaf. He warns against the use of tuning forks or other instruments held on the bones of the head, when the vibration may be only felt not heard, as tests of hearing.

EDUCATION

In the early ages the deaf were regarded as idiots and were killed out of hand. They had no place in the social order of things and were regarded as mere encumbrances. Later on, isolated cases are on record of the deaf being taught. The Venerable Bede relates that in 700 St. John of Beverley taught a deaf mute to speak. But it was not until the 16th century that any serious attempt was made to instruct the deaf. At this time, Jerome Cardan, who was born in Pavia in 1501, stated that the deaf could be instructed by writing. This method was put into practice by a Spanish Benedictine monk, Pedro Ponce (b. 1520). Another Spanish monk, Juan Paulo Bonet, taught the deaf to speak. He published a book on the subject in 1620.

Great Britain.— In England, Dr. John Bulwer in 1648, and Dr. William Holder in 1669, both wrote on the subject of teaching the deaf and dumb. In 1680, George Dalgarno, a Scotsman, wrote his *Deaf and Dumb Man's* Tutor. In 1760, a school for the deaf was opened in Edinburgh by Thomas Braidwood, and one in Paris at the same time by the Abbé de l'Epée. In 1783 Braidwood moved to London and in 1792 the London Asylum for the Deaf and Dumb was founded. This was the first British Institution for the deaf.

Up to nearly the end of the 19th century the education of the deaf was provided for mostly by charity. In 1893, the report of the Royal Commission which had been appointed to consider the condition of the blind and deaf, was published. As a result, the Elementary Education (Blind and Deaf Children) Act was passed. This provided for the compulsory attendance at school of deaf children between 7 and 16 years of age, and made it the duty of Local Education Authorities to make suitable provision for the education of the deaf. In this way State action was established.

Although the compulsory age for attendance at school is 7 years, children are admitted much earlier. Deaf children receive their education in day schools and residential schools. The day schools are maintained by Local Education Authorities and, with the exception of eight which are maintained by local education authorities, the residential schools are provided by voluntary committees. For the year ended March 1927 there were 50 schools, day and residential, with an accommodation for 4,826 pupils in England and Wales. Children are mostly taught by the oral method, that is by means of speech and speech-reading, although a proportion do not benefit by this method. These are taught by means of writing and a manual alphabet. The curriculum in schools for the deaf includes besides speech and speech-reading, the ordinary elementary school subjects. Vocational training is given in boot-making, cabinet-making, dress-making, laundry-work, etc. The London County Council provides the following schools for its deaf children: (1) Six day schools for deaf children up to 13 years of age. (2) Five day schools for partially-deaf children. (3) One residential school for deaf boys from 13 to 16 years of age, with provision for vocational training. (4) One residential school for deaf girls from 13 to 16 years of age, with provision for vocational training. (5) One residential school for deaf boys and girls up to 16 years of age who have a defect other than deafness.

The National College of Teachers of the Deaf has for many years past advocated the scientific classification of deaf children for the purposes of instruction according to the history and degree of their deafness and their mental condition. Clearly, the partially deaf and those who lose their hearing after the habit of speech has been naturally acquired, stand in a different relation to education from the deaf born, whose minds have never been stimulated by heard speech. Up to comparatively recent times, both types were grouped together for instructional purposes. The movement to give these children the advantages of a hearing environment and to train them by methods adapted to children who hear is steadily growing, and schools for partially deaf children are increasing in number. This is only part of the classification necessary to ensure that such type and condition of deafness shall receive the special educational care it needs. The London County Council Institution for the defective deaf at Penn is another step in this direction.

The Board of Education is the official department which issues statistics relating to the deaf and these necessarily apply to children, The incidence of deafness in children as shown in the

returns of the local education authorities for 1924 was ·81 per 1,000 children. The incidence of deafness in school children varies very widely in different districts and is shown in the chief medical officer's report to be 5·18 per 1,000 children in the Isles of Scilly and ·33 in Southport.

The central authority controlling schools for the deaf in this country is the medical branch of the Board of Education and all schools are open to inspection by the chief medical inspector and his staff. The British Deaf and Dumb Association is a national body consisting of deaf adults together with the leaders, hearing and deaf, of the local welfare societies.

The great advance in the education of the deaf during the 20th century established their fitness for higher educational and technical training. With this conviction the leaders of the schools and welfare societies for the deaf initiated in 1923 a movement for the reconstitution of the then national bureau for promoting the general welfare of the deaf, established in 1911, which was reorganized as the National Institute for the Deaf and came into being in April, 1925. The main attention of the Institute has been devoted to the industrial conditions of the deaf, the conditions of the deaf in poor-law institutions and mental hospitals, fuller citizenship of the deaf.

The general objects of the Institute are:— The prevention of deafness; the education of the deaf including the proper administration of the law effecting the attendance of deaf children at suitable schools, and the furtherance of their early training; the re-education of the partially deaf through speech-reading; the provision of efficient training in trades for children leaving school, and of opportunities for continued academic study; the adjustment of official and trade regulations where they operate harshly against the deaf worker; the provision of opportunities for the higher education of the deaf; the adequate care of the blind-deaf and the mentally defective deaf; the social elevation and fuller citizenship of the deaf; supplying information to, and advising public departments, private bodies, and individuals needing assistance, and generally, by propaganda, whether in the way of local or national action, to influence the public in favour of the deaf, with a view to bringing about necessary reforms.

International Action.—At the International Conference of Teachers of the Deaf held in London in 1925, which was attended by leading experts from some 15 nations, recommendations were adopted urging the need for opportunities for the higher education and technical training of the deaf after school age; the establishment of classes for the partially deaf in connection with schools for hearing children, such classes to be taught by specialist teachers of the deaf; the enforcement of a compulsory hearing test in elementary schools in order to ensure the detection and treatment of deafness in its early stages; the appointment of national committees to enquire into, and report upon, all matters affecting the education, training, industrial and social conditions of the deaf in the various countries represented; and the establishment in every country of a national organization to promote the general interests of the deaf throughout life. The Conference also decided to establish an international organization of teachers,

Denmark.— This was the first country in the world to introduce by royal decree in 1817 compulsory instruction for deaf children. The first school was opened at Copenhagen in 1807. The State provides for the education of all deaf children. The compulsory period of education is 8 years, children being admitted to school between the ages of 7 and 8. Classification is good and most of the children are taught orally. A proportion are taught by means of writing and spelling.

Norway.—As in Denmark the education of the deaf in Norway is undertaken by the State. For this purpose the country is divided into two districts, north and south, each having a school where pupils are admitted annually. There is a private agricultural and trade school in South Norway.

Sweden.—Up to 1926, unlike other Scandinavian countries the education of the deaf in Sweden was undertaken by local authorities, the State only allowing a grant per head for this purpose. In 1927 there was a measure before Parliament providing for State control.

Holland.— Instruction for the deaf goes as far back as 1790, when an Institute for the Deaf and Dumb was founded at Groningen. Dutch schools for the deaf are all private and are subsidized by the state and municipal authorities. Children are taught on the oral method, and nearly all pupils learn a trade.

France.— The Act of 1882 made instruction for deaf children compulsory. Besides several state schools there are many schools which are controlled by religious and private bodies. The National Institution in Paris was founded in 1785. The one in Bordeaux in 1795, and the one in Chambery in 1860. The age of admission of children is 6 years although children may be admitted earlier.

Japan.— The education of the deaf in Japan is of comparatively recent growth. The first special school was established in Kyoto in 1878. In 1923 a bill was passed by Parliament granting state aid to schools for the deaf. (C. SH.)

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UNITED STATES

The increasing emphasis on oralism in the United States is breaking down the barriers that separated the totally or partially deaf from normal people when only signs were used. The teaching of speech and lip-reading is now generally prevalent so that the word "dumb" is stripped of its one-time significance in America. As the deaf are educated, they cease to be dumb. The latter word has been eliminated by law from titles of institutions. According to the 1920 census the deaf numbered 44,885 but an unofficial estimate of totally and partially deaf runs into millions.

Education.— The first attempt to teach a deaf-mute recorded in the United States was Philip Nelson's in Rowley, Mass., 1679. From 1773 to 1776 there was a deaf boy in John Harrower's school, Fredericksburg, Va., but not until the early 19th century was concerted action taken to educate deaf children. Francis Green, of Boston, whose deaf son was sent to Edinburgh to be educated at Thomas Braidwood's institution, became much interested in the problem. With some ministers, he attempted a census of Massachusetts, 1803, when 75 deaf were found. They then estimated 500 deaf in the United States and urged the creation of a special school. In 1810 in New York, the Rev. Dr. John Stanford found several deaf children in the city almshouses and tried to instruct them, efforts which later resulted in the founding of the New York institution. A grandson of Thomas Braidwood, John Braidwood, began to teach a family of deaf children in Virginia in 1812, later establishing a school. After six precarious years alternately in that State and New York, he died, and the first American oral school for the deaf ended. Meantime, the case of Alice Cogswell, the deaf daughter of a Hartford physician, interested a group of men. Their investigations, 1812, disclosed 84 deaf in the vicinity. They estimated 400 in New England and 2,000 in America. In 1815 they organized a society to instruct the deaf, raised $2,278 and sent a young minister, the Rev. Thomas Hopkins Gallaudet, to Europe to learn methods of teaching the deaf. Gallaudet studied the sign language method at the Abbé Sicard's school in Paris, which influenced the whole course of the education of the deaf in America. When Gallaudet returned in 1816, he was accompanied by the celebrated Laurent Clerc, himself deaf, one of the Paris institution's teachers. On April 15, 1817, the Hartford school was opened with subscriptions from New York, Philadelphia, Albany, New Haven and other cities amounting to $12,000 and an appropriation of $5,000 from Connecticut, probably the first made in the United States for other than regular schools. It used the sign language of de l'Epée and Sicard, the manual alphabet and writing as the basis of instruction. In 1819 the Federal Government granted 23,000 ac. of public land, the proceeds from which formed a fund of $339,000. The New England States, Georgia and South Carolina (beginning 1834) sent deaf children to the school, renamed American asylum.

In May 1818 the New York Institution for the Deaf was

opened. Of the 62 attending, 32 were "charity pupils" provided for by the city. Thirty-eight belonged to distant parts of New York State, 19 to the city, four to New Jersey and one to Connecticut. After an exhibition by the students in 1819 the State legislature appropriated $10,000, and granted "a moiety of the tax on lotteries in the city of New York" which for 14 years formed a good income.

In Philadelphia, David Seixas began teaching deaf children in his home in 1819 or early in 1820. His work was noted by a group of citizens who, after an exhibition of results accomplished in 1821, helped to secure a charter and a *per caput* appropriation from the State of $160. The Hartford school lent him Laurent Clerc. New Jersey began at once to send pupils to the Pennsylvania institution, Maryland followed in 1827 and Delaware, 1835. Kentucky in 1823 was the fourth State to establish a school for the deaf, the Kentucky asylum at Danville, which was the first school established distinctly as a State enterprise. Other States followed, interest in many cases in the South being aroused by tours of the educated deaf who exhibited what could be done for these hitherto neglected members of society. In 1863, there were 22 schools for the deaf with 2,012 pupils. Within 60 years of the first foundation, they were established in 31 States, great areas of public land being granted in several instances, as in Connecticut and Kentucky, for such purpose. In all the institutions, up to 1867, the manual system of instruction held sway, though the oral method had been tried at the New York institution.

In 1867 the Clarke school, Northampton, Mass., the first permanent oral school in the United States, was established. Gardiner Hubbard, a Massachusetts senator, whose daughter lost her hearing when four and one-half years old, tried to establish an oral school and unsuccessfully applied for a charter in 1864. Then the work of Harriet B. Rogers with Fannie Cushing, a deaf-mute, came to his notice. He and his friends financed a small, private oral school in 1865. An exhibition by these pupils of Miss Rogers in 1867 convinced the legislature that so-called deaf-mutes could be taught to converse A great step forward in the education of the deaf was thus made. Massachusetts voted for the incorporation of "an Institution of Deaf-Mutes at Northampton"; for "primary instruction of younger pupils than were then received"; and for "a longer term of instruction of pupils aided by the State." The Institution for the Improved Instruction of the Deaf, New York, also came into being in 1867 instituting oral instruction. Both schools exerted an influence on the early education of the deaf.

Educators of the deaf divided themselves into those who favoured the manual system supplemented by articulation and those who taught speech and lip-reading, vetoing the manual method. Manual teachers maintained that certain deaf-mutes would never learn to speak and to read lips; oral teachers considered it unjust to separate the deaf from the hearing because of lack of instruction in the use of vocal organs. Dr. Edward Miner Gallaudet's stand for the teaching of speech to deaf children after his extended European tour of 1867 influenced many instructors. In 1886 tension had sufficiently modified to permit the convention of Instructors of the Deaf to pass noteworthy resolutions urging endeavours in the schools to teach every pupil to speak and read from the lips. The resulting "combined system" is defined in the *American Annals* of *the Deaf*, the instructor's official organ, as: —

> Speech and speech-reading are regarded as very important, but mental development and the acquisition of language are regarded as still more important. It is believed that in some cases mental development and the acquisition of language can be best promoted by the Manual or the Manual Alphabet method, and, so far as circumstances permit, such method is chosen for each pupil as seems best adapted for his individual case. Speech and speech-reading are taught where the measure of success seems likely to justify the labor expended, and in some of the classrooms of most of the Combined-System schools the Oral or the Auricular method is strictly followed.

The combined and the oral systems came into increasing use. Yet even in 1904 the World's Congress of the Deaf at St. Louis ruled that champions of the oral method were not friends of the deaf and that every teacher of the deaf ought to have a working command of the sign language. Oralism was helped forward by the establishment of day schools. The Horace Mann school, Boston, was the first, starting Nov. 10, 1869, under Sarah Fuller, principal for 41 years, who gave Helen Keller her first lessons in speech. The number of day schools increased slowly up to 1894 when there were 15, and more rapidly thereafter. In 1901, for instance, they numbered 49. with 835 pupils; in 1913, 64 with 2,109 pupils; and in 1926, 101 with 2,972 pupils. Pupils from oral schools have passed on to high schools and colleges, holding their own with those who hear, and graduating successfully. New York State, to promote such higher education, provides a *per caput* sum of $300 that a hearing note-taker may attend college lectures with the deaf student and take full notes for the latter's use.

The situation may be summed up in the conclusions of the 1924–25 survey made by a committee of the National Research Council financed by the Laura Spelman Rockefeller Memorial: The typical school does not prohibit the use of manual spelling. Pupils who after ample trial do not make satisfactory progress orally are transferred and taught in the manual classes. Of the three methods of education in practice, the oral, manual and combined, no one method is superior to the others, taking into account the educational achievement of the pupils and their basic intelligence. The beginning of the 20th century saw a further development in educational methods. It was realized that the percentage of the totally deaf is small. The 1924–25 survey disclosed that but 3% of the children tested were without any hearing and the average had 25%. As early as 1886 attention had been drawn to auricular training by the commissioner of education commenting on the work of the Nebraska Institution for the Deaf to educate the brain to use the hearing so that speech might be gained. Increasingly, greater stress is being laid on the development of the remnant of hearing, known as residual hearing, really an integral part of the oral method, so that sounds and language ideas are associated. Audiometer tests have shown pupils to have from 5% to 85% of available hearing acuity. Auricular training by means of exercises teaches the child to perceive the sound of the human voice and to interpret it, giving a vocabulary, improving speech and increasing activity in the psychic acoustic centres.

Provision for the education of the deaf in local institutions is made by the diiferent States as a general rule. Only in Delaware, New Hampshire, Nevada and Wyoming are deaf children sent at public expense to a school outside the State. Several of the southern States have at least two institutions, one for white children and the other for coloured. Only nine States have compulsory attendance laws for deaf children: Indiana, where the age is 7–18; Iowa, 12–19; Maryland, 6–18; Minnesota, 8–20; North Carolina; North Dakota, 7–21; Rhode Island, 7–18; West Virginia, 8–25; and Vermont.

Higher Education. — The United States is the only country with a college of accepted standard for the deaf, awarding the usual masters' and bachelors' degrees in art and science. It was established in Washington, D.C., in 1864 as the highest department of the institution of the deaf and dumb founded by Congress in 1857. First known as the National Deaf-Mute college, it was renamed Gallaudet college in 1893, and with the Kendall school (secondary) forms the Columbia Institution of the Deaf. In 1886–87 women were admitted to the college. Its graduates have successfully pursued special courses at Johns Hopkins, George Washington, McGill and the Universities of California and Pennsylvania. Of 353 graduates, 111 are teachers, 66 home managers, 36 printers and publishers, 24 farmers, 31 in business, 20 in chemistry, 17 in the ministry or training for it, and 11 acting as supervisors or in charge of athletics in the schools.

Teachers of the deaf are educated in the oral method at Clarke school; in the combined system at Gallaudet college; at the Central institute, St. Louis, Mo.; and at the Institution for the Improved Instruction of Deaf-Mutes, New York. Several schools in Illinois, Indiana, Ohio, North Carolina, Pennsylvania, Oklahoma, New York, Connecticut, Virginia and other States have at different times and for varying periods held normal classes.

The Volta Bureau for the increase and diffusion of knowledge relating to the deaf was founded in 1887 by Alexander Graham Bell (*q.v.*), who had taught his father's "visible speech" system

at the Clarke school in 1872 and whose life was largely devoted to helping the deaf. In 1909, at its founder's suggestion, it was presented to the American Association to promote the teaching of speech to the deaf, the largest organization of teachers and friends of the deaf in the world.

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DEAF-MUTISM, MEDICAL ASPECTS OF. Mutism. or dumbness, is almost always due to malformation or disease of the ear. Children learn to speak by imitating those about them who speak. Cases have occurred in which a child with normal hearing, brought up by deaf and dumb guardians in an isolated cottage in the mountains, did not learn to speak until it came into contact with speaking people in a town.

The air vibrations constituting sound are conducted through the outer ear passage to the tympanic membrane, and from this through a chain of three small bones in the middle-ear to the inner ear or labyrinth—the essential part of the organ of hearing. The inner ear itself consists of (1) the cochlea, which is concerned in hearing, and (2) the vestibule and three semicircular canals, which together are concerned with body equilibrium. (See EAR; HEARING.) From the inner ear the cochlear and vestibular nerves pass to the corresponding centres in the brain.

Lesions of the ear producing deafness so great as to cause a child to become mute are almost always situated in the inner ear. Deaf-mutes are usually classified into (A) congenital cases due to error in development of the ears, and (B) acquired cases in which the ears, normal at birth, become diseased in childhood. Less than half the cases of deaf-mutism are congenital.

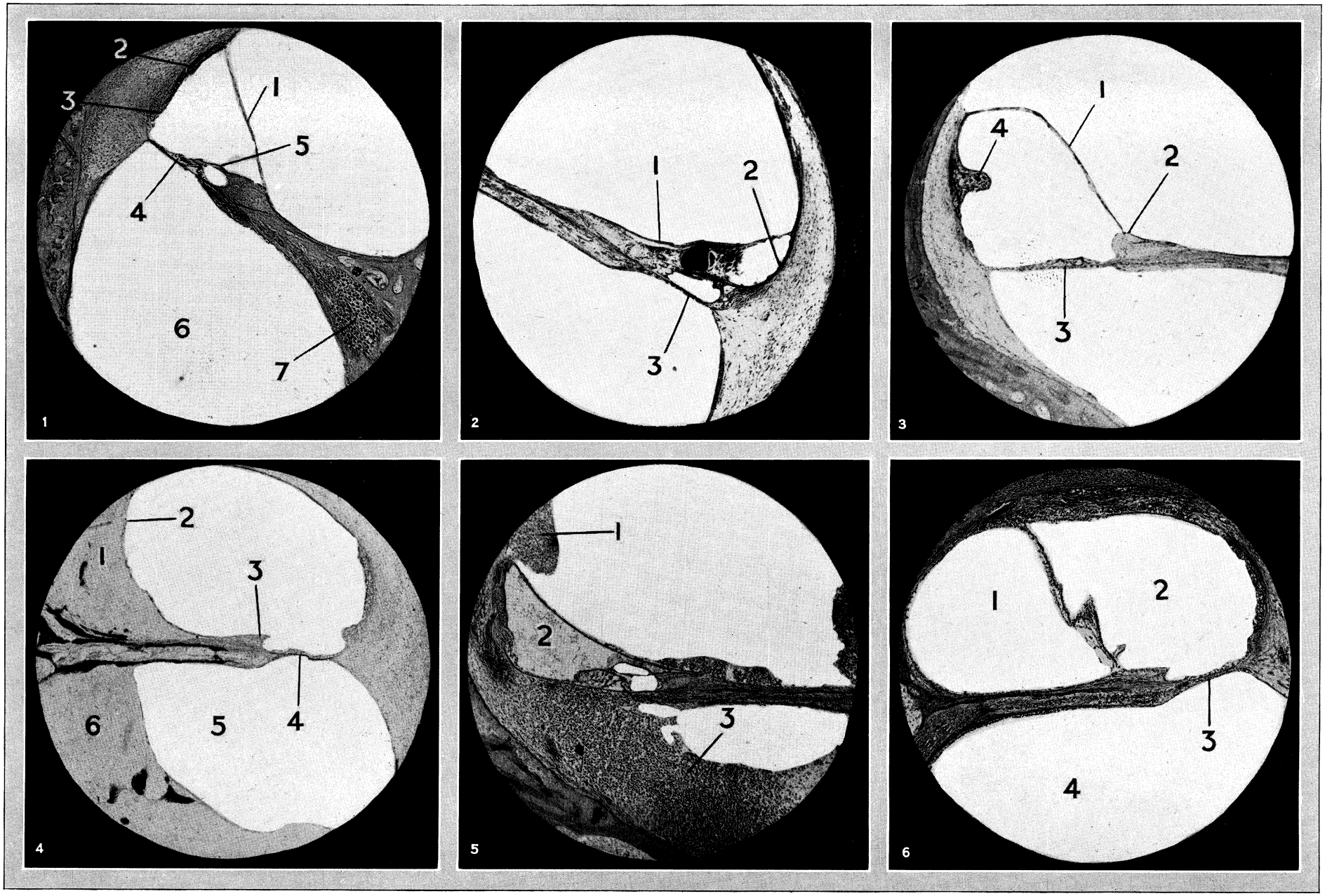
(A) Congenital cases are of two kinds: (1) "endemic" deaf-mutism, peculiar to certain districts or countries, *e.g.,* Switzerland, and associated with cretinism and goitre (see CRETINISM). Here, the lesion is in the middle ear; the drum cavity, which should contain air, being more or less filled up by connective tissue or bone. Deafness may not be very marked and the mutism is due mainly to the poor mental development of the patient. (2) The great majority of cases of congenital deafness are due to faulty development of the inner ear. This condition is known as "sporadic" deaf-mutism and is not uncommon in Britain. In the most marked instances the bony and membranous labyrinths are absent, while in the least severe cases only the membranous cochlea is involved. Between these two extremes there are several degrees of maldevelopment. Many of these patients have considerable remains of hearing. The vestibular or balancing apparatus in these cases is usually free from any developmental defect.

(B) Acquired deaf-mutism is due to injury to, or disease of, the inner ear. The deafness may only occur after the child has learnt to speak, but a child which has already acquired fluent speech may quickly become dumb if it loses its hearing, unless special training is begun at the earliest possible moment. The deafness may be produced by such conditions as (1) fracture of the base of the skull, which sometimes results in destruction of the organ of hearing on both sides; these cases are rare. (2) Suppurative disease in the middle and inner ears caused by severe attacks of scarlet fever, measles, or influenza. In these diseases the infection may pass from the nose and throat up the Eustachian tube to the drum cavity, and to the mastoid process which lies behind. (As long as the infection remains localized to the middle-ear spaces the deafness is seldom or never so severe as to give rise to deaf-mutism, though the children are often so "hard of hearing" that they cannot be educated efficiently in an ordinary school.) When the infection spreads from the middle to the inner ears, it gives rise to such severe changes that deaf-mutism results. Both the middle and inner ears on each side are filled with pus and, if the patient recovers, the inner ears are more or less obliterated by the formation of connective tissue and new bone, with consequent destruction of the nerve endings of the hearing and balancing apparatus. (3) Meningitis, the infective material finding its way outwards from the brain to the inner ear on each side along the sheath of the nerve of hearing. These children, if and when they recover from meningitis, are not only deaf but have lost their power of balancing for a time and have to learn to walk again. (4) Inherited syphilis which, in Great Britain, is responsible for about 5% of cases of acquired deaf-mutism. In these patients deafness does not occur until the child has, as a rule, reached the age of nine or ten years—a period at which it has of course already learnt to speak. (5) Otosclerosis, in which there is a formation of spongy bone in the normally dense bony capsule of the inner ear that impedes or prevents movement of the stapes. This disease is a common cause of deafness in early adult life, especially in young women, but rarely occurs so early as to render the patient a deaf-mute.

The clinical examination of a case of suspected deaf-mutism is not easy. The observer has little or no means of communicating with the child. If the parents are both congenital deaf-mutes and the child is one of a family of deaf-mutes, there can of course be no difficulty in making a diagnosis; but the case is not often so clear as that. We have to seek the aid of knowledge derived from Mendelism before we can explain many of the sporadic cases of deaf-mutism. (See MENDELISM.) The history as obtained from the child's parents is often far from accurate, as they are unwilling to acknowledge, in congenital cases, that the child has never heard, and adduce such facts as that "the child notices a door slamming or a band passing in the street" as proof of hearing. The deaf-mute of course feels the vibrations caused by such disturbances. Further, the mother often states that the child can say "Mamma" and considers that this shows that it can hear, whereas an intelligent congenital deaf-mute may pick up such a word by watching its mother's lips. Even with regard to cases of acquired deaf-mutism the history of the case is often at fault, the deaf-mutism being attributed to "vaccination," or "fright," when subsequent enquiry and examination show that it has really been due to meningitis, or to the results of middle-ear disease. If the tympanic membranes show the effects of middle-ear suppuration and if the deafness has only come on after the child has learnt to speak, one may be certain that the mutism has been acquired. In other cases where the deafness has only come on at the age of eight or nine years, examination may show that the upper central incisor teeth are peg-shaped and notched and that the cornea has become cloudy as the result of congenital syphilitic infection. Cases of acquired deaf-mutism due to meningitis in infancy are hard to diagnose, but as a rule a clear history is obtained if the meningitis occurred in later childhood. These children are totally deaf. The rare cases which are caused by fracture of the base of the skull are also not difficult to diagnose.

Considerable help in the clinical diagnosis of deaf-mutism may be obtained from examining the semicircular canal apparatus or balancing portion of the ear. A normal child, if turned round rapidly in a rotating chair, becomes very giddy and shows twitching movements of the eyes (nystagmus). Cases of congenital deaf-mutism, in which the maldevelopment is confined to the hearing portion of the ear, react like normal children, but cases of acquired deaf-mutism due to destruction of the labyrinth from any of the causes described above almost invariably fail to become giddy on rotation. Another method of testing the balancing portion of the inner ear is to syringe the ear with cold water. In a normal person such syringing produces giddiness and twitching movements of the eye and, if too prolonged, induces vomiting Here again congenital cases react like normal children, while the acquired cases are not disturbed even by the most prolonged cold syringing. Nevertheless, it is not possible in every case to classify the child as a congenital or as an acquired deaf-mute.

The hearing power of children who are suspected of being deaf-mutes may be tested in various ways, but it is impossible to be quite certain that a child has been born deaf before it reaches the age of one year. It is best to have the child seated on the knee of its mother or nurse and to attract its attention by showing it some small object. (In some cases the question arises whether the absence of response to sound is due to deafness or to idiocy. The true deaf-mute child is generally mentally alert and



PATHOLOGICAL ASPECTS OF DEAF-MUTISM

1. Normal cochlea of dog. (1) Reissner's membrane. (2) Normal stria vascularis. (3) Spiral prominence. (4) Basilar membrane. (5) Normal membrana tectoria. (6) Scala vestibuli. (7) Spiral ganglion. 2. Cochlea in congenital deaf-mutism. (1) Depressed Reissner's membrane. (2) Atrophied stria vascularis. (3) Basilar membrane; cochlear canal largely filled with a mass of cells and colloid material. 3. Congenital deaf-mutism, with dilated cochlear canal. (1) Reissner's membrane displaced upwards. (2) Membrana tectoria. (3) Maldeveloped Corti's organ. (4) Stria vascularis, with tumour formation. 4. Acquired deaf-mutism. (1) Scala vestibuli filled with new connective tissue. (2) Retracted Reissner's membrane. (3) Hushke's tooth; tectorial membrane should be attached. (4) Basilar membrane with degenerated Corti's organ. (5) Patent part of scala tympani. (6) Connective tissue and bone in scala vestibuli; nerve fibres absent in lamina. 5. Inflammation of labyrinth due to meningitis. (1) Pus in scala vestibuli. (2) Cochlear canal containing sero-purulent exudate: Corti's organ lying on basilar membrane. (3) Scala tympani filled with pus. 6. Congenital syphilitic deafness. (1) Scala vestibuli. (2) Dilated cochlear canal. (3) Basilar membrane with degenerated Corti's organ: membrane tectoria absent. (4) Scala tympani

at once takes notice of a coin or a watch shown to it.) An assistant stands well behind the child and blows a whistle, sounds a rattle, or claps his hands, and the observer notes whether the child pays attention to the loud noise suddenly created behind it. The assistant must not stand too near, otherwise the child may feel the vibrations caused, for instance, by the clapping of hands. Kerr Love recommends a dinner bell to test the hearing of deaf children. The child is instructed to count the strokes. At a later age tuning-forks of varying pitch may be used to ascertain whether the child can hear them when vibrating close to but not touching the ear. Vowel sounds may also be spoken in a loud voice into the child's ear, but he must not be allowed to see the face of the examiner, as a good "lip-reader" may detect from the face or lips the particular vowel which is being used. Some deaf-mutes have a fair amount of hearing which may be used for educational purposes; indeed there are at the present time in deaf-mute schools many children who should really be educated in special schools for the hard-of-hearing. Such schools, however, exist in but few centres in Great Britain. For education and training of deaf-mutes, *see* DEAF AND DUMB.

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DEAK, FRANCIS (FERENCZ) (1803–1876), Hungarian statesman, was born at Sojtor in the county of Zala on October 17, 1803. Of an ancient and distinguished family, he was educated for the law and practised first as an advocate and ultimately as a notary. His reputation in his own county was quickly established and when in 1833 his elder brother, Antal, was obliged by ill-health to relinquish his seat in the Hungarian parliament, the electors chose Ferencz in his stead. No man 'owed less to external advantages. He was to all intents and purposes a simple country squire. His true greatness was never exhibited in debate. It was in friendly talk, generally with a pipe in his mouth and an anecdote on the tip of his tongue, that he exercised his extraordinary influence over his fellows. He convinced them from the first of his disinterestedness and sincerity, and impressed them by his instinctive faculty of always seizing the main point and sticking to it. Perhaps he is unique in history, for though neither soldier, nor diplomatist, nor writer he became the leader of a great party by sheer force of intellect and moral superiority. This is all the more remarkable because he appealed to no passion but patriotism, and avoided power instead of seeking it.

During the struggle between Austria and Hungary for the preservation of the Hungarian constitution, Déak and Count Stephen Szechényi were the leaders of that party who wished all proceedings to be conducted in a strictly legal manner, and who therefore were opposed to the extreme revolutionary methods of Kossuth and his followers. In the diet of 1839–40 it was Déak who brought about an understanding between a reactionary government in need of money and recruits for the army and a Liberal opposition determined to vindicate Hungary's political rights. He did not sit in the diet of 1843–44 because his election was the occasion of bloodshed in the struggle between the Clericals who would have ousted him and the Liberals who brought him in. After the constitutional victory of 1848 he became minister of justice in the Batthyány ministry. All through the stormy days that followed, culminating in the War of Hungarian Independence, he never ceased to urge moderation and the adoption of a strictly legal position, but Kossuth and the extremists got the upper hand. "YOU cannot argue with a drunken man," he is reported to have said, "and at the moment the diet is drunk." When it became obvious that the Vienna Government did not intend to keep its promises to Hungary, Déak resigned with Batthyány, but without ceasing to be a member of the diet. He was one of the parliamentary deputation which waited in vain upon Prince Windischgratz in his camp. *(See* HUNGARY: *History.)* He then retired to his estate at Kehida. After the War of Independence he was tried by court-martial but acquitted.

After 1854 he spent the greater part of his time in Pest, where his room at the "Queen of England" inn became the centre for those patriots who in the dark days of the Bach administration looked to his wisdom for guidance. He did all in his power to stimulate the moral strength of the nation and to keep its hopes alive. He considered armed resistance dangerous, but he was the immutable defender of the continuity of the Hungarian constitution on the basis of the reforms of 1848. The Kossuth faction looked for salvation to a second war with Austria engineered from abroad, while the followers of Szechényi adopted an attitude of resignation, equally repugnant to Déak.

The Italian war of 1859 convinced the Austrian Government of the necessity of a reconciliation with Hungary. Bach was replaced by Schmerling and an imperial patent of April 19, 1860 removed some of the chief grievances of the Magyars. The October diploma of the same year was intended to provide the empire with a federal system of government on constitutional lines. Déak rejected it, but at the request of the government he went to Vienna to set forth the national demands. He insisted on the re-establishment of the constitution in its integrity as a *sine qua* non. On February 16, 1861 the government withdrew the diploma and issued a patent which was a return to the former centralist and bureaucratic system. On April 6 the diet met at Pest. Déak rose to defend the national right and traditions, and on June 5 moved an address to the crown refusing to recognize the February patent, insisting on the laws of 1848 as the sole basis of accord, and reminding the Emperor that an uncrowned king was no true sovereign of Hungary. The speech of Déak on this occasion was his finest effort and he was acknowledged the leader of the nation by all parties. He next proposed to the emperor that he should break away from counsellors who had sought to oppress Hungary, and restore the constitution as a personal act. The emperor thereupon dismissed Schmerling, suspended the February constitution and summoned the coronation diet. Of that diet Déak was the indispensable leader, and all parties left him to conduct the delicate negotiations with the emperor. The committee of which he was president had completed its work when the Austro-Prussian War broke out. The extreme party would have used the defeat of Koniggratz to extort still more favourable terms, but Déak made it easy for the emperor in the hour of his humiliation. To his question, "What does Hungary demand?" Déak answered, "Nothing more after Sadowa than before it." On Feb. 18, 1867 the restoration of the Hungarian constitution was publicly announced in the diet, and a responsible ministry was formed under the premiership of Count Julius Andrbssy. Déak himself refused to take office. There was still one fierce parliamentary struggle, in which Déak defended the compromise (Ausgleich) of 1867, both against the Kossuthites and against the Left-centre, which had detached itself from his own party under the leadership of Kálmán Tisza (*q.v.*). It was the wish of the diet that Déak should exercise the functions of a palatine at the coronation, but he refused the honour, just as he had refused every other reward and distinction. "It was beyond the king's power to give him anything but a clasp of the hand." His reward was the assurance of the prosperity and tranquillity of his country and the reconciliation of the nation and its sovereign. This service reconciled him to the loss of much of his popularity; for a large part of the Hungarian people looked upon the compromise of 1867 as a surrender and blamed Déak for it. He died at midnight of July 28–29, 1876; his funeral was celebrated with royal pomp on Feb. 3. A mausoleum was erected by national subscription and in 1887 a statue overlooking the Danube was erected to his memory.

See *Speeches* (Hung.) ed. by Man6 Konyi (Budapest, 1882); Z. Ferenczi, *Life of Dtak* (Budapest, 1894); *Memorials of Ferencz Dtak* (Budapest, 1889–90); Ferencz Pulszky, *Charakterskizze* (Leipzig 1876); R. Springer, *Die Krise des Dualismus und das Ende der Déakistischen Episode in der Geschichte der Habsburgschen Monarchie* (Vienna and Leipzig, 1904); L. Eisenmann, *Le Compromis Austro-Hongrois de 1867* (1904).

DEAKIN, ALFRED (1856–1919), Australian statesman, was born at Melbourne on Aug. 3, 1856. Educated at Melbourne university, he was called to the Victorian bar in 1877. He entered the Victorian legislature in 1880, and from 1883 onwards held

several important ministerial posts. After the fall of the coalition ministry in 1895 he remained a private member of the legislature, though office was repeatedly offered to him, until 1900. In that year he came to London to discuss with Chamberlain more particularly the legal points in the Australian Commonwealth Constitution Bill. In Victoria his public speeches helped on the Federation movement and in 1901, as attorney-general, he was included in the first Federal cabinet of Sir Edmund Barton, whom he succeeded as prime minister in 1903. During his legislative career in Victoria he was active in promoting social legislation and an ardent advocate of preference in favour of Great Britain. This fiscal policy he pursued during his three Federal premierships (1903–04, 1905–08, 1909–10), and supported Australia's co-operation in imperial defence, being responsible for the inception of the measure authorizing Australian naval constructioh in 1909, and for the invitation to Lord Kitchener to visit Australia and report on the question of defence. After 1910 he led the Opposition in the Australian parliament until compelled to retire, owing to ill-health, in 1912. He died at Melbourne on Oct. 7, 1919. Deakin had made a special study of the irrigation problem, and wrote three books on irrigation in Western America (1885), in Egypt and Italy (1887), and in India (1892). The Irrigation Act of 1886 was largely his work.

See W. Murdoch, Alfred **Deakin** (1923); B. R. Wise, Making of *the Australian Commonwealth* (1913).

DEAL, a seaport and municipal borough in the Dover parliamentary division of Kent, England, $9\frac{1}{4}$ mi. N.N.E. of Dover on the Southern railway. Pop. (1938) 23,420. Area 4.5 sq.mi. It consists of Loner Deal, on the coast; Middle Deal; and about a mile inland, though formerly on the coast, Upper Deal, which is the oldest part. The borough was extended in 1931 to include the urban district of Walmer and other areas. Frequented as a seaside resort, the town derives further importance from its vicinity to the Downs, a fine natural roadtrack between the shore and the Goodwin Sands, about 9 mi. long and 6 mi. wide, in which large fleets of windbound vessels may lie protected against the north, west and easterly gales. The trade consists in the supply of provisions and naval stores, which are conveyed to the ships in need of them by "hovellers," as the boatmen are called along the Kentish coast. The Deal hovellers, pilots and lifeboatmen are famous for their skill. Fish curing and a few other industries are carried on St Leonard's church in Upper Deal dates from the Norman period The site of the old navy yard is occupied by villas. The esplanade, nearly 4 mi long, extends through Walmer to the south, and north to the ruins of Sandown castle, and has a promenade pier, owned by the corporation. The golf-links are well known. At the south end of the town is Deal castle, erected by Henry VIII in 1539, together with the castles of Sandown, Walmer and Sandgate. They were built alike and consisted of a central keep surrounded by four lunettes. Sandown castle was the prison in which Col. Hutchinson, the Puritan soldier, was confined and is said to have died, September 1664. It was removed on becoming endangered by encroachments of the sea. The "captain" of Deal castle is appointed by the lord warden of the Cinque Ports.

Deal is one of the possible sites of the landing-place of Julius Caesar in Britain. Later in the period of Roman occupation the site was inhabited but was not a port. In the Domesday Survey, Deal (*Dola,* Dale, Dele) is mentioned among the possessions of the canons of St. Martin, Dover, as part of the hundreds of Buesborough and Cornilo; it seems from early times to have been within the liberty of the Cinque Ports as a member of Sandwich, but was not continuously reckoned as a member before the reign of Henry VI. In the time of Henry VIII Deal was a fishing village half a mile from the sea, but the growth of the navy and the increase of trade brought ships in increased numbers to the Downs. Lower or New Deal was then built along the shore. William III incorporated the town in 1698–99 and granted a market and fairs, with a court of Pie Powder The Cinque Ports were first represented in the parliament of 1265; the two members returned by Sandwich represented Sandwich, Deal and Walmer, until they were disfranchized in 1885. In World War II 2,000 houses had been damaged by German air raids by the end of 1941.

DEAL. A British term commonly used to designate the soft woods derived from the Scotch pine (*Pinus* sylvestris) which is called yellow or red deal, and the spruce fir (Abies excelsa) which is called white deal. The former is by far the better timber. Deal is freely imported into the British Isles from Scandinavia and Russia, and so widely used for building and other purposes that the world is threatened with a soft-wood famine.

The term deal (derived from Dan. deel, plank) is also used as the name of a soft-wood measurement. A deal in England is a piece of pine wood sawn gin. wide and 2 to 4in. thick, not less than 8ft. long. (See TIMBER.)

DEALER, one who sells at retail to the public. This term is used to cover nearly all retailers except department and chain stores, and in the loose parlance of trade it is sometimes applied to the individual units of chain-store systems. The term "dealer" formerly meant one who bought and sold primarily without a place to stock a quantity of merchandise; he was sometimes also referred to as a "curb dealer"; *i.e.,* one who transacted his business from the sidewalk.

DEAL-FISH, the name applied to marine fishes of the genus *Trachypterus,* which, together-kith the oar-fish (*q.v.*), comprises the family *Trachypteridae,* or ribbon-fish. Deal-fish inhabit the middle waters, probably not below 200 fathoms, and are characterized by their long, laterally compressed bodies, short head, narrow mouth and feeble dentition. The dorsal fin extends the length of the back, the anal is absent, and the caudal, when present, is reduced. The pectoral fins are small. In young deal-fish some of the fin-rays are prolonged in an extraordinary way. Deal-fish may reach a length of eight feet. They have a world-wide distribution. All the specimens found at the surface of the sea have been more or less mutilated by the release from the enormous pressure under which they are accustomed to live. The commonest species is T. arcticus.

DEAN, primarily one having authority over ten; the title of an ecclesiastical dignitary, or of a university or civil official (Lat. decanus, from Gr. δέκα, ten).

The original use of the word decanus was evidently to denote a military grade: it occurs in this sense in the De Re *Militari* of Vegetius (c. 386). Slightly later (c. 400), St. Jerome uses it in the Vulgate, instead of the *decurio* of the Old Latin version, for the "rulers of tens" in Exod. xviii. 21, 25. It was also applied, from the late 4th century onwards, to the members of a gild, whose occupation was the burial of the dead, as well as to certain minor officials of the imperial household, and in later times of the empire to various civil functionaries. In the Visigothic and Lombardic codes it occurs as the title of a subordinate judge, having jurisdiction within a district called a deanery (decania) or tithing; in the Anglo-Saxon system the corresponding official was entitled dean, tithing-man or head-borough.

In monastic life the term was used at an early period to denote a monk having charge of ten monks (St. Augustine, De Mor. *Eccl.* Cath., i. 31, etc.); and it occurs in this sense in the Rule of St. Benedict (ch. 21). As monachism developed the title came to be applied to various special functionaries, e.g., *foris* decanus, the monk responsible for the external business of a monastery.

In its now most familiar use, as denoting the head of a cathedral or collegiate chapter, the title probably owes its origin to this monastic usage, since many of the cathedrals were in the charge of monks. In the 8th century the decanus as a cathedral official was subordinate to the *praepositus* or provost, who presided over the chapter as the bishop's vicegerent; but during the next few centuries deans were almost everywhere substituted for provosts.

The office of rural dean, representing one type of the earlier archpriest (*q.v.*), is of great antiquity in the Western Church, going back to the time (at least as early as the 6th century) when the bishops of the large dioceses found it necessary to subdivide the diocese into districts called archipresbyterates or deaneries (*decanatus*), each with an archpriest (later entitled rural dean) at its head. This functionary supervised the local clergy, and to some extent represented the bishop within his district, but was

always subordinate to the archdeacon. At the present day, in the Roman Catholic Church, the powers and duties of rural deans vary considerably from country to country, and even from diocese to diocese; being restricted in some cases to presiding at the monthly conference of the clergy. In the Church of England the office fell into practical abeyance at the Reformation, but was revived about the middle of the 19th century; rural deans may act as deputies to the bishop and archdeacon, and are supposed in particular to see that the churches and parsonages within their district are in proper repair.

The title "dean of the sacred college" is borne by the oldest (in standing, not in age) of the cardinal-bishops, who takes the title of bishop of Ostia and Vellelri. Perhaps the use of the word "dean," as signifying the oldest member of any corporation or body of men, may be derived from its application to dignitary. The dean of the sacred college is in the ecclesiastical hierarchy second to the pope alone. A compendious account of his privileges and special functions may be found in the work of G. Moroni, vol. xix., p. 168.

There are four sorts of deans of whom the law of England takes notice: (1) The dean and chapter are a council subordinate to the bishop, assistant to him in matters spiritual relating to religion and in matters temporal relating to the temporalities of the bishopric. The dean and chapter are a corporation, and the dean himself is a corporation sole. Deans are said to be either of the old or of the new foundation—the latter being those created and regulated after the dissolution of the monasteries by Henry VIII. The deans of the old foundations before the Ecclesiastical Commissioners Act, 1541, were elected by the chapter on the king's *congé d'élire*; those of the new foundation (and, since the act, of the old foundation also) are appointed by the king's letters patent. It was at one time held that a layman might be dean; but since 1662 priest's orders are a necessary qualification. By the act of 1841 the dean is required to be in residence eight months, and the canons three months, in every year. The bishop is visitor of the dean and chapter. (2) A dean of peculiars is the chief of certain peculiar churches or chapels. He "hath no chapter, yet is presentative, and hath cure of souls; he hath a *peculiar*, and is not subject to the visitation of the bishop of the diocese." The only instances of such deaneries are Battle (Sussex), Bocking (Essex) and Stamford (Rutland). The deans of Jersey and Guernsey have similar status. (3) The third dean "hath no cure of souls, but hath a court and a *peculiar,* in which he holdeth plea and jurisdiction of all such ecclesiastical matters as come within his peculiar. Such is the dean of the arches, who is the judge of the court of the arches, the chief court and consistory of the archbishop of Canterbury, so called of Bow Church, where this court was ever wont to be held." *(See* ARCHES, COURT OF.) The parish of Bow and twelve others were within the peculiar jurisdiction of the archbishop in spiritual causes and exempted out of the bishop of London's jurisdiction. They were in 1845 made part of the diocese of London. (4) Rural deans *(see* above) are clergymen whose duty is described as being "to execute the bishop's processes and to inspect the lives and manners of the clergy and people within their jurisdiction." *(See* Phillimore's *Ecclesiastical* Law.)

The bishop of London is *ex officio* dean of the province of Canterbury, and in that capacity summons the bishops of the province to Convocation. In the colleges of the English universities one of the fellows usually holds the office of "dean," and is specially charged with the discipline, as distinguished from the teaching functions of the tutors. In some universities the head of a faculty is called "dean"; and the president of the Scottish Faculty of Advocates is called the Dean of Faculty. In each of these cases the word is used in a non-ecclesiastical and purely titular sense.

DEAN, FOREST OF, a district in the west of Gloucestershire, England, between the Severn and the Wye. It is oval in form, 20 m. long and 10 m. wide, and still retains its true forest character. The surface is undulating, its elevation ranging from 120 to nearly 1,000 ft., and its sandy peat soil renders it most suitable for the growth of timber. It has been a royal forest from time immemorial. In the reign of Charles I. the forest contained 105,537 trees, and the king granted it to Sir John Wyntour for £10,000, and a fee farm rent of £2,000. The grant was cancelled by Cromwell; but at the Restoration only 30,000 trees were left, and Wyntour, having got another grant, destroyed most of these. In 1680 an Act was pasaed to enclose 11,000 acres and plant with oak and beech for supply of the dockyards. Near Coleford and Westbury pit workings of the Roman period have beer, discovered.

DEANE, RICHARD (1610–1653), British general-at-sea, major-general and regicide, was a younger son of Edward Deane of Temple Guiting or Guyting in Gloucestershire, where he was baptized July 8, 1610. In 1644 he held a command in the artillery under Essex in Cornwall and took part in the surrender after Lostwithiel. Appointed comptroller of the ordnance, he commanded the artillery at Naseby and during Fairfax's campaign in the west of England in 1645. In May of that year Deane was appointed lieutenant of artillery to Cromwell in Ireland. Cromwell refused thus to be put out of the way, and Deane followed his example. He commanded Cromwell's right wing at Preston (Aug. 17–19, 1648). He was one of the commissioners for the trial of Charles I. and a member of the committee which examined the witnesses. He signed the death warrant.

In 1649 the office of lord high admiral was put into commission The first commissioners were Edward Popham, Robert Blake and Deane, with the title of generals-at-sea. At the outset of the battle off the North Foreland (June 1–3, 1653) Deane was killed. He was buried in Henry VII.'s chapel at Westminster Abbey, to be disinterred at the Restoration.

See J. Bathurst Deane, *The Life of Richard Deane (1870).*

DEANE, SILAS (1737–1789), American diplomat, was born in Groton, Conn., on Dec. 24, 1737. He graduated at Yale in 1758 and in 1761 was admitted to the bar. From 1774 to 1776 he was a delegate from Connecticut to the continental congress. Early in 1776 he was sent to France by Congress, as a secret agent to induce the French Government to lend its financial aid to the colonies. Subsequently he became, with Benjamin Franklin and Arthur Lee, one of the regularly accredited commissioners to France from Congress. On arriving in Paris, Deane secured the shipment of many vessel loads of arms and munitions of war to America. He also enlisted the services of a number of Continental soldiers of fortune, among whom were Lafayette, Baron Johann De Kalb and Thomas Conway. His carelessness in keeping account of his receipts and expenditures led, in 1777, to his recall to face charges. Before returning to America, however, he signed on Feb. 6, 1778, the treaties of amity and commerce and of alliance which he and the other commissioners had successfully negotiated. In America he was defended by John Jay and John Adams, and after stating his case to Congress was allowed to return to Paris (1781) to settle his affairs. The publication of some "intercepted" letters in Rivington's *Royal Gazette* in New York (1781), in which Deane declared his belief that the struggle for independence was hopeless and counselled a return to British allegiance, aroused such animosity against him in America that for some years he remained in England. He died on shipboard in Deal harbour, England, on Sept. 23. 1789 after having embarked for America on a Boston packet. No evidence of his dishonesty was ever discovered, and Congress recognized the validity of his claims by voting $37,000 to his heirs in 1842. He published his defence in *An Address to the Free and Independent Citizens of the United States of North America* (Hartford, Conn., and London, 1784).

See *The Correspondence of Silas Deane* published in the Connecticut Historical Society's *Collections,* vol. ii.; and *The Deane Papers,* in the New York Historical Society's *Collections* (1887–90). *See* also Winsor's *Narrative and Critzcal History,* vol. vii. chap. i.; Wharton's *Revolutionary Diplomatic Correspondence* of *the United States* (1889); and G L. Clark, *Silas Deane: A Connecticut Leader in tlze American Revolution* (1913).

DEARBORN, HENRY (1751–1829). American soldier and secretary of War, was born at Hnmpton in south-eastern New Hampshire. Upon hearing of the battle of Lexington, he left the practice of medicine to join the provincial forces and served as an officerat the battle of Bunker Hill, Arnold's expedition to Quebec

(where he was taken prisoner and exchanged), battle of Saratoga, Valley Forge, battle of Monmouth, Sullivan's expedition against the Indians, and the siege of Yorktown. He kept a detailed journal throughout the war, which gives a valuable first-hand account of the principal campaigns of the Revolution. Upon the organization of the Government, President Washington designated him United States marshal for the District of Maine, and in 1792 he was elected to Congress, where he served as a Republican for two terms. He was secretary of War through the administration of President Jefferson, 1801–1809. In *1803* he issued an order for "erecting barracks and a strong stockade" at "Chikago," "with a view to the establishment of a Post." The important part which this post, Fort Dearborn, played in the early history of Chicago. has given his name a lasting association with that city. In Jan. *1812*, President Madison appointed him senior major general of the United States Army. Upon the outbreak of hostilities with England, he undertook to carry out an extensive plan of campaign, including an invasion of Canada at several points. After a long succession of delays and reverses, he was relieved of his command in July *1813*. In *1822*, President Monroe appointed him minister to Portugal. He died in Roxbury, Mass. (H. D. SM.)

DEARBORN, a city of Wayne county, Michigan, U.S.A., 10 mi. W. of Detroit, on the Michigan Central railroad. The population was 2,470 in *1920* but grew rapidly to *50,358* in 1930, and was *63,584* in 1940 by the federal census. It is a residential suburb and is known as the home of Henry Ford (*q.v.*), who was born on a farm near the city. Ford restored the farm to its early appearance, and built at Dearborn a "museum village" of old buildings collected from all parts of the United States and from England.

DEATH, the permanent cessation of the vital functions in the bodies of animals and plants, the end of life or act of dying. The word is the English representative of the substantive common to Teutonic languages, as "dead" is of the adjective, and "die" of the verb; the ultimate origin is the pre-Teutonic verbal stem dau-; cf. Ger. Tod, Dutch dood, Swed. and Dan. dod.

For the scientific aspects of the processes involved in life and its cessation *see* BIOLOGY, PHYSIOLOGY, PATHOLOGY, and allied articles; and for the consideration of the prolongation of life *see* LONGEVITY. Here it is only necessary to deal with the more primitive views of death and with certain legal aspects.

FROM A WOODCUT BY HANS HOLBEIN THE YOUNGER

SIXTEENTH CENTURY PORTRAYAL OF DEATH

Ethnology.— To the savage, death from natural causes is inexplicable. At all times and in all lands, if he reflects upon death at all, he fails to understand it as a natural phenomenon. If a man dies without being wounded he is considered to be the victim of the sorcerers and the evil spirits with which they consort. Throughout Africa the death of anyone is ascribed to the magicians of some hostile tribe or to the malicious act of a neighbour. A culprit is easily discovered either by an appeal to a local diviner or by torturing some one into confession. In Australia whenever a native dies, no matter how evident it may be that death has been the result of natural causes, it is at once set down that the defunct was bewitched. Even to-day the peasantry of many European countries believe that all disease is the work of demons. Sleep and trance are regarded as the temporary, death as the permanent, absence of the soul regarded as the vital principle, as the moral principle and as the intellectual principle. It may be diffused all through the body but can be concentrated in one organ (*see* HEAD-HUNTING). It inheres in each and every part in excreta and hair clippings and for safety may be hidden in some external object.

The body's shadow or reflection is the soul, and subject to a malice of enemies. The soul is pictured as a man's breath (*anima*), and the word "breath" has become a synonym for life itself. The phrase "last breath" expresses the savage belief that there departs from the dying in the final expiration a something tangible, capable of separate existence—the soul. Myths account for its origin. Sometimes it is a "tabu" which has been broken and gives Death power over man. In India Yama, the god of Death, the first man, married his sister and thereby violated the fundamental law of exogamy, breach of which to this day in many cases still entails actual as well as civil death. In other myths, men were destined by Divine Mercy to be immortal but the messenger of the glad tidings failed or erred.

See Sir *J. G.* Frazer, *The Belief in Immortality*, vol. i. (1913), *The Golden Bough* (**Perils** *of the Soul*).

REGISTRATION

Legal Requirements.— The registration of burials in England goes back to the time of Thomas Cromwell, who in *1538* instituted the keeping of parish registers. Statutory measures were taken from time to time to ensure the preservation of registers of burials, but it was not until *1836* (the Births and Deaths Registration Act) that the registration of deaths became a national concern. The law for England was consolidated by the Births and Deaths Registration Acts *1874* and *1926*. Under the former act, the registration of every death and the cause of the death is compulsory. When a person dies in a house information of the death and the particulars required to be registered must be given within five days of the death to the registrar to the best of the person's knowledge and belief by one of the following persons:— (I) The nearest relative of the deceased present at the death, or in attendance during the last illness of the deceased. If they fail, then *(2)* some other relative of the deceased in the same sub-district (registrar's) as the deceased. In default of relatives, (3) some person present at the death, or the occupier of the house in which, to his knowledge, the death took place. If all the above fail, (4) some inmate of the house, or the person causing the body of the deceased to be buried. The person giving the information must sign the register. Similarly, also, information must be given concerning death where the deceased dies not in a house.

Where written notice of the death, accompanied by a medical certificate of the cause of death, is sent to the registrar, information must nevertheless be given and the register signed within 14 days after the death by the person giving the notice or some other person as required by the act. Failure to give information of death, or to comply with the registrar's requisitions, entails a penalty not exceeding *40* shillings, and making false answers to any question put by the registrar relating to the particulars required to be registered, or making false statements with intent to have the same inserted in the register, is punishable either summarily with a penalty of £10, or, on indictment, with penal servitude for seven years, or with imprisonment for two years with or without hard labour.

The registrar, upon registering the death, must' forthwith give to the person giving the information a certificate under his hand that he has registered the death; hut where he has received written notice of the death, accompanied by a medical certificate of the cause of death, he may, before registering the death and subject to such conditions as may be prescribed, give to the person sending the notice, if required to do so, a certificate under his hand that he has received notice of the death.

The body of the deceased cannot be disposed of before the certificate of the registrar, or order of the coroner, has been delivered to the person effecting the disposal, *i.e.*, the person by whom the register of burials in which the disposal is to be registered is kept. or, in the case of a burial in a churchyard or graveyard of a parish or ecclesiastical district under the Burial Laws Amendment Act *1880*, the relative, friend, or legal representative who is responsible for the burial of the deceased. Where, however, the disposal is by burial, the person effecting the disposal may proceed with the burial if satisfied by a written declaration in prescribed form by the person procuring the disposal that a certificate or order has been issued. The person effecting the dis-

posal must, within 96 hours of the disposal, notify the registrar in the prescribed manner as to the date, place and means of disposal. The registrar, on the expiration of the prescribed period after the issue of a certificate by him or of a coroner's order, if no notification as aforesaid has been previously received by him, must make inquiry of the person to whom the certificate or order was given; and such person must give information to the best of his knowledge and belief as to the person having the custody of the certificate or order, the place where the body is lying, or, if disposed of, the person effecting the disposal.

It is the duty of the father or mother of a still-born child to give information to the registrar of the particulars required to be registered concerning the still-birth. Upon doing so, he or she must either (1) deliver to the registrar a written certificate that the child was not born alive, signed by a registered medical practitioner or certified midwife who was in attendance at the birth or who has examined the body; or (2) make a declaration in prescribed form to the effect that no such practitioner or midwife was present at the birth, or has examined the body, or that his or her certificate cannot be obtained and that the child was not born alive.

The registration of deaths at sea is regulated by the Births and Deaths Registration Act 1874 together with the Merchant Shipping Act 1894.

Death can be proved by the production of a certified copy of the entry in the register of birth and deaths, which is evidence not only of the fact of death, but also of the date of death, the sex, rank, or profession of the dead person, and the cause of death.

Presumption of Death. — The fact of death may, in English law, be proved not only by direct but by presumptive evidence. When a person disappears and is not heard of for seven years, the presumption of law arises that he is dead (Nepean v. Doe, 1837, 2 M. and W. 894). In Scotland, by the Presumption of Life (Scotland) Act 1891, the presumption is statutory. In those cases where people disappear under circumstances which create a strong probability of death, the court may, for the purpose of probate or administration, presume the death before the lapse of seven years (see *In the* Goods of *Matthews,* 1898, p. 17). The question of survivorship, where several persons are shown to have perished by the same calamity, has been much discussed. It was at one time thought that there might be a presumption of survivorship in favour of the stronger party. But it is now clear that there is no such presumption; the question is one of fact depending wholly on evidence, and, if the evidence does not establish the survivorship of any one, all must be taken to have died at the same moment (Wing v. *Angrave,* 1860, 8. H. L. Cas. 183). This rule has been applied by the court of probate where husband and wife were both killed in a railway accident, and the bodies were found two hours afterwards, and administration was granted to their respective next of kin (*In* the Goods of Wheeler, 1861, 31 L. J. P. M. & A., 40); so also where husband and wife were proved to have been on board a ship which was supposed to have been lost at sea (In *the* Goods of Alston, 1892, p. 142).

Civil Death is an expression used in law in contradistinction to natural death. Formerly, a man was said to be dead in law (1) when he entered a monastery and became professed in religion; (2) when he abjured the realm; (3) when he was attainted of treason or felony. Since the suppression of the monasteries there has been no legal establishment for professed persons in England, and the first distinction has therefore disappeared, though for long after the original reason had ceased to make it necessary grants of life estates were usually made for the terms of a man's natural life. The act abolishing sanctuaries (1623) did away with civil death by abjuration; and the Forfeiture Act 1870, that on attainder for treason or felony.

For the statistics of the death-rate of Great Britain as compared with that of the various European countries see GREAT BRITAIN. See also ANNUITY; CAPITAL PUNISHMENT; CREMATION; INSURANCE, ARTICLES ON; MEDICAL JURISPRUDENCE, etc.

THE UNITED STATES

Legal **Registration.**—It is generally provided that the State department of health shall have charge of the registration of deaths, shall provide the necessary forms and blanks for obtaining and preserving such records, and shall procure the faithful registration of each death. For this purpose the States are, as a general rule, divided into registration districts, sometimes called vital statistics registration districts, in each of which there is a registrar charged with the registration of births and deaths. In Massachusetts and in some other States this duty is imposed upon each town clerk.

It is provided by statute in most States that the body of any person whose death occurs in the State shall not be buried, cremated, deposited in a vault or otherwise disposed of or removed from or into any registration district, or be temporarily held pending further disposition, more than 72 hours after death unless a permit for burial removal or other disposition shall have been properly issued by the registrar of the district. Whenever it is practicable, no such burial or removal permit shall be issued by any registrar until a complete and satisfactory certificate of death has been filed with him. If, however, a dead body is transported from one State into a district in another State, the transit or removal permit issued in accordance with the law of the place of death has the force of a burial permit. It is frequently required that the certificate of death shall be of the standard form recommended by the United States Bureau of the Census and adopted by the American Public Health Association and shall contain: — (I) the place of death, including the State, county, township, village or city; (2) the full name of the decedent. If an unnamed child, the surname preceded by "unnamed"; (3) sex and colour or race—as white, black, mulatto, Indian, Chinese, Japanese, etc.; (4) conjugal condition, whether single, married, widowed or divorced; (5) place and date of birth, including year, month and day; (6) age in years, months and days; (7) name of father and maiden name of mother; (8) birth-place of mother; (9) occupation; (10) signature and address of informant; (11) date of death, year, month and day; (12) statement of medical attendance on decedent, fact and time of death, including time last seen alive; (13) cause of death; (14) signature and address of physician or official making medical certificate; (15) place and date of burial or removal; (16) signature and address of undertaker; (17) official signature of registration with date when certificate was filed and registered number.

The personal statistical particulars should be authenticated by the signature of the informant, who should be the nearest of kin or other competent person acquainted with the facts. The statement of the facts relating to the disposition of the body shall be signed by the undertaker. The medical certificate shall be made and signed by the legally qualified physician, if any, last in attendance on the deceased. The cause of the death must generally be stated so as to show the disease or sequence of causes resulting in the death.

In regard to the registration of still-born children, in some jurisdictions the law provides that the child shall be registered as a birth and also as a death, and separate certificates of birth and death shall be filed with the registrar; in others, the still-born child is merely registered as a death. A certificate is not required for a child that has not advanced to the fifth month of inter-gestation.

If a death occur without medical attendance, it is the duty either of the undertaker or other person who learns of the death to notify the local health officer. The latter immediately investigates and certifies the cause of death. If, however, he has reason to believe that the death may have been due to unlawful act or neglect, he refers the case to the coroner for his investigation and certification. The undertaker must file the certificate of death with the local registrar, and obtain a burial or removal permit prior to any disposition of the body, which he delivers to the person in charge of the place of burial.

Presumption of Death. — The fact of death may, as a general rule, be proved by presumptive evidence. An unexplained absence of seven years at common law raised a presumption of death. This is still the period in most jurisdictions in this country, though a few have by statute adopted a shorter period, *e.g.,* five years in Arkansas, and five years in Indiana for the sole purpose of

authorizing the administration of an estate. Death may in some cases be presumed from the facts surrounding the disappearance indicating death within a shorter time than seven years. The English rule prevails in the United States that the presumption is of the fact of death only and not of the time of death. There are some cases, however, in which death has been presumed to have occurred at the expiration of the seven-year period.

Survivorship. — In the absence of circumstantial evidence, in the case of a common disaster, there is as a general rule, no presumption as to survivorship. In some States, however, there are codes embodying certain presumptions as to survivorship. Otherwise, the law will treat the case as one to be established by evidence, and the burden is placed on him who claims survivorship.

DEATH, BIOLOGICAL ASPECTS OF. The life cycle of individual multicellular organisms, standing relatively high in the scale of organic specialization, as for example, a fly, a bird or a man, is typically divisible into five biologically differentiated,and usually distinct, phases as follows: (a) The formation of the zygote, which is the individual, by the union of ovum and spermatozoon in the process called fertilization. The life-history of the individual, as a distinct and biological entity, begins with this event. (b) The period of development and growth, which has two sub-phases, commonly designated respectively as embryonic or foetal, and post-embryonic or post-natal. The duration of this growth phase of the life-cycle varies widely in different organisms, as from 8 to 10 days in the fruit fly, *Drosophila,* to more than 20 years in man. This phase comes normally to an end in most forms of higher animal life, and is succeeded by (c) the phase of adult stability, in which no marked changes are observable either in the direction of growth or degeneration. This phase is the "prime of life" in common parlance. Its duration in time is again widely variable. Sooner or later the individual can

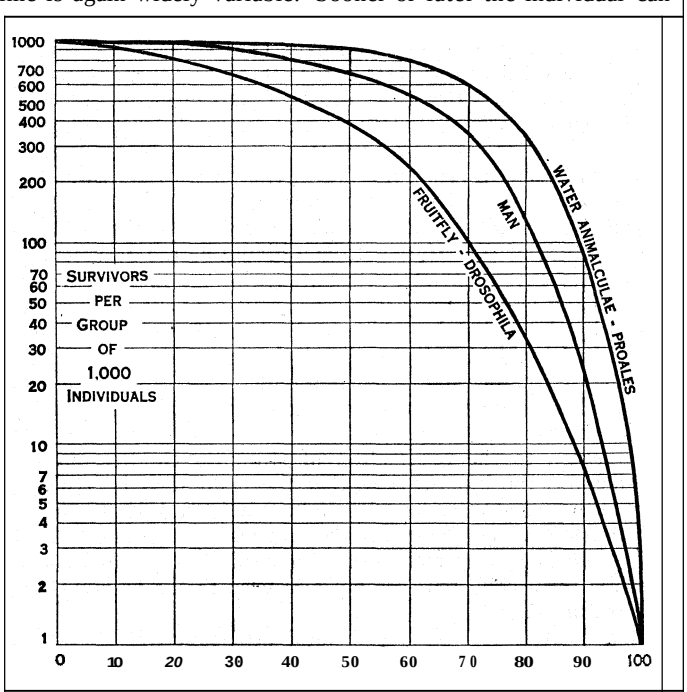

FIG. 1. — SURVIVAL RATES FOR MAN. A FRUIT FLY (DROSOPHILA) AND WATER ANIMALCULA (PROALES) AT CORRESPONDING AGES
The lower figures are the biologically equivalent life spans represented as equal and divided into 100 units

be observed to have passed definitely into the next phase of the life-cycle, which may be designated (d) the period of senescence. This phase is characterized by a progressive waning in the intensity of the vital processes generally, accompanied by regressive and degenerative changes in the structures of the body. The duration in time of this portion of the life-cycle again varies greatly, but ultimately, in all the more highly specialized organisms, the life of the individual, as such, comes to an end with the terminal event of the cycle (*e*) death. By this term is designated the cessation of all vital capacity.

The Cycle of Life. — In the cycle of individual life as outlined, the most significant phases biologically are obviously (b) growth and (d) senescence. Phases (a) and (e) (fertilization and death) are the terminal events of the important periods (b) and (d). Phase (c) is transitional between (b) and (d), and may be wholly absent, as when obvious senescent changes follow immediately upon the cessation of obvious growth. Indeed it is doubtful if phase (c) has theoretically any place in the life-cycle at all. Perhaps in cases where a stable adult plateau in the middle of the cycle seems to exist, it merely means that the changes of growth or of senescence are proceeding at too slow a rate to be observable by the relatively crude methods available.

In the case of the human species phases (b), (cj, and (*d*) are rather definitely and precisely limited by the biological phenomena of birth; puberty (precisely established in the female by the onset of menstruation, or *menarche*); the ending of the capacity to reproduce (marked in the female by the cessation of menstruation, or menopause) and its diminution to statistically insignificant proportions in the male at about the same age; and death. Pearl has shown (*The Natural* History of Population, 1939) that the average age at menarche, for large samples covering many different countries and peoples, is very close to 15 years, and that the average age of menopause for similarly representative samples is between 47 and 48 years. So, in round figures, human life after birth can be divided into three periods: (1) The *pre-reproductive* period of infancy and childhood, extending from birth to about 15 years of age. In this period the individual is incapable of self-maintenance or support on its own unaided resources, as well as of reproduction. (2) The *reproductive* period, extending from about 1j to about 50 years. In this period of life the work that supports the human socio-biological structure is mainly done, as well as the reproducing that continues the species. (3) The post-reproductive period, extending from about 50 years to the end of life. In this period the old, besides being incapable of reproduction to any statistically significant degree, are in large part dependent for their support upon the work done in the middle (reproductive) period of life; either by themselves with a concomitant saving for old age of the products of their efforts, or by others.

When statistics of population are arranged according to this threefold age classification a striking regularity or rule may be observed all over the world. This regularity may be stated as follows: Always and everywhere about one-half of the whole living population falls in the middle age group (15–49 years inclusive); while the other half is made up of the young (0–14 years inclusive) and the old (50 years and over) together, these two latter groups standing statistically in a compensatory relation to each other. In populations where there is a high proportion in the 0–14 year group there is a correspondingly small proportion in the 50 year and over group. Examples of this relationship are shown in the following table of the populations of 20 countries:

Country	Year	Percentage of living population aged:		
		0–14 yrs.	15–49 yrs.	50+ yrs.
Brazil	1920	42·7	48.3	8·9
Cuba	1919	42·3	47·5	10·1
Turkey	1935	41·3	45·5	13·2
India (excluding some provinces)	1931	39·9	50·4	9·7
Mexico	1930	39·2	50·2	10·6
Chile	1930	37·2	51·2	11·5
U. S. S. R. (including Asiatic territory)	1926	37·2	49·9	13·1
Japan	1930	36·7	48·1	15·2
Greece	1928	32·1	50·9	17·0
Canada	1931	31·7	51·6	16·6
Union of South Africa (whites only)	1936	31·2	52·5	16·3
Italy	1931	29·7	50·9	19·4
United States of America	1930	29·4	53.4	17·3
Eire	1926	29·2	48·4	22·4
Norway	1930	28·4	51·2	20'3
Australia	1931	27·5	53·3	19·1
Germany (excluding Saar Territory)	1933	24·2	54·0	21·8
England and Wales	1931	23·8	53·4	22.8
France	1931	22·0	51·4	25·7
Sweden	1935	22·2	54·4	23·4
Averages	1929·7	32·4		16·7

(This table ~ ~computed f r o official census data given in the *Statistical Yearbook of the League of Nations,* 1938.)

From this table it is seen that countries with high rates of reproduction, and consequently relatively high proportions of their people in the 0–14 year or pre-reproductive phase (such as Brazil, Cuba, and Turkey) have but a small proportion of persons over 50 years of age in their populations. On the other hand countries reproducing only sparely (such as England, France, and Sweden) have a relatively high proportion of old people in the population, but only a low proportion aged 0–14 years.

It has been alleged that man is unique among living things in having a disproportionately long, and from one point of view biologically useless, post-reproductive phase in the life cycle. This is not so. Other species are similar to man in this respect. Thus Pearl and Miner (Mem. *Musée* Roy. *d'Hist. Nat.* de Belgique, 2 ser., fasc. 3, 1936) showed that the females of a moth (Acrobasis *caryae,* the pecan nut case bearer) spend an average of about 25% of their total imaginal life-span—which in chronological times lasts only 6 to 8 days on the average—in the post-reproductive phase, as compared with 26% as an average for human females.

Senescence and Death.— The special problem of the biology of death is the analysis and elucidation of phases (d) and (e) of the life-cycle, senescence and death. As a result of investigations in this special field of general biology certain broad generalizations are now possible. The more important of these will now be discussed.

Time Duration.— The time duration of the entire individual life-cycle varies enormously, both between different forms of life, species, genera, families, etc., and also between different individuals belonging to the same species. Thus the maximum duration of life of the rotifer, *Proales decipiens,* is eight days (Noyes). At the other extreme there are other authentic records of individual reptiles living to as much as 175 years. Among mammals man is, on the average, the longest lived, with the elephant as his nearest competitor for this position.

Zoological Groups.—The differences between distinct groups of animals (species, genera, families, etc.) in respect to the length of the life-span stand in no generally valid, orderly relationship to any other broad fact now known in their structure or life-history. In spite of many attempts to establish such relationships every one so far suggested has been upset by well-known facts of natural history. Thus it has been contended that the duration of an animal's life is correlated with its size, in the sense that the larger the animal the longer its life. But plainly this has no general validity. Men and parrots are smaller than horses, but have life-spans of much greater length.

Individual Differences.— The differences between individuals of the same species in the duration of their lives are distributed in a lawful and orderly manner, in marked contrast to the apparently haphazard character of the inter-group variation in length of life-span just discussed. The individual variation in the duration of life is capable of exact mathematical description, and, indeed, its treatment constitutes a special branch of mathematics, known as actuarial science. It has been shown by R. Pearl and his students that if the life of different animals, such as the rotifer, Proales, the fly, *Drosophila,* various other insects and man, be measured not in absolute time-units of years or days, but in terms of a relative unit, namely a hundredth part of the biologically equivalent portions of the life-span in the several cases, then the distribution of individual variation in duration of life, or the distribution of mortality in respect to age, or, in short, the life-curve, is quantitatively similar in these widely different forms of life almost to the point of identity. This is illustrated in fig. 1.

These facts suggest that the observed difference between individuals in duration of life are primarily the result of inborn differences in their biological constitutions (their structural and functional organizations) and only secondarily to a much smaller degree, the result of the environmental circumstances in which their lives are passed.

Inheritance.— This inference is supported by the further fact that the differences between individuals which find expression in varying degrees of longevity, or duration of life, are definitely inherited. It has been proved experimentally by cross-breeding long-lived and short-lived strains of the fruit fly *Drosophila*

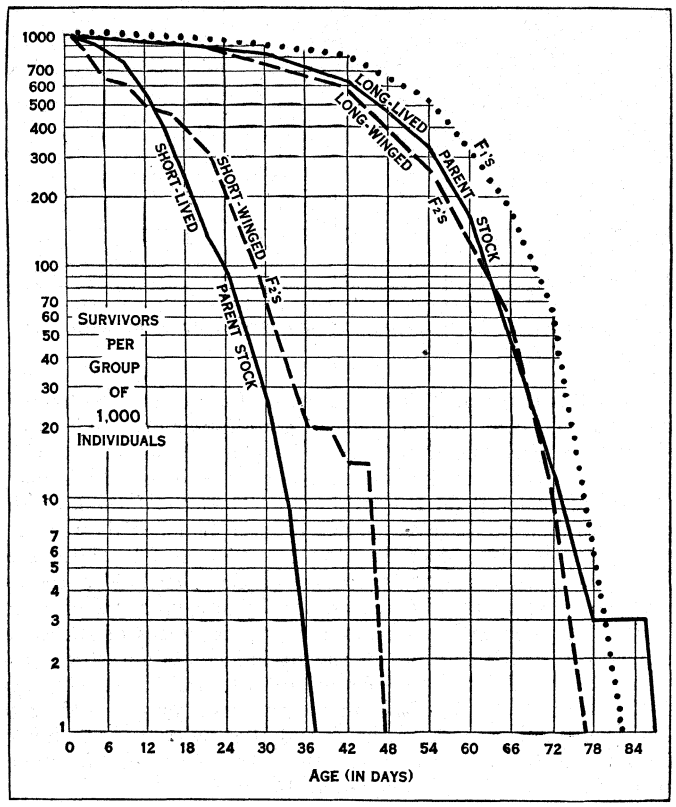

FIG. 2.—SHOWING HOW LONGEVITY IS INHERITED AMONG FRUIT FLIES WHEN A LONG-LIVED IS CROSSED WITH A SHORT-LIVED STOCK

The first generation of progeny (dotted line, F_1's) is longer lived than either parent stock and, when inbred, produces progeny of two kinds (F_2's), a short-winged, which is short-lived, and a long-winged, which is long-lived. The Mendelian laws of heredity are thus seen to hold, in the case of these fruit flies, for longevity, which is shown to behave like a definitely inheritable quality

melanogaster (Hyde, Pearl and his students, Parker and González). The results of such an experiment are shown in fig. 2.

In the first generation (F_1) from such a cross the progeny exhibit a life-curve essentially like that of the long-lived parent stock, but with a slightly greater average duration. If now these F_1 individuals are bred together *inter* se there are produced in the second cross-bred generation (F_2) two kinds of individuals, one of which (long-winged) has a life-curve like the original long-lived parent stock, while the other (short-winged) resembles in duration of life the original short-lived parent stock. In addition to these experiments along Mendelian lines, it has been shown that there can be isolated from a general population of wild *Drosophila* inbred strains showing definite and permanent innate difference in average longevity. The conclusion that individual differences in life duration are fundamentally an expression of hereditary differences between individuals is firmly established.

The importance of inheritance in determining human longevity has been demonstrated from various different lines of approach. In this field Karl Pearson and Alexander Graham Bell were pioneers. Pearl and Pearl studied intensively the ancestry of 36j persons living at ages of 90 and above about whose six immediate ancestors (2 parents and 4 grandparents) there was complete information. They compared with this group 136 persons chosen at random from the general population, all of whose 6 immediate ancestors were dead, and at known and recorded ages. This comparison group had an average living age of 48.75 years, and contained 29 persons over 60 at the time of observation, 6 over 70, and 1 over 80. The average age of the group was almost 16 years higher than that of the living white population of the United States in 1930.

Fig. 3 shows how the ancestry of the nonagenarian and centenarian group compared with the group of ordinary persons in respect of average longevity.

FIG. 3.— INFLUENCE OF IMMEDIATE ANCESTORS UPON AVERAGE LONGEVITY

From this diagram it is seen that, on the average, each single immediate ancestor, father, mother, grandfather or grandmother, of the extremely longevous persons of panel A on the left side, was longer lived than the corresponding ancestor of the ordinary persons of panel B on the right side. Thus the fathers of the longevous died at the average age of 72·4 years. This was 12·3 years, or over 20%, older than the average age of the fathers of the panel B folk at the right end of the chart. The central panel, A-B, gives the differences, in absolute numbers of years (upper figures in each sex sign) and as percentages of the panel B means, for each category of the six immediate ancestors. The "computed total longevity" figures for the individuals observed in the rectangles at the bottom are the resultants of adding to the mean number of years the A and B individuals had already lived at the time of observation the expectations of life proper to those ages, as given in a standard life table.

From this chart two important results emerge regarding the influence of heredity upon longevity, namely:

(a) People who achieved extreme longevity had immediate ancestors (parents and grandparents) who were, on the average, definitely longer lived than the corresponding ancestors of the general run of the population. This was true without exception for each particular category of immediate ancestors.

(b) This hereditary influence promoting longevity was between two and three times as great relatively for parents as it was for grandparents.

A specific study was made as to how each of the parents of the extremely longevous persons was bred relative to longevity, as compared with the parents of the general run of folk. This led to the results shown in fig. 4. In this study an individual who died under 50 years of age was regarded as short lived; one who died between 50 and 69 as average or mediocre in life duration, and one who died at 70 or over as long lived. Fig. 4 shows the percentages of the fathers and mothers respectively that had (a) both of their parents long lived (shown by the solid black portion of each bar); (b) one parent long lived and the other mediocre or short lived (shown by the cross-hatched portion of each bar); and (c) neither of their parents long lived (shown by the white portion of each bar).

The picture presented by fig. 4 is precise and striking. The nonagenarians and centenarians were produced by parents who were themselves bred out of wholly longevous parentage in more than half of all the cases observed—a markedly higher proportion than that shown by the parents of the general population sample. At the other end of the genetic scale the opposite is true. Fewer than half as many proportionally of the nonagenarians and centenarians as of persons generally were produced by parents who themselves had no longevous parentage whatever. There can be no question or doubt that breeding was of great importance in the production of these nonagenarians and centenarians.

Actuarial studies have also demonstrated the importance of heredity in the achievement of long life. This fact has been equally established by life tables for parents of children who died at specified ages, and by life tables of children of parents having specified degrees of longevity. For example such studies have shown that the mean-after-lifetime of fathers of children dying (or living) at ages of 80 and over is about 26% greater at age 20; 43% greater at age 40; 75% greater at age 60; and 58% greater at age 80, than the mean-after-lifetime at the same ages of fathers of children dying under 5. The corresponding excesses in expectation of life of mothers mere 27% at age 20; 27% at age 40; 36% at age 60; and 23% at age 80. Throughout the whole life-span the parents of the very long-lived children appear to be persons of superior biological constitution, as evidenced by their ability to keep on living.

Similar studies have shown that the sons of fathers dying (or living) at ages of 80 years and over have a mean-after-lifetime about 13% greater at birth than that of the sons of fathers dying between 50 and 79 years of age, and 22% greater than that of sons of fathers dying under 50 years of age.

Further evidence for the innate constitutional superiority of the longevous was afforded by Pearl's and Raenkham's (Human *Biology*, vol. 4, 1932) analysis of the causes of death of nonagenarians on the basis of the official records of the Census Bureau. That analysis led to the conclusion that nonagenarians are a selected lot of people. They are the ultimate survivors after all the rest of mankind has gone, unable to meet the vicissitudes of life and keep on living. Nonagenarians and centenarians come to be such because they have organically superior constitutions, resistant to infections, soundly organized to function efficiently as a whole organism and keep on doing it for a very long time. Observations on mortality at ages have indicated that throughout life infections and other harmful environmental forces were, on the whole, tending to take off the weaker and leave the stronger. Medical knowledge and skill, improved sanitation and better conditions of life generally have been able to prevent an increasingly larger amount of premature mortality before age 50. Especially have these agencies been able to reduce the lethal effects of infections, or at least to postpone to a later part of the life-span their fatal action. But ultimately there is left a group of extremely old people, for whom on the whole infections have no particular terrors. In all the early part of their lives they have been able successfully to resist infections, and to a remarkable degree still are in extreme old age. These people eventually die. But a great many of them die, not because the noxious forces of the environment kill them, but because their vital machinery literally breaks down, and particularly that important part of it—the circulatory system.

Natural Death a Novelty.— Neither senescence nor natural death is a necessary, inevitable consequence or attribute of life. Natural death is biologically a relatively new thing, which made its appearance only after living organisms had advanced a long way on the path of evolution. The evidence supporting this conclusion is manifold, and may be considered under several heads. (a) Various single-celled organisms (Protozoa, *q.v.*) prove, under critical experimental observation, to be, in a certain sense, immortal. They reproduce by simple fission of the body, one individual becoming two, and leaving behind in the process nothing corresponding to a corpse. The brilliant work of Woodruff and his students, in particular, has demonstrated that this process may

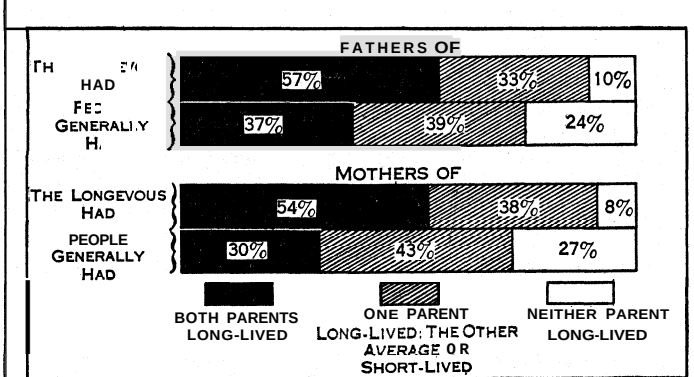

FIG. 4.—THE PERCENTAGE DISTRIBUTION, RELATIVE TO THE NATURE OF THE PARENTAL MATINGS PRODUCING THEM. OF THE FATHERS AND OF THE MOTHERS OF (A) AN EXTREMELY LONGEVOUS GROUP (NONAGENARIANS AND CENTENARIANS). AND (B) A SAMPLE OF PEOPLE GENERALLY

go on indefinitely, without any permanent slacking of the rate of cell-division corresponding to senescence, and without the intervention of a rejuvenating process such as conjugation or endomixis, providing the environment of the cells is kept favourable. (b) The germ cells of all sexually differentiated organisms are, in a similar sense, immortal. Reduced to a formula we may say that the fertilized ovum (united germ cells) produces a soma and more germ cells. The soma eventually dies. Some of the germ cells prior to that event produce somata and germ cells, and so on in a continuous cycle which has never yet ended since the appearance of multicellular organisms on the earth. (c) In some of the most lowly-organized groups of many-celled animals or Metazoa, the power of multiplication by simple fission, or budding off of a portion of the body which reproduces the whole, is retained. This asexual, or agamic, mode of reproduction occurs as the usual, but not exclusive, method in the three lowest groups of multicellular animals, the sponges, flatworms and coelenterates. More rarely it may occur in other of the lower invertebrates.

So long as reproduction goes on in this way in these multicellular forms there is no place for death. In the passage from one generation to the next no residue is left behind. Agamic reproduction and its associated absence of death also occur commonly in plants. Budding and propagation by cuttings are the usual forms in which it is seen. The somatic cells have the capacity of continuing multiplication and life for an indefinite duration of time, so long as they are not accidentally caught in the breakdown and death of the whole individual in which they are at the moment located.

(*d*) There is some evidence that in certain fish there is no occurrence of senility or natural death, but that instead the animal keeps on growing indefinitely, and would be immortal except for accidental death. The animal soma in such cases behaves like the root stock of a perennial plant. (For further discussion of this line of evidence see interesting correspondence by Geo. P. Bidder, in Nature, vol. cxv., 1925, passim and M. A. C. Hinton's monograph of the Voles and *Lemmings* [British Museum, 1926], in which it is concluded that voles of the genus *Arvicola* "are animals that never stop growing and never grow old.") (e) The successful cultivation in vitro of the tissues of higher vertebrates, even including man himself, over an indefinitely long period-of time, demonstrates that senescence and natural death are in no sense necessary concomitants of cellular life. Carrel and Ebeling, by transferring the culture at frequent intervals into fresh nutrient medium, have kept alive and in perfectly normal and healthy condition, a culture of tissue (see TISSUE CULTURE) from the heart of a chick embryo for more than 25 years; *i.e.*, for much longer than the normal life-span of the fowl. There is every reason to suppose that, by the continuation of the same technique, the culture can be kept alive indefinitely. The experimental culture of cells and tissues in vitro has now covered practically all of the essential tissue elements of the metazoan body, even including some of the most highly differentiated of those tissues. Nerve cells, muscle cells, heart muscle cells, spleen cells, connective tissue cells, epithelial cells from various locations in the body, kidney cells and others have all been successfully cultivated in vitro.

Potential Immortality.— Itmay fairly be said that the potential immortality of all essential cellular elements of the body either has been fully demonstrated, or has been carried far enough to make the probability very great, that properly conducted experiments would demonstrate the continuance of the life of these cells in culture to any indefinite extent. It is not to be expected, of course, that such tissues as hair or nails would be capable of independent life, but these are essentially unimportant tissues in the animal economy, as compared with those of the heart, the nervous system, the kidneys, etc. Generalizing from results of tissue culture work of the last three decades, it is highly probable that all the essential tissues of the metazoan body are potentially immortal, when placed separately under such conditions as to supply appropriate food in the right amount, and to remove promptly the deleterious products of metabolism.

Death Among Multicellular Animals.— A fundamental reason why the higher multicellular animals do not live forever appears to be that in the differentiation and specialization of function of cells and tissues in the body as a whole, any individual part does not find the conditions necessary for its continued existence. In the body any part is dependent for the necessities of its existence, as for example nutritive material, upon other parts, or put in another way, upon the organization of the body as a whole. It is the differentiation and specialization of function of the mutually dependent aggregate of cells and tissues which constitute the metazoan body that brings about death, and not any inherent or inevitable mortal process in the individual cells themselves.

When cells show characteristic senescent changes it is perhaps because they are reflecting, in their morphology and physiology, a consequence of their mutually dependent association in the body as a whole,

Deaths due primarily to organic breakdown or failure of	Mean age at death (years)		Median age at death (years)	
	Male	Female	Male	Female
1. Alimentary tract and associated organs of digestion	25·54±·06	28·24±·07	4·98±·08	14·93±·09
2. Respiratory system	32·24±·05	32·57±·06	31·86±·07	28·24±·08
3. Skeletal and muscular system	35·09±·29	37·96±·32	33·02±·36	35·96±·41
4. Endocrinal system	44·17±·82	44·15±·36	45·45±1·03	43·42±·46
5. Skin	46·73±·34	42·45±·46	53·47±·43	48·96±·58
6. Sexual system	47·37±·32	42·47±·08	57·96±·40	40·88±·11
7. Nervous system	49·11±·08	51·56±·09	54·64±·10	60·29±·12
8. Circulatory system and blood	54·50±·07	54·25±·08	62·04±·09	62·14±·09
9. Excretory system (kidneys and associated organs)	57·94±·07	54·24±·09	61·37±·09	57·50±·11

and not any necessary progressive process inherent in themselves. In other words, in the light of present knowledge, it seems necessary to regard senescence, in part at least, as a phenomenon of the multicellular body as a whole resulting from the fact that it is a differentiated and integrated morphologic and dynamic organization. This phenomenon is reflected morphologically in the component cells. But it apparently does not primarily originate in any particular cell because of the fact that the cell is old in time, or because that cell in and of itself has been alive; nor does it occur in the cells when they are removed from the mutually dependent relationship of the organized body as a whole and given appropriate physico-chemical conditions. In short, senescence appears not to be a primary or necessary attribute to the physiological economy of individual cells as such, but rather of the body as a whole.

Times of Death.— The different organ-systems of the body have characteristic times of breaking down and leading to death. These differences probably represent in considerable part different innate degrees of organic fitness of the different tissues and organs, and also in part the degree of exposure of the different organ-systems to environmental stresses and strains. The table above, based upon mortality returns of the U.S. Registration Area in 1910, illustrates these differences. The figures tabulated are (a) the mean or average age at death, and (*b*) the median age at death (that is, the age so chosen that the same number of deaths occur below this age as the number occurring above it).

There are thus wide differences in the time of breakdown of the dif-

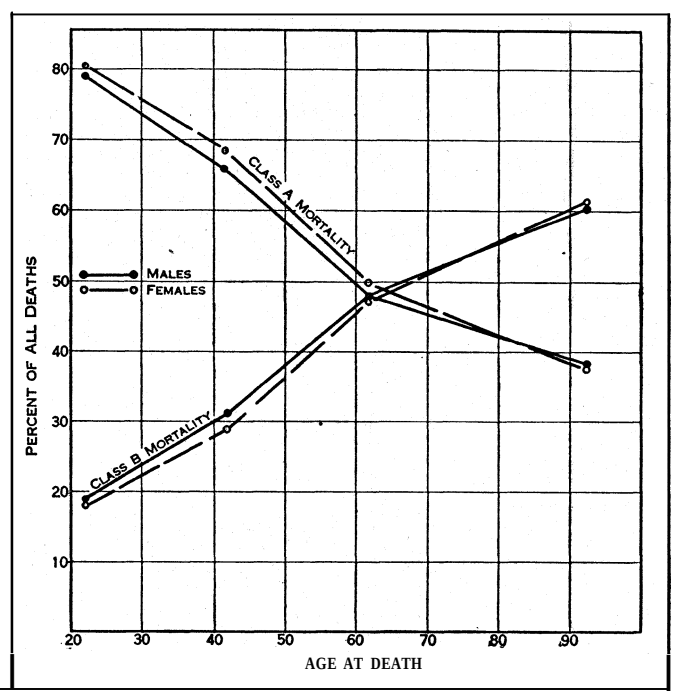

FIG. 5.— THE TRENDS. AT FOUR ADULT AGE PERIODS FROM AGE 20-24 ON TO THE END OF THE LIFE SPAN. OF MORTALITY HAVING ITS PATHOLOGICAL LESIONS AND/OR CLINICAL MANIFESTATIONS ASSOCIATED WITH (A) ORGAN SYSTEMS NORMALLY IN DIRECT CONTACT WITH THE EXTERNAL ENVIRONMENT (PLUS EXTERNAL CAUSES EXCEPT SUICIDE): AND (B) ORGAN SYSTEMS NORMALLY NOT IN DIRECT CONTACT WITH THE EXTERNAL ENVIRONMENT (PLUS "SENILITY")

ferent organ-systems, as reflected in mortality. The alimentary tract, on the average, "wears" rather less than half as long as the cxcrctory system.

The structural and functional organization of the vertebrate body is Such that certain organ-systems come normally and regularly into direct and immediate contact with the external environment, while other organ-systems do not, but are, on the contrary, protected from such contact. On this basis the organ-systems may be classified as follows.

A	B
Orgall-systems coming into direct contact with the etternal environmeni	*Organ-systems not coming into direct contact with the external environment*
Respiratory system	Circulatory system
Sex organs	Skeletal and muscular system
Kidneys and associated excretory organs	Nervous system
Alimentary tract	Endocrine system
Skin	

The mortality of white persons in the U.S. Registration Area, during the five-›ear period 1923–27 inclusive has been subsumed under this A (unprotected) and B (protected) classification of organ-systems by Pearl and Raenkham, with the results shown in fig. 5.

It is seen from this diagram that, with advancing adult age the proportion of deaths due to causes having their pathological lesions or clinical manifestations associated with the organ-systems of the body which are normally and regularly in direct contact with the external environment (Class A mortality) *decreased,* while the proportion having their pathological lesions or clinical manifestations associated with the organ-systems normally protected from direct contact with the external environment (Class B mortality) *increased.*

Death and the Environment. — It is a plain fact of experience that the environmental circumstances surrounding an organism may, in varying degrees, condition its duration of life. Thus complete starvation can induce death in a much shorter time than would have occurred in the absence of starvation. Similarly, there are many poisons that are lethal in appropriate doses. But, quite apart from such extremc and violent agents, the effect upon longevity of the never-ceasing changes in the normal environment is a matter of the first importance in reaching an understanding of the biology of death. The vast literature embodying the results of modern studies on nutrition and diet has shown, directly and indirectly, the role played by this factor in influencing life duration. Research in the field of nutrition has shown that qualitatively the diet of each particular kind of living organism must contain certain chemical elements and compounds in adequate amounts and proportions if life is to continue. Only within very narrow limits can there be any substitutions for these essentials. In some cases the requirements are absolutely rigid and obligatory. Clinical experience and investigation has shown that quantitatively there are limitations to the amount of food intake if the maximum potential longevity is to be realized. Too much food can shorten life as well as too little. The studies of Curt P. Richter have indicated that the normal appetite of animals lower in the evolutionary scale than man is a highly effective regulatory governor of food intake, as regards both quality and quantity. Rats given a free choice of chemically pure food elements tend to make for themselves a diet that is physiologically optimal.

In man critical studies by appropriate statistical and actuarial methods have thrown light upon the relation between longevity and certain widespread environmental circumstances. Evidence has been accumulated to show, for example, that the moderate consumption of alcoholic beverages is not significantly associated statistically with differences between individuals in life duration; that, on the other hand, the smoking of tobacco is significantly so associated, in the sense that as the average amount of smoking shown by a group increased the expectation of life decreased; and that the amount or degree of expenditure of energy in physical labour after age 40 is significantly associated statistically with differences in longevity — as the amount of such expenditure increased the expectation of life decreased.

Rejuvenation. — In recent years numerous attempts have been made to achieve "rejuvenation" (*q.v.*) of the aging body and to lengthen the span of life by various surgical alterations of certain endocrinal organs, particularly the essential organs of sex. Nevertheless, whatever may he the immediate physical and psychological effects of such procedures, there is as yet no convincing evidence that they alter the expectation of life of the individual. On the other hand certain experimental studies on lower organisms have shown that under defined and reproducible conditions the span of life may be greatly increased beyond that normal to the species under usual conditions. Such results are of great biological interest even though, in the present state of knowledge, they have no evident application to the prolongation of human life. Gould and her associates (*Annals of Bot*, vol. xlviii, 1934) experimented with seedlings of the cantaloup (*Cucumis melo*) grown under sterile conditions in the dark, so that all their food came from the supply stored in their own cotyledons. It was found that if measured portions of this stored food were removed by aseptic surgical operations on the cotyledons the total duration of life of the seedlings, as well as the duration of each of the component phases of the life-cycle, could be prolonged up to as much as 6 to 7 times the normal expectation for the amount of food available. Furthermore the amount of growth, however measured, was increased as compared with the normal for the same amount of available food. Other experimental studies on various lower animals have shown that partial starvation materially increased the duration of life.

Senescence. — Many theories of senescence have been advanced. No one of them can be regarded as entirely satisfactory, or as generally established by the evidence. Most of them suffer from the logical defect of setting up some particular observed attribute or element of the phenomenon of senescence itself, such as protoplasmic hysteresis, slowing rate of metabolism (meaning essentially only reduced activity), etc., as the cause of the whole. More experimental work on the problem is essential; in particular in the direction of producing at will, and under control, the objective phenomenon of senility irrespective of the age of the organism, and conversely preventing the appearance of these phenomena in old animals.

BIBLIOGRAPHY. — The literature on the subjects treated in this article is widely scattered in biological, medical and statistical journals and separate treatises. The following books summarize the field, and will serve to introduce the reader to the detailed literature: C. M. Child. *Senescence and Rejuvenescence* (1915); *E.* Korschelt, *Lebensdauer, Alter und Tod* (1922); R. Pearl, *The Biology of Death* (1922); *T.* Brailsford Robertson, *The Chemical Basis of Growth and Senescence* (1923); R. Pearl, *Studies in Human Biology* (1924); *The Rate of Living* (1928); R. Pearl and Ruth D. Pearl, *The Ancestry of the Long-lived* (1934); *L.* I. Dublin and A. J. Lotka, *Length of Life. A Study of the Life Table* (1936); E. V. Cowdry (Editor), *Problems of Ageing. Biological and Medical Aspects* (1939). (R. PL.)

DEATH-RATE. Since communities vary in numbers of population, it is the practice to compare their death statistics in the form of death-rates per 1,000 of population. Thus, there were 1,380,986 deaths reported in the United States during 1938; since the population for that year was estimated to have been 130,215,-000, the death-rate was 10·6 per 1,000 of population. In England and Wales, the death-rate in 1938 was 11·6 per 1,000 of population. The death-rate computed simply as the ratio of the total deaths in a community within a calendar year to its total population living during the same period is known as the crude annual death-rate.

Age, Sex, and Race Incidence. — Death-rates may be computed specifically for each sex and age, and also for each race living in the community. Thus, among white persons in the United States, the death-rate during 1937 was 10·8 per 1,000, while among Negroes it was appreciably higher, namely 14·7 per 1,000. The death-rate among males is higher than that among females in most countries of the western world. For example, in the United States during 1937 there were 12·0 white male deaths per 1,000 white males living while the figure for white females was 9·6 per 1,000. The corresponding death rates in England and Wales for 1937 were 13·2 per 1,000 males and 11·7 per 1,000 females.

When the number of deaths occurring at a specific age within a calendar year is divided by the number living at that age, the result obtained is an annual age-specific death-rate. There is a striking variation in the age-specific death-rate with advancing age It is very high in the first year of life, but diminishes rapidly as the child grows older, and reaches a minimum at about age 10 or 11 years. From this point, the death-rate increases, at first slowly, until the fifth decade of life, and then more and more rapidly to the end of the natural span of life. The experience of the total population of the United States during 1937 may be cited as an example. Starting with a death-rate of a little more than 50 per 1,000 babies in the first year of life, the figures fell to a minimum of practically one per 1,000 children at age 10. The death-rate per 1.000 then rose to 2.73 at age 20, to 3.85 at age 30, to 12·04 at age 50, and to 53·29 at age 70.

Standardized Death-Rate. — In view of the marked variation of the age-specific death-rate with regard to age, it is evident that the crude death-rate of a community is strongly influenced by the age distribution of its total population. Even if two communities have identical age-specific death-rates, the crude death-rate of one may be higher than that of the other simply because it has a larger proportion of its population in the higher ages of life. According to one method adopted to obviate this difficulty in making a valid comparison of the situation in two communities, the death-rates are "standardized." The "standardized" death-rate of a community is the death-rate which would prevail in the community if

TABLE I. Average Annual Deaths per 1,000 Total Population in Certain Countries for the Period r936 to 1938

Country	Death Rater per 1,000 1936 to 1938	Country	Death Rates per 1,000 1936 to 1938
NORTH AVERICA		EUROPE (Continued)	
United States	11·1	Ireland, orthern	14·4
Canada	9·8	Italy	13·9
Mexico.	23·0*	Latvia	14·0
SOUTH AMERICA		Lithuania	13·0
Argentina	11·9	Netherlands	8·7
Chile	24.6	Norway.	10·3
Colombia	16·0	Poland	14·0
Uruguay	10·2*	Portugal	16·0
Venezuela	18·1	Rumania	19·4
EUROPE		Scotland	13·3
Austria	13·5	Spain.	15·7†
Belgium	13·0	Sweden	11·8
Bulgaria	13·7	Switzerland	11·4
Czechoslovakia	13·4	Yugoslavia	16·2*
Denmark	10·7	ASIA	
Eire	14·4	India, British	22·9*
England and Wales.	12·0	Japan	17·1*
Estonia	14·9	Palestine.	16·7
Finland	13·3	OTHER COUNTRIES	
France	15·2	Australia	9.5
Germany	11·7	Egypt	27·5*
Greece	15·1*	New Zealand	9·2
Hungary	14·3	Union of South Africa (Whites)	10·1*

*Average for 1935 to 1937. †Average for 1934 and 1935.

its population had the age distribution of some suitably selected standard population. The actual operation of computing a "standardized" death-rate consists in (1) multiplying the age-specific death-rates of the community by the number of persons at corresponding ages in the standard population; (2) summing the resulting products for all ages; (3) dividing the sum so obtained by the total population of the standard The result is the "standardized" death-rate. The process may be extended to standardize death-rates for variations in the sex and colour constitution of communities. Standardized death-rates are not always available and it accordingly becomes necessary to make mental allowance for the extraneous effects of age, sex and racial composition of communities whose crude death-rates are being compared. (See *Average Length* of *Life* below.)

International Comparisons. — The death-rates of the United States and of England and Wales compare very favourably with those for most countries of the world. Among the few countries with lower death-rates during the period 1936–38 are: Canada, with a death-rate of 9.8 per 1,000; Denmark. 10·7; The Netherlands, 8.7; Norway, 10·3; Australia, 9.5; and New Zealand, 9.2. The following countries, among others, experienced death-rates of 20 per 1,000, or more: Mexico, 23·0; Chile. 24.6; British India, 22.9; and Egypt, 27·5. In addition to these countries. there are many others with poor health conditions which do not compile their death statistics. The foregoing death-rates, and those for several other countries, are shown in Table I.

Trend. — There has been a steady decrease in the death-rate in most western countries since about the middle of the 19th century; the improvement has been particularly marked since 1900 (see Table 11). Thus, in England and Wales, the crude death-rate from 1851 to 1870 was, on the average, somewhat over 22 per 1,000, while during the decade 1901–1910 it averaged 16·9 per 1,000. The downward movement continued to a low of 12·0 per 1,000 during 1931–35; following a slight rise to 12·4 in 1937, it dropped to 11·6 in 1938. In the United States, the death-rates per 1,000 fell from an average of 15·7 during 1901–10 to a record low of 10·6 in 1938. France experienced a decline in the death-rate from a level of about 24 per 1,000 during 1851–80 to a level somewhat over 15 per 1,000 since 1930. In Germany, the drop was from about 27 per 1,000 during 1851–80 to a little less than 12 per 1,000 since 1926. A more accurate picture of changes in mortality conditions with lapse of time may be obtained from a comparison of age-specific death-rates. A comparison of this kind inevitably shows that the greatest improvements have been at the youngest ages, while practically no change in death-rate has taken place at the older ages. Thus, in the United States, the death-rate in the first year of life in 1901 was 124 per 1,000, while in 1937, it was only a little over 50 per 1,000. At age 20, the death-rates per 1,000 were 5.89 in 1901 and 2·73 in 1937, while at age 50 they were 14·59 and 12·04 respectively; at age 70, the corresponding figures were 56·41 and 53·29.

TABLE II. Average Annual Deaths per 1,000 Total Population in Selected Countries for Specified Periods and Years from 1851 to 1938

Period or Year	United Stales	England and Wales	France	Germany	Italy	Sweden
1851–60	*	22·3	24·0	26·4	*	21
1861–70	*	22·5	23·7	26·9	*	20
1871–80	*	21·0	23·7	27·2		18
1881–90	*	20·1	22·1	25·1	30·0	17 0
1891–1900	*	18·8	21·5	22·3	27 3	
1901–10	15·7	16·9	19·4	18·7		
1911–13	14·1	14·7	18·1	15·6	19 4	13 9
1914	13·6	13·9	18·8	19·0	17 9	
1915	13·6	14·0	18·5	21·4	20 4	
1916	14·0	15·7	17·5	19·2	19 7	13 6
1917	14·3	14·3	17·9	20·5	19 2	13 4
1918	18·1	14·2	22·0	24·7	32 9	18 0
1919	12·9	17·3	19·3	15·6		14·5
1920	13·1	14·0	17·2	15·1		13·1
1921–25	11·8	12·2	17·2	13·3	17 3	
1926–30	11·8	12·1	16·8	11·8	16 0	12 1
1931–35	10·9	12·0	15·7	11·2	14 1	11 6
1936	11·5	12·1	15·3	11·8	13 7	12 0
1937	11·2	12·4	15·0	11·7	14 2	12 0
1938	10·6	11·6	15·4	11·7	13 9	11 5

Marital Status. — When marital status is taken into consideration, it is usual to find, in western countries, that the death-rates are lowest among the married and highest for the widowed and divorced, while those for the single fall in-between. An exception to this general situation is found at the early child-bearing ages, where the risks of maternity among married women are sufficient to bring their death-rate to a level higher than that for the single, widowed, or divorced women of the same ages. The lower death-rates of the married as compared to those of the single at the same ages may be ascribed in part to the stabilizing influence of marriage, which is inducive to longevity; but also in part to the fact that persons in indifferent health may thereby be deterred from marrying. Death-rates per 1,000 for New York State, 1929–31, typify the differentials according to marital status: at age 20, the rate for married women was 3.78 and that for the single women was 2·50; at age 40, the rates were 5.34 for the married. 6·07 for the single, and 6·70 for the widowed. Among men, the death-rates per 1,000 at age 25 were 2·81 for the married and 4·71 for the single; at age 40, they were 6·08 for the married. 12.84 for the single, and 13.16 for the widowed.

Occupation. — There is a distinct gradation in the death-rates in passing from the lowest to the highest social-economic classes of a community. In a study based upon the United States census of 1930 and death statistics for 10 States during that year, it was found that the death-rates per 1,000 males between the ages 15 to 64 years in the several social-economic classes were as follows: unskilled workers, 13·1; semi-skilled workers. 9.9; skilled workers, 8·1; clerks, proprietors, managers and officials, 7.4; professional men, 7·0; and agricultural workers, 6.2 per 1.000 There is evidence that variation in death-rates of men according to social-economic class arises primarily from the environment associated with their occupation and that the occupational risks involved have only a relatively small influence.

Causes of **Death.**—Death-rates may also be computed according to the cause of death. Thus, the death-rates for the 10 leading causes of death per 100,000 total persons in the United States during 1937 were, in order of rank: heart disease, 268; influenza and pneumonia, 115; cancer, 112; cerebral haemorrhage, 87; accidents, 82; nephritis, 80; tuberculosis, 54; diseases of early infancy and congenital malformations, 49; diabetes mellitus, 24; and arteriosclerosis, 17. These 10 causes accounted for 79% of the deaths from all causes

There have been striking changes in the death-rates for certain causes of death in the United States since 1900. For example, the death-rate for typhoid fever was 36 per 100,000 in 1900, but only 2 per 100 000 in 1937 For tuberculosis, the decline was from 202 to 54 for the corresponding period; in the case of diarrhoea and enteritis the death-rate dropped from 133 to 15 Preventive measures have practically eliminated diphtheria as a cause of death; its death-rate fell from 43 in 1900 to 2 in 1937. On the

TABLE III. Average Length of *Life* in Certain Countries

Country	Period	Average Life, Years	
		Males	Females
NORTH AMERICA			
United States, Whites	1901	48.23	51·08
	1910	50·23	53.62
	1919–20	55.33	57·52
	1929–31	59·12	62.67
	1937	60·75	65·08
Negro	1929–31	47.55	49·51
Canada	1930–32	58.96	60·73
EUROPE			
Austria	1930–33	54·47	58 53
Belgium	1928–32	56·02	59.79
Bulgaria	1925–28	45·92	46.64
Czecho-slovakia	1929–32	51·92	55·18
Denmark	1931–35	62·0	63.8
Eire	1935–37	58·20	59.62
England and Wales	1841	40·19	42·18
	1901–10	48·53	52.38
	1930–32	58·74	62·88
	1937	60·18	64·40
Estonia	1932–34	53·12	59.60
Finland	1931–35	53·94	58·69
France	1928–33	54·30	59·92
Germany	1932–34	59·86	62·81
Greece	1928	49·09	50·89
Hungary	1930–31	48·27	51·34
EUROPE (Cont.)			
Iceland	1901–10	48.3	53·1
Ireland, Northern	1925–27	55·42	56·11
Italy	1930–32	53·76	56·00
Latvia	1934–36	55.39	60·93
Netherlands	1931–35	65·1	66·4
Norway	1921–31	60·98	63.84
Poland	1925–27	48.2	51·1
Russia	1926–27	41·93	46·79
Scotland	1930–32	56·0	59·5
Sweden	1755–76	33·20	35·70
	1816–40	39.50	43.56
	1901–10	63·22	65·33
	1931–35		
Switzerland	1929–32	59·25	63·05
ASIA			
China (rural)	1929–31	34·85	34.63
India, British	1931	26·91	26·56
Japan	1926–30	44·82	46.54
OTHERS			
Australia	1932–34	63·48	67·14
New Zealand	1931	65·04	67·88
Union of So. Africa, Whites	1936	60·01	64·00

other hand, many important causes of death have shown increases in their rates. Mortality from heart disease practically doubled in the period from 1900 to 1937. The death-rate for cancer rose from 63 per 100,000 in 1900 to 112 in 1937. A large part of the increase in the death-rates for heart disease and cancer may be attributed to the increase in proportion of older persons in the population and to improvement in diagnosis. The death-rate per 100,000 from diabetes mellitus rose gradually from 10 in 1900 to 24 in 1937. Deaths from automobile accidents, which were very rare in 1900, claimed 30 out of every 100,000 persons in 1937.

Average Length of Life.- he average length of life, which is also known as the expectation of life at birth, is the number of years the average newly born baby may expect to live if the age-specific death-rates remain constant as of the calendar year or period for which the figure is computed. The average length of life thus provides a composite measure of the age-specific death-rates of a community independent of its age distribution. The superiority of this figure, over the "standardized" death-rate, as a composite measure lies in the fact that it is independent of any arbitrarily chosen age distribution used as a standard.

The average length of life for white persons in the United States is much the same as that for England and Wales. In 1937, white males in the United States had an average length of life of 60.75 years and white females of 65.08 years, while the corresponding figures for England and Wales in 1937 were 60.18 years for males and 64.40 years for females. Sweden has the longest series of figures for the average length of life. Whereas males in that country had an average length of life of only 33.20 years in 1755–76, the figure increased steadily to 63.22 years in 1931–35. For the average length of life for other countries see Table III.

BIBLIOGRAPHY.—Louis I. Dublin and Alfred J. Lotka, *Length of Life* (1936); Louis I. Dublin and Alfred J. Lotka, *Twenty-Five Years* of Health Progress (Metropolitan Life Insurance Co., 1937); Walter F. Wilcox, Introduction to the Vital Statistics of the United States (Bureau of the Census, 1933). (A. J. Lo.)

DEATH VALLEY, a depressed basin in Inyo county, Calif. The name commemorates the fate of a party of "forty-niners" who perished here, by thirst or by starvation and exposure. The exceedingly arid Death Valley region lies immediately north of the Mojave desert and then stretches east from the Sierra Nevada mountains, covering a large part of Inyo county and extending into Nevada. The valley proper, which is some 50 m. long and on an average 20 to 25 m. broad from the crests of the enclosing mountain ranges, is below sea-level (276 ft.). This is the lowest point on the continent and in a direct line it is less than 80 m. E. of Mt. Whitney, 14,495 ft. high, the highest peak in the United States. The mountains about it are high and bare, and brilliant with varied colours. The Amargosa river, entering the valley through a deep canyon at the south, disappears in the basin, leaving the surface crusted with white salts. The fact that this limited region is the final area of concentration for a very extensive drainage system is thought to explain the extent and supposed depth of the deposits of salt, borax and nitrate of soda found in the basin. Death Valley is one of the hottest regions in the world. The minimum daily temperature in summer is rarely below 70° F (in the shade); the maximum may, for days in succession, be as high as 120°, and the U.S. Weather Bureau has recorded an extreme of 134°.

See W. C. Mendenhall, "Some Desert Watering Places in South-eastern California and South-western Nevada," U.S. Geological Survey, Water Supply Paper No. 224.

DEATH-WARNING, a term used in psychical research for an intimation of the death of another person received by other than the ordinary sensory channels, *i.e.,* by (1) a sensory hallucination or (2) a massive sensation, both being of telepathic origin. (See TELEPATHY.) Both among civilized and uncivilized peoples there is a widespread belief that the apparition of a living person is an omen of death; but until the Society of Psychical Research undertook the statistical examination of the question, there were no data for estimating the value of the belief. (See HALLUCINATION.)

DEATH-WATCH, a popular name given to insects of two distinct families which burrow and live in old furniture, and produce a mysterious "ticking" sound vulgarly supposed to foretell the death of an inmate of the house. The name is often applied to two small beetles *Xestobium rufovillosum* and *Anobium punctatum* (fam. Anobiidae) but belongs more properly to the former insect. The sound is a sexual call, and is produced by the beetle striking the front of the head upon the surface upon which it is standing. Certain book-lice (order Psocoptera) are sometimes known as lesser "death-watches," but the ability of such minute soft insects to produce audible sound is doubtful. The names *Atropos pulsatoria* and *Troctes divinatorius,* given to two of the common species, bear witness to the superstition regarding the fateful significance of the sound.

DE BARY, HEINRICH ANTON (1831–1888), German botanist, was born on Jan. 26, 1831, at Frankfurt-on-Main. He studied medicine at Heidelberg, Marburg and Berlin, and in 1853 settled at Frankfurt as a surgeon. In 1854 he became privatdocent for botany in Tiibingen, and professor at Freiburg in 1855, migrating to Halle in 1867, and in 1872 to Strasbourg, where he was the first rector of the University, and where he died on Jan. 19, 1888.

De Bary will be remembered as the founder of modern mycology, a science which he revolutionized by his celebrated *Morphologie und Physiologie d. Pilze,* etc., of 1866. His appreciation of the real significance of symbiosis and the dual nature of lichens is one of his most striking achievements. It is as an investigator of the then mysterious Fungi, however, that de Bary stands out. He not only laid bare the complex facts of the life-history of many forms; *e.g.,* the Ustilagineae, Peronosporeae, Uredineae and many Ascomycetes, but insisted on the necessity of tracing the evolution of each organism from spore to spore. One of his most fruitful discoveries was the true meaning of infection as a morphological and physiological process, which he traced in *Phytophthora, Cystopus, Puccinia* and other Fungi, and thereby demonstrated the significance of parasitism. He showed wherein lay the essential differences between a parasite and a saprophyte.

These researches led to the explanation of epidemic diseases, de Bary's contributions to which are well seen in his classical work on the potato disease in 1861. They also led to his discovery of *heteroecism* (or metoecism) in the Uredineae, the truth of which he demonstrated in wheat rust experimentally (1863). He described the phenomena of sexuality in Peronosporeae and Ascomycetes—*Eurotieum,* Erysiphe, *Peziza,* etc., and established the existence of parthenogenesis and apogamy on a firm basis. He did much work on the Chytridieae, Ustilagineae, Exoasceae and Phalloideae, as well as on the Myxomycetes; he contributed to algology in his monograph on the Conjugatae (1858), and investigated Nostocaceae (1863), Chara (1871), Acetabularia (1869), etc. In 1877 appeared his *Comparative* Anatonty of Ferns *and* Phanerogams, and in 1885 his Lectures on Bacteria (Eng. trans. 1887).

Memoirs of de Bary's life will be found in *Bot. Centralbl.* (1888), xxxiv. 93, by Wilhelm; *Ber. d. d. bot. Ges.* vol vi (1888) p. viii., by Reess, each with a list of his works; *Bot. Zeitung* (1889), vol. xlvii. No. 3, by Graf zu Soems-Laubach.

DEBENTURES AND DEBENTURE STOCK: *see* COMPANY LAW.

DEBORAH, the name of two women mentioned in the Old Testament (Heb. for "bee"). (1) Foster-mother of Rebecca, buried under the "Oak of Weeping" below Bethel (Gen. xxxv. 8). It has been suggested that this tree is connected with the "palm-tree of Deborah," between Bethel and Ramah (Judges iv. 5), the home of Deborah. (2) This latter is the famous prophetess and "judge," who, in company with Barak, son of Abinoam, delivered Israel from a Canaanite oppression.

Two narratives of this exploit have been preserved, an account in prose in Judges iv., and a descriptive poem in Judges v. They differ in one or two important detsils. The most obvious contrast is in the identity of the enemy overthrown. The prose narrative makes the enemy Jabin, king of Hazor, though a prominent part is played by his commander-in-chief, Sisera, who lived at Haro-sheth-haggoyim. In the poem Jabin does not appear, and Sisera is an independent king. It is possible that the introduction of Jabin is due to the conflation of two traditions, one of which referred to Sisera, while the other was parallel to the story of the defeat of Jabin, king of Hazor, by Joshua (Josh. xi. 1–9) at the Waters of Merom. Another contradiction is to be found in the manner of Sisera's death. In Judges ch. iv. he is murdered in his sleep, in ch. v. he is struck down from behind whilst drinking a bowl of milk.

Assuming that the tradition preserved in ch. v. is the older, we can do something to reconstruct the actual history of the events. Israel holds the wilder parts of the country, the hills and the forests, but their settlements in the central range are cut off from those in the northern hills by a chain of Canaanite (Egyptian?) fortresses down the plain of Esdraelon. For the time the plain dominates the hills; the Israelites are disarmed and their communications are cut. At the instigation of the prophetess Deborah, and possibly aided by her spells, Barak raises the clans of Ephraim, Benjamin, Machir (Manasseh), Zebulun, Issachar and Naphtali. Asher, Dan, Gilead (Gad) and Reuben hold aloof. Judah and Simeon are not mentioned. The Israelite clans fall on the enemy at Taanach; a thunderstorm, in which Israel sees the coming of Yahweh, strikes terror into the Canaanites, their chariots are useless on the sodden ground, and the Kishon swollen by torrential rains, sweeps away the fugitives. Sisera escapes on foot, pursued by Barak, but, taking refuge in the tent of Heber the Kenite, is treacherously slaughtered as he drinks.

The poem is one of the most important documents of ancient times. It is contemporary with the events to which it refers, and is therefore invaluable as a picture of the life of Israel in the early days of the settlement. Further, it is in itself a magnificent lyric outburst, and proves a very high standard of poetic skill in ancient Israel.

BIBLIOGRAPHY.—For fuller details *see* G. A. Cooke, *History and Song* of *Deborah* (1892), the commentaries on Judges and the histories of Israel. Paton *(Syria and Palestine,* pp. 158 *sqq.)* suggests that the battle was against the Hittites (Sisera, a successor of Shamgar). *See* also L. W. Batten, *Journ. Bibl. Lit.* pp. 31–40 (1905), who regards Judges v. and Josh xi. as duplicates; Winckler, *Gesch. Israels,* ii. 125–135; *Keilinschr. u. d. Alte Teste* 3rd ed., p. 218; and Ed. Meyer, *Israeliten,* pp. 272 *sqq,* 487 *sqq.;* also Burney, *Judges, ad loc.* Eissfeldt, *Die Quellen des Richterbuches,* pp. 22, 23. **(T. H. R.)**

DE BOSIS, ADOLFO (1863–1924), Italian poet and man of letters, was born at Ancona. He studied at the University of Rome, where he graduated in law and practised for a few years, but was always more interested in literature. In 1895 he became editor of *Il Convito.* Although he became manager of the Italian Carbide Company, he continued his literary activities. He translated Shelley's "Prometheus Unbound" (1922) and Homer into Italian verse. He collected his own poems in a volume entitled *Amori ac silentio sacrum* (1900, rep. 1914, 1923). De Bosis exercised considerable influence on the younger authors of his time, many of whom were inspired by his deep love of the classics and keen sense of beauty. He died near Ancona on Aug. 29. 1924.

DEBRECEN, one of the largest towns in Hungary (pop. 1939, 128,442), is at the junction of three contrasted regions, viz.:—the extensive Hortobagy pastures or *puszta,* the Nyirseg sandy plateau and the marshes of the Berettyo. In early times it commanded two important routes, the salt way from Szatmar to western Europe and the road from Bohemia to Transylvania, both traversed by important trade movements in the mediaeval period; it is still an important railway junction. It developed as a market centre with special interests in cattle and grain and as a walled town attracted numerous refugees from surrounding plundered villages during the Turkish advance in the 15th century. Partly as a result of this the municipality acquired large areas of territory until it covered an area of nearly 400 sq.mi. Much of this was cultivated by farmers who maintained houses and often worked in the town during the winter season but of recent years villages known as *tanyas* have grown up in the surrounding district. The town tends more and more to function as the centre of economic and intellectual inspiration for its region through its fairs, its agricultural academy, its well-equipped university and its long tradition of spiritual independence which has made it the focus of Protestant ideals in Hungary and gained for it the name of "Calvinistic Rome." This outlook first determined in the 16th century has caused a stormy history but strengthened its position in the national structure.

Apart from its agricultural activities many varied industries have developed upon a small and local scale, notably the manufacture of soap, prepared foodstuffs and tobacco.

DEBS, EUGENE VICTOR (1855–1926), American Socialist leader, was born at Terre Haute, Ind., on Nov. 5, 1855. On leaving the public schools he became in 1871 a locomotive fireman. In 1879 he was elected city clerk of Terre Haute and in 1881 was re-elected. During 1885 he was a member of the Indiana legislature. Previous to this, in 1880, he was elected secretary and treasurer of the Brotherhood of Locomotive Firemen and was appointed editor of *The Locomotive Firemen's Magazine.* In 1893 he organized the American Railway Union and was elected president of the union, serving four years. In 1894 he led the strike which, beginning in the Pullman-car plants, soon involved the railways leading into Chicago.

Debs was arrested on a charge of conspiracy to kill, and acquitted, but was later convicted of contempt of court for violating an injunction, and sent to gaol for six months (May–Nov. 1895). In 1897 he joined the Socialist movement. He was Socialist candidate for the Presidency of the United States in 1900, 1904, 1908, 1912 but declined the nomination in 1916. In 1907 he was on the editorial staff of the *Appeal to Reason,* and in 1914 became editor-in-chief of the National Rip-Saw, a Socialist paper published at St. Louis. He was an advocate of industrial unionism, though he eventually dissociated himself from the I.W.W. (*q.v.*), and was one of the chief opponents of Samuel Gompers (*q.v.*).

He was a pacifist and in Sept. 1918 was convicted of violating the Espionage Act and sentenced to ten years in the penitentiary. In 1920, while in prison, he was again nominated presidential candidate by the Socialists and received 915,302 votes. His sentence was commuted by President Harding in Dec. 1921. He died at Elmhurst, Ill., Oct. 19, 1926. He was one of the foremost figures in American Socialism.

He was the author of *Liberty* (1895); *Unionism and Socialism, a Plea for Both* (1904); *The American Movement* (1904); *Industrial Unionism* (1905); *The Growth of Socialism* (1910); *The Children of the Poor* (1911); and *Walls and Bars* (1927). Also *see* Stephen Marion Reynolds, *Life of Eugene V. Debs* (1910); Max Eastman, *The Trial* of *Eugene V. Debs* (1919); Walter Hurt, *Eugene V. Debs: an Introduction* (1919); David Karsner, *Debs: His Authorized Life and Letters* (1919); and Scott Nearing, *The Debs' Decision* (1919). Consult also *Debs' Magazine.*

DEBT, a definite sum due by one person to another. Putting aside those created by statute, recoverable by civil process, debts may be divided into three classes: (1) judgment debts *(see* JUDGMENT DEBTOR), (2) specialty debts, (3) simple contract debts. As to judgment debts, it is sufficient to say that, when by the judgment of a court of competent jurisdiction an order is made

that a sum of money be paid by one of two parties to another, such a debt is not only enforceable by process of court, but it can be sued upon as if it were an ordinary debt. A specialty debt is created by deed or instrument under seal. Until 1869 specialty debts had preference under English law over simple contract debts in the event of the bankruptcy or death of the debtor, but this was abolished by the Administration of Estates Act of that year. The main difference now is that a specialty debt may, in general, be created without consideration, as, for example, by a bond under seal, and that a right of action arising out of a specialty debt is not barred if exercised any time within 20 years, whereas a right of action arising out of a simple contract debt is barred unless exercised within six years. (See LIMITATION, STATUTES OF.) Any other debt than a judgment or specialty debt, whether evidenced by writing or not, is a simple contract debt. There are also certain liabilities or debts which arise from tacit or implied contracts to pay.

At English common law debts and other choses in action were not assignable (see CHOSE), but by the Judicature Act, 1873, any absolute assignment of any debt or other legal chose in action, of which express notice in writing is given to the debtor, trustee or other person from whom the assignor would have been entitled to receive or claim such debt, is effectual in law The discharge of a debt may take place either by payment of the amount due, by accord and satisfaction, *i.e.*, acceptance of something else in discharge of the liability, by set-off (*q.v.*), by release, or under the law of bankruptcy (*q.v.*). It is the duty of a debtor to pay a debt without waiting for any demand, and, unless there is a place appointed either by custom or agreement, he must seek out his creditor for the purpose of paying him unless he is "beyond the seas." Payment by a third person to the creditor is no discharge of a debt, as a general rule, unless the debtor subsequently ratifies the payment.

Imprisonment for debt, the evils of which have been so graphically described by Dickens, was abolished in England by the Debtors Act, 1869, except in cases of default of payment of penalties, default by trustees or solicitors and certain other cases. But in cases where a debt or instalment is in arrear and it is proved to the satisfaction of the court that the person making default either has or has had since the date of the order or judgment the means to pay the sum in respect of which he has made default and has refused or neglected to pay, he may be committed to prison at the discretion of the judge for a period of not more than 42 days. In practice, a period of 21 days is usually the maximum period ordered. Such an imprisonment does not operate as a satisfaction or extinguishment of the debt, and no second order of commitment can be made against him for the same debt, although where the court has made an order or judgment for the payment of the debt by instalments a power of committal arises on default of payment of each instalment. In Ireland imprisonment for debt was abolished by the Debtors Act (Ireland) 1872, and in Scotland by the Debtors (Scotland) Act, 1880. In France it was abolished in 1867, in Belgium in 1871, in Switzerland and Norway in 1874 and in Italy in 1877. In the United States imprisonment for debt was universal under the common law, but it has been abolished in every State, except in certain cases, as where there is any suspicion of fraud or where the debtor has an intention of removing out of the State to avoid his debts. (See also CONTRACT; BANKRUPTCY; PAYMENT; NATIONAL DEBT.)

In the United States the law is in general as stated above. But the effect of a seal to make consideration unnecessary to the creation of a debt has been very generally abolished by statute; even where not abolished, the effect has commonly been reduced to raising a prima facie presumption of consideration. Yet the seal commonly retains its effect of lengthening the period of limitation. The notice of an assignment need not, in the United States, be given to the debtor in writing. And the English rule that payment by a third person will not discharge has either been abolished or rendered substantially null by liberality in construing the slenderest of evidence into "ratification" by the debtor.

Debt, it should be noted, is the legal counterpart of the economic concept "credit" (*q.v.*); and where liquidity of credit is important, debts are commonly put in the form of negotiable instruments, to facilitate transfer. (See BILL OF EXCHANGE.) There is, however, some financing done by merchants transferring their book accounts — though at a heavy discount. (See ASSIGNMENT.)

DEBT CONVERSION. Conversion is the term applied to the exchange of any form of security for another form of security. Though the exchange is usually connected with a decrease in cost to the borrower of the security in question, this is not always the case. It is sometimes necessary, more particularly in time of war when a series of loan operations is probable, to assure subscribers to an earlier issue that they will be entitled to "convert" it to any later issue made on more favourable terms. Such a provision was a common feature of British war loans, for instance, holders of $3\frac{1}{2}\%$ War Loan were entitled to convert into 5% War Loan, and holders of National War Bonds of the first three series retained a right to convert at any time on favourable terms into 5% War Loan. Similarly in the United States holders of the $3\frac{1}{2}\%$ First Liberty Loan were entitled to convert into the 4% Second Liberty Loan and holders of the Second Liberty Loan into the $4\frac{1}{4}\%$ Third Liberty Loan.

But the more frequent and more interesting cases of conversion arise in connection with debt reduction. Public debt, other than the relatively limited amount created for revenue producing purposes, usually results from a period of financial emergency in which revenue has not covered expenditure and the State has accordingly had to pledge its credit in circumstances least favourable to itself. It has, therefore, always been the natural object of financial statesmanship, as soon as normal financial conditions return, to reduce the burden of debts created under duress — after an earthquake, a famine or a war. This course is dictated by the consideration that ex *hypothesi,* the debt is raised at a price higher than the credit of the State in normal circumstances would justify. It is also desirable because as a rule the great public debts such as war debts, justified and even inevitable as they may have been, do not leave behind them any concrete object from which posterity can see that it draws tangible benefit.

Methods of Debt Reduction. — The burden of debt may be reduced in various technically distinguishable ways. In the first place, debt may be redeemed either out of budget surpluses (in Great Britain called "old sinking fund") or out of a sinking fund provided within the normal budget (in Great Britain called "new sinking fund"), these resources being applied either to paying off debt as it falls due or to the purchase of public stock or bonds on the Stock Exchange at current market prices or, where the loan contract so permits, to drawings of individual bonds by lot for payment at a fixed price, usually not necessarily at par. These latter redemptions can be effected irrespective of the date on which the debt holder is entitled to claim repayment from the State as a right. In the second place, maturing debt, that is to say, debt for which the repayment date as fixed by the loan contract has arrived, may be repaid out of money raised by new borrowing on more favourable terms. This operation, which is properly a form of redemption, is frequently, though inaccurately, described as conversion. In the third place holders of the debt which has not yet reached its maturity date may be persuaded to exchange their holdings into some other form of debt. This is debt conversion proper, its essential feature being the exchange of one obligation for another. Conversion is normally a voluntary process. Forced conversion, such as for instance the Italian "Lictor" Loan of 1926, is a practical operation in certain cases. Whether it is a wise operation depends on such factors as the financial position and traditions of the country concerned; the nature of the crisis with which it is faced; and its probable needs for further credit. Obviously, when a particular class of persons have lent money to the community on agreed contractual terms, it requires very exceptional circumstances to justify subsequent compulsion to accept other terms presumably less advantageous to themselves.

These three methods of debt reduction are frequently practised in combination. Indeed, with a large volume of debt no one

of them can be successful in isolation; each contributes to, and is a condition of, the success of the others. Large revenue surpluses applied to debt redemption in Great Britain and the United States of America in the years immediately following 1918 were the essential preliminary to that appreciation of the national credit of the two countries which caused their public securities to rise in price and consequently enabled the two Treasuries to replace old debt by new debt on cheaper interest terms. Where the total debt is large, the maintenance of a substantial sinking fund provided out of revenue is primarily required for this purpose. A reduction in the supply of any commodity tends to intensify the demand for that commodity and thus to increase the price which the seller can obtain. **A** reduction in the volume of debt has precisely the same effect. The borrowing Government can sell its wares at a better price by reducing the amount in supply. A sinking fund which removes stock or bonds from the market and cancels them enhances the price of what remains and enables maturing debt in excess of what can actually be paid off to be replaced at a lower interest rate. Similarly, the reduction in the volume and the increase in the value of Government securities enables conversion schemes to be launched with success.

It is futile to single out any one method of debt reduction as a success or a failure. The general result usually flows from the combined use of all methods; and the attribution of specific portions of that result to any single method tends to be misleading. Redemption and conversion go together. Thus, in Great Britain the interest charge for the debt was reduced by £19,000,000 per annum in the period between 1920–21 and 1925–26. If, to compare like with like, allowance is made for the fact that in the former year only £289,000 was paid on the debt due to the United States Government while in 1925–26 the full interest charge of over £28,000,000 was paid, the real reduction in interest charge is seen to be more than £47,000,000 per annum. Of this reduction it may be said that £29,500,000 was due to the repayment of debt from revenue; £16,000,000 to the replacement of short-term floating debt by cheaper floating debt; and £1,500,000 to strictly identifiable long-term conversions. It is, however, impossible to say what would have been the result of any one of these three methods without the concomitant of the other two.

Conditions of Conversion. — It is usually held that for successful conversion certain preliminary conditions must be fulfilled. The problem is to persuade the holder of a given security that it is in his interest to accept instead another security subject to different terms as regards interest, redemption date and possibly other privileges. The holder will probably be affected in the first place by his belief in the political stability of the borrowing Government. He will not wish to extend in time his commitment to a State which is politically insecure or which for any reason is likely in the visible feature to depreciate its credit. He will require to be convinced that his new commitment if he accepts conversion, is not likely to fall in value. The first condition is therefore the prospect of general stability as regards both external and internal politics. In the next place the investor will need to be persuaded that general financial conditions are such that the new security which he is offered is likely to represent as much as he can expect to receive if he waits until his existing security is paid off and he has to seek a new investment. The normal type of conversion would be somewhat as follows: A security is due for repayment or can be called by the borrower for repayment, say five years hence. The borrower wishes to replace that security now by a conversion issue carrying a lower rate of interest and repayable, say 30 years hence. His chance of persuading the holder to accept such a proposal will therefore depend on the holder's estimation of the relative advantages of making certain of a lower rate of interest for the longer period of 30 years, and of retaining for another five years his original (higher) rate of interest subject to the risk that when paid off in five years time he will not be able to reinvest his money so profitably as if he had accepted the conversion offer. The second condition of successful conversion is therefore a general belief that financial tendencies are such that future interest rates are likely to decline. The outward sign of such a belief is usually that the security to be converted is quoted in the market at or over its redemption value, for that means that the market thinks that the interest payable on that security is above the normal current rate. Thus for the 14 months previous to the Goschen conversion in 1888 Consolidated 3% Stock had averaged £101 9s. 9d. in spite of the fact that the Government could call the stock for repayment at £100. Finally much depends on the amount of the issue to be converted. A very large issue is physically difficult to handle; the number of holders who from ignorance or inertia will not respond to a conversion offer, even if advantageous to them, may in the aggregate be great; and for both reasons the amount of the issue not converted may remain considerable. It may almost be said that in normal circumstances a third condition of successful conversion is that not too much is attempted at any one time. In many cases there is a special feature which emphasizes the importance of this condition. It is frequently necessary in order to bring holders into a conversion scheme to announce that such holders as do not convert will be paid off by the borrowing Government. The unwillingness of the holder to be paid off is a motive to induce him to convert. But a Government can only make such an announcement if it can feel sure that it can readily raise the amount of cash it will require to pay off those who do not convert. This will depend partly on the size of the issue and therefore of the probable unconverted remanet to be paid off; and partly on the position of the Government's short-term debt. The Government will probably have to have recourse to short-term borrowing to meet the remanet, and the cost and possibility of such borrowing will depend entirely on the amount of short Government paper already in existence. At the time of the Goschen conversion the unfunded debt (treasury bills, exchequer bills and exchequer bonds) was only £17,385,100; and the Government had consequently no difficulty in raising at reasonable rates the £19,817,952 it temporarily required to redeem non-converted stock.

British Conversions. — The more important conversions of British Government debt have been as follows: —

(a) Before *the* World *War:*

1749. Pelham offered holders of £57,703,475 4% stocks then standing above par a new stock bearing 4% interest till 1750, 3½% interest till 1757 and thereafter 3% interest. £54,413,433 stock was converted at an annual saving of £272,067 for five years and then of £350,101; and the balance was paid off at par.

1822. Vansittart offered holders of Navy 5% and Irish 5%, then standing at 108⅞ to an amount of £152,422,143, a 4% stock at 105; £149,627,867 was converted at an annual interest saving of £1,197,025; and the balance of £2,794,276 paid off in cash. This conversion owing to the issue at 105 added £7,481,350 to the nominal total of the National Debt.

1824. Robinson offered holders of £76,248,180 4% annuities then standing at 101¾ and new 3½% stock at par. £68,000,000 was converted at an interest saving of £381,242 per annum.

1830. Goulburn offered holders of the £153,561,091 4% stock (remaining from Vansittart's operation in 1822) now standing at 1024, either 34% stock at par or 5% stock at 70. £150,790,179 was converted, all but £670,567 into 3½% stock, with an annual interest saving of £753,952.

1844. Goulburn ofiered holders of the £248,860,663 34% stock resulting from the 1824 and 1830 conversions now standing at 101⅝ conversion at par into a stock carrying 3¼% for ten years and then 3%. £248,757,311 was converted at an annual saving of £621,893 per annum for the first ten years, and £1,243,786 per annum thereafter.

1884. Childers endeavoured to convert £612,761,061 3% stock standing at 101¾ into either 24% stock at 102 or 2½% stock at 108. But only £22,362,595 was converted, at a saving in interest of £62,303 per annum, and an increase of £1,515,604 on the nominal total of the debt.

1888. Goschen offered the holders of £557,992,508 new 3% (Goulburn) Reduced Three per cents (Pelham) and 3% Consols, then standing at 103¾, a new stock at par ("Consols") bearing 2¾% interest, to be reduced after 25 years to 2½%. £514,314,702 was converted (over 92%) at an annual saving of £1,411,943 for 25 years and of £2,823,886 thereafter. (It is interesting to

observe that in every case the stock converted was standing at a high price; that the largest operation attempted, that of Childers in 1884, was a failure; and that chancellors of the Exchequer were not deterred by increase in nominal debt from effecting interest savings. It will also be observed that stocks originally 5% or 4% were brought down to 34% or 2½% by a series of operations. In the conversions of Vansittart, 1822, Goulburn, 1830 and 1844, and Goschen, 1888 [except as regards Reduced Threes and Consols], the assent of holders to conversion was assumed unless they signified dissent within a prescribed period.)

(b) Since the World War:

Between March 31, 1914, and March 31, 1920, British Deadweight Debt rose from £649,770,000 to £7,831,744,000, and of the later enormous figure only some £315,000,000 was permanently funded. The scope for debt conversion, provided that satisfactory financial and political conditions could be secured, was thus large. In addition to cash amounting in the six years 1920–26 to £708,308,000 applied out of revenue to debt redemption, and to very large reborrowings to meet maturities as they fell due, the British Treasury launched a number of pure conversion operations. These operations, still in 1928 in progress, should be regarded as a single whole rather than a series of separate transactions each by itself comparable, say, to the Goschen conversion. The difficulties arising from (a) the slow recovery to sound financial conditions, (b) the large amounts to be handled, and (c) the large outstanding floating debt are very clearly reflected in the relatively slow progress. The Treasury have had to conduct their operations under far from ideal conditions.

The main conversion operations have been as follows:

April 1921. Holders of 5% National War bonds repayable at a premium on various dates from Oct. 1922 to Sept. 1925, were offered 3½% Conversion Loan at £160 to £163 for each £100 bond. £164,000,000 5% bonds were converted into £266,000,000 3½% loan at an increased interest charge of £1,110,000 per annum against which must be set (a) the advantage of postponing the maturity for many years and avoiding an increase in short-term debt, (b) a saving of £3,381,000 in premiums.

February 1922. Holders of 5% Exchequer bonds were offered 3½% Conversion Loan at £136. £14,500,000 were converted into £19,500,000 Conversion Loan, with an interest saving of £35,000 per annum.

April 1922. £70,000,000 5% War bonds due in October 1922 and April 1923 converted into £94,000,000 3½% Conversion Loan at £134, with an interest saving of £218,000 per annum.

1923. £11,000,000 5% National War bonds converted at par (with cash payment of £2 15s %) into 4½% Treasury bonds 1932. Interest saving, £57,000 per annum.

1924. Holders of 5¾% Exchequer bonds offered the choice of (a) 4½% Conversion Loan 1940/44 at par (with cash payment of £2 15s %) or (b) 44% Treasury bonds 1934 at par. £82,000,000 of bonds were converted at par, with an annual interest saving of £1,026,800.

April 1924. Holders of 5% War Loan 1929–47 (to a total of £200,000,000) were offered 4½% conversion Loan 1940/44 at 103. £148,000,000 was converted into £153,000,000 Conversion Loan at an interest saving of £541,000 per annum.

1925. Three issues of 34% Conversion Loan: Jan. for £59,660,000; April £30,000,000; Sept. £40,000,000; thus reducing the floating debt from £845,825,000 in 1924 to £816,641,000.

Oct. 1926. Holders of 5% Treasury Bonds invited to convert and £82,700,000 converted; Dec. new issue of Consolidated Loan, conversions to which amounted to £128,060,313.

Feb. 1927. Holders of £135,247,000 5% Treasury bonds 1927, £135,258,000 5% National War bonds were offered conversion into 4½% Treasury bonds 1934 at par or 4% Consols at varying prices. £94,989,000 Treasury bonds and £65,341,000 War bonds were converted at an interest saving of £466,000 per annum. At the same time £35,420,000 tax free 4% War bonds were converted into £41,796,000 4% Consols at an increased gross interest of £165,000 per annum but subject to tax.

Dec. 1928. Holders of £153,987,000 5% War bonds payable at 105 were offered 5% Treasury bonds 1933–35 at £105 10s. £110,857,000 were converted into £116,984,000 Treasury bonds at an increase in interest of £305,000.

Down to 1928 the net result of conversions on the annual interest charge was not great. Their importance lay in providing by postponement for the heavy maturities of debt and in clearing the way for future conversions. In 1932, as a measure to promote national recovery after the narrowly averted financial crisis of 1931, the large 5% War Loan was converted to 3½%.

United States Conversions.—After the Civil War the Federal debt amounted to about $3,000,000,000 of which $500,000,000 was short-term debt. Secretary Hugh McCulloch commenced in 1865 by turning this short debt into go-year 6% Notes. By 1868 he had repaid out of surplus $519,000,000; and he then, while maintaining a high annual debt redemption, converted these 30-year Notes into 20-year Notes (with a right to pay them off in five years). His successor, Secretary Boutwell, having further reduced the debt outstanding, was able in 1870 to convert the 6% Notes into $200,000,000 5%, $300,000,000 44% and $1,000,000,000 4% Notes.

After the World War the United States had the advantage of a debt two-thirds the size of that of Great Britain, very much larger resources on which to draw, and a revenue for many years consistently in excess of its normal appropriations, so that by December 31, 1930 it had reduced its total indebtedness from $26,596,701,648.01 (Aug. 31, 1919) to $16,026,087,087.07. By a series of conversions in 1924, 1927, and 1928 it also cut its interest charges nearly $21,000,000. per annum.

But much more extensive refunding operations were carried out during the years 1933–35 when a favorable money market enabled the Government to bring its average interest rates down drastically. Most conspicuous in this program was the redemption of all outstanding Liberty bonds, successive calls were announced for April 15, 1934, October 15, 1934, April 15, 1935, June 15, 1935, and October 15, 1935; and before each date new bonds or notes at substantially lower rates were offered in exchange for the called issue. These offers were all well subscribed with the result, according to a public announcement by Secretary of the Treasury Morgenthau, that the nation stood to save approximately $100,000,000. yearly in interest.

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DEBT INSURANCE: *see* CREDIT. IXSOLVEXCY OR BAD DEBT INSURANCE.

DEBTS, INTER-ALLIED: see INTER-ALLIED DEBTS.

DEBUSSY. CLAUDE ACHILLE (1862–1918), French composer, was born at St. Germain-en-Laye on Aug. 22, 1862, and died in Paris on March 26, 1918. His musical training he received at the Paris Conservatoire under Marmontel, Lavignac, Massenet and Guiraud. There, between 1874 and 1884, he gained many prizes for solfège, pianoforte playing, accompanying, counterpoint and fugue, and, in the last-named year, the coveted Grand Prix de Rome by means of his cantata *L'Enfant* prodigue. In this composition germs of unusual and "new" talent were already latent, though, in the light of later developments, it is not very easy to discern them, for then Debussy had not come under the influence which ultimately turned his mind to the system which he afterwards used in so remarkable a manner.

Early Tendencies.—It was not long, however, before these highly-individual tendencies revealed themselves. For, in order to fulfil that condition of the Prix de Rome which entails the submitting periodically of compositions to the judges, Debussy sent to them his symphonic suite, Printemps, to which exception was immediately taken by the judges on the ground of its formlessness and other unacademic qualities. Following in the wake of Printemps came La *damoiselle* klue for female voices (solo and chorus) and orchestra—a setting of a French version of Rossetti's "The Blessed Damosel"—which, in the eyes of the judges, was even more unorthodox than its predecessor, though, be it said, fault was found almost as much with the libretto as with the music. So poor was the impression produced by these works, indeed, that

both were denied the customary public performance.

The Rome period over, Debussy returned to Paris, whence shortly he went to Russia, where he came directly under the influence already referred to. That is to say, he absorbed here the native music, especially that of Moussorgsky who, recently deceased, had left behind him the reputation of a musical nihilist, and on his return to Paris the results became speedily apparent. At the same time the effect of this Russian visit should not be overrated, and there is no reason to suppose that it did more than confirm and strengthen tendencies which were already deeply implanted, and would have quite certainly revealed themselves in due course in any event.

Recognition Tardy. — Public recognition was rather slow in coming to Debussy, but in 1893 the Société Nationale de Musique performed his *La damoiselle élue,* in 1894 the Ysaye quartet introduced the string quartet (one of his greatest achievements), while in the same year was heard another of his most remarkable and individual creations, the now world-famous prelude *L'Après-midi d'un faune,* which could no longer leave room for doubt as to the originality of its composer. Concurrently also, his pianoforte pieces were being performed more and more. The works named were followed in due course by his only opera, *Pelléas et Mklisande,* first heard at the Opéra Comique on April 30, 1902. Then it was little understood, but understanding came in due course, and it was recognized as one of the most notable contributions to the repertory of the lyric stage since Wagner.

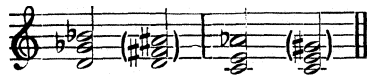
In an Apologia which he subsequently published, Debussy declared that in composing *Pelléas* he had wanted to dispense with "parasitic musical phrases." "Melody," he observed, "is, if I may say so, almost anti-lyric and powerless to express the constant change of emotion and life. Melody is suitable only for the chanson, which confirms a fixed sentiment. I have never been willing that my music should hinder, through technical exigencies, the change of sentiment and passion felt by my characters. It is effaced as soon as it is necessary that these should have perfect liberty in their gestures or in their cries, in their joy and in their sorrow." And these principles found exquisite expression in the work as carried out, of which Dr. Ernest Walker has happily observed — "It is one of the great landmarks in the history of opera; it is the summit of musical impressionism, catching every faint nuance of the words, always suggesting rather than saying, but always tense and direct and full of throbbing beauty."

Works for Piano and Orchestra. — But, outstanding as is *Pelléas* et *Me'lisande,* it is surpassed even in importance by Debussy's contributions to piano literature, in which by the novelty of his methods he was responsible. for the greatest development which had been efiected in the technique since Chopin. In such things as *La Soirée dans Grenade, Jardins sous la pluie, L'isle joyeuse, Reflets dans l'eau, Bruykres* and *La Cathédrale engloutie,* he revealed possibilities which had previously been entirely unsuspected in the best known and most exhaustively studied of all instruments. Such music might not be of the highest order, indeed it made no pretensions to bigness or grandeur, but in its delicacy, subtlety and refinement, in its exquisite adaptation of the most novel means to the purposes of the most sensitive musical impressionism, it possessed a fascination all its own, and may be said to have opened a new chapter in the history of the art.

Debussy's work for the orchestra was, as a whole, of less significance in the technical sense; he did many fine things also, besides the consummate *L'Après-Midi,* in this field. Such are the exquisite nocturnes *Nuages, Fêtes* and *Sirènes,* one and all the last word in delicate impressionism. Neither should mention be omitted of his songs, all characterized by the same individuality of style and perfection of workmanship distinguishing his music as a whole, and including such examples as "Mandoline," "Recuillement," "Fantoches," "La Flûte de Pan" and "La Chevelure," things which have long since won universal favour.

Musical System. — AS to the theories, so much debated, of this remarkable musician, probably in the whole range of musical history there has not appeared a more difficult theorist to "place." Unquestionably Debussy introduced a new system of colour into music, which has begun already to exert widespread influence. Roughly, Debussy's system may be summarized thus:

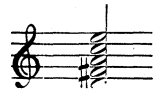
First, a scale basis is of six whole tones (enharmonic), as middle C, D, E, G♭, A♭, B♭, which are of excellent sound when super-imposed in the form of two augmented unrelated triads,



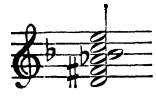
used frequently incomplete (*i.e.,* by the omission of one note) by Debussy.

Now, upon the basis of an augmented triad a tune may be played above it provided that it be based upon the six-tone scale, and a fugue may be written, the re-entry of the subject of which may be made upon any note of the scale, and the harmony will be complete.

Secondly, a free use of the chord of the 7th, 9th, 11th and 13th upon *every* degree of the scale instead of (as in the conventional theory) only upon the tonic, super-tonic and dominant, in conjunction with melodies constructed upon the ordinary diatonic scale. These two methods have an interesting connection which can be shown, *i.e.,* let a major 9th be taken:



one may conventionally flatten or sharpen the fifth of this (A becoming ♯ or ♭ as desired): if *both* the flattened and sharpened fifths be taken in the one chord this chord is arrived at,



which is composed of the notes of the aforesaid scale whole-tone. It will be noticed that chords of the 9th in sequence and in all forms occur in Debussy's music as well as the augmented triad harmonics, where the melodic line is based on the tonal scale. This, in all likelihood, is the outcome of Debussy's instinctive feeling for the association of his so-called discovery with the ordinary scale.

But the appearance of a whole-tone scale as a by-product of two ordinary chords a tritone apart (as in a Neapolitan cadence) decorated by passing notes:

$$\begin{Bmatrix} \text{CDE} & \text{F♯} & \text{G♯} & \text{A♯} \\ \text{C} & \text{F♯} & & \end{Bmatrix}$$

must not be confused with the conscientious avoidance of classical key-relation which Debussy intends. As is shown in the article HARMONY, even Debussy's whole-tone scale really falls into the classical scheme, with much more various results. Debussy himself becomes eclectic in his later works; though he would never have allowed the whole-tone chord to resolve in a classical polyphony. (R. H. L.; X.)

DÉCAEN, CHARLES MATHIEU ISIDORE, COUNT (1769–1832), French soldier, was born at Caen on April 13, 1769. He made his name during the wars of the French Revolution under Kléber, Marceau and Jourdan, in the Rhenish campaigns. In 1799 he became general of division, and fought at Hohenlinden (Dec. 1800). Selected by Napoleon early in the year 1802 for the command of the French possessions in the East Indies, he set sail with Admiral Linois early in March 1803 with a small expeditionary force, touched at the Cape of Good Hope (then in Dutch hands), and noted the condition of the fortifications there. On arriving at Pondicherry he found matters in a very critical condition. Though the renewal of war in Europe had not yet been heard of, the hostile preparations adopted by the Marquis Wellesley caused Decaen to withdraw promptly to the Isle of France (Mauritius), where, for eight years, he sought to harass British trade and prepare for plans of alliance with the Mahratta princes of India. They all came to naught. Linois was captured by a British squadron, and ultimately, in 1811, Mauritius itself fell to the British. Decaen then received the command of the French troops in Catalonia. He died of the cholera in 1832

See M. L. E. Gautier, Biographie du *général Decaen* (Caen, 1850); J. Tessier, "Le général Decaen aux Indes," in Rev. Hist. vol. xv.

DECALIN, a chemical substance obtained by reduction of naphthalene (*q.v.*); it is decahydronaphthalene, $C_{10}H_{18}$.

DECALOGUE, another name for the biblical Ten *Commandments*, in Hebrew the Ten *Words* (Deut. iv. 13, x. 4; Exod. xxxiv. 28), written by God on the two tables of stone (Exod. xxiv. 12, xxxii. 16), the so-called Tables of the Revelation (E.V. "tables of testimony," Exod. xxxiv. 29), or Tables of the Covenant (Deut. ix. 9, 11, 15) (in patristic Gr. ἡ δεκάλογος *sc.* βίβλος Or νομοθεσία). These tables were broken by Moses (Exod. xxxii. 19), and two new ones were hewn (xxxiv. 1), and upon them were written the words of the covenant by Moses (xxxiv. 27, sqq.) or, according to another view, by God himself (Deut. iv. 13, ix. 10). They were deposited in the Ark (Exod. xxv. 21; 1 Ki. viii. 9). In Deuteronomy the inscription on these tables, which is briefly called the covenant (iv. 13), is expressly identified with the words spoken by Jehovah (Yahweh) out of the midst of the fire at Mt. Sinai or Horeb (according to the Deuteronomic tradition), in the ears of the whole people on the "day of the assembly," and rehearsed in vi. 6–21. The order of the commandments varies in some ancient texts (Vatican ms. of the LXX., Nash Papyrus), and there are differences in detail between the form in which the Decalogue appears in Exodus and in Deuteronomy. Further, the term "Ten Words" does not occur in Exod. xx., but is found in Exod. xxxiv. 28, in a context which seems to imply that the words mentioned had immediately preceded this passage. Accordingly some scholars would find another Decalogue embedded in Exod. xxxiv. 10–26.

The Decalogue of **Exod. xx.,** Deut. **v.**—Comparison between the two texts, especially in the law of the Sabbath, strongly suggests that neither form is original, both having been expanded from a rather shorter common source. It seems that in the earlier commandments even this common source has been extended from a much more concise primitive form, and that the commands first took the form of simple injunctions and prohibitions of the same type as "Thou shalt not steal."

Different views have been held as to the actual divisions of the Decalogue. Thus Philo regarded Exod. xx. 2–3 as the first commandment, while the Talmud made v. 2 the first and vv. 3–6 the second, thus identifying the sins of apostasy and idolatry. In Christian circles the Roman and Lutheran Churches make the first commandment extend from v. 2 to v. 6, and distinguish the coveting of a wife from the coveting of property. (This last is only possible on the basis of the text in Deuteronomy.) The arrangement of the Orthodox Eastern, Calvinistic and Anglican Churches takes Exod. xx. 2 as an introduction, separates the prohibition of apostasy from that of the making of images, and unites the clauses prohibiting covetousness into a single commandment. Different opinions obtain as to the date of the Decalogue. The general tendency is to place it late rather than early, though the view that the whole is Mosaic has been revived by some modern scholars (*e.g.*, McFadyen and Volz).

The Decalogue of Exod. xxxiv. 12–26.—This passage contains a number of precepts, and if we are to see here the original "Ten Words" referred to in v. 28, it is clear that we have them in a greatly expanded form. It is, moreover, far from certain as to how we are to apportion the "Ten Words" among the precepts contained in these verses. We may, perhaps, find the best arrangement as follows (1) prohibition of worship paid to other gods, (2) prohibition of molten images, (3) observance of the feast of unleavened bread, (4) the feast of weeks, (5) the feast of the ingathering at the beginning of the year, (6) the seventh day rest, (7) firstlings and firstfruits (separated in the text as it stands), (8) prohibition of leaven with sacrificial blood, (9) sacrificial fat must not be left over till the morning, (10) a kid must not be seethed in its mother's milk.

It goes without saying that other arrangements are possible, and none is wholly satisfactory. But on any identification of the individual precepts, two features stand out clearly. In the first place the provisions are all ritual rather than ethical, and in the second place, while some of them are equally adapted to a nomad people in the wilderness and to a settled agricultural community, others could only have applied to the conditions of the latter. It is worth noting that most of the precepts are found also in the "Book of the Covenant" (Exod. xx.–xxiii. E.), where they occur unconnected with one another. This fact, together with the very simple type of ritual enjoined, has suggested a Judaean rather than an Ephraimite origin for Exod. xxxiv. 12–26.

The Decalogue in Christian Theology.—Following the New Testament, in which the '(commandments" summed up in the law of love are identified with the precepts of the Decalogue (Mark x. 19; Rom. xiii. 9; cf. Mark xii. 28 ff.), the ancient Church emphasized the permanent obligation of the ten commandments as a summary of *natural* in contradistinction to ceremonial precepts, though the observance of the Sabbath was to be taken in a spiritual sense (Augustine, *De spiritu* et *litera,* xiv.; Jerome, De celebratione *Paschae*). The mediaeval theologians followed in the same line, recognizing all the precepts of the Decalogue as moral precepts de *lege* naturae, though the law of the Sabbath is not of the law of nature, in so far as it prescribes a determinate day of rest (Thomas, summa, $I^{ma}II^{dae}$ qu. c. art. 3; Duns, *Super* sententias, lib. iii. dist. 37). The most important mediaeval exposition of the Decalogue is that of Nicolaus de Lyra; and the 15th century, in which the Decalogue acquired special importance in the confessional, was prolific in treatises on the subject (Antoninus of Florence, Gerson, etc.).

Important theological controversies on the Decalogue begin with the Reformation. The question between the Lutheran (Augustinian) and Reformed (Philonic) division of the ten commandments was mixed up with controversy as to the legitimacy of sacred images not designed to be worshipped. The Reformed theologians took the stricter view. The identity of the Decalogue with the eternal law of nature was maintained in both churches, but it was an open question whether the Decalogue. as such (that is, as a law given by Moses to the Israelites), is of perpetual obligation. The Socinians, on the other hand, regarded the Decalogue as abrogated by the more perfect law of Christ; and this view, especially in the shape that the Decalogue is a civil and not a moral law (J. D. Michaelis), was the current one in the period of the 18th century rationalism. The distinction of a permanent and a transitory element in the law of the Sabbath is found, not only in Luther and Melanchthon, but in Calvin and other theologians of the Reformed church. The main controversy which arose on the basis of this distinction was whether the prescription of one day in seven is of permanent obligation. It was admitted that such obligation must be not natural but positive; but it was argued by the stricter Calvinistic divines that the proportion of one in seven is agreeable to nature, based on the order of creation in six days, and in no way specially connected with anything Jewish. Hence it was regarded as a *universal* positive law of God. But those who maintained the opposite view were not excluded from the number of the orthodox. The laxer conception found a place in the Cocceian school.

Bibliography.—Geffcken, *Über die verschiedenen Eintheilungen* des Dekalogs und *den Einfluss* derselben *auf* den *Cultus;* W. Robertson Smith, Old Test. Jew; Church, pp. 331–345, where his earlier views (1877) in the Ency. Brit. are largely modified (cf. also Evtg. *Hist.* Rev. [1888] p. 352); Montefiore, Hibbert *Lectures* (1892), Appendix 1; W. R. Harper, *Internat. Crit. Comm.* on *Amos* and Hosea, pp. 58–64 (on the position of the Decalogue in early pre-prophetic religion of Israel); C. A. Briggs, Higher Criticism of *Hexat.*, pp. 189–210; see also Exodus and Deuteronomy. (W. R. S.; S A. C.)

DECAMPS, ALEXANDRE GABRIEL (1803–1860), French painter, was born in Paris on March 3, 1803, and died at Barbizon on Aug. 22, 1860. In his youth he travelled in the East, and reproduced oriental life and scenery with a bold fidelity to nature that made his works the puzzle of conventional critics. He died in consequence of being thrown from a vicious horse while hunting at Fontainebleau. He was probably the first of European painters to represent scenes from Scripture history with their true and natural local background. Of this class were his "Joseph sold by his Brethren," "Moses taken from the Nile," and his scenes from the life of Samson, nine vigorous sketches in charcoal and white. Decamps produced a number of genre pic.

tures, chiefly of scenes from French and Algerine domestic life. Probably the best known of all his works is "The Monkey Connoisseurs." a clever satire of the jury of the French Academy of Painting, which had rejected several of his earlier works on account of their divergence from any known standard.

See Moreau's *Decamps et son oeuvre (1869).*

DE CANDOLLE, ALPHONSE: see (*s.v.*) CANDOLLE, AUGUSTIN PYRAME DE.

DECAPOLIS, a league of ten cities situated with one exception on the eastern side of the upper Jordan and the sea of Tiberias. The names of the ten cities are Damascus, Philadelphia, Raphana, Scythopolis (=Beth-Shan, now *Beisan,* W. of Jordan), Gadara, Hippos, Dion, Pella, Gerasa and Kanatha. Of these Damascus alone retains its importance. Scythopolis (as represented by the village of Beisan) is still inhabited; the ruins of Pella, Gerasa and Kanatha survive. Scythopolis, in command of the communications with the sea and the Greek cities on the coast, was a very important member of the league. The purpose of the league was mutual defence against the marauding Bedouin tribes that surrounded them.

It was soon after Pompey's campaign in 64–63 B.C. that the Decapolis league took shape. The cities comprising it were united by the main roads on which they lay, their respective spheres of influence touching one another. A constant communication was maintained with the Mediterranean ports and with Greece. The cities were subject to the governor of Syria and taxed for imperial purposes

The best account is in *G.* A. Smith's *Historical Geography* of *the Holy Land,* chap. xxviii.

DECASTYLE, the architectural term given to a portico that has ten columns, as in the temple of Apollo Didymaeus at Miletus; also applied to a building with such a portico (see TEMPLE).

DECATUR, STEPHEN (1779–1820), American naval commander, was born at Sinnepuxent (Md.) on Jan. 5, 1779, and entered the U.S.Navy as a midshipman in 1798. He was promoted lieutenant and saw service in the short naval war with France (1798-1800). In 1803 he commanded the "Enterprise," a part of Commodore Preble's squadron in the Mediterranean, and in Feb. 1804 led an expedition into the harbour of Tripoli to burn the U.S. frigate "Philadelphia," which had fallen into Tripolitan hands. He succeeded and made his escape under battery fire with only one man wounded. This exploit earned him his captain's commission and a sword of honour from Congress. He was engaged in all the attacks on Tripoli during 1804 and 1805.

In the War of 1812 his ship the "United States" captured H.M.S. "Macedonian." In 1813 he was appointed commodore to command a squadron in New York harbour, soon blockaded by the British. In an attempt to break out in Jan. 1815 his flagship the "President" was forced to surrender to a superior force. Subsequently he commanded in the Mediterranean against the corsairs of Algiers, Tunis and Tripoli with great success. He was made a Navy commissioner (Nov. 1811), an office which he held until killed in a duel with Commodore James Barron at Bladensburg (Md.) on March 22, 1820. A toast of his has become famous—"Our country! In her intercourse with foreign nations may she always be in the right; but our country, right or wrong."

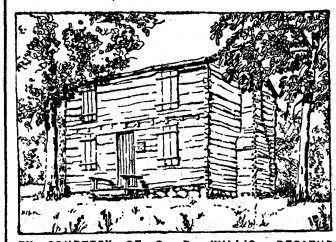
See A. S. Mackenzie, ***Life*** of *Decatur* (Boston, *1846).*

DECATUR, a city of northern Alabama, U.S.A., on the Tennessee river, 75m. N. of Birmingham, served by the Louisville and Nashville and the Southern railways; the county seat of Morgan county. It was formed in 1927 by the consolidation of Albany, formerly called New Decatur (pop. 7,652 in 1920) and Decatur (pop. 4,752 in 1920), and its population was 16,604 in 1940 by the federal census. The city has many important manufacturing industries, including a large cotton mill, steel works, lumber mills and woodworking plants, cotton gins and compresses, cottonseed oil mills, silk and hosiery factories, tanneries, iron foundries, flour mills and shipbuilding.

DECATUR, a town of Georgia, on the Georgia railroad, adjoining the city limits of Atlanta, at an altitude of 1,000 ft.; the county seat of Dekalb county. The population was 6,150 in 1920 (21% Negroes) and was 16,561 in 1940 by the federal census. It is a residential suburb, the seat of Columbia Theological seminary (Presbyterian), and of Agnes Scott college for women (Presbyterian), founded in 1889 as a "female seminary" and named after the mother of a generous benefactor, Col. George W. Scott. Decatur was incorporated in 1823.

DECATUR, a city in central Illinois, U.S.A., on Lake Decatur; the county seat of Macon county. It is on federal highways 36 and 51, and state highways 47, 48 and 121, and is served by the Baltimore and Ohio, the Illinois Central, the Illinois Terminal (electric), the Pennsylvania and the Wabash railways. The land area is 9.5 sq.mi. The population was 57,510 in 1930, and 59,305 in 1940 by the federal census. Decatur is a pleasant city, of diversified manufacturing industries, in a rich agricultural region underlain with coal. It has a commission form of government. The assessed valuation in 1940 was $32,875,770. Bank debits in 1940 amounted to $239,330,000.

There are parks in and near the city covering 960 ac., in one of which the original county courthouse (of logs) is preserved. Lake Decatur (12 mi. long), constructed in 1922–23 to assure an ample and dependable supply of water, provides fishing, boating and bathing. There is one coal mine within the city. The factory output in 1935 was valued at $32,035,000. Corn products (starch, syrup, hominy, meal, flour, oil, feed, sugar) and soybean products (oil meal, oil, sauce, lecithin, flour) are among the most important manufactures, and the corn-milling plants have a grinding capacity of over 60,000 bushels a day. Others of importance are brass plumbing goods, soda-fountain and office fixtures; malleable and gray iron, structural and sheet steel. The Wabash has its principal repair shops there, also its hospital for employees. The James Millikin university (opened 1903) has an endowment of over $1,250,000. Decatur was founded in 1829 and was named after Stephen Decatur. It was the first Illinois home of Abraham Lincoln, and the Grand Army of the Republic was organized there on April 6, 1866.



BY COURTESY OF C. R. WILLIS, DECATUR, ILL.

COURTHOUSE IN MACON COUNTY, ILLINOIS, ERECTED 1829, WHERE ABRAHAM LINCOLN PRACTISED LAW WHILE ON THE EIGHTH JUDICIAL CIRCUIT

DECATUR, a city of eastern Indiana, U.S.A., on St. Mary's river, 100 mi. N.E. of Indianapolis; the county seat of Adams county. It is on federal highway 27, and is served by the Erie, the Nickel Plate and the Pennsylvania railways. The population was 4.762 in 1920 (97% native white) and was 5,861 in 1940 by the federal census. It is surrounded by a farming and lumbering region, and has various factories. Decatur was settled about 1836 and incorporated in 1882.

DECAZES, ÉLIE, DUC (1780–1860), French statesman, was born at Saint Martin de Laye (Gironde) on Sept. 28, 1780. He studied law, became a judge in the tribunal of the Seine in 1806, was attached to the cabinet of Louis Bonaparte in 1807, and was counsel to the court of appeal at Paris in 1811. Immediately upon the fall of the empire he declared himself a royalist, and remained faithful to the Bourbons through the Hundred Days. He made the personal acquaintance of Louis XVIII., who appointed him prefect of police at Paris in July 1815. His marked success in that difficult position won for him the ministry of police, in succession to Fouché, on Sept. 24. In the interval he had been elected deputy for the Seine (Aug. 1815) and both as deputy and as minister he led the moderate royalists. His formula was "to royalize France and to nationalize the monarchy." The Moderates were in a minority in the chamber of 1815, but Decazes persuaded Louis XVIII. to dissolve the house, and the elections of Oct. 1816 gave them a majority. As minister of police he had to suppress the insurrections provoked by the ultra-royalists (the White Terror); then, after the resignation of the duc de Richelieu, he took the actual direction of the ministry, although the nominal president was General J. J. P. A. Dessolle (1767–1828). We held at the same time the portfolio of the interior. The cabinet, in

which Baron Louis was minister of finance, and Marshal Gouvion Saint Cyr remained minister of war, was entirely Liberal; and its first act was to suppress the ministry of police, as Decazes held that it was incompatible with the régime of liberty. His reforms met with the strong hostility of the chamber of peers, where the ultra-royalists were in a majority, and to overcome it he got the king to create 60 new Liberal peers. He then passed the laws on the press, suppressing the censorship. By reorganization of the finances, the protection of industry and the carrying out of great public works, France regained its economic prosperity, and the ministry became popular. But the powers of the Grand Alliance had been watching the growth of Liberalism in France with an anxiety that was increased by the election of the celebrated Abbé Grégoire. A threat of foreign intervention, rather than the clamour of the "Ultras," forced Louis XVIII. to urge a change in the electoral law that should render such a "scandal" as Grégoire's election impossible for the future. Dessolle and Louis, refusing to embark on this policy, now resigned; and Decazes became head of the new ministry, as president of the council (Nov. 1819). But the exclusion of Grégoire from the chamber and the changes in the franchise embittered the Radicals without conciliating the "Ultras." The news of the revolution in Spain in Jan. 1820 added fuel to their fury, and when, on Feb. 13 the duke of Berry was murdered, clamorous tongues loudly accused Decazes of being an accomplice in the crime. Decazes, indeed, foreseeing the storm, at once placed his resignation in the king's hands. Louis at first refused. But in the end he was forced to yield to the importunity of his family (Feb. 17th); and Decazes, raised to the rank of duke, passed into honourable exile as ambassador to Great Britain.

In Dec. 1821 he returned to sit in the house of peers, when he continued to maintain his Liberal opinions. After 1830 he adhered to the monarchy of July, but after 1848 he remained in retirement. He had organized in 1826 a society to develop the coal and iron of the Aveyron, and the name of Decazeville was given in 1829 to the principal centre of the industry. He died on Oct. 24, 1860.

His son, LOUIS CHARLES ÉLIE DECAZES, duc de Gliicksberg (1819–1886), was born at Paris, and became minister plenipotentiary at Madrid and at Lisbon. In 1871 he was elected deputy to the National Assembly by the Gironde, and was chosen by the duc de Broglie as minister of foreign affairs in Nov. 1873. He voted with the Orleanists the "constitutional laws" of 1875, and approved of MacMahon's parliamentary *coup d'état* on May 16, 1877. He died on Sept. 16, 1886.

On the Duc Decazes *see* E. Daudet, *Louis* XVIII. *et le duc Decazes* (1899), and his "L'ambassade du duc Decazes" in the ***Revue*** *des deux mondes* for *1899.*

DECAZEVILLE, a town of south-central France, in the department of Aveyron, 34 mi. N.W. of Rodez by the Orléans railway. Pop. (1936) 11,154. It possesses iron mines and is the industrial centre of the coal- and iron-fields of the Aveyron, which supply the iron-works established by the Duc Decazes, minister of Louis XVIII. A statue commemorates the founder.

DECCAN (Sans. *Dakshina,* "the South"), *a* name applied, according to Hindu geographers, to the whole of India situated south of the river Nerbudda. It is sometimes understood as the country between that river and the Kistna, the latter having long formed the southern boundary of the Mohammedan empire of Delhi. In the more extended meaning it comprehends the whole Indian peninsula, and in this view the Eastern and Western Ghats constitute the most striking feature. These two ranges unite in the north with the Vindhya mountains, and thus form a vast triangle enclosing the high table-land from Cape Comorin to the valley of the Nerbudda. The surface of this table-land slopes from west to east—the great rivers, the Cauvery, Godavari, Kistna and Pennar, though deriving their sources from the base of the Western Ghats, all finding their way into the Bay of Bengal through fissures in the Eastern Ghats.

History.—The authentic history of the Deccan only begins with the 13th century A.D. (For the early history *see* the article INDIA: *History;* and also BOMBAY PRESIDENCY; *History.)* In 1294 Ala-ud-Din Khilji, emperor of Delhi, invaded the Deccan, stormed Devagiri, and reduced the Yadava rajas of Maharashtra to the position of tributary princes *(see* DAULATABAD), then proceeding southward overran Telingana and Carnata (1294–1300). In 1307, owing to non-payment of tribute, a fresh series of Muslim incursions began, under Malik Kafur, ending in the final ruin of the Yadava power; and in 1338 the reduction of the Deccan was completed by Mohammed ben Tughlak. The imperial sway was, however, of brief duration. Telingana and Carnata speedily reverted to their former masters; and this defection on the part of the Hindu states was followed by a general revolt of the Muslim governors, resulting in the establishment in 1347 of the independent Mohammedan dynasty of Bahmani, and the consequent withdrawal of the power of Delhi from the territory south of the Nerbudda. On the dissolution of the Bahmani empire (1482), its dominions were distributed into the five Mohammedan states of Golconda, Bijapur, Ahmadnagar, Bidar and Berar. To the south of these the great Hindu state of Carnata or Vijayanagar (*q.v.*) still survived; but this, too, was destroyed, at the battle of Talikota (156j), by a league of the Mohammedan powers, who also in their turn soon disappeared before the victories of the Delhi emperors. Their rule was of short duration. In 1706 the Mahrattas acquired the right of levying tribute in southern India, and their principal chief, the Peshwa of Poona, became a practically independent sovereign. A few years later the emperor's viceroy in Ahmadnagar, the nizam-al-mulk, threw off his allegiance and established the seat of an independent government at Hyderabad (1724). The remainder of the imperial possessions in the peninsula were held by chieftains acknowledging the supremacy of one or other of these two potentates. In the sequel, Mysore became the prize of the Mohammedan usurper Hyder Ali. Mysore formed one of the earliest British conquests in the Deccan. Tanjore and the Carnatic were shortly after annexed. In 1818 the forfeited possessions of the Peshwa added to their extent, and these acquisitions, with others which have more recently fallen to the paramount power by cession, conquest or failure of heirs, form a continuous territory stretching from the Nerbudda to Cape Comorin.

See J. D. B. Gribble, *History of the Deccan (1896);* Prof. Bhandarkar, "Early History of the Dekkan" *(Bombay Gazetteer);* Vincent *A.* Smith, *Early History of India* revised by S. M. Edwardes (1924).

DECELEIA (Gr. Δεκελεία), an Attic deme, on the pass which led over the east end of Mt. Parnes towards Oropus and Chalcis, commanding the Athenian plain. Its eponymous hero, Decelus, was said to have indicated to the Tyndaridae, Castor and Pollux, the place where Theseus had hidden their sister Helen at Aphidnae; and hence there was a traditional friendship between the Deceleians and the Spartans (Herodotus ix. 73). This tradition, together with the advice of Alcibiades, led the Spartans to fortify Deceleia as a basis for permanent occupation in Attica during the later years of the Peloponnesian War, from 413–404 B.C. Its position enabled them to harass the Athenians frequently and to form a centre for fugitive slaves and other deserters. The royal palace of Tatoi has been built on the site.

See PELOPONNESIAN WAR; also Judeich in Pauly-Wissowa, *Realencyklopädie.*

DE CELLES, ALFRED DUCLOS (1843–1925), Canadian writer, was born at St. Laurent, and educated at Quebec seminary and Laval university. He edited successively the newspapers *Le Journal de Quebec, La Minerve* and *L'Opinion Publique* before becoming librarian of the Dominion parliament in 1880. Thenceforth he devoted himself to history, producing *La crise du régime parlementaire* (1888); *A la conquête de la liberté en France et au Canada* (1890); *Les constitutions du Canada* (1890); *Les États-Unis* (1896); *Papineau, Cartier* (1905); *Cartier et son temps* (1907); papers in vol. xv. of *Canada and its Provinces* on "The Province of Quebec" (1914); and *The "Patriotes" of 1837* (1920).

DECEMBER (Lat. *decem,* ten), the last month of the year. In the earliest Roman calendar, the year was divided into ten months, the last of which was called December, or the *tenth* month, and this name was retained for the last or 12th month

of the year as now divided. Julius Caesar gave the month its present length. The Saturnalia occurred in December, which explains the phrase of Horace "libertate Decembri utere." Martial applies to the month the epithet *canus* (hoary), and Ovid styles it *gelidus* (frosty) and *fumosus* (smoky). The Saxons called it *winter-monath,* winter month, and *heligh-monath,* holy month, from the fact that Christmas fell within it. Thus the modern Germans call it Christmonat. In December is the date of the winter solstice, when the sun reaches the tropic of Capricorn.

DECEMVIRI, "the ten men," the name applied by the Romans to any official commission of ten, followed by a statement of the purpose for which the commission was appointed, *e.g., Xviri* stlitibus iudicandis, sacris *faciundis,* etc.

I. Usually, it signified the temporary commission which superseded all the ordinary magistrates from 451 to 449 B.C., for the purpose of drawing up a code of laws. In 462 B.C. a tribune proposed the appointment of a commission to draw up a code to secure for the plebs a defence against magisterial caprice. In 452 B.C. decemvirs were appointed to draw up a code; during their tenure of office all other magistracies were in abeyance, but they were bound to maintain the rights of the plebs. The first board of decemvirs (wholly patrician) held office during 451 B.C.; the chief man among them was Appius Claudius (see CLAUDIUS). The decemvirs ruled with singular moderation, and submitted to the *Comitia* Centuriata a code of laws in ten headings. So popular were the decemvirs that another board of ten was appointed for the following year, some of whom, if the extant list of names is correct, were plebeians. These added two more to the ten laws of their predecessors, thus completing the Laws of the Twelve Tables (see ROMAN LAW). But their rule then became violent and tyrannical. They were forced to abdicate (449 B.C.).

II. The judicial board of decemvirs (stlitibus *judicandis*) formed a civil court concerned mainly with the status of individuals. They were originally a body of jurors under the presidency of the praetor (*q.v.*), but eventually became minor magistrates of the republic, elected by the Comitia *Tributa.*

III. The priestly board of decemvirs (sacris *faciundis*) was half patrician and half plebeian. They were first appointed in 367 B.C., instead of the patrician *duumviri* who had hitherto performed religious duties. Their chief function was the care of the Sibylline books, and the celebration of the games of Apollo and the Secular Games.

IV. Decemvirs were also appointed from time to time to control the distribution of the public land (*agris* dandis adsignandis; see AGRARIAN LAWS).

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DECEPTION TEST, a name given to the measurement of certain bodily changes caused by the effort of lying, or by fear due to a sense of guilt. Working at Graz, Austria, in 1914, Vittorio Benussi devised a test based on the idea that the rate of breathing is affected by the effort of telling a lie, and that this change could be accurately measured. Three years later Harold Burtt further developed this method in the Harvard Psychological Laboratory. In 1917 W. M. Marston, working in the same laboratory, had tested the relation of blood pressure to the effort of lying, but found that all persons examined showed blood pressure higher than normal whether they lied or told the truth.

A psychological deception test, based on association of words, was devised in Austria by Wertheimer and Klein in 1904, and developed by Carl Jung in Switzerland in 1905. Jung read a list of words to three nurses suspected of stealing a purse. Some of these words referred to objects which would have been seen when the theft was committed, and the suspects were asked to give associated words. In Jung's view the guilty nurse gave words which would not have been in the mind of an innocent person and further revealed guilt by delay in answering.

The vegetable alkaloid scopolamin was used by a Texas physician, R. E. House, with the idea that it produced a garrulous semi-intoxication in which the truth was likely to be blurted out. Another test depends on the variation in electrical conductivity of the skin caused by the secretion of sweat under pressure of emotion. The objection to these forms of trial by ordeal is that they are considered too uncertain to be used with assurance in criminal trials.

See C. T. McCormick, "Deception Test and the Law of Evidence," California Law Review (Sept. 1927).

DECEREBRATE RIGIDITY: see EQUILIBRIUM, ANIMAL.

DE CESARE, CARLO (1824–1882), Italian political economist and legislator, was born at Spinazzola. He studied at Naples and was successively inspector-general of the banks of issue, secretary-general of agriculture, industry and commerce in 1868, and counsellor of the "cour des comptes." In his chief work, *Manuale di* Economia *pubblica* (2 vols., 1862), he advocated the doctrines of Ricardo. Of his numerous other works the most important are *Il* mondo civile e industriale nel secolo xix (1857); Del *potere temporale* del Papa (2nd ed., 1861); *Il primo unitario* italiano (2nd ed., 1861); La *Politica, L'Economia* e la Morale die moderni *Italiani* (1869); and La *Germania* Moderna (2nd ed., 1874). De Cesare died at Rome in 1882.

DECHAMPS, ADOLPHE (1807–1875), Belgian statesman, born on June 17, 1807, at Melle; in 1842 became governor of Luxembourg, in 1843 minister of public works, during his office working for the opening up of railways, and in 1845 minister of foreign affairs. His intimate knowledge of contemporary politics is exhibited in his La Second Empire (1859); *L'Empire* et *L'Angleterre* (1860); La France et *L'Allemagne* (1865) and Le Prince de Bismarck et *l'entrevue* des *trois empereurs* (1873). He died on July 19, 1875.

See E. de Moreau, *A. Dechamps* (Brussels, 1911).

DECHEN, HEINRICH VON (1800–1889), German geologist, was born in Berlin on March 25, 1800, and was educated in the university in that city. He was in the service of the mining department of the Prussian State for 44 years in all, being its director from 1841 to 1864. He paid special attention to the coal-formation of Westphalia and northern Europe generally and wrote some important works on the mineralogy of the Rhineland, but his main work was a geological map of Rhenish Prussia and Westphalia in 35 sheets on the scale of 1:80,000, issued with two volumes of explanatory text (1855–82). He published also a small geological map of Germany (1869). He died at Bonn on Feb. 15, 1889.

DECIDUOUS, a botanical and zoological term for "falling in season," as of petals after flowering, leaves in autumn, the teeth or horns of animals, or the wings of insects.

DECIMAL: see ARITHMETIC; FRACTION; NUMERALS.

DECIMAL COINAGE, any currency in which the various denominations of coin are arranged in multiples or submultiples of ten (Lat. decem) with reference to a standard unit. Thus if the standard unit be 1 the higher coins will be 10, 100, 1,000, etc., the lower ·1, ·01, ·001, etc. In a perfect system there would be no breaks or interpolations, but the actual currencies described as "decimal" do not show this rigid symmetry. In France the standard unit—the franc—has the 10 franc and the 100 franc pieces above it; the 10 centime below it; there are also, however, 50 franc, 20 franc, 5 franc, 2 franc pieces as well as 50 and 20 centime and other denominations. Similar irregularities occur in the German and United States coinages.

Subject to these practical modifications the leading countries of the world (Great Britain and India are the chief exceptions) have adopted decimal coinage. The United States led the way (1786 and 1792; see MORRIS, GOUVERNEUR), and France soon followed (1799 and 1803), her system being extended to the countries of the Latin Union (1865). Germany (1873), the Scandinavian States (1875), Austria-Hungary (1870, developed in 1892) and Russia (1839 and 1897) are further adherents to the decimal system. The Latin-American countries and Japan (1871) have also adopted it.

In Great Britain proposals for decimalizing the coinage have often been discussed. Besides the inconvenience of altering the

established currency, the difficulty of choosing between the different schemes propounded has been a considerable obstacle. One plan took the farthing as a base: then 10 farthings = 1 doit ($2\frac{1}{2}d.$), 10 doits = 1 florin (2*s.* 1*d.*), 10 florins = 1 pound (20*s.* 10*d.*). The advantages claimed for this scheme were the preservation of the smaller coins and the avoidance of interference with the smaller retail prices. Its great disadvantage was the destruction of the existing unit of value. Another proposal would retain the pound as unit and the florin, but would subdivide the latter into 100 "units" (or farthings reduced 4%) and introduce a new coin = 10 units (2.4*d.*). By it the unit of account would remain as at present, and the shilling (as 50 units) would continue in use. The alteration of the bronze and several silver coins, and the need of readjusting all values and prices expressed in pence, formed the principal difficulties.

A third scheme, which was connected with the assimilation of English to French and American money, proposed the establishment of an 8s. gold coin as unit, with the tenpenny or franc and the penny (reduced by 4%) as subdivisions. The new coin would be equivalent to 10 francs or (by an anticipated reduction of the dollar) 2 dollars.

A fourth scheme was put forward by the Decimal association to meet the objections raised by the royal commission on coinage of 1918–20 to the proposed £-mill system (=£ divided into 1,000 parts). This scheme left all the silver coins unchanged but proposed to increase the value of the copper coins by 20%, so that the shilling would consist of ten instead of 12 pence.

For the general question of monetary scales *see* MONEY. and for the decimal system in reference to weights and measures *see* METRIC SYSTEM and MEASURES AND WEIGHTS. (C. F. B.)

DĚČIN or TETSCHEN, a town on the right bank of the Elbe in Bohemia, Czechoslovakia; it owes its chief importance to the fact that it shares with the sister town of Podmokly (q *v.*) the guardianship of the entrance to Bohemia from Saxony It has a varied development of industry, its products comprising chemicals, confectionery, dyes, plaster of Paris, cotton goods, cellulose, flour and beer. The town is dominated by a rocky height crowned by an old 17th century chateau and the frontier position is evident in the fact that its control alternated between Saxony and Bohemia and in the composition of the population, 13,034, of whom about 10,000 are German. The town has road and rail connection with Bodenbach. With the Sudetenland the town was occupied in 1938 by the Germans.

DECIUS, GAIUS MESSIUS QUINTUS TRAIANUS (AD 201–251), Roman emperor, was born at Budalia near Sirmium in lower Pannonia in 201. About 245 the emperor Philip the Arabian entrusted him with a command on the Danube, and in 249 (or end of 248), having been sent to put down a military rising in Moesia and Pannonia, he was proclaimed emperor, against his will. Philip advanced against him and was slain near Verona. Decius had to take the field at once against the Goths, who crossed the Danube and overran Moesia and Thrace. The details of the campaign are obscure. The Goths were surprised by the emperor while besieging Nicopolis on the Danube; at his approach they crossed the Balkans and attacked Philippopolis Decius followed but was defeated near Beroë. Philippopolis fell and its commander, Priscus, declared himself emperor under Gothic protection. The siege had so exhausted the Goths that they offered to surrender their booty and prisoners on condition of being allowed to retire unmolested. But Decius, who had succeeded in surrounding them, refused their offer. The final engagement took place on swampy ground in the Dobruja near Abritum (Abrittus) or Forum Trebonii and ended in the defeat and death of Decius and his son. Decius was a capable soldier and administrator. The chief blot on his reign was the systematic and authorized persecution of the Christians, which had for its object the restoration of the religion and institutions of ancient Rome. Decius tried to revive the separate office and authority of the censor. The choice was left to the senate, who unanimously selected Valerian (afterwards emperor) who declined the responsibility. The invasion of the Goths and the death of Decius put an end to the abortive attempt.

See Aurelius Victor, *De Caesaribus,* 29, *Epit.* 29; Jordanes, *De rebus Geticis, 18;* fragments of Dexippus, in C. W. Muller, ***Frag. Hist. Graec.*** iii (1849); Edward Gibbon, *Decline and* Fall, chap 10; H. Schiller, *Geschichte der römischen, Kaiserzeit,* i (pt. 2), 1883.

DECIUS MUS, PUBLIUS: *see* MUS.

DECIZE, a town of central France, in the department of Nièvre, on an island in the Loire, 24 mi. S.E. of Nevers by the Paris-Lyon railway. Pop. (1936) 3,357. Julius Caesar mentions it as Dhcetia, stronghold of the Aedui, and in 52 B C held there a meeting of the senate to settle the leadership of the tribe and to reply to his demand for aid against Vercingetorix. Later the counts of Nevers owned it, and granted it a charter of franchise in 1226 The church of Saint Aré dates in part from the 11th and 12th centuries; there are also ruins of a castle of the counts of Nevers. Decize is the starting point of the Nivernais canal. The coal mine of La Machine, which belongs to the Schneider company of Le Creusot, lies 4 mi. to the north. The industries of Decize and its suburbs on both banks of the Loire include the working of gypsum and lime, and the manufacture of ceramic products and glass. Trade is in horses from the Morvan, cattle, coal. iron. wood and stone.

DECKEN, KARL KLAUS VON DER (1833–1865), German explorer, was born on Aug. 8, 1833, at Kotzen. He left the military service of Hanover in 1860 to explore East Africa. He reached the volcanic mountain, Kilimanjaro, which he ascended to the height of 15,000 ft., and then explored the East African coast. In 1865 he attempted to navigate the Juba river, but with three others was murdered in Bardera by the Somali, the rest of the party escaping to Zanzibar.

See O. Kersten, *K.K.* v. *der Deckens Reisen in Ostafrika (4* vols., 1869–79).

DECKER, SIR MATTHEW, BART. (1679–1749), British merchant and writer on trade, born in Amsterdam in 1679, went to London in 1702 and established himself there as a merchant. He was a director of the East India company, sat in parliament for four years as member for Bishop's Castle, and was high sheriff of Surrey in 1729. He was created a baronet by George I in 1716 Decker's fame as a writer on trade rests on two tracts. The first, *Serious considerations on the several high duties which the Nation in general, as well as Trade in particular, labours under, with a proposal for preventing the removal of goods, disclzarging the trader from any search, and raising all the Publick Supplies by one single Tax* (1743; name affixed to 7th ed., 1756), proposed to do away with customs duties and substitute a tax upon houses He also suggested taking the duty off tea and putting instead a licence duty on households wishing to consume it. The second, an *Essay on the Causes of the Decline of the Foreign Trade, consequently of the value of tlze lands in Britain, and on the means to restore both* (1744), has been attributed to W. Richardson, but internal evidence is strongly in favour of Decker's authorship. He advocates the licence plan in an extended form; urges the repeal of import duties and the abolition of bounties, and, in general, shows himself such a strong supporter of the doctrine of free trade as to rank as one of the most important forerunners of Adam Smith. Decker died on March 18. 1749.

See the exhaustive article by Prof. E. C. K. Gonner in Palgrave's *Dict.* Pol. *Econ.*

DECLARATION, formerly, in an action at English law, a precise statement of the cause of action. Under the system of pleading established by the Judicature act 1875, the declaration has been superseded by a statement of claim setting forth the facts on which the plaintiff relies. Declarations are now in use only in certain local courts of record, and in those of the United States and some British colonies in which the common law system of pleading survives. In the United States a declaration is termed a '(complaint," which is the first pleading in an action. It is divided into parts—the *title* of the court and term; the *venue* or county in which the facts are alleged to have occurred; the *commencement,* which contains a statement of the names of the parties and the character in which they appear; the *statement* of the cause of action; and the *conclusion* or claim for relief. *(See* PRACTICE AND PROCEDURE.)

The term is also used in other English legal connections; *e.g.,*

IN CONGRESS, JULY 4, 1776.

The unanimous Declaration of the thirteen united States of America.

When in the Course of human events it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation. We hold these truths to be self-evident, that all men are created equal; that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles, and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn, that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object, evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security. — Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world. — He has refused his Assent to Laws, the most wholesome and necessary for the public good. — He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them. — He has refused to pass other Laws for the accommodation of large districts of people, unless those people would relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only. — He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public Records, for the sole purpose of fatiguing them into compliance with his measures. — He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people. — He has refused for a long time, after such dissolutions, to cause others to be elected; whereby the Legislative powers, incapable of Annihilation, have returned to the People at large for their exercise; the State remaining in the mean time exposed to all the dangers of invasion from without, and convulsions within. — He has endeavoured to prevent the population of these States; for that purpose obstructing the Laws for Naturalization of Foreigners; refusing to pass others to encourage their migrations hither, and raising the conditions of new Appropriations of Lands. — He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary powers. — He has made Judges dependent on his Will alone, for the tenure of their offices, and the amount and payment of their salaries. — He has erected a multitude of New Offices, and sent hither swarms of Officers to harass our people and eat out their substance. — He has kept among us, in times of peace, Standing Armies, without the Consent of our legislatures. — He has affected to render the Military independent of and superior to the Civil power. — He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation: — For Quartering large bodies of armed troops among us: — For protecting them by a mock Trial, from punishment for any Murders which they should commit on the Inhabitants of these States: — For cutting off our Trade with all parts of the world: — For imposing Taxes on us without our Consent: — For depriving us in many cases of the benefits of Trial by Jury: — For transporting us beyond Seas to be tried for pretended offences — For abolishing the free System of English Laws in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule into these Colonies: — For taking away our Charters, abolishing our most valuable Laws and altering fundamentally the Forms of our Governments: — For suspending our own Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever. — He has abdicated Government here, by declaring us out of his Protection and waging War against us. — He has plundered our seas, ravaged our Coasts, burnt our towns, and destroyed the lives of our people. — He is at this time transporting large Armies of foreign Mercenaries to compleat the works of death, desolation and tyranny, already begun with circumstances of Cruelty & perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation. — He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, or to fall themselves by their Hands. — He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose known rule of warfare is an undistinguished destruction of all ages sexes and conditions. In every stage of these Oppressions We have Petitioned for Redress in the most humble terms: Our repeated Petitions have been answered only by repeated injury. A Prince whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people. Nor have We been wanting in attentions to our British brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and of consanguinity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, Enemies in War, in Peace Friends.

We, therefore the Representatives of the united States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do in the Name and by authority of the good People of these Colonies solemnly publish and declare, That these United Colonies are, and of Right ought to be Free and Independent States; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do. — And for the support of this Declaration, with a firm reliance on the protection of divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor.

John Hancock

Button Gwinnett
Lyman Hall
Geo Walton

Wm Hooper
Joseph Hewes
John Penn

Edward Rutledge
Thos Heyward Junr.
Thomas Lynch Junr.
Arthur Middleton

Samuel Chase
Wm Paca
Thos Stone
Charles Carroll of Carrollton

George Wythe
Richard Henry Lee
Th Jefferson
Benj Harrison
Thos Nelson Jr.
Francis Lightfoot Lee
Carter Braxton

Robt Morris
Benjamin Rush
Benj Franklin
John Morton
Geo Clymer
Jas Smith
Geo Taylor
James Wilson
Geo Ross

Caesar Rodney
Geo Read
Tho M:Kean

Wm Floyd
Phil Livingston
Frans Lewis
Lewis Morris

Richd Stockton
Jno Witherspoon
Fras Hopkinson
John Hart
Abra Clark

Josiah Bartlett
Wm Whipple

Saml Adams
John Adams
Robt Treat Paine
Elbridge Gerry

Step Hopkins
William Ellery

Roger Sherman
Sam Huntington
Wm Williams
Oliver Wolcott

Matthew Thornton

THE DECLARATION OF INDEPENDENCE OF THE UNITED STATES

A facsimile reproduction of the DECLARATION OF INDEPENDENCE, given to the world on July 4, 1776, although the resolution of independence was adopted by the colonial Congress on July 2. It was written by Thomas Jefferson and slightly amended by John Adams and Benjamin Franklin. The original document is enshrined in the Library of Congress, Washington, D. C. The printed text is to be found on the other side of this plate.

DECLARATION OF INDEPENDENCE

IN CONGRESS, JULY 4, 1776

THE UNANIMOUS DECLARATION of the thirteen united STATES OF AMERICA.

WHEN in the Course of human events it becomes necessary for one people to dissolve the political bands which have connected them with another. and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.—We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness.—That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed,—That whenever any Form of Government becomes destructive of these ends, it is the Right oi the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience hath shewn that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right. it is their duty, to throw off such Government, and to provide new Guards for their future security.—Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world.—He has refused his Assent to Laws, the most wholesome and necessary for the public good.—He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them.—He has refused to pass other Laws for the accommodation of large districts of people, unless those people would relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only.—He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their Public Records, for the sole purpose of fatiguing them into compliance with his measures.—He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people.—He has refused for a long time, aiter such dissolutions, to cause others to be elected; whereby the Legislative Powers, incapable of Annihilation, have returned to the People at large for their exercise; the State remaining in the mean time exposed to all the dangers of invasion from without, and convulsions within.—He has endeavoured to prevent the population of these States; for that purpose obstructing the Laws for Naturalization of Foreigners; refusing to pass others to encourage their migrations hither, and raising the conditions of new Appropriations of Lands.—He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary Powers.—He has made Judges dependent on his Will alone, for the tenure of their offices, and the amount and payment of their salaries.—He has erected a multitude of New Offices, and sent hither swarms of Officers to harass our people, and eat out their substance. He has kept among us, in times of peace, Standing Armies without the Consent of our legislatures.—He has affected to render the Military independent of and superior to the Civil Power.—He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation:—For quartering large bodies of armed troops among us:—For protecting them, by a mock Trial, from punishment for any Murders which they should commit on the Inhabitants of these States:—For cutting off our Trade with all parts of the world:—For imposing Taxes on us without our Consent:—For depriving us in many cases, of the benefits of Trial by Jury:—For transporting us beyond Seas to be tried for pretended offences:—For abolishing the free System of English Lau-s in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule into these Colonies:—For taking away our Charters, abolishing our most valuable Laws and altering fundamentally the Forms of our Governments:—For suspending our own Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever.—He has abdicated Government here, by declaring us out of his Protection and waging War against us.—He has plundered our seas, ravaged our Coasts, burnt our towns, and destroyed the lives of our people.—He is at this time transporting large Armies of foreign Mercenaries to compleat the works of death, desolation and tyranny, already begun with circumstances of Cruelty & Perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation.—He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, or to fall themselves by their Hands.—He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose known rule of warfare, is an undistinguished destruction of all ages, sexes and conditions. 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WE, THEREFORE, the Representatives of the UNITED STATES OF AMERICA, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare. That these United Colonies are, and of Right ought to be FREE AND INDEPENDENT STATES; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do.—And for the support of this Declaration, with a firm reliance on the protection of Divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor.

John Hancock
Button Gwinnett
Lyman Hall
Geo. Walton
Wm. Hooper
Joseph Hewes
John Penn
Edward Rutledge
Thos. Heyward, Jr.
Thomas Lynch, Jr.
Arthur Middleton
Samuel Chase
Wm. Paca
Thos. Stone
Charles Carroll of Carrollton
George Wythe
Richard Henry Lee
Th. Jefferson
Benj. Harrison
Thos. Nelson, Jr.
Francis Lightfoot Lee
Carter Braxton
Robt. Morris
Benjamin Rush
Benj. Franklin
John Morton
Geo. Clymer
Jas. Smith
Geo. Taylor
James Wilson
Geo. Ross
Caesar Rodney
Geo. Read
Tho. M:Kean
Wm. Floyd
Phil. Livingston
Frans. Lewis
Lewis Morris
Richd. Stockton
Jno. Witherspoon
Fras. Hopkinson
John Hart
Abra. Clark
Josiah Bartlett
Wm. Whipple
Saml. Adams
John Adams
Robt. Treat Paine
Elbridge Gerry
Step. Hopkins
William Ellery
Roger Sherman
Sam. Huntington
Wm. Williams
Oliver Wolcott
Matthew Thornton

THE DECLARATION OF INDEPENDENCE OF THE UNITED STATES

The Text of the Declaration of Independence. The original document is shown in facsimile on the other side of this plate

the Declaration of Insolvency *(see* BANKRUPTCY); the Declaration of Title, for which, when a person apprehends an invasion of his title to land, he may, by the Declaration of Title act 1862, petition the Court of Chancery *(see* LAND REGISTRATION); or the Declaration of Trust *(see* TRUSTS). By the Statutory Declarations act 1835 a solemn declaration may be substituted for an affidavit. In nearly all civilized countries an affirmation is now permitted to those who object to take an oath or upon whose conscience an oath is not binding. *(See* AFFIDAVIT; OATH.)

An exceptional position in law is accorded to a Dying or Deathbed Declaration. Where the charge is one of homicide it is the practice to admit dying declarations of the deceased with respect to the cause of his death. Unsworn declarations as to family matters, *e.g.,* as to pedigree, may also be admitted as evidence, as well as declarations made by deceased persons in the course of their duty. *(See* EVIDENCE.)

In the United States the declaration survives in such States as still follow common law pleading. It is a statement of all material facts constituting the plaintiff's cause of action in a methodical and legal form filed appropriately. Where code pleading has been adopted, the complaint supersedes the old declaration.

In the United States, the declaration of intention is that statement of an alien that he intends to renounce his or her citizenship and acquire that of the United States. Popularly it is known as "first papers." It may be filed at any time in a court competent in naturalization matters, even though the alien may not be naturalized until he has been a resident for five years. A declaration expires if the alien fails to file his application for naturalization or "second papers" within a period of seven years thereafter. If subsequently he desires to take out naturalization papers, he must file a new declaration of intention. Two years must elapse between the filing of the declaration of intention and the application for naturalization.

DECLARATION OF INDEPENDENCE in United States history, the act (or document) by which the 13 original States of the Union broke their colonial allegiance to Great Britain in 1776. The controversy preceding the war *(see* AMERICAN REVOLUTION) gradually shifted from one primarily upon economic policy to one upon issues of pure politics and sovereignty, and the acts of Congress, as viewed to-day, seem to have been carrying it, from the beginning, inevitably into revolution; but there was apparently no general and conscious drift toward independence until near the close of 1775. The first colony to give official countenance to separation as a solution of colonial grievances was North Carolina, which, on April 12, 1776, authorized its delegates in Congress to join with others in a declaration to that end. The first Colony to instruct its delegates to take the actual initiative was Virginia, in accordance with whose instructions—voted on May 15—Richard Henry Lee, on June 7, moved a resolution "that these United Colonies are, and of right ought to be, free and independent States." John Adams of Massachusetts seconded the motion. The conservatives could only plead the unpreparedness of public opinion, and the radicals conceded delay on condition that a committee be meanwhile at work on a declaration "to the effect of the said . . . resolution," to serve as a preamble thereto when adopted. This committee consisted of Thomas Jefferson, John Adams, Benjamin Franklin, Roger Sherman and Robert R. Livingston. To Jefferson the committee entrusted the actual preparation of the paper. On July 2, by a vote of 12 States—10 voting unanimously, New York not voting, and Pennsylvania and Delaware casting divided ballots (3 votes in the negative)—Congress adopted the resolution of independence; and on the 4th, Jefferson's "Declaration." The 4th has always been the day celebrated, the decisive act of the 2nd being quite forgotten in the memory of the day on which that act was published to the world. "Independence Day" is a holiday in all the States and Territories of the United States. It should also be noted that as Congress had already, on Dec. 6, 1775, formally disavowed allegiance to parliament, the Declaration recites its array of grievances against the crown, and breaks allegiance to the crown. Moreover, on May 10, 1776, Congress had recommended to the people of the Colonies that they form such new governments as their representatives should deem desirable; and in the accompanying statement of causes, formulated on May 15, had declared it to be "absolutely irreconcilable to reason and good conscience for the people of these colonies now to take the oaths and affirmations necessary for the support of any government under the crown of Great Britain," whose authority ought to be "totally suppressed" and taken over by the people—a determination which, as John Adams said, inevitably involved a struggle for absolute independence, involving as it did the extinguishment of all authority, whether of crown, parliament or nation.

Though the Declaration reads as "In Congress, July 4, 1776. The unanimous Declaration of the thirteen united States of America," New York's adhesion was in fact not voted until the 9th, nor announced to Congress until the 15th—the Declaration being unanimous, however, when it was ordered, on the 19th, to be engrossed and signed under the above title. As read before the army meanwhile, it was headed "In Congress, July 4, 1776. A Declaration by the representatives of the United States of America in General Congress assembled." Contrary to the inference naturally to be drawn from the form of the document no signatures were attached on the 4th. As adopted by Congress, the Declaration differs only in details from the draft prepared by Jefferson; censures of the British *people* and a noble denunciation of slavery were omitted, appeals to Providence were inserted, and verbal improvements made for the sake of terseness and measured statement. The document is full of Jefferson's fervent spirit and personality, and its ideals were those to which his life was consecrated. It is the best known and the noblest of American State papers. Though open to controversy on some issues of historical fact, not flawless in logic, necessarily partisan in tone and purpose, it is a justificatory preamble, a party manifesto and appeal, reasoned enough to carry conviction, fervent enough to inspire enthusiasm. It mingles—as in all the controversy of the time, but with a literary skill and political address elsewhere unrivalled—stale disputation with philosophy. The rights of man lend dignity to the rights of Englishmen, and the broad outlook of a world-wide appeal, and the elevation of noble principles, relieve minute criticisms of an administrative system.

Jefferson's political theory was that of Locke, whose words the Declaration echoes. Both Locke and Jefferson wrote simply of political equality, political freedom. Even within this limitation, the idealistic formulae of both were at variance with the actual conditions of their time. The variance would have been greater had their phrases been applied as humanitarian formulae to industrial and social conditions. The Lockian theory fitted beautifully the question of colonial dependence, and was applied to that by America with inexorable logic; it fitted the question of individual political rights, and was applied to them in 1776, but not in 1690; it did not apply to non-political conditions of individual liberty, a fact realized by many at the time—and it is true that such an application would have been more inconsistent in America in 1776 as regards the negroes, than in England in 1690 as regarded freemen. The Declaration's influence upon American legal and constitutional development has been profound. Locke, says Leslie Stephen, popularized "a convenient formula for enforcing the responsibility of governors"—but his theories were those of an individual philosopher—while by the Declaration a State, for the first time in history, founded its life on democratic idealism, pronouncing governments to exist for securing the happiness of the people, and to derive their just powers from the consent of the governed. It was a democratic instrument, and the revolution a democratic movement; in South Carolina and the Middle Colonies particularly, the cause of independence was bound up with popular movements against aristocratic elements. Congress was fond of appealing to "the purest maxims of representation"; it sedulously measured public opinion; took no great step without an explanatory address to the country; cast its influence with the people in local struggles as far as it could; appealed to them directly over the heads of conservative assemblies; and in general stirred up democracy. The Declaration gave the people recognition equivalent to promises, which, as fast as new governments were instituted, were converted by written constitutions into

rights, which have since then steadily extended.

For 101 years after the Declaration was proclaimed it had no permanent home. During its wanderings, it found shelter in 10 cities and 5 states, twice narrowly escaped destruction by fire, and in both the Revolutionary War and the War of 1812 was nearly captured by the British. In 1894, when the text of the manuscript had been dimmed by more than 50 years' exposure to light and its signatures damaged by too frequent rolling of the parchment, the document was placed in a safe in the State Department library. Finally, in 1921, it was removed to the Library of Congress, where it is on permanent exhibition in a shrine specially constructed for its preservation and safekeeping.

The signers were: John Hancock (1737–92), of Massachusetts, president; Button Gwinnett (c. 1732–77), Lyman Hall (1725–90), George Walton (1740–1804), of Georgia; William Hooper (1742–90), Joseph Hewes (173—79), John Penn (1741–88), of North Carolina; Edward Rutledge (1749–1800), Thomas Heyward, Jr. (1746–1809), Thomas Lynch, Jr. (1749–79), Arthur Middleton (1742–87), of South Carolina; Samuel Chase (1741–1811), William Paca (1740–99), Thomas Stone (1743–87), Charles Carroll (1737–1832) of Carrollton, Md.; George Wythe (1726–1806), Richard Henry Lee (1732–94), Thomas Jefferson (1743–1826), Benjamin Harrison (1740–91), Thomas Nelson, Jr. (1738–89), Francis Lightfoot Lee (1734–97), Carter Braxton (1736–97), of Virginia; Robert Morris (1734–1806), Benjamin Rush (1745–1813), Benjamin Franklin (1706–go), John Morton (1724–77), George Clymer (1739–1813), James Smith (c. 1719–1806), George Taylor (1716–81), James Wilson (1742–98), George Ross (173—79), of Pennsylvania; Caesar Rodney (1728–84), George Read (1733–98), Thomas McKean (1734–1817), of Delaware; William Floyd (1734–1821), Philip Livingston (1716–78), Francis Lewis (1713–1803), Lewis Morris (1726–98), of New York; Richard Stockton (1730–81), John Witherspoon (1722–94), Francis Hopkinson (1737–91), John Hart (1708–So), Abraham Clark (1726–94), of New Jersey; Josiah Bartlett (1729–95), William Whipple (1730–85), Matthew Thornton (1714–1803), of New Hampshire; Samuel Adams (1722–1803), John Adams (1735–1826), Robert Treat Paine (1731–1814), Elbridge Gerry (1744–1814), of Massachusetts; Stephen Hopkins (1707–8j), William Ellery (1727–1820), of Rhode Island; Roger Sherman (1721–93), Samuel Huntington (1732–96), William Williams (1731–1811), Oliver Wolcott (1726–97), of Connecticut. Not all the men who rendered the greatest services to independence were in Congress in July 1776; not all who voted for the Declaration ever signed it; not all who signed it were members when it was adopted. The greater part of the signatures were certainly attached on Aug. 2; but at least six were attached later. With one exception—that of Thomas McKean, present on July 4, but not on Aug. 2, and permitted to sign in 1781—all were added before printed copies with names attached were first authorized by Congress for public circulation in Jan. 1777.

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(F. S. P.)

DECLARATION OF LONDON: see BLOCKADE, CONTRABAND, PRIZE, NEUTRALITY, VISIT and SEARCH.

DECLARATION OF PARIS (1856) owes its origin to the diametrically opposing views of Great Britain and France on the carriage of property at sea at the time of the Crimean War. In 1854 France allowed enemy goods in neutral vessels to go free, but confiscated neutral goods in enemy vessels, whilst Great Britain confiscated enemy goods in neutral vessels, but respected neutral goods in enemy vessels. The situation was an impossible one for neutrals. Accordingly each Power abandoned part of its doctrines and acceded to part of its ally's doctrines. This compromise finds expression in Articles 2 and 3 of the Declaration, which stated four principles of international law:—

1. Privateering is and remains abolished; 2. The neutral flag covers enemy's goods, with the exception of contraband of war; 3. Neutral goods, with the exception of contraband of war, are not liable to capture under the enemy's flag; 4. Blockades in order to be binding must be effective, that is to say, maintained by a force sufficient really to prevent access to the coast of the enemy. (See Hertslet, Treaties, x. p. 547.)

The Declaration was signed by Austria, France, Great Britain, Prussia, Russia, Sardinia and Turkey, and acceded to by all the Powers except Bolivia, Spain, United States, Uruguay and Venezuela. Spain acceded in 1908. The United States withheld formal adherence on the ground that, not possessing a large navy, she was obliged to rely upon privateers, and she would not agree to their abolition unless the principle of the immunity of private property at sea were generally accepted. At the commencement, however, of the Civil War and again in the Spanish American War, 1898, she declared her adherence to the Declaration for the duration of hostilities only. Spain in the latter war, whilst repudiating any obligation to the Declaration, announced that she would take a similar course.

During the World War it was declared in the British Prize Court that the court would regard the Declaration not only in the light of rules binding in the conduct of war, but as a recognized and acknowledged part of the law of nations; see *The* Marie Glaeser, 1 B. and C. P. C. 38 (414). But with the disappearance of the "Free List"; by the extension of the term "contraband" to all commodities of use, directly or indirectly, to the enemy in the operations of war; by the presumption of hostile destination; by the application of the doctrine of continuous voyage, Article 2 became almost wholly nullified. Article 3 was also rendered almost wholly nugatory by the German submarine method of indiscriminate destruction. Whilst the neutral owner of goods on board an enemy vessel was entitled to their restitution or value when brought in for adjudication, he took the risk of all necessary acts of war. It was held by the French and German Prize Courts that in the case of lawful destruction of an enemy merchant vessel compensation for loss of neutral goods on board could not be claimed. Sinking at sight, without visit and search, was, however, illegal, and it has now been prohibited by the Treaty of Washington, 1922, Parl. Pap. 1922 [Cmd. 1627], ratified by the United States, the British Empire, Italy and Japan. Article 4 was reproduced in the Declaration of London and it was objected that the so-called blockade of the German coast on the Baltic was not effective, since neutral Baltic States still had access to German Baltic ports. The answer is that the British measures were taken under the law of contraband and not under those of blockade. (H. H. L. B.)

DECLARATOR, in Scots law, a form of action by which some right of property, or of servitude, or of status, or some inferior right or interest, is sought to be judicially declared.

DE CLIFFORD, BARON: see CLIFFORD.

DECLINATION, in magnetism is the angle between true north and magnetic north, *i.e.*, the variation between the true (geographic) meridian and the magnetic meridian. It is derived from Lat. declinare, to decline. In 1596 at London the angle of declination was 11° E. of N., in 1652 magnetic north was true north, in 1815 the magnetic needle pointed 24½° W. of N., in 1891 18° W., in 1896 17° 56′ W. and in 1906 17° 45′. The angle is gradually diminishing and the declination will in time again be 0°, when it will slowly increase in an easterly direction, the north magnetic pole oscillating slowly around the North Pole. Regular daily changes of declination also occur. Magnetic storms cause irregular variations sometimes of one or two degrees. (See

TERRESTRIAL MAGNETISM.)

In astronomy the declination is the angular distance, as seen from the earth, of a heavenly body from the celestial equator, thus corresponding with terrestrial latitude. (See ASTRONOMY.)

DECOLORIZING, in practical chemistry and chemical technology, the removal of coloured impurities from a substance. Charcoal, preferably prepared from blood, is frequently used; when shaken with a coloured solution it often retains the coloured substances, leaving the solution clear. Thus the red colour of wines may be removed by filtering the wine through charcoal; the removal of the dark-coloured impurities of crude sugar may be similarly effected. Other "decolorisers" acting through purely chemical reactions are sulphurous acid, permanganates and manganates, all of which have received application in the sugar industry. (See CHARCOAL and ADSORPTION.)

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DECORAH, a city of north-eastern Iowa, U.S.A., on the Upper Iowa river; the county seat of Winneshiek county. It is on federal highway 52, and is served by the Chicago, Milwaukee, St. Paul and Pacific and the Rock Island railways. The population in 1940 federal census was 5,303. It is the seat of Luther college (1861). Decorah is supported by farming, and the main product is corn which is fed to hogs, and the hogs in turn are marketed. No corn is sold. A famous ice cave is near by. Decorah was founded about 1849; incorporated as a city in 1871.

DECORATED PERIOD, in architecture, the name of the second of the three periods into which the English Gothic was usually divided, generally embracing the first three quarters of the 14th century. It may itself be divided into two, the earlier half being known as the Geometric period, and the later as the Curvilinear, although no definite date separates these two parts. The Geometric Decorated style is characterized by window tracery based on the arch, the circle and the quatrefoil and trefoil, frequently much cusped. (See CUSP.) Windows of great width and height were thus treated, with two, four, six or even eight lights, or main subdivisions. In the later, or curvilinear style, the ogee curve, or curve of double curvature, controls tracery design. Two main types thus developed; one, in which the tracery bars form a net, the other in which flame-like, or flowing forms predominate (*See* TRACERY.) In the entire decorated period moulding profiles are heavy and complex; carved ornament is intricate and of great naturalism. The most famous examples are the east end of Lincoln cathedral and the crossing and western part of the choir of Ely. During the decorated period, church vaulting became much complicated and subdivided by the addition, first of tiercerons, which are additional vaulting ribs springing from the capital, and rising to the ridge; toward the end of the period there also appeared liernes, which are smaller ribs of little structural value, connecting the more important ribs, and so forming star or network patterns. (T. F. H.)

DECORATION DAY, a holiday, known also as Memorial Day, observed in the northern States of the United States on May 30, originally in honour of soldiers killed in the American Civil War, but subsequently also in honour of those who fell in later wars. Before the close of the Civil War May 30 was thus celebrated in several of the Southern States; in the North there was no fixed celebration until 1868, when (on May 5) Commander-in-Chief John A. Logan, of the Grand Army of the Republic, issued a general order designating May 30, 1868, "for the purpose of strewing with flowers or otherwise decorating the graves of comrades who died in defense of their country during the late rebellion"; Logan did this "with the hope that it will be kept up from year to year." In 1882 the Grand Army urged that the "proper designation of May 30 is Memorial Day"—not Decoration Day. Rhode Island made it a legal holiday in 1874, Vermont in 1876 and New Hampshire in 1877; and by 1910 it was a legal holiday in all the States and Territories save Alabama, Alaska, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Texas In Virginia May 30 is observed as a Confederate Memorial Day. June 3 (the birthday of Jefferson Davis) is observed as Confederate hfemorial Day in Louisiana and Tennessee; April 26, in Alabama, Florida, Georgia and Mississippi; and May 10, in North Carolina and South Carolina.

DECORATIVE ART, that art which is concerned with the decoration of objects which in themselves are not necessarily beautiful, hence practically the same meaning as applied art or the arts and crafts. Decorative art may concern itself with the treatment of architectural units, furniture, textiles or any other object which the human being feels should not only be useful but beautiful. If the object has no use other than that of its aesthetic appeal the art is no longer decorative but falls into what is known as fine art.

Good decorative art is appropriate in its adaptation and seems to be a part of the object upon which it is executed, as though it had sprung from within, rather than as though it had been applied on the surface. In days past the craftsman who made an object decorated it so that this principle was more closely adhered to, but the modern method sometimes leads to the execution of a decoration which has little or nothing to do with the structure, material or feeling of the object. (See PAINTING; DRAWING; SCULPTURE; ARTS AND CRAFTS, etc.) (W. E. Cx.)

DE CORT, FRANS (1834–1878), Flemish poet, was born on June 21, 1834, at Antwerp, and died on Jan. 18, 1878, at Elsene. He edited the *Schelde* from 1858, and from 1861 to his death was secretary to the general auditor of the Brussels military court. His Leideren (2 vols., 1857), his *Zingzang* (1866) and his *Leideren* of 1868 show great tenderness and feeling. His translation of poems from Burns appeared in 1862. He also made many fine translations from Jasmin, the Provençal poet, and from the German.

DECOY, a contrivance for the capture or enticing of duck and other wild fowl within range of a gun, hence any trap or enticement into a place or situation of danger. Decoys are usually made on the following plan: long tunnels leading from the sea, channel or estuary into a pool or pond are covered with an arched net, which gradually narrows in width; the ducks are enticed into this by a tame trained bird, also known as a "decoy" or "decoy-duck." In America the "decoy" is an artificial bird, placed in the water as if it were feeding, which attracts the wild fowl within range of the concealed sportsman. The word "decoy" has etymologically a complicated history. It appears in English first in the 17th century in these senses as "coy" and "coy-duck," from the Dutch *kooi,* a word which is ultimately connected with Latin *cavea,* hollow place, "cage."

BY COURTESY OF VON LENGERKE AND DETMOLD, INC.

ARTIFICIAL DUCK DECOYS USED TO LURE LIVE FOWL

DECREE, in earlier form Decreet, an authoritative decision having in some places the force of law; also the judgment of a court of justice. In Roman law, a decree (*decretum*) was the decision of the emperor, as the supreme judicial officer, settling a case which had been referred to him. In ecclesiastical law the term was given to a decision of an ecclesiastical council settling a doubtful point of doctrine or discipline (*cf.* also DECRETALS). In English law decree was more particularly the judgment of a court of equity, but since the Judicature acts the expression "judgment" (*q.v.*) is employed in reference to the decisions of all the divisions of the supreme court. A "decree *nisi,*" now "order nisi," is the conditional order for a dissolution of marriage made by the divorce court (*see* DIVORCE). *Decreet arbitral* is a Scottish phrase for the award of an arbitrator. In some foreign countries, *e.g.* in Spain, royal decrees may amount to legislation, while in some the subsequent ratification by the legislature is required. In the United States, a decree is the judgment given in courts of admiralty and equity. In addition to the decree *nisi,* courts of equity sometimes issue decrees of nullity, for annulment of marriages.

DECRESCENDO (It.), abbr. *decresc.,* lit. "decreasing," *i.e.,* as used in the familiar musical direction, diminishing in loudness. The sign ⟩ conveys the same meaning.

DECRETALS (*Epistolae* decrefoles), the name (see DECREE above), which is given in Canon Law to those letters of the pope which formulate decisions in ecclesiastical law; they are generally

given in answer to consultations, but are sometimes due to the initiative of the popes. These furnish, with the canons of the councils, the chief source of the legislation of the church, and form the greater part of the *Corpus Iuris*. In this connection they are dealt with in the article on Canon Law.

The False **Decretals.**—A special interest, however, attaches to the celebrated collection known as the False Decretals. This collection, indeed, comprises at least as many canons of councils as decretals, and the decretals contained in it are not all forgeries. It is an amplification and interpolation, by means of spurious decretals, of the canonical collection in use in the church in Spain in the 8th century, all the documents in which are perfectly authentic. With these amplifications, the collection dates from the middle of the 9th century.

The author assumes the name of Isidore, evidently the archbishop of Seville, who was credited with a preponderating part in the compilation of the *Hispana (see* CANON LAW); he takes in addition the surname of Mercator, perhaps because he has made use of two passages of Marius Mercator. Hence the custom of alluding to the author of the collection under the name of the "pseudo-Isidore."

The collection is divided into three parts. The first, which is entirely spurious, contains, after the preface and various introductory sections, 70 letters attributed to the popes of the first three centuries, up to the council of Nicaea, *i.e.,* up to but not including St. Silvester; all these are a fabrication of the pseudo-Isidore, except two spurious letters of Clement, which were already known. The second part is the collection of councils, classified according to their regions, as it figures in the *Hispana;* the few spurious pieces which are added, and notably the famous Donation of Constantine (*q.v.*), were already in existence. In the third part the author continues the series of decretals which he had interrupted at the council of Nicaea. But as the collection of authentic decretals does not begin till Siricius (385), the pseudo-Isidore first forges 30 letters, which he attributes to the popes from Silvester to Damasus; after this he includes the authentic decretals, with 35 apocryphal ones, generally given under the name of those popes not represented in the authentic collection, but sometimes also under the names of the others, for example, Damascus, St. Leo, Vigilius and St. Gregory; with one or two exceptions he does not interpolate genuine decretals. The series stops at St. Gregory the Great (d. 604), except for one letter of Gregory II. (715–731). The forged letters are not, for the most part, entirely composed of fresh material; the author draws his inspiration from the notices on each of the popes given in the *Liber Pontificalis;* he inserts whole passages from ecclesiastical writers; and he antedates the evidences of a discipline which actually existed; so it is by no means all invented.

Thus the authentic elements were calculated to serve as a passport for the forgeries, which were, moreover, skilfully composed; and the collection thus blended was passed from hand to hand without meeting with any opposition. At most all that was asked was whether those decretals which did not appear in the *Liber canonum* (the collection of Dionysius Exiguus, accepted in France) had the force of law, but Pope Nicholas having answered that all the pontifical letters had the same authority, they were henceforward accepted, and passed in turn into the later canonical collections. No doubts found expression until the 11th century, when Cardinal Nicholas of Cusa (d. 1464) and Juan Torquemada (d. 1468) freely expressed their suspicions. More than one scholar of the 16th century, George Cassander, Erasmus, and the two editors of the *Decretum* of Gratian, Dumoulin (d. 1568) and Le Conte (d. 1577), decisively rejected the False Decretals. This contention was again upheld, in the form of a violent polemic against the papacy, by the Centuriators of Magdeburg *(Ecclesiastics historia,* Basle, 1559–74); the attempt at refutation by the Jesuit Torres *(Adversus Centur. Magdeburg. libri quinque,* Florence, 1572) provoked a violent rejoinder from the Protestant minister David Blondel *(Pseudo-Isidorus et Turrianus rapulantes,* Geneva, 1620). Since then, the conclusion has been accepted, and all researches have been of an almost exclusively historical character.

Date.—The author shows himself acquainted with the False Capitularies, three books of capitularies of the Frankish kings (mostly spurious) purporting to have been written by a certain Benedict, a deacon of Mainz. These are for civil legislation what the False Decretals are for ecclesiastical, and their date, 847, gives the earliest possible date for the latter; on the other hand, in a letter of Lupus, abbot of Ferrières, written in 858, and in the synodical letter of the council of Quierzy in 857 are to be found quotations which are certainly from these false decretals; and further, an undoubted allusion occurs in the statutes of Hincmar to his diocese on Nov. 1, 852. The composition of the collection may then be dated approximately at 850.

Aim of the Forger.— This is clearly stated in his preface; the reform of the canon law, or rather its better application. But in what particular respects he wishes it to be reformed can be best deduced from certain preponderant ideas which make themselves felt in the apocryphal documents. He constantly harps upon accusations brought against bishops and the way they were judged; his wish is to prevent them from being unjustly accused, deposed or deprived of their sees; to this end he multiplies the safeguards of procedure, and secures the right of appeal to the pope and the possibility of restoring bishops to their sees. His object, too, was to protect the property, as well as the persons, of the clergy against the encroachments of the temporal power. In the second place, Isidore wishes to increase the strength and cohesion of the churches; he tries to give absolute stability to the diocese and the ecclesiastical province; he reinforces the rights of the bishop and his comprovincials; while he initiates a determined campaign against the *chorepiscopi;* finally, as the keystone of the arch he places the papacy. These aims are most laudable and in no way subversive.

Canonical Influence.—It is certain that in 864 Rothad of Soissons took with him to Rome, if not the collection, at least important extracts from the pseudo-Isidore; M. Fournier has pointed out in the letters of the pope of that time, "a literary influence, which is shown in the choice of expressions and metaphors," notably in those passages relating to the *restitutio spolii;* but he concludes by affirming that the ideas and acts of Nicholas I. were not modified by the new collection: even before 864 he acted in affairs concerning bishops, *e.g.,* in the case of the Breton bishops or the adversaries of Photius, patriarch of Constantinople, exactly as he acted later; all that can be said is that the False Decretals, though not expressly cited by the pope, "led him to accentuate still further the arguments which he drew from the decrees of his predecessors," notably with regard to the *exceptio spolii.* In the papal letters of the end of the 9th and the whole of the 10th century, only two or three insignificant citations of the pseudo-Isidore have been pointed out; the use of the pseudo-Isidorian forged documents did not become prevalent at Rome till about the middle of the 11th century, in consequence of the circulation of the canonical collections in which they figured; but nobody then thought of casting any doubts on their authenticity. One thing only is established, and this may be said to have been the real effect of the False Decretals, namely, they gave a powerful impulse in the Frankish territories to the movement towards centralization round the see of Rome, and opposed legal obstacles to unjust proceedings against the bishops.

BIBLIOGRAPHY.—The best edition is that of P. Hinschius, *Decretales pseudo-Isidorianae et capitula Angilramni* (Leipzig, **1863**). In it the authentic texts are printed in two columns, the forgeries across the whole width of the page; an important preface of ccxxviii. pages contains, besides the classification of the mss., a profound study of the sources and other questions bearing on the collection. The nationality and place of composition has been the subject of much discussion. The view that they originated at Rome has long been abandoned. Hinschius and others argue that they were composed in the province of Reims: *see* for instance Hinschius, Preface, p. ccviii.; Tardif, *Histoire des sources du droit canonique* **(1887)**; Schneider, *Die Lehre der Kirchenrechtsquellen (1892).* The latter afterwards inclined to place them in the Province of Tours and at Le Mans, a conclusion defended by Simson, *Die Entstehung der pseudoisidorianischen Fälschungen* **(1886)** and by Fournier, "La Question des fausses décrétales" in the *Nouvelle Revue historique de droit français et étranger* **(1887,** 1888), and in the *Revue d'histoire ecclésiastique de Louvain V.* (1906, 1907).

DECURIO, a Roman official title, used in three connections. (1) A member of the senatorial order in the Italian towns, and in provincial towns organized on the Italian model. The number of *decuriones* was usually 100. The qualifications for the office were fixed in each town by a special law (*lex municipalis*). Cicero alludes to an age limit, to a property qualification, and to certain conditions of rank. The method of appointment varied. Cicero speaks of the senate in the Sicilian towns as appointed by a vote of the township. But in most towns the chief magistrate drew up a list (album) of the senators every five years. The decuriones held office for life. They were convened by the magistrate, who presided as in the Roman Senate. Their powers were extensive. In all matters the magistrates were obliged to act according to their direction, and in some towns they heard cases of appeal against judicial sentences passed by the magistrate. By the time of Julius Caesar (45 B.C) special privileges were conferred on the decuriones, including the right to appeal to Rome for trial in criminal cases. Under the principate their status underwent a marked decline. The office was no longer coveted, and means were devised to compel members of the towns to undertake it. By the time of the jurists it had become hereditary and compulsory. This change was largely due to the heavy financial burdens which the Roman Government laid on the municipal senates.

(2) The president of a *decuria,* a subdivision of the curia, (*q.v.*).

(3) An officer in the Roman cavalry, commanding a troop of ten men (*decuria*).

BIBLIOGRAPHY.—W. Liebenam, Stadteverwaltung im romischen *Kaiserreiche* (1900); Pauly-Wissowa, *Realencyklopädie* (1901); **A. H.** J. Greenidge, Roman Public Life (1901); J. **E.** Sandys, Companion to Latin Studies (1921), with useful bibliography; W. E. Heitland, The Roman Republic (1923).

DEDEAGATCH, officially known as Alexandroupolis, a seaport of Western Thrace in the Hebros province, 10 m. N.W. of the Maritsa estuary, on the Gulf of Enos, an inlet of the Aegean sea. Pop. about 12,000, Greeks and Armenians. A monastic community of Dervishes, of the Dédé sect, which was established here in the 15th century, shortly after the Turkish conquest, gave to the place its name. Until 1871 Dédéagatch was a mere cluster of fishermen's huts. Then settlers attracted by the possibilities of trade in the products of the valonia oak forest nearby gathered here. In 1884 it was made a sanjak. In 1889 the Greek archbishopric of Enos was transferred to Dédéagatch. On the opening, in 1896, of the Constantinople-Salonica railway, a large proportion of the transit trade which Enos, situated at the mouth of the Maritza, had acquired, was diverted to Dédéagatch, and an era of unprecedented prosperity began; but when the railway connecting Burgas on the Black sea with the interior was opened, in 1898, Dédéagatch lost all it had won from Enos. Owing to the lack of shelter in its open roadstead, the port has not become the great commercial centre which its position otherwise qualifies it to be. It is, however, one of the chief outlets for the grain trade of the Adrianople, Demotica and Xanthi districts. In the Balkan War of 1913 the town was occupied for a time by Greeks but later handed to Bulgaria. In 1915 when Bulgaria annexed the coastal plains from the Maritsa to the Struma, Dédéagatch became permanently Bulgarian until 1918. After the collapse of Bulgarian opposition in 1918 the town was used for the concentration of British troops against the Turkish frontier. When the Peace Treaty drew the Bulgarian frontier along the mountains north of the coastal plains Dédéagatch fell to Greece. After the treaty of Lausanne the Greek frontier was withdrawn to the Maritsa river. Dédéagatch became a frontier town and Enos fell to Turkey. In 1941 Dédéagatch was occupied by Bulgaria.

See Admiralty Handbook of Macedonia, pp. **463-464 (1920)**; *Survey* of International *Affairs,* 1920–23, pp. 338–340 (1925).

DEDEKIND, JULIUS WILHELM RICHARD (1831–1916), German mathematician, was born at Brunswick on Oct. 6, 1831. He studied at Gottingen, where he obtained his doctorate in 1852. After holding various minor posts he became professor of mathematics at the Technische Hochschule at Brunswick in 1894. He died at Brunswick on Feb. 12, 1916. Dedekind's most important work, *Stetigkeit und irrationale Zahlen* (1872), deals with the theory of ideal numbers. He wrote a preface to the collected works of Riemann (1876), and edited Dirichlet's researches on the theory of numbers. The later editions of this work have an appendix containing Dedekind's own work on ideal primes. He was also the author of a memoir on the vibrations of a liquid ellipsoid.

DEDHAM, a town of Massachusetts, U.S.A., on the Charles river, 10mi. S.W. of Boston; the county seat of Norfolk county. It is served by the New York, New Haven and Hartford railroad. The population was 10,792 in 1920 (26% foreign-born white) and 15,508 in 1940. The principal manufactures are envelopes, paper drinking cups and pottery (a variety of true crackleware). Dedham was one of the first two inland settlements of the colony, "planted" in 1635 and incorporated in 1636. A free public school, supported by direct taxation, was established in 1645.

DEDICATION, the setting apart of anything for a special object; especially the consecration of altars, temples and churches; also the inscription prefixed to a book, etc., and addressed to some particular person, formerly designed to gain the patronage of the person addressed. In law, the setting apart by a private owner of a road to public use. (See HIGHWAY.)

The Jewish Feast of Dedication was observed for eight days from the 25th of Kislev (*i.e.,* about Dec. 12), to commemorate the purging (164 B.C.) of the temple after its desecration by Antiochus Epiphanes: See 1 Macc. i. 20–64, iv. 36–59; 2 Macc. i. 9, 18, ii. 16, v. 15–16, vi. 1–11; John x. 22; also Josephus, Antiq., vii. 6–7, xii. v. 4 (where it is called the Feast of Lights).

Dedication of Churches.—The custom of solemnly dedicating buildings set apart for Christian worship must be almost as old as Christianity itself. Before the reign of* Constantine Christian churches were few, and any public dedication of them would have been dangerous in those days of persecution. But from the early 4th century allusions to and descriptions of the consecration of churches become plentiful.

Like so much else in the worship and ritual of the Christian Church, this service is probably of Jewish origin. The hallowing of the tabernacle and its ornaments (Exod. xl), the dedication of the temples of Solomon and Zerubbabel (1 Ki. viii., Ezra vi.), the rededication of the latter by Judas Maccabaeus (see above), the dedication of Herod's temple (Josephus, Antiq. xv. xi 6), and our Lord's recognition of the Feast of Dedication (John x. 22, 23)—all support this hypothesis.

Eusebius (*Hist.* Eccles., x. 3–4) speaks of the dedication of churches rebuilt after the Diocletian persecution, including that of the church at Tyre in A.D. 314–315. The consecrations of the church of the Holy Sepulchre, built by Constantine at Jerusalem (A.D. 335), and of other churches after his time are described by Eusebius and other ecclesiastical historians. From them we gather that every consecration was accompanied by a celebration of the Holy Eucharist, a sermon, and special dedicatory prayers St. Ambrose and other writers mention also the deposition of relics, and a vigil overnight, and there are occasional references to the tracing of the Greek and Latin alphabets on the pavement of the church.

The separate consecration of altars, by sacerdotal blessing and unction with chrism, is prescribed in canons of the councils of Agde (506) and Epaone (517). St. Columbanus (d. 615) is said to have also used holy water (Walafrid Strabo, Vita S. *Galli,* cap. 6). At an early date the right to consecrate churches was reserved to bishops, as by the council of Braga in 563 and in the 8th century Irish collection of canons known as "Synodus Patritii." Accordingly, it is in the pontifical that we find the fully developed consecration service. This occurs in a form closely resembling that now used in ms. pontificals of the 10th century, one of which, believed to be a copy of that of Egbert, archbishop of York (732–766), was printed in 1853 by the Surtees Society. Some idea of the general character of the service may be obtained from the following outline of it as performed in England before the Reformation, according to the use of Sarum (printed by W. Maskell, *Monumenta ritualia ecclesiae Anglicanae,* 2nd ed., vol i. pp. 195–239, from an early 15th century pontifical).

There is a preliminary office for laying a foundation-stone (Maskell, pp. 191–94). On the day of consecration the bishop vests in a tent outside the church, proceeds thence to the church door, a single deacon being inside the church, and there blesses holy water, twelve lighted candles being placed outside and twelve inside the church. He sprinkles the walls all round outside, and knocks at the door; these two actions are repeated twice and after the third knocking he enters the church with his attendant clerics, all laity being excluded. He then fixes a cross in the centre of the church and the litany is said, including a special petition for the consecration of church and altar. He next inscribes the Greek and Latin alphabets, in form of a St. Andrew's cross, on the pavement cindered for the purpose; blesses water, mingled with salt, ashes and wine, and sprinkles thrice the walls inside the church, then the centre of the church longwise and crosswise on the pavement, and then goes round the outside of the church sprinkling it thrice. Returning to the centre of the church he sprinkles holy water to the four points of the compass and toward the roof. Next he anoints with chrism the twelve internal and twelve external wall-crosses, afterwards perambulating the church thrice inside and outside, censing it.

Consecration of Altar. — Then follows the consecration of the altar. Holy water is mixed with chrism, and with the mixture the bishop makes seven crosses on the altar. The altar is sprinkled seven times or thrice with water not mixed with chrism, and the altar-table is washed, censed and wiped. A cross is made with oil of catechumens in the centre of the altar; the altar-stone is anointed with chrism; and the whole altar is rubbed with oil of catechumens and with chrism. Incense is blessed and the altar censed, five grains of incense being placed crosswise in the centre and corners, and on the grains five slender candle-crosses, which are lit. Afterwards the altar is scraped and cleansed; the altar-cloths and ornaments are sprinkled with holy water and placed on the altar, which is then censed. The service ends with the celebration of mass. The various collects, psalms, anthems, benedictions, etc., have been omitted for the sake of brevity.

The Sarum rite described above is substantially identical with that of Rome; but the latter contains in addition one important feature, viz., the translation of relics, found also in the Gallican and other uses. After the sprinkling of the church, the bishop prepares cement at the altar. He then goes to the place (outside the church) where the relics have been placed overnight and carries them in solemn procession to the church door, where he addresses the people and the founder, and two decrees of the council of Trent are read, together with the deed of foundation. Then the bishop, anointing the door with chrism, enters the church with the relics and deposits them in the cavity on the altar, censes and covers them, and anoints the cover. The altar is then censed and wiped, as in the Sarum order.

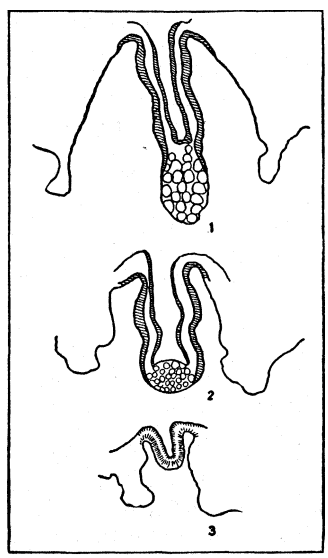
This use of relics goes back to the time of St. Ambrose (see above), but was not universal. The council of Cealchythe (Chelsea) in 816 ordered that part of the consecrated Host should be enclosed if relics were not obtainable. The tracing of the Greek and Latin alphabets on the church floor can be traced back certainly to the beginning of the 10th century, and is doubtless earlier. Its origin and precise meaning are unknown, but various explanations have been suggested by Rossi and others. The annual commemoration of the dedication of a church is probably as old a custom as that of dedication itself. In the Roman Catholic Church it is observed as a double feast of the first class, with octave.

The dedication service of the Eastern Church is long and elaborate (see J. M. Neale, *Hist.* of the Holy Eastern Church, part ii., 1850, pp. 1042–45). Relics are prepared and guarded overnight in a neighbouring sacred church. On the day, the bishop goes to the latter, vests and returns in procession with the relics to the new church, and goes round it. When he comes to the door the relics are laid on a table called the tetrapodion and the epistle and gospel are read. A second and third procession follow, after which the bishop is admitted into the church, the relics are placed in the reliquary and set on the altar, and the bishop is wrapped in a roll of linen over his vestments. He then washes the altar with warm water and with wine and makes crosses on it with chrism. The altar is vested and the service ends with the liturgy, which is repeated daily for seven days.

There is no authorized form for the dedication of a church in the reformed Church of England. A form was approved by the convocation of Canterbury in 1712, and an almost identical form was submitted in 1715, but neither form ever received royal sanction. Anglican bishops have, however, drawn up forms for use in their various dioceses. In the diocese of London, for instance, the bishop, attended by clergy and churchwardens, receives outside the west door a petition for consecration; the procession then moves round the whole church outside, while certain psalms are chanted. On again reaching the west door the bishop is admitted after knocking thrice and advances to the east end of the church. He there lays the keys on the table "which is to be hallowed." The Veni Creator is sung, followed by the litany with special suffrages. The bishop then blesses the font, chancel, lectern, pulpit, stalls and holy table. The deed of consecration is read and signed and Holy Communion is celebrated. The Church of Ireland and the episcopal Church of Scotland have no fully authorized form of dedication, but various forms have been issued on episcopal authority.

DEDIFFERENTIATION, a biological term meaning the reverse of differentiation, *i.e.*, for processes which lead to organisms or their parts reverting to greater simplicity; the term reduction has also been employed, but is unsatisfactory as it is in demand for chromosome-reduction. (See CYTOLOGY.) Dedifferentiation in its strict sense should not be applied to simple cases of degeneration, but in practice it is often impossible to draw the line.

Dedifferentiation in many Protozoa (*q.v.*) may be a regular and physiological phenomenon. When Protozoa with complicated structure, such as many Ciliates, reproduce by simple fission, many of the old structures dedifferentiate, the daughter-cells acquiring new organs of the same kind by new differentiation. In Bursaria, Lund has shown that, in addition, damage or unfavourable conditions will cause the whole animal to revert to a sphere without any trace of normal differentiation. Redifferentiation to the normal form may occur from this state or from any stage in the process. Similar total dedifferentiation occurs in the encystment of *Bursaria* and many other unicellular forms.

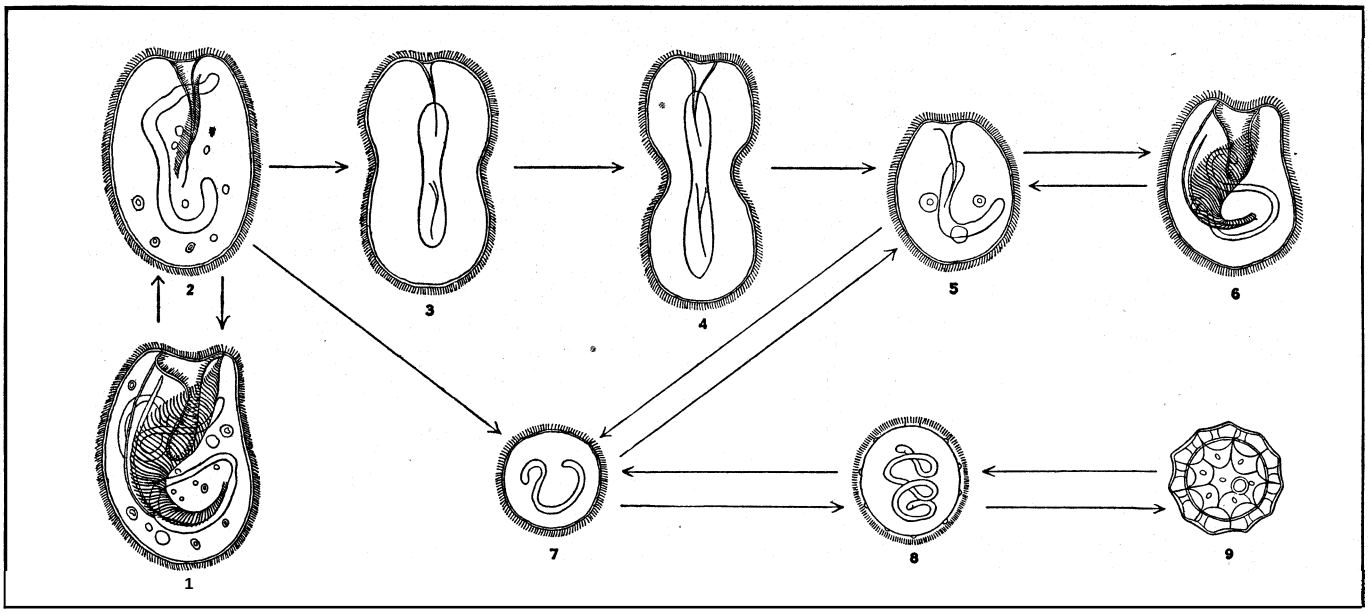


FROM DE BEER, 'AN INTRODUCTION TO EXPERIMENTAL EMBRYOLOGY (CLARENDON PRESS)

FIG. I. — STAGES IN THE DEDIFFERENTIATION OF THE TENTACULOCYST OF AURELIA. BY STARVATION (1) Normal tentaculocyst. (2) Slightly dedifferentiated. (3) Dedifferentiated to a small knob without the characteristic structure

Starvation is a frequent cause of dedifferentiation. The common Hydra, by this and other means, may be made to lose all its tentacles, and eventually revert to a mere spheroid with no mouth, and similar phenomena have been described in sea-anemones. The common jelly-fish *Aurelia*, kept without food, shrinks enormously in bulk, some parts, *e.g.*, the gelatinous bell, being much more reduced than others like the mouth-tentacles; specialized tissues lose their histological differentiation, *e.g.*, the genital organs and the special sense-organs, the tentaculocysts. In the worm *Ophryotrocha*, remarkable dedifferentiation occurs if it is damaged or mutilated.

In starvation, there will clearly be a "struggle of the parts," the less resistant breaking down and serving as food for the rest. Starvation itself is apparently favourable to dedifferentiation, but when this has once begun, the tissue can be more readily made to degenerate into mere food-materials. This differential resistance of tissues has sometimes been turned to physiological ac-

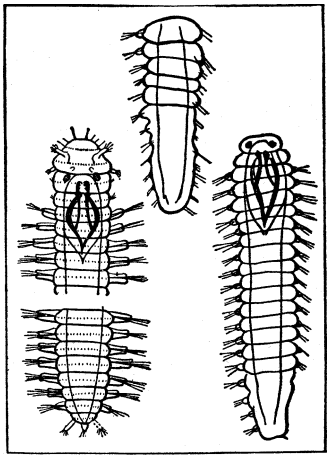


BY COURTESY OF WISTAR INSTITUTE OF ANATOMY AND BIOLOGY, FROM LUND. "REVERSIBILITY OF MORPHOGENETIC PROCESSES IN BURSARIA"

FIG. 2.— DIAGRAM ILLUSTRATING REVERSIBILITY OF DEVELOPMENTAL PROCESSES IN BURSARIA

(1) Normal animal. (2) to (4) Dedifferentiation preparatory to division. (5) and (6) A product of division, redifferentiating. (1) (2) and (7). Dedifferentiation to a sphere as reaction to unfavourable conditions. (8) and (9) Formation of resting-stage (cyst). The arrows indicate the direction in which the steps may be taken. Many steps are reversible

count in higher forms, *e.g.,* the salmon's sexual organs grow enormously while the fish is in fresh water, though it takes no or negligible food during this time. The necessary material is supplied by the dedifferentiation and later degeneration of the muscles. Similarly the wing-muscles of the queen ant are so constructed that when she breaks off her wings after the nuptial flight, they dedifferentiate, eventually becoming converted into food-material.



FROM KORSCHELT, "REGENERATION AND TRANSPLANTATION" (GUSTAV FISCHER)

FIG. 3.—DEDIFFERENTIATION OF OPHRYOTROCHA PUERILIS

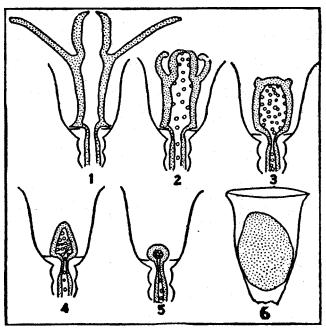
On left, anterior and posterior ends of body, normal. Right and centre, partial and almost complete dedifferentiation after injury

Dedifferentiation is often complicated by resorption. When the process has reached a certain stage, many kinds of cell migrate out of the tissues. In higher forms with massive tissues this is not possible, and resorption is usually effected by phagocytes devouring the dedifferentiating cells. This is so in the tail-resorption of metamorphosing tadpoles; the tissues begin to dedifferentiate, but are subsequently attacked by phagocytes.

In lower types, the fate of dedifferentiating organs is largely determined by the space available to the emigrating cells, *e.g.,* in colonial Hydroids, such as *Obelia,* when exposed to unfavourable conditions, the polyps start to dedifferentiate as does *Hydra;* but the large spaces of the less susceptible stalk are available for the cells migrating out of the tissues, and accordingly the polyps become entirely resorbed into the stem. The same is true in the social Ascidian *Perophora.* In both cases the amount of stalk or stolon left attached to an individual (zooid) determines the final result. If the amount of stalk is relatively large, total resorption occurs. If small, the result is a dedifferentiated zooid.

One particularly interesting point has been elicited by Child. By applying depressant agents such as weak alcohol to pieces of Hydroid stems *(Corymorpha)* he obtained dedifferentiation which led to complete obliteration of the original polarity. On being replaced in sea water, regeneration took place, but at right angles to the direction it would have taken if no dedifferentiation had occurred.

The Ascidians are the most highly organized animals in which total dedifferentiation is possible. This has been best worked out in *Clavelina.* Halved animals may, in the midst of normal regeneration, dedifferentiate to a small opaque spheroid, from which later a whole organism may arise. Intact whole animals, if small, may also dedifferentiate thus. Dedifferentiation may be induced by leaving in unchanged water, redifferentiation by change of water. Two successive dedifferentiations, each followed by redifferentiation, have been obtained in a single animal, though deprived of food throughout. The internal organs become greatly simplified, and different parts are affected at a very different rate; the cells revert to an embryonic type. Recovery is not possible from the most extreme stages, but at all earlier stages the process is reversible.



FROM HUXLEY AND DE BEER IN "THE QUARTERLY JOURNAL OF MICROSCOPICAL SCIENCE"

FIG. 4.—DEDIFFERENTIATION AND RESORPTION IN OBELIA

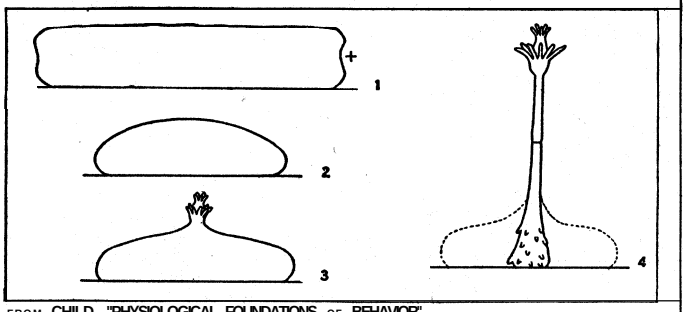
(1) to (5) When a section of stem is left attached to the polyp. (1) Normal polyp. (2) Dedifferentiation begins, and cells start migrating into the digestive cavity. (3) Mouth closed, tentacles resorbed to knob. (4) and (5) Total resorption of tentacles and shrinkage of the polyp. (6) No stem is left attached to the polyp. Dedifferentiation alone occurs

Schultz has attemptad to show that dedifferentiation is a true reversal of normal development; but later work shows that this view is untenable. The structural changes seen are mainly due to the cells reverting to the "embryonic" type, roughly cubical when in epithelia, spherical when isolated. This, however, is not due to any mysterious force compelling return to the embryonic type because it is embryonic, but because this type has the least amount of surface relative to volume; to maintain any other form demands a continual performance of work against the forces of surface-tension, which is beyond the powers of cells exposed to other unfavourable conditions. The picture is complicated by two other factors—first, the facility with which different kinds of cells migrate out of their tissues; secondly, the different resistance of cells, leading to the least resistant breaking down and becoming food-material for the others.

Behaviour which may perhaps be included under dedifferentiation is that of (*e.g.*) certain Planarian flatworms when starved.

These do not revert to a morphologically simpler state, but become smaller, living upon their own capital. As Child showed, these reduced specimens not only acquire the proportions of normal young animals, but are in most respects physiologically young; they have undergone rejuvenation (*q.v.*). Here the destruction of reserves and the altered surface-volume relations probably effect the change automatically.

Sea-urchin larvae dedifferentiate readily in unfavourable conditions, resorbing arms and skeleton, and eventually becoming mouthless lumps. This tendency has been taken advantage of in nature, and dedifferentiation of larval tissues, followed by their resorption into the adult rudiment, is the method of normal metamorphosis (*q.v.*).

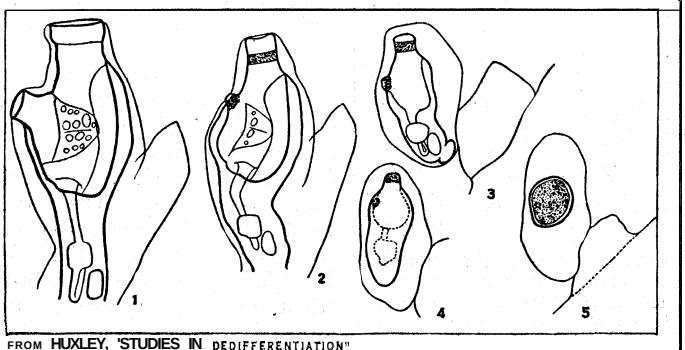


FROM CHILD, "PHYSIOLOGICAL FOUNDATIONS OF BEHAVIOR"

FIG. 5.—DEDIFFERENTIATION IN CORYMORPHA. FOLLOWED BY REDIFFERENTIATION. WITH NEW POLARITY

(1) A piece of cut stem; + is the end nearest to the polyp. (2) The same, after dedifferentiation in dilute alcohol in sea-water. (3) and (4) When replaced in pure sea-water, redifferentiation occurs, but the new stem axis is at right-angles to the old, the polyp being formed where oxygen is most abundant

A striking type of dedifferentiation is that of tumour tissue, malignant and otherwise. When a tumour is formed, the cells of the tissue from which it arises lose some of their differentiation. Roughly speaking, the greater the malignancy, the more complete the dedifferentiation. (*See* CANCER.) This type of dedifferentiation apparently differs importantly from that hitherto discussed, for tumour-cells are characterized by undue activity and multiplicative power, whereas in the other type activity is reduced, and multiplication, if present, stopped. Possibly the existence of histological differentiation is only possible at a not too high level of metabolic activity, and relatively such stable scaffoldings as connective tissue fibrils, muscle-fibres, nerve-fibrils, etc., are only constructed and maintained when the cell's activities are keyed at a certain pitch, and are broken down when they are higher; just as, to use a rough analogy, sandbanks are only laid down in a river when its rate of flow is suitable, and are destroyed if its speed increases. On the principle of the struggle of the parts, it would be expected further that if cell-metabolism were altered so as to encourage cell reproduction. less food-material would be available for maintaining structural differentiation or for activities such as secretion. However, these views, though interesting, are admittedly speculative. They do not in any case cover all the facts, since differentiation can he shown to be sometimes caused by presumably chemical stimuli from another kind of tissue, *e.g.,* when kidney-tubule tissue is cultivated alone in artificial media (*see* TISSUE-CULTURE) its cells dedifferentiate entirely; but when connective tissue is added, the tubule-cells differentiate to form regular tubules.



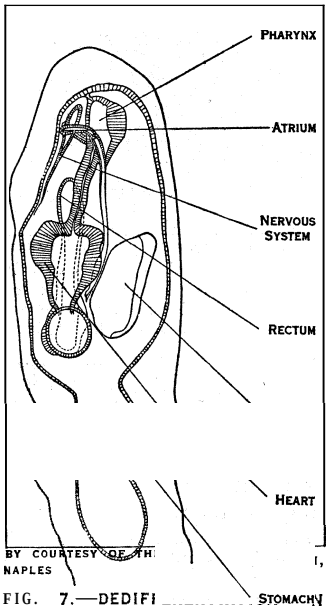
FROM HUXLEY, "STUDIES IN DEDIFFERENTIATION"

FIG. 6.— REDUCTION PHENOMENA IN THE ASCIDIAN CLAVELINA

(1) Upper part of normal specimen, showing heart (below to right), gullet, stomach, and rectum (below to left), with above, large pharynx opening by upper aperture of atrium (opening by aperture to left). The small circles are gill-slits leading from pharynx to atrium. (2) to (5) stages in dedifferentiation of the same specimen, to scale

In any event, it is a well-established fact that active cell-multiplication is incompatible with the maintenance of differentiation; we may accordingly correlate the dedifferentiation of cancer cells with this fact, and conclude that its origin is different from the dedifferentiation correlated with lowered activity.

Dedifferentiation associated with increased cell-multiplication is also seen in regeneration. In many cases, the first process observed at the cut surface after wound-healing is rapid multiplication of cells to form a so-called regeneration blastema, consisting of cells dedifferentiated as far as visible characteristics go. That they are also dedifferentiated in other respects is shown by the interesting results obtained in newts, where grafting of a young regeneration blastema, *e.g.,* of a limb, to some other region, *e.g.,* the newly-cut stump of the tail, will cause the blastema to complete the organ on to which it is grafted, instead of that by which it was first regenerated. (*See* REGENERATION; GRAFTING IN ANIMALS.) It will be seen that several diverse processes are at present lumped together under the head of dedifferentiation. Not only is the dedifferentiation correlated with increased multiplicative activity to be sharply distinguished from that correlated with depression of activity, but among depressant agencies starvation, at least in moderate degree, probably has a different, less pathological effect than exposure to chemically unfavourable conditions. Distinction should also be made between reversible dedifferentiation and that which is irreversible and therefore leads to degeneration (though reversible dedifferentiation, if long continued, often passes over into irreversible). In reversible cases, investigation is needed as to whether the dedifferentiated cells themselves redifferentiate (as in Protozoa, and undoubtedly in some Metazoan cases, *e* g , in early stages of *Clavelina's dedifferentiation*), or whether they degenerate, and redifferentiation occurs from undifferentiated "reserve" cells. Investigation is also needed with reference to "metaplasia"—the capacity for tissues to transform from one differentiated type into another. While this undoubtedly occurs, it is probably confined to the power of a tissue to pass from lower to higher grade of differentiation, as when non-cornified epidermis becomes converted into cornified under abnormal stimuli; and to redifferentiation in a new direction after passing through a dedifferentiated phase in which cell-multiplication has taken place, as in the above-cited example from regeneration. The study of tissue-culture may solve several of these problems.



BY COURTESY OF TH... NAPLES

FIG. 7.—DEDIFF... CLAVELINA

Internal anatomy of a specimen, showing the way in which certain organs dedifferentiate more rapidly than others

See also REGENERATION, GRAFTING IN ANIMALS, CANCER, TISSUE-CULTURE.

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DE DONIS CONDITIONALIBUS: *see* ENTAIL.

DEDUCTION, a term used in common parlance for the process of taking away from, or subtracting (as in mathematics),

and specially for the argumentative process of arriving at a conclusion from evidence, *i.e.*, for any kind of inference (from Lat. *deducere*, to take or lead from or out of, derive). Two forms of the verb are used, "deduce" and "deduct"; originally synonymous, they are now distinguished, "deduce" being confined to arguments, "deduct" to quantities. In this sense it includes both arguments from particular facts and those from general laws to particular cases. In logic it is generally used in contradiction to "induction" for a kind of mediate inference in which a conclusion (often itself called the deduction) is regarded as following necessarily under certain fixed laws from premises. This, the most common form of deduction, is the syllogism (*q.v.*; see also LOGIC), which consists in taking a general principle and deriving from it facts which are necessarily involved in it. This use of deduction is of comparatively modern origin; it was originally used as the equivalent of Aristotle's ἀπαγωγή (see *Prior Analytic*~B xxv.). The modern use of deduction is practically identical with the Aristotelian συλλογισμός. Logical usage is somewhat inconsistent. On the one hand, Deduction is said to be from a universal premise; on the other hand, even syllogisms consisting of singular propositions only are described as deductive. To secure consistent usage it is best to apply the term *deduction* to *all* inferences from a universal proposition (even to immediate inferences of a singular or particular proposition from a universal) and to no other inference (such as singular syllogisms). Another source of confusion lies in the fact that in Mathematics the term deduction is sometimes used as synonymous with *Analysis*. Descartes' "deductive method" is often misunderstood for this reason as it covers both deduction proper and this analytic method.

DEE, JOHN (1527–1608), English mathematician and astrologer, was born in London, and educated at St. John's college, Cambridge, becoming a fellow of Trinity. He spent two years at Louvain and at Rheims in study and lecturing, returning to England in 1551, when he received a pension from Edward VI., which he exchanged for the living of Upton-on-Severn. Soon after Mary's accession he was imprisoned on a charge of using enchantments against the queen's life, but was released in 1555. Dee enjoyed the favour of Queen Elizabeth. He was asked to name a propitious day for the coronation, gave lessons to the queen in the mystical interpretation of his writings, was sent abroad in 1578 to consult with German physicians and astrologers on the nature of her illness, and was employed by her in establishing the claim of the Crown to the overseas countries discovered by British subjects. In 1581 began his collaboration with Edward Kelly, who professed to have discovered the philosopher's stone and to be able to raise spirits. The two spent the years 1583–89 in Poland and Bohemia under the patronage of Albert Laski, palatine of Siradez. Dee returned to England in 1589. He was helped over his financial difficulties by the queen and his friends. In May 1595 he became warden of Manchester college. In Nov. 1604 he returned to Mortlake, where he died in Dec. 1608, at the age of 81, in the greatest poverty. Dee's *Speculum* or mirror, a piece of solid pink-tinted glass about the size of an orange, is preserved in the British Museum.

His principal works are: *Pvopaedeunzata aphoristica* (1558); *Monas hieroglyphica* (Antwerp, 1564); *Epistola ad Fredericum Commandinum* (Pesaro, 1570); *Preface Mathematical to the English Euclid* (1570); *Divers Annotations and Inventions added after the tenth book of English Euclid* (1570); *Epistola praefixa Ephemeridibus Joannis Feldi, a 1557; Parallaticae commentationis praxeosque nucleus quidam* (1573).

The catalogue of Dee's printed and published works is to be found in his *Compendious Rehearsal*, as well as in his letter to Archbishop Whitgift. *The Private Diary of Dr. John Dee, and the Catalogue of his Library of Manuscripts*, edited by J. O. Halliwell, was published by the Camden Society in 1842. There is a life of Dee in Thomas Smith's *Vitae illustrium virorum* (1707); Eng. trans. by W. A. Ayton, the *Life of John Dee* (1909); M. R. James, "Lists of Manuscripts Formerly owned by Dr. John Dee," *Bibliog. Soc. Trans.* Sup. no. 1. (1921).

DEE, river, south Aberdeenshire, Scotland, flowing generally eastwards from its source in the west of the county till it reaches the North Sea at the city of Aberdeen. It rises in the Wells of Dee, a spring on Ben Braeriach, one of the Cairngorms, at a height of 4,061 ft. With its tributaries the river drains an area of 1,000 sq.m. Rapid and turbulent during the first half of its course of 90 m., it broadens below Aboyne and the rate of flow is diminished. The channel towards its mouth was artificially altered in order to provide increased dock accommodation at Aberdeen, but, above, the stream is navigable only for barges and small craft for a few miles It runs through beautiful scenery especially in Braemar. About two miles above Inverey it enters a narrow rocky gorge, 300 yd. long and only a few feet wide at one part, and forms the rapids and cascades of the famous Linn of Dee. One of the finest of Scottish salmon streams, it retains its purity almost throughout. The principal places on the Dee are Castleton of Braemar, Ballater, Aboyne, Kincardine O'Neil, Banchory, Culter and Cults.

DEE, a river of Wales and England. It rises in Bala Lake, Merionethshire. Leaving the lake near Bala, it flows north-east to Corwen and turns east past Llangollen to near Overton, and then bends nearly north to Chester, and thereafter north-west through a great estuary into the Irish Sea. In the Llangollen district the Dee crosses Denbighshire, and thereafter forms the boundary of that county with Shropshire, a detached part of Flint, and Cheshire. From Bala to Overton (35 m.), the river falls about 330 ft., and its course lies through a narrow, beautiful valley, enclosed on the south by the steep slopes of the Berwyn Mountains and on the north by a succession of lesser ranges. The Vale of Llangollen is especially famous. Here an aqueduct of the Shropshire Union canal bestrides the valley; it is a remarkable engineering work completed by Thomas Telford in 1805. The Dee has a total length of about 70 m. and a fall of 530 ft. Below Overton it debouches upon its plain track. Below Chester it follows a straight artificial channel to the estuary, and this is the only navigable portion. The estuary, which is 14 m. long, and 5¼ m. wide at its mouth, between I-lilbre Point and Point of Air, is not a commercial highway like the Mersey, for at low tide it becomes a vast expanse of sand, through which the river meanders in a narrow channel. The tide rushes in with great speed over the sands, and their danger is illustrated in the well-known ballad "The Sands of Dee" by Charles Kingsley. The Dee drains an area of 813 sq.m.

DEED, in law, **a** contract in writing, sealed and delivered by the party bound to the party intended to benefit. Contracts or obligations under seal are called in English law *specialties*, and down to 1869 they took precedence in payment over *simple* contracts, whether written or not. Writing, sealing and delivery are all essential to a deed The signature of the party charged is not material, and the deed is not void for want of a date. Delivery, it is held, may be complete without the actual handing over of the deed; it is sufficient if the act of sealing were accompanied by words or acts signifying that the deed was intended to be presently binding; and delivery to a third person for the use of the party benefited will be sufficient. On the other hand, the deed may be handed over conditionally as an *escrow*, in which case it will not take effect as a deed until the conditions are performed. A deed indented, or indenture (so called because written in counterparts on the same sheet of parchment, separated by cutting a wavy line between them so as to be identified by fitting the parts together), is between two or more parties who contract mutually. The actual indentation is not now necessary to an indenture. The *deed-poll* (with a polled or smooth-cut edge, not indented) is a deed in which one party binds himself without expression of any obligations undertaken by another party. *(See* CONTRACT.)

Statutes have been enacted in many of the United States, as in Great Britain and her colonies, setting forth certain short and convenient forms for deeds, thus giving effect to statutory provisions and forms. In the United States a deed has the effect of feoffment with livery of seisin or as a deed under the statute of uses or of any species of conveyance necessary to effect the intent of the parties and not repugnant to the legal requirements.

DEED REGISTRATION: *see* LAND TITLES.

DEEMS, CHARLES (ALEXANDER) FORCE (1820–1893), American clergyman, was born in Baltimore (Md.) on Dec. 4, 1820. He graduated at Dickinson college in 1839, and

in 1841 became agent for the American Bible Society in North Carolina. He taught at the University of North Carolina and at Randolph-Macon college, was for four years (1850–54) president of the Greensboro (N.C.) Female college, and preached in a number of Southern churches. In 1868 he founded in New York city the undenominational Church of the Strangers, where he remained till his death on Nov. 18, 1893. With Phoebe Cary, one of his parishioners, he compiled *Hymns for All Christians* (1869); he also was the author of many books. For ten years he edited *Christian Thought*, organ of the American Institute of Christian Philosophy, of which he was one of the founders and president and through which the Charles F. Deems lectureship in philosophy was established at New York university.

See the memoir (1897), in part autobiography, in part the work of his sons; and the memorial number of *Christian Thought* (Feb. 1894).

DEEMSTER or **DOOMSTER,** the former title of an officer attached to the High Court of Justice in Scotland who pronounced the doom or sentence on condemned persons. Mention of this officeis made in the Doomsday Book. Deemster is the title proper to each of the two justices of the Isle of Man.

DEER, originally the name of one of two British species, the red-deer or the fallow deer, but now extended to all the family Cervidae *(see* PECORA, *ARTIODACTYLA*, *UNGULATA)*. Briefly, deer may be defined as Pecora, in which antlers are usually present in the male; when no antlers are developed, the upper canine teeth are elongated and sabre-like. The antlers arise from pedicles or bony projections of the frontal bone; when a new antler is to be formed the summits of these pedicles become highly vascular and from the blood thus supplied a bony secretion is deposited. During its growth the antler is covered with soft, hairy skin, through which run a number of blood-vessels; this skin is known as the velvet. Towards the completion of the antler's growth a more or less prominent ring of bone, the burr or coronet, is deposited at its base just above the junction with the pedicle; this tends to constrict the blood-vessels, and thus cut off the supply of blood from the antlers. When the antlers are freed from the velvet—a process usually assisted by the animal rubbing them against trees—they have a more or less rugose surface, owing to the grooves formed in them by the nutrient blood-vessels. In the antlers of the red-deer group, which form the type of the whole series, the following names have been applied to their different component parts and branches. The main shaft is termed the beam; the first or lowest tine the brow-tine; the second the bez-tine; the third the trez-tine, or royal; and the branched summit the crown, or surroyals.

The Cervidae are distributed all over Europe, Asia, northern Africa and America, but are unknown in Africa south of the Sahara. They are essentially woodland animals and where forced to dwell in open country, as in the highlands of Scotland, become stunted. Thus the prehistoric remains found in the Scottish peat-bogs indicate that a moderate sized, old time red deer (*Cervus elaphus*), which was a forest dweller, was a third as large again as well-grown modern forms. That this is not due to deterioration of the stock, but primarily to the conditions of the environment, is shown by the fact that the descendants of Scottish deer introduced into New Zealand are amongst the largest specimens known.

The existing members of the family are arranged in two subfamilies, the Moschinae containing only a single species, the musk deer, and the Cervinae, including not only the true deer but the muntjaks, roe deer, mule deer, etc.

The subfamily Moschinae is distinguished by the presence of a gall-bladder and, in the males, a large caudal gland, and by the absence of antlers, face-glands and foot-glands. The hemispheres of the brain are comparatively smooth, with few convolutions. The subspecies are distributed over a large part of central and north-eastern Asia, from Gilgit southwards to Cochin China, and eastwards to Korea. The musk deer or kastura (*Moschus moschiferus)* stands about 20 in. at the shoulder, with the hind-quarters elevated, but the Korean subspecies is smaller and more slenderly built. The hair is thick and brittle, resembling pith; the general colour is brownish speckled with grey. The ears are large and the upper canine teeth of the males greatly enlarged, projecting well beyond the lip margin. The tail is very short, and the naked area of the muzzle is extensive. Musk deer are forest dwelling animals, usually found at considerable elevations; the males secrete the "musk," from which the animal derives its name, in an abdominal gland. The record specimen carries canine teeth which project out beyond the jaw-bone for a distance of $3\frac{9}{16}$ in.; these weapons appear to be chiefly used for fighting, the bucks engaging in severe combats during the pairing-season.

The Cervinae have no gall bladder or caudal gland, but there are foot-glands at least in the hind-limbs (absent in *Pudu*); antlers are, as a rule, developed and are characteristic of all true deer. The cerebral hemispheres present numerous convolutions. It is an interesting point that the ratio between body-weight and antler-weight increases with the absolute size of the animal. Thus in the red deer (*Cervus elaphus*), it was found that in stags of mean weight 74.4 kg. the antler-weight was 2.2% of the total, in stags of mean weight 130.6 kg., it was 3.03%, and in those of 211.8 kg., 4.21%, a point of great evolutionary significance. The growth of the antlers depends also upon a number of other circumstances, which are favourable or unfavourable to the production of large, heavy antlers. Lime in the soil is very important and the amount of food available, depending on the weather, is also influential. The successive antlers of a stag increase rapidly in weight during the first few years, but after the 11th year, and sometimes before, decrease again ("go back"). The percentage increments for the red deer from Warnham Park are: — and year, 230.6%; 3rd, 72.2%; 4th, 38.6%; 5th, 18.1%; 6th, 8.5%; 7th, 5.2% *(see* J. S. Huxley, *Proc. Zool. Soc.,* London, 1926). The antlers are used in fighting other stags and only exceptionally, or as a last resort, for defence, deer trusting rather to their fleetness to escape from an enemy. It is a remarkable fact, however, that antler-less stags, which fight with their fore-hooves, seem often to be able to vanquish their antlered rivals. Most deer (but not the roe) are polygamous, the males fighting fiercely for possession of the females.

The subfamily contains 19 genera which vary in size from the pudu, standing only about $13\frac{1}{2}$ in. in height, to the gigantic moose and elk.

I. **Muntiacus.**—The members of this genus agree with all the other Cervinae, excepting the reindeer and caribou (*Rangifer*), in the absence of antlers in the females and the presence of a small, bare muzzle. They are known popularly as muntjaks or barking deer and are characterized by the tusk-like development of the upper canine teeth in the males, a feature in which these animals approach the condition found in the musk deer and resembling in this respect the tufted deer (*Elaphodus*) and the Chinese water deer *(Hydropotes)*. Six species and numerous subspecies have been described; all are small animals, with small and simple antlers consisting of a small brow-tine and a beam, arising from long, bony pedicles which are continued downwards to form prominent ridges on the frontal region of the skull. In the females these pedicles are represented by small, bony prominences surmounted by tufts of hair. The ears are small and the tail long and thin. The various species are distributed over the Indo-Malayan region eastwards as far as Sumatra and Borneo, a number of forms occur in China and one in Formosa; muntjaks do not extend into Japan. The record length of the antlers taken from the burr to the tip, is $10\frac{3}{8}$ in. The males stand about 20 to 22 in. in height at the shoulder and weigh about 38lb.

II. **Elaphodus** contains but a single species, E. *cephalophus*, or Chinese tufted deer, distinguished from the muntjaks by the small size of the antlers and by the supporting pedicles diverging inferiorly. Further, the pedicular ridges on the frontal region are absent. Four races are known, all confined to China. In size these deer about equal the larger species of muntjak.

III. llama. — Two species of *Dama* are now recogniscd, *D. dama* and *D. mesopotamica* from Persia; they are popularly known as fallow deer. In this genus, as in all the remaining gegera except *Hydropotes*, the male canine teeth when present, are not tusk-like. The antlers are large and are supported on short pedicles which do not form frontal ridges as in the muntjaks; the bez-

tine is normally absent, and the beam is palmated and bears numerous snags on the hinder edge. The coat is usually spotted with white in summer, and the height at the shoulder is about 3 ft. Originally the species were restricted to the Mediterranean countries and Persia; the typical species has, however, been introduced into many parts of Europe. The extinct Irish elk (Megaceros) is an allied genus.

IV. Axis.—Some authors regard the genera Axis, *Hyelaphus,* Rusa, Rucervus and Sika as subgenera of Cervus, but it seems more convenient to regard them as distinct. The chital or spotted deer (Axis axis) resembles *Dama* in the coat being spotted with white; the antlers are, however, very different, being long, slender and not palmated. They are three-tined, the brow-tine forming a right angle with the beam. These Indian deer are of medium size, standing about 36 in. at the shoulder; fine antlers measure as much as 39 in. along the outer curve.

V. **Hyelaphus.**—Closely allied to the chital, the hog-deer of the genus *Hyelaphus* are more stocky in build and the horn pedicles longer. The auditory bullae are very large and the coat is either spotted in summer or uniformly coloured throughout the year. The two species are confined to the Oriental region: H. *porcinus* is the best known.

VI. **Rusa.**—This genus includes large, medium-sized and small deer, normally carrying three-tined antlers in which the brow tine forms an acute angle with the beam. The coat is long and shaggy and uniformly coloured in the adults. The species are widely distributed over most of the Oriental region, extending northwards as far as Sze-chuan. Five species are recognized, of which the sambar (R. *unicolor*) is the best-known. This species is typically a very massive animal, standing as much as 54 in. at the shoulder; some stags carry exceptionally large antlers (45 to 50 in. in length).

VII. **Rucervus.**—In this genus, the species of which are all large, both the second (bez) and third tine are wanting and the beam divides into four or more branches; the brow tine forms either a right angle or continuous curve with the beam. The range includes a large part of south-eastern Asia, extending to the island of Hainan. R. duvaucelli, the barasingha or swamp-deer (confined to peninsular India), R. schomburgki, Schomburgk's deer, (remarkable for its many-tined antlers) and R. *thamin,* the thamin (with cylindrical and rugose antlers), which have a long brow-tine forming a continuation of the curve of the beam), are the best known.

VIII. **Sika.**—The sika or Japanese deer of Japan and Manchuria are medium-sized deer related to the true deer but with smaller and simpler antlers; the latter are flattened and usually four-tined. The coat is spotted with yellowish-white in summer; there is a white area bordered with black in the caudal region.

IX. **Cervus.**—In this genus, which includes the true deer, the antlers are more complex, usually having at least five tines. The tail is considerably shorter than in Sika, and the coat-colour uniform in the adult. The following species are here regarded as belonging to the typical genus:—the red deer (C. *elaphus*), wapiti (C. canadensis), Yarkand stag (C. *yarkandensis*), shou (C. *wallichi*), Macneill's deer (C. *macneilli*), hangul (C. *cashmiriensis*) and Thorold's deer (C. albirostris). The typical species (C. *elaphus*) is widely distributed, ranging over the greater part of Europe (excluding the Italian peninsula) and extending eastwards to the Caucasus and Caspian provinces of Persia. The largest of these red deer is the maral (C. e. maral) from Persia, the height at the shoulder reaching as much as $4\frac{1}{2}$ ft. The wapiti (miscalled elk in America) is typically from eastern Canada; but in addition to the New World forms, several local races have been described from central and north-eastern Asia. The wapiti may stand as much as 5 ft. 4 in. at the shoulder and carries very massive antlers. Both red deer and wapiti have been successfully introduced into New Zealand. The shou and the hangul occur in the Himalayan region.

X. **Elaphurus** is apparently most nearly related to the true deer. The antlers divide a short distance above the burr, the front branch curving forwards and again dividing, and the single hind branch projecting backwards. Only one species is known, E. *davidianus,* the mi-lu, or Père David's deer; the distributional range is uncertain, as this deer is known only from a herd formerly kept in the gardens of the Summer palace, Pekin, and their descendants, notably at Woburn abbey, England.

XI. Odocoileus inctudes the white-tailed deer (0. *virginianus*), mule deer (0. hemionus) and black-tailed deer (0. *columbianus*). In this genus and those following unlike *Dama,* Cervus, etc., the lateral metacarpals are represented by their lower, and not their upper, extremities. The antlers are large and the beam dichotomously forked; a subbasal snag is developed. The deer included in this group are exclusively American, the range extending from Alaska to Peru, Bolivia and northern Brazil. A large number of local races of the white-tailed deer have been described, from both North and South America. The mule deer and black-tailed deer are found only in North America.

XII. **Blastocerus.**—Closely allied to the foregoing, but without metatarsal gland. The antlers are large, complex and lack the sub-basal snag of *Odocoileus.* Two species are known:—B. *dichotomus,* the marsh deer; and the smaller B. bezoarticus, the Pampas deer, both South American. The former species is the largest South American deer, nearly equalling the red deer. B. bezoarticus is a little larger than a roe deer.

XIII. Hippocamelus is distinguished by the small, simple, dichotomously forked antlers, of which the front prong is the shorter, and absence of metatarsal glands. Two species occur, both in South America.

XIV. **Mazama.**—The deer of this genus are all small species allied to Hippocamelus, but distinguished by their antlers being unbranched spikes. A large number of species and subspecies have been named, distributed throughout central and tropical South America, but the distinguishing characters are, in many instances only very slight. The typical brocket (M. americana) is about 27 in. in height at the shoulder and the coat is bright rufous in colour. Some species are considerably smaller, notably M. *nana* from the Matto Grosso.

XV. **Pudu.**—This group contains two very small species, standing only $13\frac{1}{2}$ to 15 in. at the shoulder, with very small spike-like horns, both from South America.

XVI. **Capreolus.**—This genus, comprising the roe deer, is distinguished by the antlers arising almost vertically from the head; the beam divides into two upright branches, the hinder one of which again divides. It includes three species, varying in height from 26 (typical roe) to 34 in. (C. pygargus); they range over central southern Europe across Asia north of the Himalayas to the Pacific coast. The roe is monogamous. During the rutting period, the stags pursue the does in circles and often several pairs may be seen thus engaged. Although the rut takes place in autumn, the female roe shows no signs of pregnancy until the following spring, and it is suggested that development of the embryo is suspended during the winter.

XVII. **Alces.**—The members of this genus are at once distinguishable by their massive palmated horns, bordered with snags, large size (height at shoulder $5\frac{3}{4}$ to $6\frac{3}{4}$ ft.) and broad, overhanging muzzles. The European elk (*A.* alces alces) at one time extended throughout the greater part of northern Europe and part of northern Asia, but is now extinct in most parts of Europe; the American moose (*A. alces americanus*) from eastern North America is the typical moose. During the winter, a herd of moose will often trample down a space in the soft snow ("moose yard") to give them firm footing. The gait of these animals is a curiously stiff-legged run, but they nevertheless possess a considerable turn of speed notwithstanding their ungainly appearance.

XVIII. **Rangifer.**—The reindeer and caribou differ from all the preceding genera in that the female bears antlers and the muzzle is completely hairy. In size medium or large; in some subspecies the antlers are massive and broadly palmated (R. *tarandus* terraenovae), in others long and slender (R. *t. arcticus*). The various races range over the northern parts of Europe and North America as far south as northern Columbia and New Brunswick. In many parts of its range, *Rangifer* is migratory and is indispensable as a domestic animal to the Lapps of northern Europe.

XIX. **Hydropotes.**—In this genus antlers are entirely wanting, and the upper canines form long, curved tusks. The Chinese water deer (H. *inermis*) is the sole species; it stands only 20 in. at the shoulder. The general colour is rufous, much as in the brockets and the range is confined to China and Korea.

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DEERE, JOHN (1804–1886), American manufacturer and inventor of the steel plow, was born at Rutland, Vt., on Feb. 7, 1804 He attended Middlebury college for a short time, but left at the age of 17 to become an apprentice to a blacksmith in Middlebury. He established his own smithy in 1825. Eleven years later he moved to Grand Detour, Ill., where he opened a shop in partnership with Maj. Leonard Andrus. Here he began experimenting with the use of steel, instead of wood, for plowshares, and in 1837 he manufactured the first steel plow, moulded over a log. By 1846 the output of his small establishment was about 1,000 plous annually. The next year he went to Moline, Ill., where he founded his own firm, incorporated in 1868 as Deere & Company. He continued as president of the company until his death at Moline.

DEERFIELD, a town of Franklin county, Massachusetts, U.S.A., on the Connecticut and the Deerfield rivers, 33 mi. N. of Springfield; served by the Boston and Maine and the New York, New Haven and Hartford railways. The population in 1940 was 2,684. The greater part of the population is centred about the village of South Deerfield, a supply and shipping point for a large onion and tobacco-growing area. The oldest of the several villages, Old Deerfield, sometimes called "The Street," extends along one broad thoroughfare lined with elms, through a beautiful valley, bordered by hills on the east and the west. Many of the houses date from the 18th century, and the ground is dotted with tablets marking the home lots of early settlers and places where historic incidents occurred. In Memorial hall, built in 1798 for the Deerfield academy, the Pocumtuck Valley Memorial Association has assembled a collection of colonial and Indian relics. In 1896 many of the old household arts and crafts were revived and placed on a business basis by the formation of a society for the marketing of the products. For many years Deerfield (settled in 1669 and incorporated in 1673) was the frontier post of New England on the north-west. It suffered severely from the Indians in 1675 and 1677; and again. on Feb. 29, 1704, the village was surprised in the early morning by a force of French and Indians, who killed 49, captured 111 (including the Rev. John Williams, who lived to publish an account of his experiences), burned the town and on the way back to Canada killed 20 of the captives.

DEER PARK, an enclosure of pastureland for deer. The largest existing deer park in England is at Savernake (4,000 ac.).

DE FALLA, MANUEL (1876–), Spanish composer, was born at Cadiz on Nov. 23, 1876. He studied piano with José Tragó and composition with Felipe Pedrell in Madrid. In 1905 he won the prize offered by the Academia de Bellas Artes with his opera *La Vida breve.* Two years later he went to live in Paris, where he met with much help and encouragement from Debussy, Ravel, Dukas and others, who recognized the sincerity of his aims. *La Vida breve* was produced at Nice in 1913 and in Paris the year following. When at last it reached Spain it was received with great enthusiasm; but in view of the tardy recognition of the composer in his own country overtures were made to him to become a naturalized Frenchman and so improve his chances of being heard in Paris. This he declined to do, and on the outbreak of the World War in 1914 he went back to Spain, where he made an exhaustive study of Spanish folk-music—in particular of the *cante* of Andalusia—before settling in his new home in Granada in the precincts of the Alhambra. The traditional music of Spain provides an unusually rich source of inspiration, containing as it does melodic elements from the church modes introduced by early Christians and Eastern rhythms brought by the Moors. De Falla's researches in this field have made him a national composer in the profoundest sense of the word. He makes comparatively little use of traditional melodies as they stand; for although he believes that the modality of folk-tunes should, and does, form the basis of all great music, his belief implies not only a complete absorption of the spirit of that modality, but a thorough testing of the material in the light of the composer's aesthetic and ethical principles. Acting upon this, he submits his own work to the most searching revision before it is given to the public, though fortunately without destroying its effect of spontaneity. He is a firm believer in tonality and in consonant chords, having no love of dissonance for its own sake. His best-known work is the brilliant second ballet, *The Three-cornered Hat,* which was first played by the Russian Ballet at the Alhambra, London, in 1919. His first ballet, *Love the Magician,* was performed in Madrid in 1915. Another dramatic work is *Master Peter's Puppet-Show,* a scenic version of a chapter from *Don Quixote.* He also wrote: *Nights in the Gardens of Spain* for piano and orchestra; Concerto for harpsichord (or pf.), fl., ob., clar., vlin. and 'cello; *Pieces espagnoles* for piano; and *Seven Spanish Folk-Songs.*

See Manuel de Falla, *Miniature Essays* (J. & W. Chester, Ltd., London); *Dictionary of Mod. Music & Musicians* (London).

DEFAMATION, the publication concerning a person of matter which is untrue and tends to lower him in the estimation of right-thinking men, or causes him to be shunned or avoided, or exposes him to hatred, contempt or ridicule. (*See* LIBEL AND SLANDER.)

DEFAULT, in common law, a failure to do some act required by law either as a regular step in procedure or as being a duty imposed. Default in compliance with a statute renders the defaulter liable to action by the person aggrieved or to indictment if the matter of command is of public concern, subject in either case to the qualification that the statute may limit the remedy for the default to some particular proceeding specifically indicated; and in some instances, *e.g.,* in the case of local authorities, default in the execution of their public duties is dealt with administratively by a department of the Government, and only in the last resort. if at all, by recourse to judicial tribunals.

DEFEASANCE, in law, an instrument which defeats the force or operation of some other deed or estate.

DEFENCE: *see* PRACTICE AND PROCEDURE.

DEFENCE MECHANISMS, a psychological term, referring to various devices unconsciously adopted by the human mind to escape attack or to avoid unpleasant experience. The same mental mechanisms of defence which are employed by normal minds, appear in extreme form in the mental processes of the insane.

Defence Mechanisms of Normal People.—Whenever a normal person anticipates attack from an antagonist so much stronger than himself that he thinks he will be defeated if the contest ever comes to a decisive issue, he immediately tends to act in a way calculated to prevent the conflict from occurring. Such responses are termed defensive reactions. They are of two general types: anticipatory attack upon the supposed opponent, and precautionary withdrawal from the anticipated danger. Lies told by children to avoid incurring punishment and the displeasure of loved parents exemplify both types of defence mechanisms. Concealment of the child's true actions represents withdrawal from threatened conflict with an antagonist (the parent) who is sure to win if the child tries to contest the case on its merits. The falsely imagined story constitutes an inducement response, wherein the child takes the initiative in an attempt to gain the approval and favour of the parent, thus preventing anticipated attack. Emotional irritability, active dislike of superiors, and blustering, pompous manners frequently represent aggressive defence mechanisms of normal people. Shyness. seclusiveness, timidity, and sometimes day-dreaming and forgetting the names of real people and things represent the passive type of defensive mechanism.

'Defence Mechanisms of Abnormal People.—Whenever a person tries ultimately to *comply* with some unpleasant emotional situation instead of *dominating* it, the result is an abnormal state of mind. By permitting the conflicting emotions to remain in consciousness without getting rid of some, or harmonizing all, a number of abnormal states may result. The weaker emotion may

be suppressed into a "repressed complex," causing the person to perform acts over which he has no control because he does not understand what emotion is causing the acts. Or each conflicting emotion may organize about itself a separate personality, resulting in "dissociation of personality," the afflicted individual uncontrollably changing from one personality to another at different times. Many psychiatrists (Hart) attribute somnambulism, obsessions, hallucinations, and delusions to abnormal defence mechanisms similar to dissociation. Symbolization, stereotyped actions, rationalization, projection, where the patient believes other people are expressing toward him the very emotions from which he is suffering, and insane phantasy are attributed to repression.

(W. M. M.)

See Hart, *The Psychology of Insanity,* 1925; Marston, *The Emotions of Normal People,* 1928.

DEFENDANT, in law, a person against whom proceedings are instituted or directed; one who is called upon to answer in legal proceeding. (See PRACTICE and PROCEDURE.)

DEFENDER OF THE FAITH (Lat. *Fidei* Defensor), a title belonging to the sovereign of England in the same way as *Christianissimus* (Most Christian) belonged to the king of France, and Catholicus (Catholic) belongs to the ruler of Spain. It seems to have been suggested in 1516, and although certain charters have been appealed to in proof of an earlier use of the title, it was first conferred by Pope Leo X. on Henry VIII. The Bull granting the title is dated Oct. 11, 1521, and was a reward for the king's treatise against Luther. When Henry broke with the papacy, Pope Paul III. deprived him of his designation, but in 1544 the title of "Defender of the Faith" was confirmed to Henry by Parliament, and has since been used by all his successors on the English throne.

DEFERENT, in ancient astronomy, the mean orbit of a planet, which carried the epicycle in which the planet revolved. (Lat. *deferens,* bearing down.)

DEFERRED ANNUITY, a periodic fixed money payment, generally arranged on an annual, semi-annual or quarterly basis, but upon which payments do not begin until the expiration of a certain time or the occurrence of some certain event. It is quite customary for insurance companies to sell deferred annuities whose payments begin when the beneficiary reaches a certain age, often 65 years or more. The deferred annuity may continue for a stipulated number of years, or for a specified number of payments (a deferred certain annuity); it may be continued for an uncertain period (a deferred contingent annuity); or may be continued during a person's lifetime (a deferred life annuity). (See ANNUITY.)

DEFERRED ASSETS, also known as deferred charges to expense, and prepaid expenses, are items of expense which have been paid or for which liability has been assumed, but which are not properly chargeable to the current accounting period. The charging of such items to current operating costs is deferred until the period arrives to which they are applicable. The premium, for example, on an insurance policy may be paid one year in advance. Obviously, the entire premium is not applicable to the month in which payment is made or obligation assumed but to the 12 months. Thus at the end of an accounting period, only that part of the cost applicable thereto would be charged to expense; the remainder is a deferred asset.

In addition to unexpired insurance, the other common deferred assets are advertising paid in advance, development expense, moving expense and organization expense. With such items as insurance and advertising, the problem of pro-rating costs is relatively simple; with such items as development, moving and organization expenses. the problem becomes more involved. Organization expense, theoretically, extends over the entire life of the enterprise to which it applies. Since there is no way of knowing in advance how long a concern will remain in business, some arbitrary basis must be selected for writing off the organization expense. Some organizations spread the cost over a five year period, others over a ten year. period or even longer. Conservative accounting practice suggests the desirability of writing off such expense as rapidly as the profits of a business will permit.

DEFFAND, MARIE ANNE DE VICHY-CHAMROND, MARQUISE DU (1697–1780), a celebrated Frenchwoman, was born at the chbteau of Chamrond near Charolles (department of Saône-et-Loire) of a noble family on Dec. 25, 1697. Educated at a convent in Paris, she showed a sceptical and cynical turn of mind, which led the abbess to arrange that Massillon should reason with her, but he accomplished nothing. She was married at 21 to her kinsman, Jean Baptiste de la Lande, marquis du Deffand but they were separated as early as 1722. Mme. du Deffand, young and beautiful, is said by Horace Walpole to have been for a short time the mistress of the regent, the duke of Orleans (Walpole to Gray, Jan. 25, 1766). In 1721 began her friendship with Voltaire, but their regular correspondence dates only from 1736. She spent much time at Sceaux at the court of the duchesse du Maine, where she formed a close friendship with the president Hénault. In Paris she was in a sense the rival of Mme. Geoffrin, but the members of her salon were drawn from aristocratic society more than from literary cliques, though Voltaire, Montesquieu, Fontenelle and Mme. de Staal-Delaunay were among the habitués. When Hénault introduced D'Alembert, Mme. du Deffand was at once captivated by him. With the encyclopaedists she was never in sympathy, and appears to have tolerated them only for his sake. When she lost her sight in 1754 she engaged Mlle. de Lespinasse to help her in entertaining. This lady's wit and charm made some of the guests, D'Alembert among others, prefer her society to that of Mme. du Deffand, and she arranged to receive her friends for an hour before the appearance of her patron. When this state of things was discovered Mlle. de Lespinasse was dismissed (1764), but the salon was broken up, for she took with her D'Alembert, Turgot and the literary clique generally. From this time Mme. du Deffand rarely received any literary men. The principal friendships of her later years were with the duchesse de Choiseul and with Horace Walpole. Her affection for the latter, which dated from 1765, was the most durable of all her attachments. Under the stress of this tardy passion she developed qualities of style and eloquence of which her earlier writings had given little promise. In the opinion of Sainte-Beuve the prose of her letters ranks with that of Voltaire as the best of that classical epoch. Walpole refused at first to acknowledge the closeness of their intimacy from fear of the ridicule attaching to her age, but he paid several visits to Paris expressly for the purpose of enjoying her society, and maintained a close and most interesting correspondence with her for 15 years. She died on Sept. 23, 1780, leaving her dog Tonton to the care of Walpole, who was also entrusted with her papers. Of her innumerable witty sayings the best known is her remark on the cardinal de Polignac's account of St. Denis's miraculous walk of two miles with his head in his hands,—*Il* n'y a *que* le premier pas *qui coûte.*

The *Correspondance inédite* of Mme. du Deffand with D'Alembert, Hénault, Montesquieu, and others was published in 2 vols. (1809). In 1810 Mary Berry edited *Letters of the Marquise du Deffand to the Hon. Horace Walpole, afterwards earl of Orford, from 1766 to 1780* (4 vols.), and gave numerous extracts from Walpole's letters to Mme. du Deffand, since destroyed. In 1912 Mrs. Paget Toynbee published in 3 vols. *Lettres de Mme. du Deffand à Horace Walpole,* with *18* of the supposedly lost letters from Walpole. Her letters were also edited by M. de Lescure in *Correspondance complète de la marquise du Deffand* (1865), and by the marquis de Stc. Aulaire in *Correspondance ine'dite, etc.* (1859 and 1866). *See* also Sainte-Beuve, *Causeries du Lundi,* vols. i. and xiv. (1852–62); L. Percy, *Le président Hénault et Mme. du Deffand* (4th ed., 1893); P. de Ségur, *Esquisses et recits: Mme. du Deffand et sa famille* (1908).

DEFIANCE, a city of northwestern Ohio, U.S.A. at confluence of Auglaize and Tiffin rivers with the Maumee; county seat of Defiance county; on federal highway 24 and five state highways, and is served by Baltimore and Ohio and Wabash railways, bus and truck freight lines. Pop. (1940) 9,744 (federal census). It is the central market of the Maumee valley, a rich dairying and farming region. Manufactures include machine tools, radio condensers, metal stampings, screw machine products, commercial refrigeration, dairy products, luncheon meats, beer, packaging machines, service station equipment, mechanics' tools, pole line hardware It is the seat of Defiance college (Christian), estab-

lished as a normal school in 1884. The confluence of the rivers was a favourite meeting-place of the Indians. In 1794 Gen. Anthony Wayne built a fort (which he named Defiance) on a spot now included in a public park. It was rebuilt and enlarged as Fort Winchester by Gen. Harrison during the War of 1812. The town was incorporated as a village in 1836. It developed commercially after the opening of the Miami and Erie canal (1845), was made the county seat in that year, and became a city in 1881.

DEFILE, a military expression for a passage, to march through which troops are compelled to "defile," or narrow their front (from the Fr. *défiler,* to march in a line, or by "files"). The word is usually applied to a ravine or gorge in a range of hills, but a causeway over a river, a bridge and even a village may equally be called a defile. The term is also used to express, with out any special reference to military operations, a gorge among mountains. The verb "to defile" is used of troops marching on a narrow front, or narrowing their front, under all circumstances, and in this sense is the contrary of "deploy."

"Defile," in the sense of "pollute," is another form of "defoul."

DE FILIPPI, FILIPBO (1869–1938), Italian scientist and explorer, was born in Turin April 6, 1869. After graduating in medicine at the Turin University, he became assistant in the surgical clinic and lecturer in operative surgery in the University of Bologna. He published a number of important papers on physiological and biological chemistry. In 1897 he went with the Duke of the Abruzzi to Alaska as scientific observer and ascended Mount St. Elias. Although he did not accompany the Duke to the Ruwenzori in Central Africa in 1906, De Filippi wrote the report of the expedition. In 1909 De Filippi joined the Duke's expedition to the Western Himalaya and Karakoram Mts., where a point 24,600ft. high was reached on a ridge of the Bride Peak close to K2, which established a record of altitude unsurpassed until the exploits on Mount Everest (1922 and 1924). He later (1913–14) organized and led an important scientific expedition to the Karakoram range in Central Asia, under the auspices of the Indian and Italian Governments. He died Sept. 23, 1938.

He published *The Ascent of Mount St. Elias* (1900), *Ruwenzori* (1909), *Karakorant and Western Himalaya* (2 vol. 1912), *Storia della spedizione scientifica italiana nel Himàlaia, Caracorùm e Turchestàn Cinese, 1913–1914* (1924), and *Ippolito Desideri of Pistoia, S.J.: His Travels and Account of Ttbet, 1712–27* (1932 and 1937).

DEFINITION, a logical term used popularly for the process of explaining, or giving the meaning of, a word, and also in the concrete for the proposition or statement in which that explanation is expressed (Lat. *definitio,* from *de-finire,* to set limits to, describe). In logic, definition consists in determining the qualities which belong to given concepts or universals; it is not concerned with individuals, which are marked by an infinity of peculiarities, any one or all of which might be predicated of another individual. Individuals can be defined only in so far as they belong to a single kind. According to Aristotle, definition is the statement of the essence of a concept, that is, it consists of the genus and the differentia. In other words, "man" is defined as "animal" and "rational," or "rational animal," *i.e.,* the concept is (1) referred to the next higher genus, and (2) distinguished from other modes in which that genus exists, *i.e.,* from other species. "Rational animal" is thus the predicate of the statement constituting the definition. Sometimes the word "definition" is used to signify merely the predicate. It is sometimes argued that, there being no definition of individuals as such, definition is of names *(see* J. S. Mill, *Logic,* I. viii. 5), not of things; it is generally, however, maintained that definition is *of things, regarded as, or in so far as they are, of a kind.* Definition of words can be nothing more than the explanation of terms such as is given in a dictionary.

The following rules are generally given as governing accurate definition. (1) *The definition must be equivalent or commensurate with that which is defined;* it must be applicable to all the individuals included in the concept and to nothing else. Every man, and nothing else, is a rational animal. "Man is mortal" is not a definition, for mortality is predicable of irrational animals. (2) *The definition must state the essential attributes;* a concept cannot be defined by its accidental attributes; those attributes must be given which are essential and primary. (3) *The definition must be per genus et differentiam,* as we have already seen. These are the important rules. Three minor rules are: (4) *The definition must not contain the name of the concept to be defined;* if it does, no information is given. Such a proposition as "an archdeacon is one who performs archidiaconal functions" is not a definition. Concepts cannot be defined by their correlatives. Such a definition is known as a *circulus in definiendo. (5) Obscure and figurative language must be avoided,* and (6) *Definitions must not be in the negative when they can be in the affirmative.*

Definition *per genus et differentiam* is a concise description of what a certain kind of thing *is.* There is another kind of definition, known as *genetic definition,* which describes how the kind of thing in question can be *produced.* Some terms can be defined in both ways, *e.g.,* the term *circle* may be defined as "a plane curve every point of which is equidistant from a certain point called the centre," or as "a plane curve produced by moving a point at a constant distance from another point." Many chemical formulae are really genetic definitions.

DEFLATION. A diminution of the volume of currency, causing a rise in the value of money per unit and a fall in prices. Its effect varies with the degree of inflation which preceded it and which it is concerned to reduce. For a full discussion *see* INFLATION AND DEFLATION; CURRENCY; MONEY.

DEFOE, DANIEL *(c.* 1659–1731), English author, was born in the parish of St. Giles, Cripplegate, London, in the latter part of 1659 or early in 1660, of a Nonconformist family. His father James Foe, was a butcher and a citizen of London. Until late in life Daniel signed Defoe or Foe indifferently.

Daniel was educated at a famous dissenting academy, Mr. Charles Morton's of Stoke Newington, where many of the best-known Noncomformists of the time were his schoolfellows. He joined Monmouth's rebellion in 1685, and is supposed to have owed his lucky escape from the law to his being a Londoner, and therefore a stranger in the west country. Before his western escapade he had taken up the business of hosiery factor, and had married Mary Tuffley, by whom he had seven children. At the entry of William and Mary into London he is said to have served as a volunteer trooper "gallantly mounted and richly accoutred." At this period he seems to have been a sort of commission merchant, especially in Spanish and Portuguese goods, and at some time to have visited Spain on business. In 1692 he failed for £17,000. Although his creditors accepted a composition, he afterwards honourably paid them almost in full, a fact attested by not very friendly witnesses. He then became secretary and afterwards manager and chief owner of some tile works at Tilbury, but here also he was unfortunate, and his imprisonment in 1703 brought the works to a standstill, and he lost £3,000. About the middle of the reign of William III. he was introduced to the King, and in 1695 he was appointed accountant to the commissioners of the glass duty, an office which he held for four years. At this time he produced his *Essay on Projects* (1698), containing remarkable suggestions, much in advance of his time, on banks, road-management, friendly and insurance societies of various kinds, idiot asylums, bankruptcy, academies, military colleges, high schools for women, etc. In the same year he wrote the first of a long series of ingenious pamphlets on the then burning question of occasional conformity. He argued that the conscience of the Dissenters should not permit them to conform; yet he denounced the impropriety of requiring tests at all. In support of the government he published, in 1698, *An Argument for a Standing Army,* followed in 1700 by a defence of William's war policy called *The Two Great Questions considered,* and a set of pamphlets on the partition treaty. *The True-Born Englishman* (1701) is a satire in rough but extremely vigorous verse on the national objection to William as a foreigner, and on the claim of purity of blood for a nation of mixed origin. He also took part in the proceedings which followed the Kentish petition, and was the author, some say the presenter, of the *Legion Memorial,* which asserted the supremacy of the electors over the elected. The theory of the indefeasible supremacy of the freeholders of England was one of Defoe's favourite political tenets, and he returned to it in a powerfully written tract entitled *The Original Power of the Collective*

Body of the People of England examined and asserted (1701).

In an evil hour for himself Defoe wrote the anonymous *Shortest Way with the Dissenters* (1702), a statement in the most forcible terms of the extreme "high-flying" position, which some high churchmen were unwary enough to endorse, without any suspicion of the writer's ironical intention. The author was soon discovered; and the advertisement offering a reward for his apprehension gives the only personal description we possess of him, as "a middle-sized spare man about forty years old, of a brown complexion and dark brown-coloured hair, but wears a wig; a hooked nose, a sharp chin, grey eyes, and a large mole near his mouth." In this conjuncture Defoe had really no friends, for the Dissenters had already been annoyed by his rather casuistical tracts on the question of occasional conformity, and were as much alarmed at his book as the high-flyers were irritated. He was fined (Feb. 24, 1703) 200 marks, and condemned to be pilloried three times, to be imprisoned indefinitely, and to find sureties for his good behaviour during seven years. It was in reference to this incident that Pope, whose Catholic rearing made him detest the abettor of the Revolution and the champion of William of Orange, wrote in the *Dunciad*—

Earless on high stands unabash'd Defoe

—though he knew that the sentence to the pillory had long ceased to entail the loss of ears. Defoe's exposure in the pillory (July 29, 30, 31) was, however, rather a triumph than a punishment, for the populace took his side; and his *Hymn to the Pillory* is one of of the best of his writings in verse. Unluckily for him his condemnation had the indirect effect of destroying his business at Tilbury.

He remained in prison until Nov. 1, 1704, and then owed his release to the intercession of Robert Harley, who represented his case to the queen, and obtained for him not only liberty but pecuniary relief and employment, which, of one kind or another, lasted until the termination of Anne's reign. There is no doubt that Harley, who understood the influence wielded by Defoe, made some conditions. Defoe says he received no pension, but his services were certainly rewarded, and he was a secret agent of the government in 1706 and 1707 in Scotland, working in favour of the Union. In this case he was employed by Godolphin, to whom Harley had recommended him. He wrote in prison many short pamphlets, chiefly controversial, published a curious work on the famous storm of the 26th November, 1703, and started in February 1704 *The Review*. This was a paper which was issued during the greater part of its life three times a week. It was entirely written by Defoe, and extends to eight complete volumes and some few score numbers of a second issue. He did not confine himself to news, but wrote something very like finished essays on questions of policy, trade and domestic concerns; he also introduced a "Scandal Club," in which minor questions of manners and morals were treated in a way which undoubtedly suggested the *Tatlers* and *Spectators* which followed. Only one complete copy of the work is known to exist, and that is in the British Museum. After his release Defoe went to Bury St. Edmunds, though he did not interrupt either his *Review* or his occasional pamphlets. One of these, *Giving Alms no Charity, and Employing the Poor a Grievance to the Nation* (1704), is extraordinarily far-sighted. It denounces both indiscriminate alms-giving and the national workshops proposed by Sir Humphrey Mackworth.

In 1705 appeared *The Consolidator, or Memoirs of Sundry Transactions from the World in Moon,* a political satire which is supposed to have given some hints for Swift's *Gulliver's Travels;* and at the end of the year Defoe performed a secret mission, the first of several of the kind, for Harley. In 1706 appeared the *True Relation of the Apparition of one Mrs. Veal,* an excellent example of Defoe's skill as a special reporter. In the course of his service in Scotland he wrote his *History of the Union,* which appeared in 1709. In this year Henry Sacheverell delivered his famous sermons, and Defoe wrote several tracts about them and attacked the preacher in his *Review*.

In 1710 Harley returned to power, and Defoe was placed in a somewhat awkward position. He seems, in fact, to have agreed with the foreign policy of the Tories and with the home policy of the Whigs, and naturally incurred the reproach of time-serving and the hearty abuse of both parties. At the end of 1710 he again visited Scotland. In the negotiations concerning the Peace of Utrecht, Defoe strongly supported the ministerial side, to the intense wrath of the Whigs, displayed in an attempted prosecution against some pamphlets of his on the all-important question of the succession. Again the influence of Harley saved him. He continued, however, to take the side of the Dissenters in the question affecting religious liberty. He naturally shared Harley's downfall; and, though the loss of his salary might seem a poor reward for his constant support of the Hanoverian claim, it was little more than his ambiguous, not to say trimming, position must have led him to expect.

Defoe declared that Lord Annesley was preparing the army in Ireland to join a Jacobite rebellion, and was indicted for libel; and prior to his trial (1715) he published an apologia entitled *An Appeal to Honour and Justice* which is one of the chief sources for the facts of his life. He was convicted, but was liberated later in the year under circumstances that only became clear in 1864, when six letters were discovered in the Record Office from Defoe to a government official, Charles Delafaye, which, according to William Lee, established the fact that in 1718 at least Defoe was doing political work of an equivocal kind—that he was sub-editing the Jacobite *Mist's Journal* under a secret agreement with the government that he should tone down the sentiments and omit objectionable items. He had, in fact, been released on condition of becoming a government agent. He seems to have fulfilled similar functions in *Dormer's Letter* and the *Mercurius Politicus.*

The first volume of Defoe's most famous work, the immortal story—partly adventure, partly moralizing—of *The Life and Strange Surprizing Adventures of Robinson Crusoe,* was published on April 25, 1719. It ran through four editions in as many months, and then in August appeared the second volume. Twelve months afterwards the sequel *Serious Reflections*, now hardly ever reprinted, appeared. The first two parts were reprinted as a *feuilleton* in *Heathcote's Intelligencer,* perhaps the earliest instance of the appearance of such a work in such a form. The story was founded on Dampier's *Voyage round the World* (1697), and still more on Alexander Selkirk's adventures, as communicated by Selkirk himself at a meeting with Defoe at the house of Mrs. Damaris Daniel at Bristol. Selkirk afterwards told Mrs. Daniel that he had handed over his papers to Defoe. *Robinson Crusoe* is one of the world's classics in fiction. Crusoe's shipwreck and adventures, his finding the footprint in the sand, his man "Friday," are all inimitably told, but it is the conception of civilized man alone face to face with nature which has made Defoe's great work an imperishable part of world literature. In the same year appeared *The Dumb Philosopher,* or *Dickory Cronke,* who gains the power of speech at the end of his life and uses it to predict the course of European affairs.

In 1720 came *The Life and Adventures of Mr. Duncan Campbell.* This was not entirely a work of imagination, its hero, the fortune-teller, being a real person. There are amusing passages in the story, but it is too desultory to rank with Defoe's best. In the same year appeared two wholly or partially fictitious histories, each of which might have made a reputation for any man. The first was the *Memoirs of a Cavalier,* which Lord Chatham believed to be true history. *Captain Singleton,* the last work of the year, has been unjustly depreciated by most of the commentators. The record of the journey across Africa, with its surprising anticipations of subsequent discoveries, yields in interest to no work of the kind.

In 1721 nothing of importance was produced, but in the next year three works of capital importance appeared. These were *The Fortunes and Misfortunes of Moll Flanders, The Journal of the Plague Year,* and *The History of Colonel Jack. Moll Flanders* still ranks among the great English novels, and deserves far more notice than it has usually received.

The *Journal of the Plague Year,* more usually called, from the title of the second edition, *A History of the Plague,* reads like *a*

contemporary record. No one had the imaginative power necessary to create circumstantial detail in a greater measure than Defoe, and there is no more reason to presuppose a documentary basis than in the case of *Moll Flanders*. Defoe was able to make all his narratives appear true stories, and he was gifted in a high degree with historical imagination. *The History of Colonel Jack* is an unequal book, and the end of the story is less good than the beginning.

To this period belong his stories of famous criminals, of Jack Sheppard (1724), of Jonathan Wild (1725), of the Highland Rogue, *i.e.*, Rob Roy (1723). The pamphlet on the first of these Defoe maintained to be a transcript of a paper which he persuaded Sheppard to give to a friend at his execution.

In 1724 appeared also the first volume of that admirable guide, *A Tour through the whole Island of Great Britain*, which was completed in the two following years. In 1725 appeared *A New Voyage round the World*, apparently entirely due to the author's own fertile imagination and extensive reading. It has all the interest of Anson's or Dampier's voyages.

Towards the end of 1726 appeared *The Complete English Tradesman*, which called forth the scorn of Charles Lamb. To 1726 also belongs *The Political History of the Devil*. This belongs to a series of demonological works, of which the chief others are *A System of Magic* (1726), and *An Essay on the History of Apparitions* (1728), issued the year before under another title. *A Plan of English Commerce*, containing very enlightened views on export trade, appeared in 1728.

During the years 1715-28 Defoe had issued a formidable array of pamphlets and minor works which cannot be enumerated here. No man can ever have written more continuously. He must in some way or other have obtained a considerable income. In 1724 he had built himself a large house at Stoke Newington, and he had obtained on lease in 1722 a considerable estate from the corporation of Colchester, which was settled on his unmarried daughter at his death. He died in Ropemaker's Alley, Moorfields, on April 26, 1731, and was buried in Bunhill Fields. He left no will, all his property having been previously assigned, and letters of administration were taken out by a creditor. How his affairs fell into this condition, why he did not die in his own house, and why in the previous summer he had been in hiding, as we know he was from a letter still extant, are points not clearly explained. In 1724 he was, however, attacked by Mist, who was disarmed and wounded and (May 18) imprisoned. It is more likely that Mist had found out that Defoe was a government agent and quite probable that he thus informed other editors, for Defoe's journalistic employment almost ceased about this time, and he began to write anonymously, or as "Andrew Moreton." Mist had escaped to France, and may have designed revenge on Defoe. It is possible that he had to go into hiding to avoid the danger of being accused as a real Jacobite, when those with whom he had contracted to assume the character were dead.

The earliest regular life and estimate of Defoe is that of Dr. Towers in the *Biographia Britannica*. George Chalmers's *Life*, however (1786), added very considerable information. In 1830 Walter Wilson wrote the standard *Life* (3 vols.). In 1864 the discovery of the six letters stirred up William Lee to a new investigation, and the results of this were published (1869), in three large volumes. The first of these (well illustrated) contains a new life and particulars of the author's discoveries. The second and third contain fugitive writings assigned by Lee to Defoe for the first time. There is also a *Life* by Thomas Wright (1894). The best modern version is the Novels and Selected Writings of Daniel Defoe (Oxford, 14 vols. 1927–28). Charles Lamb's criticisms were made in three short pieces, two of which were written for Wilson's book, and the third for *The Reflector*. The volume on *Defoe* (1879) in the "English Men of Letters" series is by W. Minto.

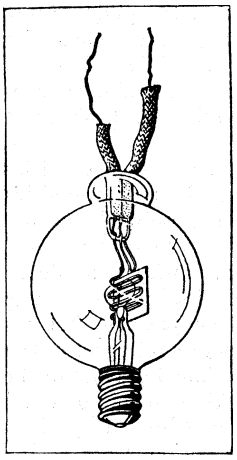
There is considerable uncertainty about many of Defoe's writings; and even if all contested works be excluded, the number is still enormous. Besides the list in Bohn's *Lowndes*, which is somewhat of an *omnium gatherum*, three lists drawn with more or less care were compiled in the 19th century. Wilson's contains 210 distinct works, three or four only of which are marked as doubtful; Hazlitt's enumerates 183 "genuine" and 52 "attributed" pieces, with notes on most of them; Lee's extends to 254, of which 64 claim to be new additions. There have been various editions of Defoe, none of them complete. In 1870 Nimmo of Edinburgh published in one volume an admirable selection from Defoe. It contains Chalmers's *Life*, annotated and completed from Wilson and Lee, *Robinson Crusoe*, pts. i. and ii., *Colonel Jack*, *The Cavalier*, *Duncan Campbell*, *The Plague*, *Everybody's Business*, *Mrs. Veal*, *The Shortest Way with Dissenters*, *Giving Alms no Charity*, *The True-Born Englishman*, *Hymn to the Pillory*, and very copious extracts from *The Complete English Tradesman*. An edition of Defoe's *Romances and Narratives* in sixteen volumes by G. A. Aitken came out in 1895. The *Selected Writings of Daniel Defoe* (14 vols.), were published by Blackwell, 1927.

The reprints and editions of *Crusoe* have been innumerable; it has been often translated; and the eulogy pronounced on it by Rousseau gave it special currency in France, where imitations (or rather adaptations) have also been common.

See also John Forster, *Historical and Biographical Essays* (1858); G. Saintsbury, "Introduction" to Defoe's *Minor Novels;* and valuable notes by G. A. Aitken in *The Contemporary Review* (February 1890) and *The Athenaeum* (April 30, 1889; August 31, 1890). Dr. Karl T. Biilbring edited two unpublished works of Defoe, *The Compleat English Gentleman* (1890) and *Of Royall Educacion* (1905), from British Museum Add. MS. 32,555. Further light was thrown on Defoe's work as a political agent by the discovery (1906) of an unpublished paper of his in the British Museum by G. F. Warner. This was printed in the *English Historical Review*, and afterwards separately.

See further P. Dottin, *Daniel De Foe et ses romans* (1924); W. E. Mann, *Robinson Crusoe en France* (1916); W. Nicholson, *The Historical sources of Defoe's Journal of the Plague Year* (Boston, 1919). William P. Trent, *Defoe: How to Know Him* (1916).

DE FOREST, LEE (1873-), American inventor, was born at Council Bluffs, Ia., Aug. 26, 1873. He was educated at the Sheffield Scientific School, Yale, receiving his B.S. in 1896 and Ph. D. in 1899, and continued his studies at the Armour Institute of Technology, Chicago. His earliest employment was with the Western' Electric Co., Chicago, in their experimental telephone laboratory. He was the first to use the alternating current generator and transmitter, which were later universally employed in wireless transmitting sets. He designed and installed the first five high-power radio stations for the U.S. Navy. The most important of his inventions was the audion amplifier, which made possible long-distance telephony. His other inventions include the oscillating audion, or three-electrode tube, and the four-electrode tube. After 1921 he devoted himself to the development of the so-called phonofilm, a talking motion picture, involving the synchronizing of sound and motion by the photographic representation of sound waves.



THE ORIGINAL AUDION, INVENTED BY DE FOREST
The audion, by regulating the amount of current that passes and magnifying feeble currents, is of vital importance to long-distance telephony and radio

He was the recipient of the Elliott Cresson medal of the Franklin Institute for his discovery of the audion in 1921. He also received the medal of the Institute of Radio Engineers and a prize from the Institute of France in 1923. He was awarded a gold medal for his work in wireless telegraphy at the St. Louis exposition in 1904 and a gold medal from the Panama Pacific exposition in San Francisco in 1915.

DEFREGGER, FRANZ VON (1835–1921), Austrian genre painter, was born in Dolsach, in Tirol, on April 30, 1835, in the old farm house Ederhof zu Stronach. He spent his youth amid the mountains as a farm labourer, and on the death of his father took over the farm, at the age of 23. Two years later he sold his farm, meaning to go to America, but eventually went to Innsbruck to study drawing and carving, to which he was devoted from his boyhood. His teacher, Franz Stolz, took him to Munich in 1861. In 1863 he went to Paris, and returning to Munich, studied under Piloty for five years. His pictures, representing the rustic life of the Tirolese, and the struggle of Tirol, under Andreas Hofer, for freedom from foreign yoke, met with success from the first. They made their appeal by the subject-matter. Among his best known works are the "Speckbacher" (1869) at the Ferdinandeum, Innsbruck; the "Wrestlers" (1870); the "Dancers" (1871); the "Return of the Victors" (1876). He is represented in most German museums and also in the Metropolitan Museum of Art, New York

DEGAS, HILAIRE GERMAIN EDGARD (1834–1917), French painter, was born in Paris on July 19, 1834 and died there

on Sept, 27, 1917. He studied under Lamothe and Ingrès at the École des Beaux Arts, and first exhibited in the Salon of 1865, contributing a "War in the middle ages," a work executed in pastel. To this medium he was ever faithful, using it for some of his best work. But he soon turned to subjects from contemporary life. He exhibited "Steeplechase" (1866), "Family Portraits" (1867) and a portrait of a dancer in the "Ballet of *La Source*" (1868). In 1869 and 1870 he restricted himself to portraits; but thenceforward he abandoned the salons and attached himself to the Impressionists. With Manet and Monet he took the lead of the new school at its first exhibition in 1874, and repeatedly contributed to these exhibitions (in 1876, 1878, 1879 and 1880). In 1868 he had shown his first study of a dancer, and in numerous pastels he proclaimed himself the painter of the ballet. He painted innumerable studies of dancers, showing an amazing mastery of drawing and of light. Several of his works may be seen at the Luxembourg Gallery, to which they were bequeathed among a collection of impressionist pictures by M. Caillehotte. In 1880 Degas showed his powers of observation in a set of "Portraits of Criminals," and he attempted modelling in a "Dancer," in wax. He afterwards returned to his studies of the sporting world, exhibiting in Dec. 1884 at the Petit Gallery two views of "Races" which had a great success, proving the increasing vogue of the artist among collectors. At the eighth Impressionist Exhibition, in 1886, Degas continued his realistic studies of modern life, showing drawings of the nude, of workwomen, and of jockeys. Besides his pastels and his paintings of genre and portraits — among these, several likenesses of Manet — Degas also handled his favourite subjects in etching and in aquatint; and executed several lithographs of "Singers at Cafés-concerts," of "Ballet-girls," and indeed of every possible subject of night-life and incidents behind the scenes. His work is to be seen not only at the Luxembourg but in many of the great private collections in Paris, in England and America. In the Centenary Exhibition of 1900 he exhibited "The Interior of a Cotton-Broker's Office at New Orleans" and "The Rehearsal."

See also G. Moore, "Degas, the Painter of Modern Life," *Magazine of Art* (1890); J. K. Huysmans, *Certains* (1889); G. Geffroy, *La Vie Artistique* (3e Série, 1894); J. B. Manson, *The Life and Work of Degas* (1927); Ambroise Vollard, *Degas* (trans. R. T. Weaver, 1928).

DE GEER, JONKHEER DIEK JAN (1870–), Dutch statesman, mas born on Dec. 14, 1870, and graduated doctor at Groningen. He was a barrister and a journalist by profession. Entering the second chamber in 1907, he became one of the leaders of the Christian Historical Union. He was burgomaster of Arnheim (1920–22), finance minister (1921–23), and in March 1926 became prime minister, retaining for himself the portfolio of finance. The new Government put forward a moderate program of retrenchment, disarmament, and the promotion of native participation in the government of the East Indies. In August 1939 de Geer again became premier.

DE GEER, LOUIS GERHARD, BARON (1818–1896), Swedish statesman and writer, was born on July 18, 1818, at Finspång castle. In 1855 he became president of the Gota Hofret, or lord justice of one of the Swedish supreme courts. From 1858–70 he was minister of justice. His greatest achievement was the reform of the Swedish representative system, whereby he substituted a hi-camera1 elective parliament, on modern lines, for the existing cumbersoine representation by estates, a survival from the later middle ages. This great measure was accepted by the *Riksdag* in Dec. 1865, and received the royal sanction on June 22, 1866. He retired from the ministry in 1870, but took office again, as minister of justice, in 1875. From 1876–80 he was minister of State, and from 1881–88 chancellor of the universities of Uppsala and Lund.

Besides several novels and aesthetic essays, De Geer wrote political memoirs of supreme merit both as to style and matter, the most notable of which are: *Minnesteckning ofver A. J. v. Höpken* (1881); *Minnesteckning ofver Hans Järta* (1874); *Minnesteckning ofver B. B. von Platen* (1886); and his own *Minnen* (1892), an autobiography, invaluable as a historical document.

See *Sveriges historia* (1881, etc.), vi.; Carl Gustaf Malmstrom, *Historiska Studier* (1897); C. Arcadius, *Louis de Geer* (1906).

DEGENERATION. This term is used in several ways in biology. It is applied by Sir E. Ray Lankester (1890) to a racial change in the direction of simplification, as contrasted with elaboration or with persistent balance. An ascidian is in some respects degenerate, *e.g.*, in its nervous system, as compared with its presumed free-swimming ancestor, or its actual free-swimming larva. Lankester defined degeneration as "a gradual change of structure in which the organism becomes adapted to less varied and less complex conditions of life; whilst elaboration is a gradual change of structure, in which the organism becomes adapted to more and more varied and complex conditions of existence. In elaboration there is a new expression of form, corresponding to new perfection of work in the animal machine. In degeneration there is suppression of form, corresponding to the cessation of work." He referred to the vestiges of limbs in certain lizards, such as *Seps* and *Bipes,* to parasitic crustaceans such as *Sacculina* and *Lernaeocera,* sedentary types like rock-barnacles and ascidians, endoparasitic animals such as some mites and Linguatulids. Lankester was careful to point out that "simplicative evolution" may be illustrated in some of the structures of an organism, while "elaborative evolution" is seen in others. Thus the ascidian is not degenerate as regards its pharynx. Lankester excluded cases where there is simplification in the number of parts, yet specialization of what remains, as in the horse limb, where only the third digit is well developed. Anton Dohrn (1875) may be mentioned as another naturalist of distinction who has emphasized degeneration as one of the alternatives of evolutionary change.

In the second place the term is often applied to retrogressive changes in the normal development, which appear to be conditions of subsequent re-differentiation of a new, and. it may be, more complicated plan. This is well illustrated in the metamorphosis of Diptera, Hymenoptera, Coleoptera, and Lepidoptera, where in varying degrees there is a destruction of the larval organization, sometimes by means of phugocytes, and a reconstruction on a new plan, that of the imago, the change being mainly due to very active complexes of small cells, called imaginal discs or folds. This was well described by Kowalevsky and by Weismann for the body-wall and alimentary tract of Dipterous larva. Analogous processes occur in other kinds of metamorphosis, as in the pilidium larva of Nemertines and the pluteus larva of sea-urchins. The dissolution of the complex tail of the tadpole is familiar and obviously much more localized than the thorough-going retrogressive changes in the pupating maggot of a blue-bottle. In these degenerative processes many cells are actually destroyed, but when the development is continued on new lines it must be supposed that certain cells return to an undifferentiated embryonic condition, and that new hereditary factors, previously inhibited, find liberating stimuli and developmental expression.

Here the term de-differentiation is useful and has been defined as the process by which specialized cells or tissues lose their characteristics and become simple or undifferentiated. Apart from its occurrence in metamorphosis, de-differentiation is seen when an organism breaks down in adverse conditions, such as cold and scarcity. If the hydroid *Obelia* is kept in unpropitious environment, the polyp may collapse into an undifferentiated bag of cells, without mouth or tentacles. The cells lose their coherence and migrate to the base of the hydrotheca, being finally absorbed into the common stem. A similar de-differentiation is well illustrated by some Ascidians, and may be an adaptive method of surviving adverse conditions. It is also well known in the case of tissues that are cultivated *in vitro,* and the interesting fact has been demonstrated by Champy and others that if the de-differentiated isolated tissue be re-planted in an appropriate living organism, re-differentiation may occur. *(See* DEDIFFERENTIATION.)

A third use of the term degeneration is for the retrogressive changes that occur during senescence, or when an organ like the thymus gland undergoes reduction of function, or when a nerve-ganglion is over-fatigued, as in the brain-cells of the short-lived summer bee.

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G. R. de Beer, *Experimental Embryology* (Oxford, 1926); J. B. S. Haldane and J. Huxley, *Animal Biology* (Oxford, 1927). (J. A. TH.)

DEGGENDORF or **DECKENDORF,** town of Bavaria, Germany, 25 mi N.W of Passau, on the left bank of the Danube, which is there crossed by two iron bridges Pop. (1939) 11,767. It is at the lower end of the beautiful valley of the Perlbach. The old town hall dates from 1566. The church of the Holy Sepulchre, built in 1337, attracts thousands of pilgrims to its *Porta Caeli* or *Gnadenpforte* (Gate of Mercy) opened annually on Michaelmas eve and closed again on Oct. 4. The town is a depôt for the timber trade of the Bavarian forest, a station for Danube steamboats and the seat of several mills, breweries, etc. On the bank of the Danube outside the town are the remains of the castle of Findelstein; and on the Geiersberg (1243 ft.), in the immediate vicinity, stands another old pilgrimage church. About 6 m. N. is the village of Metten, with a Benedictine monastery founded by Charlemagne in 801, restored as an abbey in 1840 by Louis I. of Bavaria, and well known as an educational institution. The first mention of Deggendorf occurs in 868, and it appears as a town in 1212. Henry (d. 1290) of the Landshut branch of the ruling family of Bavaria made it the seat of a custom-house; and in 1331 it became the residence of Henry III. of Natternberg (d. 1333). In 1337 a wholesale massacre of the Jews, who were accused of having thrown the sacred host of the church of the Holy Sepulchre into a well, took place in the town; and it is probably from about this date that the pilgrimage above mentioned came into vogue. The town was captured by the Swedish forces in 1633, and in the war of the Austrian Succession it was more than once laid in ashes.

See Grüber and Muller, *Der bayerische Wald* (Regensburg, 1851); *Das Kloster Metten* (Straubing, 1857); Mittermüller, *Die heil. Hostien und die Juden in Deggendorf* (Landshut, 1866).

DE GOEJE, MICHAEL JAN: *see* GOEJE, MICHAEL JAN DE.

DEGOUTTE, JOSEPH (1866–1938), French soldier, was born on April 18, 1866, at Charnay (Rhône). He entered Saint-Cyr in 1888 and joined the 4th Zouaves in 1890. After service in Madagascar, he distinguished himself in the Chinese expedition of 1900, was made a lieutenant-colonel in 1911 and sent to Morocco to take charge of the depôt at Casablanca. During the World War he became general of brigade in 1916 and led the Moroccan Division during the Somme, Champagne and Verdun campaigns. In the summer of 1918, at the head of the IV. Army, he helped Mangin to carry through the counter-offensive against the German flank. He was made major-general on the staff of the King of the Belgians in the same year. Thereafter from Oct. 1919 to Oct. 1924 he was commander-in-chief of the French armies on the Rhine, and in 1920 became a member of the Supreme Army Council. He died at Charnay, Oct. 31, 1938.

DEGREE, a step or stage. In academic usage, a degree is a title conferred by a university as a mark of proficiency in scholarship. The word was first applied to the preliminary steps to the mastership or doctorate; viz., the baccalaureate and bicentiate. "The use of academic degrees, as old as the 13th century, is visibly borrowed from the mechanic corporations, in which an apprentice, after serving his time, obtains a testimonial of his skill and a license to practise his trade and mystery" (Gibbon, *Autobiography*, 29). Originally, as the words "master" and "doctor" imply, the degree was a certificate of fitness to teach at a university. Degrees in law, medicine and theology still carry with them a license to practise the corresponding professions, but degrees in arts are no more than certificates of a certain measure of acquaintance with the subject. In modern times the practice has arisen of conferring honorary degrees as a recognition of distinction without regard to academic qualifications. (X.)

In general two practices are followed in the award of degrees. The European and South American countries have as a rule retained the degrees of the five traditional faculties: law, medicine, theology, arts and philosophy, and in granting academic recognition for work in newer fields of study have granted the degree of the faculty to which they most nearly approximate. Except in France and Spain all intermediate degrees, such as those of bachelor and master, have been abolished. In Germany the doctorate of the various faculties is the only one granted, but there is a tendency to add new signatures such as *Dr. Phil. Nat.* or *Dr. Rer. Nat.* in mathematics and sciences and *Dr. Ing.* or *Dr. Rer. Techn.* in engineering. Except in the faculty of law, where the *baccalauréat* is granted, the usual French degrees are the *licence* and *doctorat* according to the faculties; these are State degrees, to which a *doctorat d'université* has been added recently, carrying with it the recognition of a university but none from the State.

In the British universities Oxford and Cambridge have remained conservative and grant the B.A. as the first degree in most faculties; the B.Sc. and B.Litt. at Oxford are awarded for special research and examination. In 1926 Dublin introduced the B.Sc. for students who do not present a classical language in their examinations. The local universities have been more liberal in adding to the list of degrees although the B.A. and B.Sc., the latter in a great variety of special branches of science and technology, are the first degrees (M.A. in Scotland). The B.Com. in commerce, B.Arch. in architecture and B.Ed. in education are the more recent additions. The second degree is the M.A. or M.Sc., obtained everywhere by examinations except at Oxford and Cambridge where it is granted after a period of residence and payment of the prescribed dues. The doctorate (D.Sc., D. Litt., LL.D., etc.) is available in most branches, but in arts and science is usually awarded on the basis of contributions to knowledge and distinction in some special field. Since World War I an attempt has been made, but without much success, to establish the Ph D. by examination. The usual degrees are available in medicine, law and theology. In all the universities the first degrees in arts or science may be obtained as an ordinary degree or with honours.

The greatest multiplication of degrees has taken place in the United States. Not only has there been a rapid expansion of specialization in the universities and colleges, but graduation in each specialty is recognized by a distinctive degree. The commonest degrees are still the B.A. and B.S. to which the signature of the special field is added, as B.A. in Ed., or B.S. in Arch. No attempt seems to be made at standardization; thus in business are A.B. in B. and B. (business administration and banking) and B.B.A. (business administration). As soon as a new grouping of subjects takes place, it is designated by its own degree, as B.J. (journalism) or B.S. in Ae.E. (aeronautical engineering). These special fields have their corresponding designations at the more advanced levels, especially the master's degree, and although there is a tendency to retain the Ph.D. as the most advanced degree in arts and science special signatures are found; as Ed.D. (education). An attempt has been made for several years to grant certain degrees, such as L.H.D., D.D., LL.D., Litt.D., and D.C.L., *honoris causa* only. (I. L. K.)

In the science of measurement, degrees are small equal subdivisions of an interval; *e.g.*, the interval between the freezing and boiling points of water are divided into equal increments of temperature, the size of these depending on the arbitrary temperature scale chosen (*see* THERMOMETRY). The angle (*q.v.*) through which the radius of a circle turns in completing one revolution is divided into 360 degrees. The subdivisions of density scales are also termed degrees (*see* HYDROMETERS). The universal symbol for degree is a small circle at the top right-hand side of the figure denoting the number of degrees; *e.g.*, fifteen degrees centigrade is written thus: 15° C. The degree as an angular measure is further divided into 60 *minutes* of arc (1° = 60′).

In mathematics (*q.v.*), the degree of an expression is determined by the highest dimensions of its terms; thus $2x^2y+xy$ is an expression of the third degree, the first term, being the product of three variables, x, x and y, has three dimensions, and is of higher dimensions than the second which is the product of only two variables. (*See* EQUATIONS, THEORY OF.) In dynamics (*q.v.*) the expression "degrees of freedom" refers to the number of unique possible directions or modes of motion of a body (*see* also QUANTUM THEORY and GYROSCOPE).

DEHMEL, RICHARD (1863–1920), German poet, was born in Wendisch-Hermsdorf, Brandenburg, on Nov. 18, 1863. He was educated in Kremmen, Berlin and Danzig, and in 1882 began

to study philosophy. natural sciences and social economy, and also became editor of a provincial newspaper. From 1887–95 he was secretary of the Union of German Fire Insurance Companies. In 1891 he published his first volume of poetry, *Erlösungen.* This was followed by Aber die *Liebe* (1893), and *Weib und* Welt (1896). From 1899 until 1902 he travelled in Italy, Greece, Switzerland, Holland and England, and afterwards lived in Biankenese, near Hamburg. In collaboration with his first wife, Paula Dehmel, he published some books for children including *Fitzebutze* (1907). He wrote a novel in lyrical form, Zwei *Menschen* in 1903, the epic composition Die *Verwandlungen* der *Venus* in 1904 and also dramas and pantomimes. He took part as a volunteer in the World War, and in 1919 published his diary, *Zwischen* Krieg *und Menschheit.* Amongst his dramas, Die *Menschenfreunde* (1917) was successful. His Collected *Works,* 10 vols., began publication in 1906. Dehmel's work is characterized by most unusual emotional power. His theme, whether it be erotic or social, awakens in him an intensity of feeling which seeks expression with almost explosive force. Sometimes taste and even sense are swept away in this torrent; on the other hand, Dehmel had a very strong feeling for form and music, and his best pieces, where form and thought have been most successfully welded together, are among the masterpieces of the German lyric. He died at Blankanese, Feb. 8, 1920.

See *Selected Letters,* 2 vols. (1922–23); E. Ludwig, *Richard Dehmel* (1913).

DEHRA, a town of British India, headquarters of the Dehra Dun (*q.v.*) district in the United Provinces. It lies at an elevation of 2,300 ft., at the terminus of the Hardwar-Dehra railway. Dehra is the headquarters of the Trigonometrical Survey and of the Forest Department, besides being a cantonment for a Gurkha force. The Indian Forest college, which trains forest officials for all parts of India, is a fine building. Attached to it is a Research Institute for the scientific study of sylviculture and the exploitation and administration of forests. The school for training cadets of good family for the Imperial Service troops was located here; but in 1922 it was virtually replaced by the Prince of Wales' Military college, where Indian boys are trained for Sandhurst and ultimately for the king's commission in the Indian army.

The town of Dehra grew up round the temple built in 1699 by the heretical Sikh Guru, Ram Rai, the founder of the Udasi sect of Ascetics. This temple is a remarkable building in Mohammedan style. The central block, in imitation of the emperor Jahangir's tomb, contains the bed on which the Guru, after dying at will and coming back to life several times, ultimately died outright; it is an object of great veneration. At the corners of the central block are smaller monuments commemorating the Guru's wives. Pop. of town (1931) 40,409; of cantonment, 9,721.

DEHRA DUN, a district of British India, in the Meerut division of the United Provinces, with an area of about 1,189 sq.m. The Dun proper is a beautiful valley lying between the Siwalik range and the foot-hills of the Himalayas. The administrative district runs up into the latter and embraces the sanatorium of Mussoorie. The mountains in its northern section attain a height between 7,000 and 8,000 ft., one peak reaching an elevation of 8,565 ft.; the highest point of the Siwalik range is 3,041 ft. above sea-level. The principal passes through the Siwalik hills are the Timli pass, leading to the military station of Chakrata, and the Mohand pass leading to the sanatoriums of Mussoorie and Landaur. The Ganges bounds the Dehra valley on the east; the Jumna bounds it on the west. It is well wooded, undulating, and relatively temperate in climate. To the east the valley is characterized by swamps and forests, but to the west the natural depressions freely carry off the surface drainage. In 1931 the population was 230,247. A railway to Dehra from Hardwar, on the Oudh and Rohilkhand line (32 m.), was completed in 1900. The district is served by the Dun canals. Tea gardens cover a considerable area, and the valley contains a colony of European tea planters.

Dehra Dun only emerges from the mists of legend into authentic history in the 17th century A.D., when it formed part of the Garhwal kingdom. Towards the end of the century the heretical Sikh Guru, Ram Rai, expelled from the Punjab, sought refuge in the Dun and gathered a crowd of devotees. Fateh Sah, raja of Garhwal, endowed the temple which he built, round which grew up the town of Gurudwara or Dehra (*q.v.*). In the 18th century the fertility of the valley attracted the attention of Najib-ud-daula, governor of Saharanpur, who invaded it with an army of Rohillas in 1757 and annexed it to his dominion. His rule, which lasted till 1770, brought great prosperity to the Dun; but on his death it became a prey to the surrounding tribes, its desolation being completed after its conquest by the Gurkhas in 1803. In 1814 it was taken possession of by the British.

DEHYDROGENATION, the removal of hydrogen from the molecule of a chemical compound, which may be effected in the case of an organic compound by heating it in the presence of a metal, which acts as a catalyst (see CATALYSIS); *e.g.,* the alcohols (*q.v.*) lose hydrogen and yield aldehydes (*q.v.*; see also HYDROGENATION).

DEHYDRATION, in chemistry, the removal of molecules of water from a chemical compound. The water may be present in the form of water of crystallization (see HYDRATE) in which case it is removed by heating the crystals, or by placing them in an evacuated desiccator in the presence of a drying agent such as phosphorus pentoxide. Alternatively, water may form part of a molecule of an organic compound, in which case it is removed by heating the compound in the presence of a metallic oxide, which acts as catalyst (see CATALYSIS); *e.g.,* the alcohols (excepting methyl alcohol) are converted into the corresponding olefines. (See ALCOHOLS and OLEFINES.)

DEINARCHUS, last of the "ten" Attic orators, son of Sostratus (or, according to Suidas, Socrates), born at Corinth about 361 B.C. He settled at Athens early in life, and when not more than twenty-five was already active as a writer of speeches for the law courts. In 324 the Areopagus, after inquiry, reported that nine men had taken bribes from Harpalus, the fugitive treasurer of Alexander. Deinarchus wrote, for the prosecution, the three speeches which are still extant—*Against Demosthenes,* Against *Aristogeiton,* Against Philocles. The sympathies of Deinarchus were in favour of an Athenian oligarchy under Macedonian control; but it should be remembered that he was not an Athenian citizen. In the Harpalus affair, Demosthenes was doubtless innocent, and so, probably, were others of the accused. Yet Hypereides, the most fiery of the patriots, was on the same side as Deinarchus.

Under the regency of his old master, Demetrius Phalereus, Deinarchus exercised much political influence. On the restoration of the democracy by Demetrius Poliorcetes, Deinarchus was condemned to death and withdrew into exile at Chalcis in Euboea. About 292, thanks to his friend Theophrastus, he was able to return to Attica. Deinarchus died at Athens about 291.

According to Suidas, Deinarchus wrote 160 speeches; and Dionysius held that, out of 85 extant speeches bearing his name, 58 were genuine—28 relating to public, 30 to private causes. Although the authenticity of the three speeches mentioned above is generally admitted. Demetrius of Magnesia doubted that of the speech Against *Demosthenes,* while A. Westermann rejected all three. Deinarchus had little individual style and imitated by turns Lysias, Hypereides and Demosthenes. He is called by Hermogenes ὁ κριθινὸς Δημοσθένης, a Demosthenes whose strength is rougher, without flavour or sparkle.

Editions: (text and exhaustive commentary) E. Mätzner (1842); (text) T. Thalheim (1887), F. Blass (1888); *see* L. *L.* Forman, *Index Andocideus, Lycurgeus, Dinarcheus* (1897); and, in general, F. Blass, *Attirche Beredsamkeit,* iii. There is a valuable treatise on the life and speeches of Deinarchus by Dionpsius of Halicarnassus.

DEINOCRATES, a famous and original Greek architect, of the time of Alexander the Great. He tried to captivate the ambitious fancy of that king with a design for carving Mount Athos into a gigantic seated statue. This plan was not carried out, but Deinocrates designed for Alexander the plan of the new city of Alexandria, and constructed the vast funeral pyre of Hephaestion. Alexandria was, like Peiraeeus and Rhodes (see HIPPODAMUS), built on a regular plan, the streets of most earlier towns being narrow and contused.

DEIOCES (Δηιόκης) according to Herodotus (i. 96 ff.) the first king of the Medes. He narrates that, when the Medes had rebelled against the Assyrians about 710 B.C., according to his chronology (*cf.* Diodor, ii. 32), they lived in villages without any political organization. Then Deioces, son of Phraortes, was chosen judge in his village, and the justness of his decisions induced the inhabitants of the other villages to throng to him. At last the Medes resolved to set up a kingdom, and chose Deioces king. He now caused them to build a great capital, Ecbatana, with a royal palace, and introduced the ceremonial of oriental courts. He united all the Median tribes, and ruled 53 years (c. 699–647 B.C.), though perhaps, as G. Rawlinson supposed, the 53 years of his reign are exchanged by mistake with the 22 years of his son Phraortes.

The narration of Herodotus is only a popular tradition. We know from the Assyrian inscriptions that just at the time which Herodotus assigns to Deioces the Medes were divided into numerous small principalities and subjected to the great Assyrian conquerors. Among these petty chieftains, Sargon in 715 mentions Dāyukku, "lieutenant of Man" (he probably was, therefore, a vassal of the neighbouring king of Man in the mountains of south-eastern Armenia), who joined the Urarteans and other enemies of Assyria, but was by Sargon transported to Hamath in Syria "with his clan." His district is called "bit-Dāyaukki," "house of Deioces," also in 713, when Sargon invaded these regions again. So it seems that the dynasty, which more than half a century later founded the Median empire, was derived from this Dāyukku, and that his name was thus introduced into the Median traditions, which contrary to history considered him as founder of the kingdom.

DEÏOTARUS, a tetrarch of Galatia in Asia Minor, and a faithful ally of the Romans. At the beginning of the third Mithridatic war, he drove out the troops of Mithridates from Phrygia. Pompey, when settling the affairs of Asia (63 or 62 B.C.) rewarded him with the title of king and an increase of territory (Lesser Armenia). Dei'otarus naturally sided with Pompey in the civil war and after Pharsalus escaped with him to Asia. In 47 Caesar arrived in Asia from Egypt and pardoned Deiotarus for having sided with Pompey. In consequence of the complaints of certain Galatian princes, Dei'otarus was deprived of part of his dominions, but allowed to retain the title of king. On the death of Mithridates of Pergamum, tetrarch of the Trocmi, Dei'otarus was a candidate for the vacancy. Other tetrarchs also pressed their claims; Dei'otarus was accused by his grandson Castor of having attempted to assassinate Caesar when the latter was his guest in Galatia. Cicero undertook his defence, but the assassination of Caesar prevented any final decision. In his speech Cicero deals mainly with the distribution of the provinces, the real cause of the quarrels between Dei'otarus and his relatives. After Caesar's death, Mark Antony, for a large sum of money announced that, in accordance with instructions left by Caesar, Dei'otarus was to resume possession of all the territory of which he had been deprived. When civil war again broke out, Dei'otarus was persuaded to support Brutus and Cassius, but after Philippi went over to the triumvirs. He remained in possession of his kingdom till his death at a great age (see GALATIA).

See Cicero ***Philippica,*** ii. 37; ***Ad fam.*** viii. 10, ix. 12, xv. 1, a, 4; ***Ad. Att.*** xiv. 1; ***De divin.*** i. 15, ii. 36, 37; ***De harusp. resp.*** 13, and above all ***Pro rege Deiotaro;*** Appian, ***Bell. Mithrid.*** 75, 114; *Bellum Alexandrinum,* 34–41, 65–77; Dio Cassius xli. 63, xlii. 45, xlvii. 24, 48, xlviii. 33.

DEIR or **DEIR EZ-ZOR,** a town in Syria (French mandated territory until 1941), on the right bank of the Euphrates. 27½ mi. above its junction with the Khābūr: population 6,659. The chief town of a considerable area it boasts a hotel, bazaar and many shops. It has a French garrison and an aerodrome, macadamized streets and a public garden, and is a centre of commerce. In Ptolemaeus' list of towns on the right bank of the Euphrates (Geog. v. 18) the following have been identified with Deir ez-Zor: Gadirtha (Fischer, Herzfeld), *Birtha* (Kiepert), *Auzara* (=*Azaura*) (Dussaud). The ancient roads from Aleppo and Damascus to Baghdad met here. One of the modern motor routes from Damascus to Baghdad passes through the town.

DEIRA, the southern of the two English kingdoms afterwards united as Northumbria. According to Simeon of Durham it extended from the Humber to the Tyne, but the land was waste north of the Tees. York was the capital of its kings. The date of its first settlement is quite unknown, but the first king of whom we have any record is Ella or Aelle, the father of Edwin, who is said to have been reigning about 585. After his death Deira was subject to Aethelfrith, king of Northumbria, until the accession of Edwin, in 616 or 617, who ruled both kingdoms (see EDWIN) till 633. Osric the nephew of Edwin ruled Deira (633–634), but his son Oswine was put to death by Oswio in 651. For a few years subsequently Deira was governed by Aethelwald, son of Oswald.

See Bede, *Historia ecclesiastica,* ii. 14, iii. 1, 6, 14 (ed. C. Plummer, 1896); Nennius, *Historia Brittonum,* s. 64 (ed. Th. Mommsen, Berlin, 1898); Simeon of Durham, ***Opera, i, 339*** (ed. T. Arnold, 1882–85). (F. G. M. B.)

DEIRDRE, in older Irish Derdriu, the heroine of the tale of the Fate *of* the Sons *of* Uisnech, one of the "three sorrowful tales" of Ireland. According to the story, she was the daughter of Feidlimid, son of Dall, the king's story-teller. When the Ultonian braves were a-drinking in the house of Feidlimid, and his wife, then pregnant, was serving them, the child screamed from the womb of her mother. The druid Cathub prophesied that a girl-child would be born, by name Derdriu, and great evil would come with her. The Ultonians said she should be slain, but King Conchobar interfered, and ordered her to be brought up in seclusion, and kept to be his own wife. Derdriu grew up thus; but having accidentally come in contact with Nóisi, son of Uisnech, she fell in love with him, and persuaded him and his two brethren, Ainle and Ardan, to carry her off to Alba. Here the four lived together for some time, but they were enticed back by guile by Conchobar's emissaries. The three brethren were slain, and Derdriu taken to Conchobar; but she committed suicide to avoid falling into the king's hands. The *dénouement* of the tale varies, however, in different versions.

The tale is edited (without translation) in Windisch's ***Irische Texte,*** vol i. (Leipzig, 1880). A convenient edition of a modern version bas been published, with translation and vocabulary, by the Society for Preservation of the Irish Language (1898). For a modern Scottish Gaelic version *see* Alex. Carmichael, ***Deirdire*** (Paisley, 1914). (R. A. S. M.)

DEISM is a theological term bearing two accepted meanings.

1. It is the technical name for a particular philosophical doctrine concerning the relation of God to the world. Deism is then contrasted with theism (*q.v.*), though etymologically the two words are equivalent. Whereas theism asserts God to be continuously active in the world and in touch with human souls, *i.e.,* to be immanent in, or operative upon, nature and man in respect of providential guidance, revelation and grace, deism limits the divine activity to creation of the world and fixation of its primary collocations. It conceives the world-process to be determined by these alone: the world originally received from its Maker a capacity for self-development, or a delegated autonomy describable in terms of proximate causes without invocation of further divine intervention. Thus deism is what is popularly called the doctrine of an absentee-God, who, once and for all having wound up the world-machine, has left it to run its course and to work out its self-evolution. In this extreme form, deism has seldom been embraced by theological thinkers; it has rather seemed to be an exaggerated conception of the relative independence of the world and its causal nexus, But unless theism asserts somewhat of relatively fixed order and continuity of causal determination in created things, from which the Deity stands "a hand-breadth off" to give free play, so that God is not the sole operative cause in the spheres of physical process and human conduct, it lapses from the doctrine of an immanent God into pantheism. In other words, if theism is to be in earnest with the distinction involved in speaking of God and the world. and is not to adopt Spinoza's identification, expressed in his phrase God or Nature, it must accept so much of deistic tincture as to enable it to assert that there is a world-order which, however dependent on God, is in some degree independent of Him in that, when once "planted out," it evolves according to the laws of its being, and so provides a sphere for His continuous energizing. Thus pantheism

and deism are two extremes between which theism is a middle way.

2. Deism is also the received name for a trend of theological thought, not explicitly concerned with the philosophical problem above indicated. The term then has an historical, rather than a technically philosophical, signification; and this is its earlier and commoner meaning. The movement which the word indicates was connected primarily with the relation of revealed religion to natural religion, or the relation of Christian doctrine to theology mediated by reason alone, as exercised on the world and man. It manifested itself chiefly, but not exclusively, in England, and most conspicuously in the 18th century. In fact "deism" is very commonly an abridgment of the phrase "English deism of the 18th century." Deistic thought had, indeed, already appeared in the 17th century; but it was then premature and consequently still-born; whereas the movement in the first half of the succeeding century evoked widespread excitement and controversy, and profoundly influenced theological science.

Deism, as it first emerged, was the natural issue, in theology, of historical causes that operated similarly in other fields of thought. The Reformation had brought individual liberty in religion, and toleration had become a politically expedient practice. Consequently, variety of opinion found expression, from allegiance to the orthodox theology such as might be called protestant scholasticism, to the vagaries and "enthusiasms" of individuals and sects. The new physical science, progressing rapidly after the Copernican revolution, was presenting an exemplar of certain knowledge, a sound method and criterion of truth. This was the primary quest of deism. It was first prosecuted by Lord Herbert of Cherbury (1583–1648), the father of English deism, and a contemporary of Descartes. Without denying or repudiating historically "revealed" religion, such as Christianity, Lord Herbert commended a "natural" religion, not transmitted by tradition admitting of corruption, nor accepted on external authority, but demanded and established by reason common to all men, and capable of finding universal acceptance. Adopting as certain, because unquestioned in his age, the belief that in all men there is divinely implanted a faculty, such as was commonly called "natural light," comparable to instinct save that it is of the nature of rntellection rather than of sensibility, he taught that this rational light is the mediator of innate ideas or "common notions" in which the essential elements of all true religion are to be found. These are that God exists, that man's duty is to worship Him, that virtue and piety are the essentials of worship, that repentance and retribution are divinely called for from us, and that there is a future life in which reward and punishment will be meted out. Such, he further held, was the primitive form of religion, from which mankind has been diverted.

As Herbert laid the foundations of deism, in the 17th century, in so far as its positive and its philosophical aspects are concerned, so also, during the same century, did Charles Blount (1654–93) initiate the negative procedure which became the more conspicuous characteristic of deism in the later stages of its development. This procedure consisted in criticism of the Scriptures, of received views as to authorship of the sacred books, of miracles, of specific Christian doctrines, and of ecclesiastical history. It has been called negative, because its aim was not so much to commend the certainty and sufficiency of natural theology, of which deism at first asserted revealed theology to be a more or less superfluous republication, as to suggest the doubtfulness of the data, evidences and arguments, on which revealed religion had hitherto been based. The chief writers who, between 1700 and 1750, conducted this attack upon orthodoxy, were Thomas Woolston, Anthony Collins, Thomas Morgan and Thomas Chubb. They were not scholars of the highest order, nor thinkers of more than mediocre ability. Indeed they were silenced by writers better equipped with learning. Nevertheless deism of this negative or sceptical kind was not merely the exhibition of temporary unrest or discontent. It was an expression of vague suspicions which developed into critical sciences that, in the succeeding century, effected a revolution in Christian apologetic. In its championship of freedom of inquiry; in search for certainty instead of groundless or disputable opinion; in its insistence on reason as the sole instrument for acquiring and judging of truth, and in its use of the method of doubt, deism may be said to offer a parallel to the Cartesian renaissance in philosophy, and to represent the beginning of modernity in English theology. Hence, even on its negative side, deism is an important movement in the history of theological thought.

This phase of 18th century deism finds its best expression in two works. The first is *Christianity not mysterious,* by John Toland, in which it is argued that there is nothing in the Gospels that is mysterious, either in the sense of being contrary to reason or in the sense of being above or beyond reason. Toland, from one point of view, upheld the certainty of the natural theology which reason could read, and of the revelation that had been divinely vouchsafed to it. Provided they are allowed to put their own interpretation on the vague and ambiguous word "reason," most persons of common sense, as well as most philosophers, will perhaps nowadays accept Toland's conclusion. If reason include the discovery of actual premises, such as science deals with, it does not provide the infallible natural theology that deism prided itself on having found, and in comparison with which it afterwards proceeded to disparage revealed religion. Rather did Bishop Butler, the most considerable critic of the deists, hit the mark in his pregnant dictum, "probability is the guide of life." The other of the two works just now referred to, is Matthew Tindal's *Christianity as* old *as the Creation; or the Gospel a Republication of the Religion of Nature.* This book states the case in favour of natural religion more comprehensively than any other of its period: it came to be called "the deist's Bible," and it evoked in especial degree the notice of Bishop Butler and other defenders of revealed religion. The deistic creed, here set forth, is essentially similar to that of Lord Herbert; and natural religion is regarded as consisting in rational knowledge, as contrasted with subjectively caused belief, together with morality. Revelation is restricted to communication of ready-made truth; and the "natural" revelation, old as creation, is described as "internal," *i.e.,* as involved or implicated in the constitution of the world and the natures of God and man. Being thus essential or intrinsic, it is an eternal truth of reason, not contingent on historical facts.

If any one of the deists' tenets was more fundamental than another, it was their assertion that revealed religion presupposes natural religion, And this, though it was for the most part overlooked or evaded during the 19th century, may be regarded as their lasting contribution to theological thought. Unfortunately their conception of the content of natural theology, and of the rational grounds on which they supposed it to be infallibly based, involved *a priori* assumptions which, shortly after deism found its completed expression in Tindal, were demolished by Hume, and later by Kant. Genetic sciences as yet scarcely existed; evolution or development was as wanting from the stock of 18th century ideas as it was paramount in the succeeding century. So the deists worked with static ideas; and some of the assumptions, which to them seemed self-evidept truths, came to be found inconsistent with facts. Human nature and reason are evolved products; and reason as innate *lumen naturale,* to which, the deist thought, a just God *must* reveal Himself perfectly and clearly from the first, never existed. It may be observed, however, that none of those free-thinkers held the kind of deism that was here first described, but rather repudiated it as "atheism."

See Leslie Stephen, *History of English Thought in the 18th century,* Vol. I. (1876 and 1902) and the bibliography therein. (F. R. T.)

DEISTER, a chain of hills in Germany, in the Prussian province of Hanover, about 15 m. S.W. of the city of Hanover. It runs from Springe in the south of Rodenberg in the north. It has a total length of 14 m. and rises in the Hofeler to a height of 1,250 feet. The chain is well-wooded and abounds in game. There are some coal mines and sandstone quarries.

DEJAZET, PAULINE VIRGINIE (1798–1875), French actress, born in Paris on Aug. 30, 1798, first appeared on the stage at the age of five. In 1820 she started to play soubrette and "breeches" parts at the Gymnase, with such success that such parts became known as "Déjazets." After playing at the Nouveautés and the Variétés she became manager of the Folies,

renamed the Théatre Déjazet. Here, even at the age of 6j, she had marvellous success in youthful parts, especially in some previously unacted early plays of Sardou. She retired in 1868, and died on Dec. 1, 1875.

Duval, *Virginie Déjazet* (1876), *L. H.* Lecomte, *Un amour de Déjazet* (1907), and *Virginie Dtjazet* (1904).

DE KALB, a city of DeKalb county, Ill., U.S.A., on the Rishwaukee river, 60 mi. W. of Chicago It is on the Lincoln highway, is served by the Chicago and North Western, Chicago Great Western and Chicago, Milwaukee, St. Paul and Pacific railaays. Land area 2 sq mi. Population was 8,545 in 1930 and 9,146 in 1940 by federal census. Barbed wire was invented and first manufactured there. Other products manufactured are truck bodies, insulated copper mire and cable, warm air furnaces, pianos, piano accordions, player piano rolls, canned vegetables, commercial refrigerating machinery, screen cloth, day beds, bed springs, ladies' sports apparel, two-piece upholstered furniture. The total annual value of manufactured products is estimated at $18,000,000; retail sales at $8,000,000. DeKalb is in the centre of the rich agricultural lands; corn, small grain and cattle raising predominate. The Northern Illinois State Teachers' college occupies a campus of 67 ac. DeKalb was settled in 1832, incorporated a city in 1877; until 1840 it was called Buena Vista.

DE KEYSER, THOMAS (1596 or 1597–1667), Dutch painter, was born at Amsterdam, the son of the architect and sculptor Hendrik de Keyser. Aert Pietersz, Cornelis vanider Voort, Werner van Valckert and Nicolas Elias are accredited by different authorities with having developed his talent. De Keyser chiefly excelled as a portrait painter, though he also executed some historical and mythological pictures, such as the "Theseus" and "Ariadne" in the Amsterdam town hall. His portraiture is full of character and masterly in handling, and often, as in the "Old Woman" of the Budapest gallery, is distinguished by a rich golden glow of colour and Rembrandtesque chiaroscuro. Some of his portraits are life-size, but the artist generally preferred to keep them on a considerably smaller scale, like the famous "Group of Amsterdam Burgomasters" assembled to receive Marie de' Medici in 1638, now at The Hague museum. His pictures are in the Dresden and Frankfurt museums, in the Heyl collection at Worms, and the Liechtenstein gallery in Vienna. The National Gallery, London, owns a characteristic portrait group of a "Merchant with his Clerk"; The Hague museum, besides the group already referred to, a magnificent "Portrait of a Savant," and the Haarlem museum a fine portrait of "Claes Fabricius." At the Ryks museum in Amsterdam there are 12 of his works.

DEKKER, EDWARD DOUWES (1820–1887), Dutch writer, commonly known as MULTATULI, was born at Amsterdam on March 2, 1820. In 1838 he went out to Java, and obtained a post in the Inland Revenue. He rose from one position to another, until, in 1851, he found himself assistant-resident at Amboyna, in the Moluccas. In 1857 he was transferred to Lebak, in the Bantam residency of Java. By this time, however, he had begun to protest against the abuses of the colonial system. He was threatened with dismissal from his office for his openness of speech, and, throwing up his appointment, he returned to Holland in a state of fierce indignation. He determined to expose in detail the scandals he had witnessed, and he began to do so in newspaper articles and pamphlets. In 1860 he published, under the pseudonym of "Multatuli," his romance, *Max Havelaar* (Eng. trans. by W. Siebenhaar, with introd. by D. H. Lawrence, 1927). This book made a complete exposure of the abuse of free labour in the Dutch Indies. His *Miiznebrieven* (1861), in spite of their mild title of "love letters," proved to be mordant satires of the most rancorous and unsparing kind. He collected his miscellanies in uniform volumes called *Ideën* (7 vols., 1862–77), and shaking the dust of Holland from his feet, went to live at Wiesbaden. Dekker died at Nieder Ingelheim, on the Rhine, on Feb. 19, 1887. His *Brieven* (6 vols., 1890–92), and his *Verzamelde Werken* (10 vols., 1892) were edited by his widow.

See F. van Eeden, "Multatuli" in *Studien* (vol. i., 1890), and G. Jonckbloet, *Multatuli* (1894).

DEKKER (or DECKER), **THOMAS** (c. 1572–*c.* 1632), English dramatist, was born in London, and a Thomas Decker, who may probably be identified with the poet, was buried at St. James's, Clerkenwell, on Aug. 25, 1632. Ben Jonson drew him as Demetrius Fannius, the "dresser of plays," in the *Poetaster*. His name as a playwright first appears in Henslowe's *Diary* on Jan. 8, 1598, and he was busily engaged in the preparation of plays in the next few years. In all he is said to have had a hand in 44 plays. His special interest is as a depicter of London life, of the manners and tastes of the citizens and their wives, of the London apprentice, and of the young aristocrats who frequented the playhouse. About six of the plays attributed to Dekker survive. *Old Fortunatus,* drawn from a German tale already dramatized by Hans Sachs, was played on Dec. 27, 1599, and printed in 1600. *The Shoemaker's Holiday,* based on T. Deloney's prose tract, *The Gentle Craft,* was probably also played in 1599, and was printed in 1600. *Patient Grissill* (played 1600, pr. 1603) was the joint work of Dekker, Chettle and Haughton. In *Satiromastix* (played 1601, pr. 1602), which was a counterblast to Jonson's *Poetaster,* Dekker seems to have had the help of Marston. Dekker also had a hand in *Sir Thomas Wyatt* (1602), *The Honest Whore* (1604), *Westward Ho* (1604) and many others. *If it be not Good the Devil is in It* (c. 1610) and *Match Mee in London* (of unknown date) are ascribed wholly to Dekker, and many plays for which his name is given in the theatrical records are lost. The last play in which he had a share appears to be *The Noble Soldier* (c. 1631), in which Day and S. Rowley were perhaps his associates.

Dekker was also a popular pamphleteer, and one of his pamphlets, *The Gull's Hornbook* (1609) gives an unmatched picture of the London of Dekker's day by describing in detail a day in a young fop's life in the city. In *The Wonderful Year* (1603) he describes the state of London during the plague of that year with a realism that matches Defoe. Other pamphlets are *The Seven Deadly Sins of London* (1606), *Newes from Hell; Brought by the Divells Carrier* (1606), etc.

In 1613 Dekker's fortune, never too radiant, underwent eclipse. In 1598 and 1599 Henslowe had lent him money for his discharge when he had been arrested, but in 1613 he was put in the King's Bench prison for debt, and lay there certainly until 1616 and perhaps until 1619. In *Dekker his Dreame* (1620) he speaks of the "Bed in which seven years I lay dreaming," possibly referring to his prison bed.

Dekker is not one of the greatest dramatists of his time, but his loveable personality, his irrepressible humour and his Londoner's lightheartedness, whimsicality and happy-go-lucky temperament have endeared him to all students of Jacobean London. He was, too, a lyric poet of genius, and to him we owe some most charming lyrics. One of them "Art thou poor, yet hast thou golden slumbers?" is to be found in every anthology of the period.

Dekker's *Dramatic Works* were edited by R. H. Shepherd (1873); and four plays were published by E. Rhys in the *Mermaid Series* (1887). His *Non-Dramatic Works* were edited by A. B. Grosart (1884–86) for the Huth Library; and *The Gull's Hornbook* by R. B. McKerrow (1904). *See* E. K. Chambers, *The Elizabethan Stage* (vol. iii. 1923).

DE KOVEN, REGINALD (1861–1920), composer, was born at Middletown, Conn., April 3, 1861. At the age of 20 he graduated from Oxford with a doctor's degree in music. He also studied music in Stuttgart, Florence, Paris and Vienna. After his return to the United States, he wrote music criticism for many publications, including *Harper's Weekly* and the New York *World.* In 1902 he founded the Washington Symphony Orchestra, which he conducted until 1905. He was a fertile composer of comic operas, 300 songs and works for piano and orchestra. The first included *Don Quixote, The Algerian, The Fencing Master, Rob Roy, The Knickerbockers, The Mandarin, From Broadway to Tokio, The Golden Butterfly* and *Robin Hood,* the most successful of all, first given in Chicago in 1900 and since repeated often throughout the English-speaking world. Two grand operas, *Trilby* and *The Canterbury Pilgrim* (1917), were also composed by him. He died at Chicago, Jan. 16, 1920.

DE LA BECHE, SIR HENRY THOMAS (1796–1855), English geologist, was born in 1796, the son of an army officer

settled in Jamaica. The boy spent his youth in England with his mother at Lyme Regis and was educated for the army at the college at Great Marlow, but the peace of 1815 changed his career. He joined the Geological Society of London, of which he was president in 1848–49. After a period of travel in Europe he began the detailed investigation of the rocks of Cornwall and Devon. Thrown much into contact with the mining community, he conceived the idea that the nation ought to compile a geological map of the United Kingdom, to aid the scientific development of its mineral industries, and persuaded the government to give him an appointment in connection with the Ordnance Survey. This formed the starting point of the Geological Survey of Great Britain, which was officially recognized in 1835, when De la Beche was appointed director. Eventually Parliament sanctioned the erection of a museum of geology and the organization of a staff of professors. The establishment, in which were combined the offices of the Geological Survey, the Museum of Practical Geology, The Royal School of Mines and the Mining Record Office was opened in Jermyn street, London, in 1851.

De la Beche published numerous memoirs on English geology in the *Transactions of the Geological Society of London,* as well as in the *Memoirs of the Geological Survey,* notably the *Report on the Geology of Cornwall, Devon and West Somerset* (1839). In his *Researches in Theoretical Geology* (1834) he enunciated a philosophical treatment of geological questions much in advance of his time. His *Geological Observer* (1851; 2nd ed., 1853), enlarged from an earlier work, displays his talent for artistic delineation of geological phenomena. He was elected F.R.S. in 1819, was knighted in 1848, and near the close of his life was awarded the Wollaston medal. He died on April 13, 1855.

See Sir *A.* Geikie's *Memoir of Sir A. C. Ramsay* (1895), which contains a sketch of the history of the Geological Survey, and of the life of De la Beche (with portraits); also *Summary of Progress of the Geological Survey for 1897* (1898).

DELABORDE, HENRI FRANÇOIS, COUNT (1764–1833), French soldier, the son of a Dijon baker, served in the revolutionary war from the beginning. He was created count in 1808 when he was serving under Junot in Portugal. He fought the skilful action of Roliça. In 1812 he was a divisional commander under Mortier in the Russian campaign. He joined Napoleon during the Hundred Days, was court-martialled at the Restoration, but acquitted on technical grounds.

DELACROIX, FERDINAND VICTOR EUGENE (1798–1863), French historical painter, leader of the romantic movement, was born at Charenton-St. Maurice, near Paris, on April 26, 1798. His father, Charles Delacroix (1741–1805), was foreign minister under the Directory. Eugène was educated at the Lycée Napoléon, and then entered the *atelier* of Baron Guérin. He studied the works of Rubens and Paolo Veronese at the Louvre; and he was attracted by the work of Jéricault, whose influence can be traced in Delacroix's first important picture, "Dante and Virgil," exhibited in 1822 and now in the Louvre. At a time when the classic school was predominant and artists were intent on the representation of scenes of antiquity and mythology the appearance of Delacroix's "Massacre of Chios" in the Salon of 1824 marked a victory for the romantic movement. It represented in a tragic manner the atrocities enacted in Greece, and, like Byron's poetry, enlisted sympathy for the Greek War of Independence. The picture was painted in glowing colours, and contrasted with the dark canvases of the Classicists, whose opposition was roused. The aged Gros is said to have called the "Massacre of Chios" *le massacre de la peinture.* Delacroix spent some months in England in 1825, and drew fresh inspiration from the works of Byron. He was attracted by the fresh and direct painting of Constable's landscapes. His next two pictures, "Marino Faliero Decapitated on the Giant's Staircase of the Ducal Palace" and "Greece Lamenting on the Ruins of Missolonghi," with many smaller works, were exhibited for the benefit of Greek patriots in 1826. Next year he produced "Sardanapalus," from Byron's drama. After this, he says, "I became the abomination of painting, I was refused water and salt"—but, he adds with singularly happy naivete, *J'étais enchanté de moi-même!* The patrimony he inherited, or what remained of it, was 10,000 *livres de rente,* and with economy he lived on this, and continued to paint large historical pictures. In 1831 he re-appeared in the Salon with six works, among which was "Liberty leading the People," now in the Louvre, and immediately after left for Morocco, where he found the colour and light which flood his later work. "The Entry of the Crusaders" into Constantinople is a powerful colour harmony (Louvre). A visit to Madrid acquainted him with the methods of Velasquez and Goya. The "Noce Juive" (1839) in the Louvre shows the influence of Spain. In 1835, through the influence of Thiers, he received a commission to decorate the interior of the chamber of deputies, and between that date and 1861 he completed that and other great decorative works: "The Triumph of Apollo," the panel in the centre of the ceiling of the Galerie d'Apollon in the Louvre; subjects from the Divine Comedy in the library of the Luxembourg; and the mural paintings in the church of St. Sulpice, and in the Salon de la Paix in the Hôtel de Ville. Delacroix died on Aug. 13, 1863, at Champrosay, considered the greatest of the romanticist subject painters. Although he was hailed during his life time as a great revolutionary, it is not him, but Ingres, his classicist opponent and rival, whom modern painters claim as their ancestor. His large pictures representing romantic epics have not created a following. It is by his magic colour harmonies that he contributed to the development of painting; and his subtle decomposition of colour taught one of their principal secrets to the impressionists.

See *Journal d'Eugène Delacroix,* ed. P. Flat and R. Piot (1893–95); A. Robaut and Chesneau, *L'Oeuvre complet d'Eugène Delacroix* (1885); *E.* Dargenty, *Delacroix par lui-même* (1885); G. Moreau, *Delacroix et son oeuvre* (1893); Dorothy Bussy, *Eugène Delacroix* (1907); Phil. Burty, *Lettres d'Eugène Delacroix 1815–1863* (1879); Raymond Escholier, *Delacroix* (1927).

DE LA GARDIE, JAKOB, COUNT (1583–1652), Swedish field-marshal, son of Count Pontus de la Gardie, was born at Reval on June 30, 1583. In 1610 he led an army of mercenaries to Moscow in support of Basil Shuisky; after his abdication La Gardie seized Ingria and Novgorod, which acknowledged the sovereignty of the Swedes, but the Swedish army was held up before Pskov. But with the accession of the Romanovs the Russian situation changed. La Gardie defeated the Russians at Bronitski in July 1614, but Gustavus Adolphus now took charge of the operations, and with him La Gardie returned to Sweden. By the peace of Stolbova (1617) the Swedish possessions on the eastern Baltic were secured. La Gardie was promoted field-marshal, and devoted himself to the organization of the army. In 1625 he was again fighting in the Baltic provinces. On the death of Gustavus Adolphus he was appointed one of the guardians of the child queen Christina. He married in 1618 Countess Ebba Brahe, the early love of Gustavus Adolphus. He died on Aug. 22, 1652.

See A. Hamilton, *Minne af riksmarsken grefve Jakob Pontusson de la Gardie* (1880).

DE LA GARDIE, MAGNUS GABRIEL, COUNT (1622–1686), Swedish statesman, was born on Oct. 15, 1622, in Reval, son of the preceding. In 1646 Queen Christina sent him on an extraordinary mission to France, and on his return he married the queen's cousin, Marie Euphrosyne of Zweibriicken. He stood well in Christina's favour and continuously held high office until 1653 when he fell into disgrace and had to leave the court. But in the reign of Charles X. (1654–60), his brother-in-law, he held high command in the army fighting in the Ealtic provinces against Russia and Poland, and conducted the peace negotiations at Oliva (1660). Charles appointed him grand chancellor and a member of the Council of Regency of Charles XI. during his minority. He succeeded in dominating the council, and pursued a policy of reckless extravagance, and in 1672 engineered the alliance with France, which entangled Sweden two years later in the disastrous war with the elector of Brandenburg. *(See* SWEDEN: *History.)* In 1675 a special commission was appointed to enquire into the conduct of De la Gardie and his associates, and on May 27, 1682, it decided that the regents and the senate were solely responsible ior dilapidation of the realm, the compensation due by them to the Crown being assessed at 4,000,000 *daler* or £500,000. De la Gardie was treated with relative leniency, but he "received permission to re-

tire to his estates for the rest of his life" and died there in comparative poverty, a mere shadow of his former magnificent self. He was a man of brilliant social gifts and a great patron of literature and art. He presented to the library at Uppsala the famous late 5th-century *Codex Argenteus* of Ulfilas' Gothic version of the Gospels.

See Martin Veibull, *Sveriges Storhetstid* (Stockholm, 1881); Sv. *Hist.* iv.; *R. N.* Bain, *Scandinavia* (Cambridge, 1905); *Konst och Konstniirer vid M. G. de la Gardies hof* (1905).

DELAGE, YVES (1854–1920), French zoologist, was born on May 13, 1854, at Avignon. He became zoology professor at the Sorbonne in 1886. In 1901 he was made director of the laboratory of marine biology at Roscoff, Finistère. Delage was one of the first authorities on animal reproduction, hybridism and hereditary *(see* REPRODUCTION; HYBRIDISM; PROTOPLASM). He died in Paris on Oct. 8, 1920.

See *L'Hérédité et les grands problèmes de la biologie générale* (1895; 2nd. ed., 1903); *La Structure du protoplasma* (1895); *Traité de zoölogie concrète (6* vols., 1896–1902); *Les Thtories de l'Evolution* (1909, Eng. trans. 1912); *La Parthtnogtnkse naturelle et expirimentale* (1913); with M. Goldsmith, *Le Rêve, itude psychologique, philosophique et lzttiraire* (1919).

DELAGOA BAY (Portuguese for the bay "of the lagoon"), officially known as Bahia de Lourenço Marques (*q.v.*), an inlet of the Indian ocean on the east coast of South Africa, between 25° 40' and 26° 20' S, with a length of 26 m. and a breadth of 22 m. It is the northern termination of the series of lagoons which line the coast from St. Lucia bay. The opening is towards the north-east. The southern part of the bay is formed by the Inyak (native *Nyaka)* or Mahlungulu peninsula.

North of the peninsula is Inyak island, with the fishing village of Pt. Melville at its north-west point, and beyond Elephant's island. Delagoa Bay forms a valuable harbour, accessible to large vessels at all seasons of the year. The surrounding country is low and very unhealthy, but the island of Inyak has a height of 240 ft., and could be used as a sanatorium. The Manhisa or Komati river enters the sea just north of the bay; the Matolla, the Umbeluzi and the Tembe, from the Lebombo, meet in the estuary called by the Portuguese the Espirito Santo, but generally known as the English river; and the Maputa, or Lisuthu, which has its head-waters in the Drakenberg. enters in the south, as also does the Funti river. These rivers are the haunts of the hippopotamus and the crocodile.

The bay was discovered by the Portuguese navigator Antonio de Campo, one of Vasco da Gama's companions, in 1502. Antonio Caldeira explored the lower courses of the rivers entering Delagoa Bay. especially the Espirito Santo. The Portuguese visited the district from time to time. In 1721 the Dutch East India company built a fort and "factory" on the spot where Lourenço Marques now stands; but in 1730 the settlement was abandoned. Thereafter the Portuguese had—intermittently—trading stations on the Espirito Santo. In 1771, the Austrian Asiatic company of Trieste attempted to establish a station there, but were expelled. Intermittent native wars followed the building of a fortress on the site of the present town, in 1781. In 1823 W. F. W. Owen concluded treaties of cession with native chiefs, and appropriated for Britain the country from the English river southwards; in 1824 the Portuguese, disregarding the British treaties, concluded others with the natives, and endeavoured (unsuccessfully) to take military possession of the country. The sovereignty of either power was left undecided till the claims of the Transvaal Republic rendered a solution of the question urgent Great Britain had taken no steps to exercise authority on the spot, while the ravages of Zulu hordes confined Portuguese authority to the limits of their fort. In 1835 Boers had attempted to form a settlement on the bay, which is the natural outlet for the Transvaal; and in 1868 the Transvaal President, Marthinus Pretorius, claimed the country on each side of the Maputa down to the sea. In the following year, however, the Transvaal acknowledged Portugal's sovereignty over the bay. In 1861 Bickford had declared Inyak and Elephant's island British territory. In 1872 the dispute between Great Britain and Portugal was submitted to the arbitration of M. Thiers, the French President; and on July 24, 1875, his successor, Marshal MacMahon, declared in favour of the Portuguese. It had been previously agreed by Great Britain and Portugal that the right of pre-emption in case of sale or cession should be given to the unsuccessful claimant to the bay. Portuguese authority over the interior was not established until some time after the MacMahon award; nominally the country south of the Manhisa river was ceded to them by the Matshangana chief Umzila in 1861. In 1889 another dispute arose between Portugal and Great Britain in consequence of the seizure by the Portuguese of the railway running from the bay to the Transvaal. This dispute was referred to arbitration, and in 1900 Portugal was condemned to pay nearly £1,000,000 in compensation to the shareholders in the railway company. *(See* LOURENÇO MARQUES and GAZALAND.)

For an account of the Delagoa Bay arbitration proceedings *see* Sir E. Hertslet, *The Map Of Africa by Treaty* (1909). Consult also the British blue-book; *Delagoa Bay, Correspondence respecting the clatms of Her Majesty's Government* (1875); *L.* van Deventer, *La Hollande et la Baie Delagoa* (The Hague, 1883); G. McC. Theal, *The Portuguese in South Africa* (1896); Tesset, *The Key to South Afrtca, Delagoa Bay* (1899), and *History of South Africa since September 1795* (1908). *The Narrative of Voyages to explore the shores of Africa . . . performed . . . under direction of Captain W. F. W. Owen, R.N.* (1833) contains much interesting information concerning the district in the early part of the 19th century.

DELAINE. A term which applies strictly to an all-woollen fabric of light and fine texture and constructed with the plain calico weave. The fabric may be all white or piece-dyed, *i.e.,* dyeing the cloth in the "piece," after weaving, as distinct from coloured cloth woven from warp and weft yarn dyed previous to weaving. Delaine fabrics are also sometimes figured with patterns in various colours. The pattern may be printed on the warp, before weaving, after the manner adopted in chintzes and cretonnes (*q.v.*) and in Chiné silk fabrics, while others are printed with patterns after weaving, as in calico printing. One quality of delaine is made with 54 warp ends per inch, of 46's, and 64 picks per inch of 64's Botany wool.

Delaine union fabrics are also produced from a cotton warp and Botany weft, with 30's counts of yarn for both warp and weft, and with 64 warp threads and picks per inch. Some fabrics described as "delainettes" are produced from all-cotton both for warp and weft of soft spun yarn, and finished with a soft finish similar to that of the lighter and finer textures of flannelette (*q.v.*). (H. N.)

DE LA MARE, WALTER JOHN (1873–), British poet and novelist, of Huguenot descent, was born on April 25, 1873, at Charlton, Kent, and educated in London at St. Paul's Cathedral Choir school. From 1889 to 1908 he was engaged in business in London, but he had already printed poems and prose, writing as "Walter Ramal" in *The Cornhill* and other magazines, and in 1901 his *Songs of Childhood* appeared, his novel *Henry Brocken* following in 1904. A grant from the Privy Purse enabled him to devote himself fully to literary work, and he gradually found a growing audience for his delicate and highly individual work. *The Return* (1910) won the Polignac prize. *The* Listeners *and other Poems* (1912), *Peacock Pie* (1913), *Motley and Other Poems* (1918) brought him to the front rank of his contemporaries, and his *Collected Poems, 1901–1918,* appeared in 1920. A fairy play, *Crossings,* was published in 1921, and also further poems, *The Veil.* The long novel, *Memoirs* of *a Midget* (1921), showed his prose gifts at their highest; it also showed him to be a master of fantasy (he gives substance and verisimilitude to the fantastic) and of symbolism, and the critics have seen in him the heir of Maeterlinck tradition. Later books were volumes of stories: *The Riddle* (1924), *Broomsticks* (1925), *The Connoisseur and other Stories* (1926). De la Mare was a close friend of Rupert Brooke, and wrote an interesting essay on him in 1919.

See R. L. Megroz, *Walter de la Mare* (1924).

DELAMBRE, JEAN BAPTPSTE JOSEPH (1749–1822), French astronomer, was born at Amiens on Sept. 19, 1749. In 1771 he became tutor to the son of M. d'Assy, receiver-general of finances. He attended the lectures of J. J. Lalande, who induced d'Assy in 1788 to install an observatory for his benefit at his own

residence Here Delambre observed and computed almost uninterruptedly, and in 1790 obtained for his Tables of Uranus the prize offered by the academy of sciences. He was admitted to the Institute on its organization in 1795, and became, in 1803, perpetual secretary to its mathematical section. He served from 1795 on the bureau of longitudes. From 1792 to 1799 he was occupied with the measurement of the arc of the meridian extending from Dunkirk to Barcelona, and published a detailed account of the operations in *Base du systbme métrique* (3 vols., 1806, 1807, 1810). He succeeded Lalande in 1807 as professor of astronomy at the Collège de France, and was treasurer to the imperial university from 1808 until its suppression in 1815. Delambre died in Paris on Aug. 19, 1822. He wrote: *Histoire de l'astronomie ancienne* (2 vols., 1817); *Histoire de l'astronomie au moyen âge* (1819); *Histoire de l'astronomie moderne* (2 vols., 1821); *Histoire de l'astronomie au XVIII^e siècle* (edit. C. L. Mathieu, 1827); *Tables écliptiques des satellites de Jupiter*, inserted in the third edition of J. J. Lalande's *Astronomie* (1792), and republished in an improved form by the bureau of longitudes in 1817, and other works.

DELAMERE or **DE LA MER, GEORGE BOOTH, 1ST** BARON (1622–1684), son of William Booth, of Dunham Massey in Cheshire, was born in Aug. 1622. He was returned for Cheshire to the Long Parliament in 1645 and to Cromwell's parliaments of 1654 and 1656. In 1655 he was appointed military commissioner for Cheshire and treasurer at war. He was one of the excluded members who tried and failed to regain their seats after the fall of Richard Cromwell in 1659. He had for some time been regarded by the Royalists as a well-wisher to their cause, and now became one of the chief leaders of the new "Royalists" who at this time united with the cavaliers to effect the Restoration. A rising was arranged for Aug. 5 in several districts, and Booth took charge of operations in Cheshire, Lancashire and North Wales. He seized Chester on the 19th and marched towards York. The plot, however, had failed in other parts of the country, and Lambert defeated Booth's men at Nantwich Bridge. Booth himself was captured at Newport Pagnell on the 23rd and was imprisoned in the Tower. He was soon liberated, sat in the parliament of 1659–60, and was one of the 12 members deputed to carry the message of the Commons to Charles II. at The Hague. In July 1660 he received a grant of £10,000, and on April 20, 1661, he was created Baron Delamere, with a licence to create six new knights. The same year he was appointed *custos rotulorum* of Cheshire. He died on Aug. 8, 1684, and was buried at Bowdon.

His second son, HENRY (1652–1694) who succeeded him in the barony, was created earl of Warrington in 1690. He was implicated in the Rye House Plot (1683), joined William of Orange in 1688, and received many honours from the new king.

DELAND, MARGARETTA WADE (CAMPBELL) (1857–), American writer, was born at Allegheny, Pa., Feb. 23, 1857. She studied in private schools and at Cooper Union in New York, and for a time taught drawing. In 1880 she married L. F. Deland, of Boston. She attracted attention with her first novel, *John Ward, Preacher* (1881), which dealt with religious and social questions after the manner of Mrs. Humphry Ward. Her books include *The Story of a Child* (1892); *The Awakening of Helena Richie* (1906); *The Iron Woman* (1911); *The Rising Tide* (1916); and *The Vehement Flame* (1922). She is most popularly known for her sympathetic studies of village life and character, *Old Chester Tales* (1899) and *Dr. Lavendar's People* (1904).

DE LAND, a city of Florida, U.S.A., 10om. S.S.E. of Jacksonville, on the St. John's river, 18m. from the Atlantic ocean; the county seat of Volusia county. It is served by the Atlantic Coast Line railroad, and by river steamers to Jacksonville. The population was 5,246 in 1930 and 7,041 in 1940 by the federal census. It is in a region of beautiful hills, pine groves and lakes. where winter truck-farming and the growing of citrus fruits are important. Ponce de Leon springs are 8 mi. north. De Land is the seat of the John B. Stetson university, established as an academy in 1884 by the founder of the town, and re-named in 1889 after John Batterson Stetson, a Philadelphia hat-manufacturer, who gave it nearly $500,000. The town was founded in 1876, by Henry A. De Land, a manufacturer of Fairport, N. Y., who built a public school in 1877, a high-school in 1883 and the academy mentioned above in 1884.

DELANE, JOHN THADDEUS (1817–1879), editor of *The Times*, born in London and educated at King's college, London, and Magdalen college, Oxford. He was called to the bar at the Middle Temple in 1847. Delane was editor of *The Times* for 36 years (1841–77), and under his rule the paper acquired very great influence at home and abroad. It had become a power in British politics under Delane's predecessor, Barnes; and under Delane it attained a larger cosmopolitan standing. He superintended in detail the work of the leader writers and foreign correspondents of the paper. Among the latter in Delane's day were Thomas Chenery in Constantinople, and Blowitz in Paris. An example of the caution exercised by Delane in foreign affairs may be cited. When in 1875 Blowitz sent word that Bismarck contemplated a fresh attack on France, Delane held back the news for a fortnight until he had been able to send Chenery to Paris to substantiate the report. Delane had an impartial mind, and built up a tradition of independence of the Government of the day, even when it was a Conservative one.

See the biographies by Arthur Irwin Dasent (1908) and Sir Edward Cook (1915).

DELANO, JANE ARMINDA (1862–1919), American nurse, was born at Townsend, N.Y., on March 12, 1862. She graduated from the Bellevue hospital school of nursing in 1886. In 1888 she was asked to take charge of a temporary hospital during the yellow fever epidemic in Jacksonville, Florida. After an experience as visiting nurse in Arizona, in the days of the still war-like Apache Indians, she was appointed superintendent of nurses at the University of Pennsylvania hospital, Philadelphia. Pa., 1891; and director of nursing at her alma mater in 1902. From 1909–12, she served as superintendent of the U.S. Army Nurse Corps. During the latter part of this period she accepted the chairmanship of the National Committee on Red Cross Nursing Service and began the development of a nursing reserve. In 1909 there were but 950 nurses on the Red Cross records. A month after the outbreak of the World War, ten picked units from the 5,000, then on the rolls, sailed for Europe. Before the end of the war 20,000 Red Cross nurses served at home and abroad with the army, navy and the American Red Cross in its work among the civilian population. When in France on a tour of inspection she died at Savenay, on April 15, 1919, worn out by war work. After a military funeral overseas her body was brought home on a U.S. transport for interment at Arlington National cemetery, on Sept. 18, 1920. Her decorations included Japanese, Austrian and Pan-American medals, and her country's D.S.M. awarded posthumously for "extraordinary devotion to duty."

DELANY, MARY GRANVILLE (1700–1788), an Englishwoman of literary tastes, was born at Coulston, Wilts, on May 14, 1700, and died on April 15, 1788. She was a niece of the 1st Lord Lansdowne. In 1718 she was unhappily married to Alexander Pendarves, a rich old Cornish landowner, who died in 1724. During a visit to Ireland she met Dean Swift and his intimate friend, the Irish divine, Patrick Delany, whose second wife she became in 1743. After his death in 1768 she passed all her summers with her bosom friend the dowager duchess of Portland—Prior's "Peggy"—and when the latter died George III. and Queen Charlotte, whose affection for their "dearest Mrs. Delany" seems to have been most genuine, gave her a small house at Windsor and a pension of £300 a year. At this time Mrs. Delany was a charming and sweet old lady, with a reputation for cutting out and making the ingenious "paper mosaiks" now in the British Museum; she had known everyone worth knowing in her day, had corresponded with Swift and Young, and left an interesting picture of polite society in her *Autobiography and Letters*, 1700–88, an abridged version of which was compiled by G. Paston, 1900. Burke calls her "a real fine lady"—"the model of an accomplished woman of former times."

See *Mrs. Delany at Court and among the Wits*. Arranged from the "Autobiography and Correspondence. . . ." With an introduction by R. Brimley Johnson (1925).

DE LA REY, JACOBUS HERCULES (1847–1914), Boer general, was born in the Lichtenburg district in what is now the Orange Free State, and in his youth and early manhood fought in the Rafir wars. In 1893 he entered the Volksraad of the South African Republic, where he supported the policy of Gen. Joubert. At the outbreak of the war with Great Britain in 1899 De La Rey was made a general, and fought in the western campaign against Lord Methuen and Lord Roberts. He won his first great success at Nitral's Nek on July 11, 1900, where he compelled the surrender of a strong British detachment. In the second or guerrilla stage of the war De La Rey was conspicuously successful. He was assistant to Gen. Louis Botha and a member of the government with charge of operations in the western Transvaal. The principal actions in which he was successful (see also TRANSVAAL: History) were Nooitgedacht, Vlakfontein and the defeat and capture of Lord Methuen at Klerksdorp (March 7, 1902). The British general was severely wounded in the action, and De La Rey released him at once, being unable to afford him proper medical assistance. This humanity and courtesy marked De La Rey's conduct throughout the war. After the conclusion of peace De La Rey, who had shared in the negotiations, visited Europe with other Boer generals to raise funds for resettlement. In Dec. 1903 he went on a mission to India, and induced the Boer prisoners of war detained at Ahmednagar to accept the new order of things and to take the oath of allegiance. In Feb. 1907 Gen. De La Rey was returned unopposed as member for Ventersdorp in the legislative assembly of the first Transvaal parliament under self-government. At the outbreak of the World War he was implicated in Maritz's rebellion, and was shot dead by a police patrol at Johannesburg on Sept. 16, 1914.

DE LA RIVE, AUGUSTE ARTHUR (1801–1873), Swiss physicist, was born at Geneva on Oct. 9, 1801. He was the son of Charles Gaspard de la Rive (1770–1834), who became professor of pharmaceutical chemistry at the Academy of Geneva in 1802 and rector in 1823. In 1823 de la Rive was appointed to the chair of natural philosophy in the Academy of Geneva. He devoted himself specially with François Marcet (1803–83), to the investigation of the specific heat of gases, and to observations for determining the temperature of the earth's crust. Electrical studies, however, engaged most of his attention. His experiments on the voltaic cell were of importance in the development of electrical theory; the results were published in 1836. In common with Faraday, de la Rive held the theory that voltaic electricity was due to chemical action. In 1840 he described a process for the electro-gilding of silver and brass, for which in the following year he received a prize of 3,000 francs from the French Academy of Sciences. Between 1854 and 1858 he published a *Traité de l'électricité théorique et appliquée*, which was translated into several languages. De la Rive's birth and fortune gave him considerable social and political influence. He was distinguished for his hospitality to literary and scientific men, and for his interest in the welfare and independence of his native country. In 1860, when the annexation of Savoy and Nice had led the Genevese to fear French aggression, de la Rive was sent by his fellow-citizens on a special embassy to England, and succeeded in securing a declaration from the English Government, which was communicated privately to that of France. Later (1867) he carried out a series of researches on the discharge of electricity through gases, with observations on the critical pressure and the conductivity of the cathode dark space. He died suddenly at Marseille on Nov. 27, 1873.

DELAROCHE, HIPPOLYTE, commonly known as PAUL, (1797–1856), French painter, was born in Paris on July 17, 1797. He studied under Gros and exhibited for the first time in the Salon of 1822. He visited Italy in 1838 and 1843, when his father-in-law, Horace Vernet, was director of the French Academy. His studio in Paris was in the rue Mazarin, where he never spent a day without some good result, his hand being sure and his knowledge great. His subjects, definitely expressed and popular in their manner of treatment, illustrating certain views of history dear to partisans, yet romantic in their general interest, were painted with a firm, solid, smooth surface, which gave an appearance of the highest finish. Delaroche held a course midway between the classicists and the romanticists. His long series of historical pictures had a great popular success and were made familiar in thousands of homes by engravings of them. Three of them are in the Louvre: "The Death of Queen Elizabeth" (1827), "The Children of Edward IV." (1830), and "The Young Martyr." But his easel pictures no longer have much importance.

In 1837 Delaroche received the commission for the great picture, 27 mitres long, in the hemicycle of the lecture theatre of the École des Beaux-Arts. This represents the great artists of the modern ages assembled in groups on either hand of a central elevation of white marble steps, on the topmost of which are three thrones filled by the architects and sculptors of the Parthenon. To supply the female element in this vast composition he introduced the genii or muses, who symbolize or reign over the arts, leaning against the balustrade of the steps. The portrait figures are nearly all unexceptionable and admirable. This great and successful work is on the wall itself, an inner wall, however, and is executed in oil. It was finished in 1841 and considerably injured by a fire which occurred in 1855, which injury he immediately set himself to remedy (finished by Robert-Fleury); but he died before he had well begun, on Nov. 4, 1856.

See L. Runtz, ***Oeuvre de Paul Delaroche,*** photographic reproductions, with a notice by H. Delaborde and Jules Goddé (1858). Rees, ***Delaroche*** (1880).

DELARUE, GERVAIS (1751–1835), French historical investigator, formerly regarded as one of the chief authorities on Norman and Anglo-Norman literature, was a native of Caen who took refuge in England during the French Revolution. His principal works are *Essais historiques* sur *les* Bardes, les Jongleurs, et les Trouvkres normands et *anglo-normands* (3 vols., 1834), and books on the history of his native town.

DE LA RUE, WARREN (1815–1889), British astronomer and inventor of the photo-heliograph, son of Thomas De la Rue, was born in Guernsey on Jan. 18, 1815. He constructed in 1850 a 13-in. reflecting telescope, mounted first at Canonbury, later at Cranford, Middlesex, and with its aid executed many drawings of the celestial bodies. In 1851 he saw a daguerrotype of the moon by G. P. Bond, shown at the great exhibition of that year. Employing the more rapid wet-collodion process, he succeeded before long in obtaining exquisitely defined lunar pictures, which remained unsurpassed until the appearance of the Rutherford photographs in 1865. In 1854 he turned his attention to solar physics, and in order to obtain a daily photographic representation of the state of the solar surface he devised the photo-heliograph, described in his report to the British Association, "On Celestial Photography in England" (1859), and in his Bakerian Lecture (*Phil. Trans.* vol. clii.). Regular work with this instrument, begun at Kew by De la Rue in 1858, was carried on there for 14 years; and was continued at Greenwich from 1873 to 1882. The results obtained in the years 1862–66 were discussed in two memoirs, entitled "Researches on Solar Physics," published by De la Rue, in conjunction with Professor Balfour Stewart and Mr. B. Loewy, in the Phil. Trans. (vol. clix. and vol. clx.). The photographs which he took in Spain of the solar eclipse of July 18, 1860, proved beyond doubt the solar character of the prominences or red flames, seen around the limb of the moon during a solar eclipse. In 1873 De la Rue presented most of his astronomical instruments to the university observatory, Oxford; in 1887 he provided it with a 13-in. refractor to enable it to take part in the International Photographic Survey of the Heavens. With Dr. Hugo Miiller as his collaborator he published many chemical papers between 1856 and 1862, and investigated, 1868–1883, the discharge of electricity through gases by means of a battery of 14,600 chloride of silver cells. He was twice president of the Chemical Society, and also of the Royal Astronomical Society (1864–66). He died in London on April 19, 1889.

DELATOR, in Rome, one who gave notice (deferre) to the treasury officials of moneys due to the imperial *fiscus* (see AERARIUM). This meaning was extended to those who lodged information as to punishable offences, and further, to those who brought a public accusation against any person. Although the word delator ("common informer") is confined to imperial times,

the right of public accusation had long been in existence. When exercised from patriotic motives its effects were beneficial, but when rewards were introduced this was no longer the case. Cicero expresses his opinion that such accusations should be undertaken only in the interests of the State or for other urgent reasons. Under the empire the system degenerated into an abuse, which reached its height during the reign of Tiberius.

Delatores were drawn from all classes of society. The objects of their attacks were the wealthy, all possible rivals of the emperor, and those whose conduct implied a reproach against the imperial mode of life. Special opportunities were afforded by the law of *maiestas* (treason) which (originally directed against attacks on the ruler by word or deed) was made to cover all kinds of irrelevant accusations. The chief motive for these accusations was no doubt the desire of amassing wealth, since by the law of *maiestas* one-fourth of the goods of the accused was assured to the accuser (who was hence called *quadruplator*). Pliny and Martial mention instances of enormous fortunes amassed by those who carried on this hateful calling. But it was not without its dangers. If the *delator* lost his case he was liable to the same penalties as the accused; he was exposed to the risk of vengeance at the hands of the proscribed, or of their relatives; while emperors like Tiberius had no scruples about putting out of the way those creatures for whom they had no further use. Under the better emperors severe penalties were inflicted upon the *delatores*. Titus drove into exile or reduced to slavery those who had served Nero, after they had been flogged in the amphitheatre. The abuse reappeared under Domitian; they were again banished by Trajan, and threatened with capital punishment in an edict of Constantine.

See J. *E. B.* Mayor's note on Juvenal iv. 48 for ancient authorities; also J. E. Sandys, *Companion to Latin Studies* (1921), with useful bibliography.

DELAUNAY, ELIE (1828–1891), French painter, was born at Kantes on June 12, 1828, and died in Paris on Sept. 5, 1891. He studied under Flandrin and at the École des Beaux-Arts. He worked in the classicist manner of Ingres until, after winning the Prix de Rome, he went to Italy in 1856, and abandoned the ideal of Raphaelesque perfection for the sincerity and severity of the quattrocentists. As a pure and firm draughtsman he stands second only to Ingres. After his return from Rome he was entrusted with many important cominissions for decorative paintings, including the frescoes in the church of St. Nicholas at Nantes; the three panels of "Apollo," "Orpheus," and "Amphion" at the Paris opera-house; and 12 paintings for the great hall of the council of state in the Palais Royal. His "Scenes from the Life of Ste Geneviève," which he designed for the Pantheon, remained unfinished at his death. The Luxembourg museum has his famous "Plague in Rome" and a nude figure of "Diana"; and the Kantes museum, the "Lesson on the Flute." In the last decade of his life he achieved great popularity as a portrait painter.

DELAUNAY, LOUIS ARSÈNE (1826–1903), French actor, was born in Paris, the son of a wine-seller. He studied at the Conservatoire, and made his first formal appearance on the stage in 1845, in *Tartufe* at the Odéon. Three years later he made his début at the Comédie Française as Dorante in Corneille's *Le Menteur,* and began a long and brilliant career in young lover parts, which he continued to act until he was 60, his grace, marvellous diction and passion enchanting his audiences. He was especially happy in the plays of De Musset. He was made a Chevalier of the Legion of Honour in 1883, and retired in 1887.

See *Souvenir de M. Delaunay de la Comédie-Française* (1901).

DELAUNAY-BELLEVILLE, LOUIS (1843–1912), French engineer, was born at Corbeil on Nov. 20, 1843. Educated at St. Barbe and the École Polytechnique, he entered the Naval Engineering school in 1864 and in 1867 left to join the Bellerille works at St. Denis, near Paris. He became a partner and finally head of the firm which produced the well-known Belleville boilers, and also the motor car callrd by his name. From 1890 he was president of the Paris Chamber of Commerce. He died at Cannes on Feb. 10, 1912

DELAVIGNE, JEAN FRANÇOIS CASIMIR (1793–1843), French poet and dramatist, was born on April 4, 1793, at Havre, and was educated in Paris at the Lycée Napoléon. His *Dithyrambe sur* la *naissance du roi de Rome* (1811) secured for him a sinecure in the revenue office. Inspired by the catastrophe of 1815, Delavigne wrote the stirring patriotic poems entitled *Messéniennes.* In 1819 his play *Les vêpres Siciliennes,* refused for the Théâtre Français, was performed at the Odéon. In *Paria* (1821) he expressed political opinions which led to his deprivation of a comfortable sinecure, but Louis Philippe compensated him by making him librarian at the Palais Royal. Here he wrote the *École des vieillards* (1823), his best comedy, which gained his election to the Academy in 1825. To this period also belong La *Princesse Aurélie* (1828) and *Marino Faliero* (1829), a drama in the romantic style.

At the revolution of 1830 his song "La Parisienne," set to music by Auber, was on the lips of every Frenchman, and rivalled in popularity the "Marseillaise." Of the many historical dramas written by Delavigne under the July monarchy the most famous is *Louis* XI. (1837). His last work was *Charles VI.* (1843), an opera libretto partly written by his brother Germain (1790–1868). In 1843 he started for Italy in search of health, but died at Lyons on Dec. 11, 1843.

Delavigne's *Poésies* and his *Théâtre* were published in 1863. His *Oeuvres complètes* (new ed., 1855) contains a biographical notice by his brother, Germain Delavigne, who is best known as a librettist in opera. *See* also Sainte-Beuve, *Portraits littéraires,* vol. v.; *A.* Favrot, *Étude sur Casimir Delavigne* (1894), and *F.* Vuacheux, *Casimir Delavigne* (1893).

DELAWARE, popularly called the "Diamond State," is one of the 13 original states of the United States of America. It is situated in the eastern part of the peninsula formed by Chesapeake bay and the estuary of the Delaware river, between 38° 27′ and 39° 50′ N. lat. and between 75° 2′ and 75° 4j′ W. long. The state has a length of about 100 mi. and an average width of a little more than 20 mi.; its total area being 2,057 sq mi., of which 79 sq mi. are inland water surface. Excepting Rhode Island, it is the smallest state in the union. Delaware is bounded north and northwest by Pennsylvania, east by the Delaware river and Delaware bay, which separate it from New Jersey, and by the Atlantic ocean; south and west by Maryland.

Physical Features. — Delaware lies on the Atlantic coastal plain and is for the most part level and low, its average elevation above the sea being about 60 feet. Topographically, the state is two unequal areas, divided by a line following the general course of White Clay and Christina creeks. Northward of this line the country is rolling, with bold hills, moderately deep valleys and rapid streams. Southward, the country is level or gently undulating West of Wilmington there rises a ridge which crosses the state in a northwesterly direction and forms a watershed between Christina and Brandywine creeks, its highest elevation above sea level being 440 ft. at Centerville. South of the Christina there begins another elevation, sandy and marshy, which extends almost the entire length of the state from northwest to southeast and forms a second water parting. The streams that drain the state are small and insignificant. Those of the north flow into Brandywine and Christina rivers, whose estuary into Delaware river forms Wilmington harbour; those of the southwest have a common outlet in the Nanticoke river of Maryland; those of the east empty into Delaware bay and the Atlantic ocean. The principal harbours are those of Wilmington, New Castle and Lewes. The shore of the bay is marshy, that of the Atlantic is sandy. In Kent county there are more than 60,000 ac. of tidal marshland, some of which has been reclaimed by means of dikes; Cypress swamp, in the extreme south, has an area of 50,000 acres. Hornblende, felspar, granite of the Brandywine region and kaolin are found in the north. The prevailing soils of the region are clays, sometimes mixed with loam. Next, to the southward, come the Cretaceous formations and clays suitable for terra-cotta manufacture. The soils of this region are mainly loams. The remainder of the state has a sandy soil resting on Tertiary white and blue clays.

Minerals of economic value are found only in the north part of the state. Kaolin, mined chiefly in the vicinity of Hockessin,

New Castle county; granite, used for road-making and rough construction work, found near Wilmington; and brick and tile clays are the products of greatest importance.

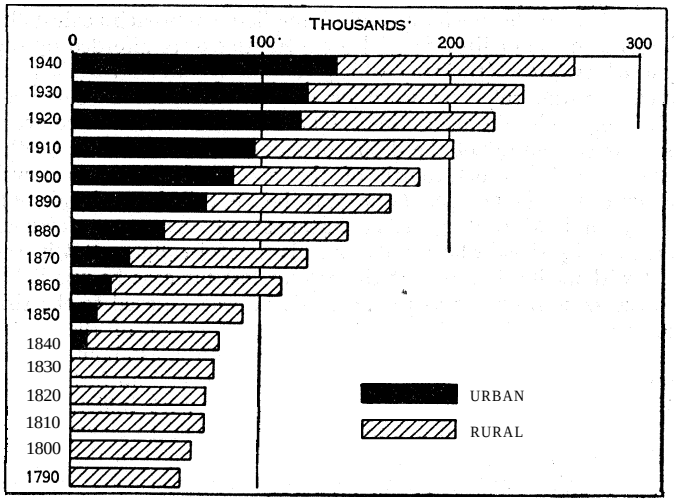
The proximity of the Delaware and Chesapeake bays helps to give Delaware a mild climate. The mean annual temperature is approximately 53° F, ranging from 52" in the S. to 56° in the N., and the extremes of heat and cold reported by the U.S. weather bureau are 107° in the summer and −12° in the winter. The annual rainfall, greater on the coast than inland, ranges from 40 to 45 inches.

Government. — The Constitution by which Delaware is governed was adopted in 1897. Like the Constitutions of 1776, 1792 and 1831, it was promulgated by a Constitutional Convention without submission to the people for ratification, and amendments may be adopted by a two-thirds vote of each house in two consecutive legislatures. Its character is distinctly democratic. The property qualification of State senators and the restriction of suffrage to those who had paid county or poll taxes are abolished; but suffrage is limited to adults who can read the State Constitution in English and, unless physically disqualified, can write their names, and who have registered. In 1907 an amendment to the Constitution was adopted which struck out from the instrument the clause requiring the payment of a registration fee of $1 by each elector. Important innovations in the Constitution of 1897 were the office of lieutenant-governor and the veto power of the governor, which extends to parts and clauses of appropriation bills; a bill may be passed over his veto by a three-fifths vote of each house of the legislature, and a bill becomes a law if not returned to the legislature within ten days after its reception by the governor, unless the session of the legislature shall have expired in the meantime. The governor's regular term in office is four years, and he is ineligible for a third term. All his appointments to offices where the salary is more than $500 must be confirmed by the senate; all pardons must be approved by a board of pardons.

Representation in the legislature is according to districts, there being ten districts in each county for the election of members in the lower house for two years; and five senatorial districts in each county for the election of members in the upper house for four years; in addition, the city of Wilmington, which is in New Castle county, has five representative districts and two senatorial districts. In Nov. 1906, the people of the State voted (17,248 for; 2,162 against) in favour of the provision of a system of advisory initiative and advisory referendum; and in March, 1907, the general assembly passed an act providing initiative and referendum in the municipal affairs in the city of Wilmington. The organization of the judiciary is similar to that under the old English system. Six judges (a chancellor, a chief justice and four associate justices) of whom there shall be at least one resident in each of the three counties, and not more than three shall belong to the same political party, are appointed by the governor, with the consent of the senate, for a term of 12 years. Certain of the judges hold courts of chancery, general sessions, oyer and terminer, and orphans' courts; the six together constitute the supreme court, but the judge from whose decision appeal is made may not hear the appealed case unless the appeal is made at his own instance.

Corporations cannot be created by a special act of the legislature, and no corporation may issue stock except for an equivalent value of money, labour or property. In order to attract capital to the State, the legislature in 1899 passed a general corporation act which reduced the taxes on corporations, forbade the repeal of charters and gave permission for the organization of corporations with both the power and the name of trust companies. A liberal policy is still pursued in respect to mergers and consolidations of corporations organized under the laws of the State, but all corporations using the word "trust" in their titles are under the supervision of the insurance commissioner and are compelled by law to make at least two reports each year to the commissioner.

Legislative divorces are forbidden by the Constitution, and a statute of 1901 subjects wife-beaters to corporal punishment. Although punishment by whipping and by standing in the pillory was prohibited by an act of Congress in 1839, in so far as the Federal Government had jurisdiction, both these forms of punishment were retained in Delaware, and standing in the pillory was prescribed by statute as a punishment for a number of offences, including highway robbery, various kinds of larceny and forgery, and even pretending "to exercise the art of witchcraft, fortune-telling or dealing with spirits." In 1905, by a law approved on March 20, the pillory was abolished. The whipping post is still



BY COURTESY OF THE U.S. BUREAU OF THE CENSUS

URBAN AND RURAL POPULATION OF DELAWARE: 1790 TO 1940

maintained in Delaware, and whipping continues to be prescribed as a punishment for a variety of offences, although in 1889 a law was passed which prescribed that "hereafter no female convicted of any crime in this State shall be whipped or made to stand in the pillory," and a law passed in 1883 prescribed that "in case of conviction of larceny, when the prisoner is of tender years, or is charged for the first time (being shown to have before had a good character), the court may in its discretion omit from the sentence the infliction of lashes." An old law still on the statute books prescribes that "the punishment of whipping shall be inflicted publicly by strokes on the bare back, well laid on." In 1929 the death penalty for first-degree arson was abolished.

The unit of local government is practically the county, the old "hundred," which formerly corresponded to the township of Pennsylvania, having become almost obsolete.

The marriages of whites with Negroes and of insane persons are null; but the children of the married insane are legitimate.

There was settled by decision of the United States supreme court in 1934 the boundary dispute between Delaware and New Jersey which had almost led to another "oyster war." The court upheld Delaware's claim to territory as far as the low-water mark on the New Jersey shore within a twelve-mile radius of Mew Castle. Farther down the Delaware river, however, it decreed that the boundary should follow the centre of the ship channel and not, as Delaware had contended, the geographic middle of the river. New Jersey thus succeeded in establishing its right to certain oyster beds.

Population. — The population of Delaware in 1790 was 59,096; in 1820 it was 72,749; in 1850, 91,532; in 1880, 146,608; in 1910, 202,322; and in 1940, 266,505. This last figure represents an increase of 11.8% over the population in 1930. The population per square mile was 134.7, as compared with 44.2 for the United States as a whole. Of the 1940 population, 139,432, or 52.3%, lived in urban places, that is, in cities and towns of 2,500 or more. The number of occupied dwelling units returned in the housing census of 1940 was 70,572, which is approximately the same as the number of families. The average population per family (occupied dwelling unit) declined from 4.0 in 1930 to 3.8 in 1940.

The white population of Delaware formed 86.6% of the total

in 1940, as compared with 86.3% in 1930, practically all the nonwhite population being Negro. The number of males per 100 females in the entire population of the state was 104.0, the sex ratio being 103.6 for the white and 106.7 for the nonwhite population.

The population of the state and of its principal cities is summarized for recent censuses in the following table:

Area	Population			Percent of increase	
	1940	1930	1920	1930–40	1920–30
The State	**266,505**	**238,380**	223,003	11.8	**6.9**
Urban	139,432	**123,146**	120,767	13.2	2.0
Rural	127,073	115,234	**102,236**	10.3	12.7
Percent urban	52.3	51.7	54.2		
Principal cities:					
Wilmington	112,504	106,597	**110,168**	5.5	−3.2
Dover	5,517	**4,800**	**4,042**	14.9	18.8

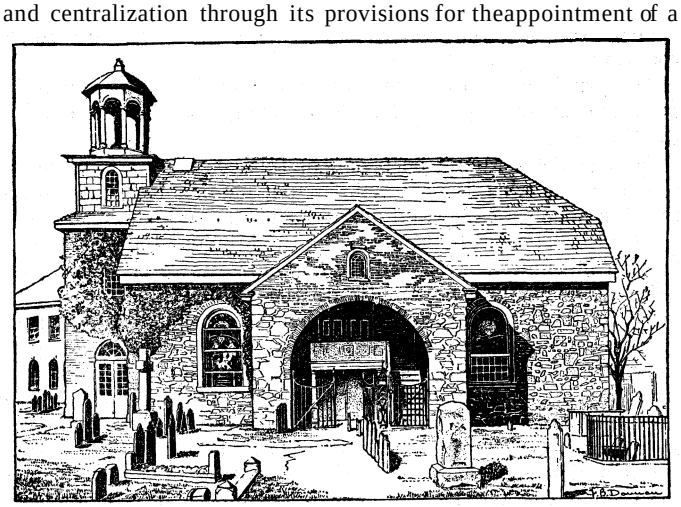
Finance and Taxation. — The state income from all sources, during the fiscal year ending June 30, 1940, amounted to $17,148,023. Important sources of revenue were general property, licences, permits, motor vehicle licences, income tax, motor vehicle fuel taxes, filing fees and subventions and grants from the federal government.

The total amount of state expenditures for the fiscal year ending June 30, 1940, was $18,433,019. Of this amount $4,355,372 was expended upon the state highways and $6,420,683 was appropriated for education. For charities, hospitals and corrections $2,052,622 was expended and for health and sanitation, $393,668. For the protection of persons and property $1,246,132 was expended.

A state banking department was created (1919), with a banking commissioner and a deputy, whose duty it is to examine every bank at least once a year. In 1921 a budget plan, which became effective in 1923, was adopted for the state.

Education. — The educational system of the state has been considerably improved within recent years. The maintenance of a public-school system is rendered compulsory by the state constitution, and a new compulsory school law came into effect in 1907. The first public-school law, passed in 1829, was based largely on the principle of "local option," each school district being left free to determine the character of its own school or even to decide, if it wished, against having any school at all.

The system thus established proved unsatisfactory, and a new school law in 1875 brought about a greater degree of uniformity and centralization through its provisions for theappointment of a



OLD SWEDISH CHURCH AT WILMINGTON, DELAWARE. BUILT IN 1698 BY SWEDISH COLONISTS AND STILL USED AS A PLACE OF WORSHIP

state superintendent of free schools and a state board of education.

In 1888, however, the state superintendency was abolished and county superintendencies were created instead, the legislature thus returning, in a measure, to the system of local control. Centralization was again secured, in 1898, by the passage of a law increasing the powers of the state board of education.

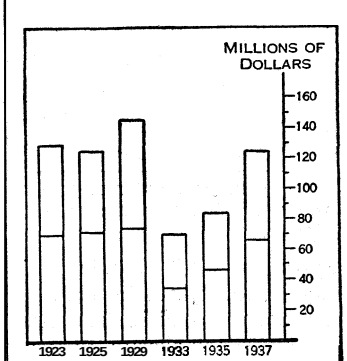
After 1910 a distinct advance was made in the field of education. Better facilities for the training of teachers were developed, and new school buildings erected in many parts of the state. In 1940 the enrolment in public elementary and secondary schools was 44,372, the number of boys being 22,604 and the number of girls 21,768. The average number of days the schools were open was 183. Teachers employed totalled 1,717, and the number of school buildings in use was 203. The enrolment in elementary and secondary schools was: whites 37,400, Negroes, 6,972. White pupils enrolled numbered 26,111, Negro pupils numbered 18,261. Separate schools are maintained for Negro pupils throughout the whole educational system. The total expenditure for education in 1940 was $6,420,683, including $1,498,805 for higher education for whites and Negroes. It had increased $3,217,683 over that expended in 1924. The schools are supported in part from the state school fund and in part from local taxation.

Prior to 1913 the state's participation in higher education was confined to Delaware college, at Newark, founded in 1833 as Newark college, but rechartered, after suspension from 1859 to 1870, as a state institution. The college receives financial support from the United States land grant of 1862 and the supplementary appropriation of 1890.

In 1913 the Women's college was founded and affiliated with Delaware college, with the same faculty, but entirely separate in buildings, classes and student organizations. In 1921 the two colleges were incorporated as the University of Delaware. The relations between the colleges have grown steadily closer since then. The faculty in 1940–41 numbered 159. The total value of university property in 1940 was $4,932,007; the income for the fiscal year 1939–40 was $856,548. The total undergraduate attendance in 1940-41 was 599 men and 304 women. The agricultural experiment station, also affiliated with the university, was established in 1888 under the Hatch act of 1887. Under the Purnell act, increased federal appropriations to the agricultural experiment station made possible greater expansion of education in improved agricultural methods.

An outstanding phase of educational development was the erection of school buildings in various parts of the state, made possible by gifts approximating $4,000,000 by Mr. Pierre S. du Pont to an organization of citizens known as the Service Citizens of Delaware. The legislature appropriated some $3,000,000 for public-school construction in 1931 so as to furnish work for the state's unemployed.

Charities and Correction. — The charitable and penal administration of Delaware was very poor until Sept. 1919, when the state board of charities began to function. Before the creation of this board the tax-supported institutions of penal and corrective character had never been subject to supervision by any central state agency, except as the general assembly or some temporary commission may have inspected them occasionally. The institutions supported in whole or in part by the state in 1924 were: the Delaware State Hospital for the Insane, at Farmhurst; the Home for the Feeble Minded, at Stockley; the Blind Shop, at Wilmington; the Ferris Industrial School of Delaware, at Marshallton; Delaware Industrial School for Girls, at Claymont; Wilmington House of Detention, at Wilmington; Industrial School for Coloured Girls of Delaware, at Marshallton; Palmer House, at Dover; Layton Home for Aged Coloured People, at U'ilmington; Soldiers' Rest Room, at Delaware City; and the St. Michael's Day Nursery and Hospital for Babies, at Wilmington. Each of the three counties of Delaware maintains an almshouse and a jail, and the three jointly maintain, with aid from the United States district court, the New Castle county



GRAPH SHOWING VALUE OF PRODUCTS IN DELAWARE FOR SELECTED YEARS, AND (LOWER PART OF COLUMN) THE COST OF MATERIALS USED

workhouse. In 1923 the state health and welfare commission was created and vested with the duties of the then existing child's welfare commission, the tuberculosis commission and the state board of health.

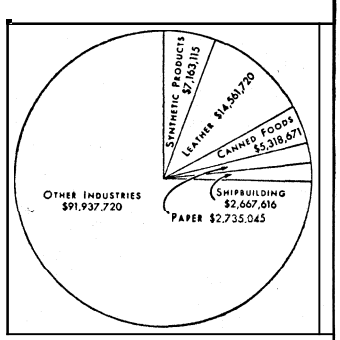
The state has regular appropriations for charitable, correctional and medical-charitable purposes.

Industry, Trade and Transportation. — Delaware's population was chiefly rural and agricultural until 1920, when the urban population exceeded the rural for the first time. This change in population ratio was in a great measure due to rapid industrial development during the World War of 1914–18. After the passage of the Agricultural Extension act (1911), co-operative associations developed, and especially after 1918 the farm bureau movement made swift progress. In 1940 the number of farms was 8,994, as compared with 9,707 in 1930, a decrease of 713. All land in farms in 1930 amounted to 900.815 ac.; in 1940, 895,507 ac., being 70·7% of the total land area of the state. The value of all farm property in 1940 was $54,898,828, a decrease of $12,042,919 from the figures for 1930.

The cash income from all crops in 1940 was $8,083,000. The total production of wheat was 1,406,000 bu.; of hay, 101,000 tons; of Irish potatoes, 443,000 bu.; of sweet potatoes and yams, 725,000 bu.; of soybeans for beans, 364,000 bu. Delaware is a great producer of tomatoes and fruits, especially apples and strawberries whose 1940 productions were 1,909,000 bu. and 400,000 crates, respectively. The farm population in 1940 by federal census was 45,724.

The development of manufacturing in Delaware has not been so extensive as the situation of the state, its facilities for water and railway transportation and the proximity of the coal and iron fields of Pennsylvania would seem to warrant; the intense industrial activity during the war of 1914–18, however, influenced Delaware greatly, especially Wilmington and its environs. New Castle county, in which Wilmington is situated, in 1920 reported 88.7% of the total wage earners and 92.2% of the total value of products.

The peak year for manufacturing in Delaware was 1919, when 32,972 wage earners were engaged, and gross production amounted to $165,073,009 In 1937 Delaware had 21,052 wage earners engaged in manufacturing (under the factory system); the total paid in wages was $22,991,808; the gross value of products was $124,383 887. Important industries were: synthetic products, leather, cars and general shop construction and repairs by steam railway companies, shipbuilding, iron and steel, canning and preserving of fruits and vegetables, paper and wood pulp, bread and bakery products, slaughtering and meat packing, and foundry and machine shop products.



LEADING INDUSTRIES OF DELAWARE AND THE VALUE OF THEIR PRODUCTION, 1937

The U.S. bureau of mines estimated the total mineral products in 1924 to be worth $512,105, but by 1933 their value had dwindled to $135,000; in 1938 it was $320,621. Of these, sand and gravel, kaolin and clay products were most important. The forests, which once afforded excellent timber, including white oak for shipbuilding, have been greatly reduced by constant cutting; in 1919 it was estimated that 222,659 ac. were in woodland, of which 46,187 ac. were merchantable timber. The lumber production in that year was 27,000,000 bd.ft., but in 1924 the production had decreased to 14,000,000 bd.ft., in 1929 to 10,000,000 bd.ft., and in 1937 to only 6,000,000 bd.ft. The fisheries are chiefly oyster, crab, clam, menhaden and alewife. In 1937 the catch totalled 50,941,000 lbs. valued at $319,400. Delaware has good facilities for transport. Its railway mileage in 1937 was 300; the Pennsylvania, the Baltimore and Ohio and the Reading systems cross the northern part of the state, while the Pennsylvania system runs the length of the state below Wilmington.

In 1936 Delaware had 1,702 mi. of improved roads in the state highway system, and during 1938 $4,140,000 was expended on rural highways. In 1938 the registration of motor vehicles was 64,078.

The Delaware and Chesapeake canal (about 13½ mi. long), which crosses the northern part of the Delaware-Maryland peninsula from the Delaware river to Chesapeake bay, has in recent years been widened and deepened by the war department, thus affording a shorter passageway for larger ships from Philadelphia to Baltimore and improving an important link of the proposed inland waterway for commerce. Wilmington is the centre of a customs district in which New Castle and Lewcs are included, and although much of the trade is coastwise, it is expected that the recently constructed marine terminal at Wilmington, near the mouth of the Christina river, will afford adequate facilities to attract increasing ocean-going trade. Imports at Wilmington amounted to 632,974 cargo tons in 1937; exports in the same year totalled 1,643 cargo tons.

History. — Before the coming of the white men, the present state of Delaware was inhabited by tribes of aborigines of the Leni-Lenape stock, later called Delaware Indians. Of an ancient and proud lineage, they were known as the "original people" and bore the familiar name of "grandfathers of the red men." The Nanticokes, occupying the lower part of Delaware and the eastern shore of Maryland, were a fishing and trapping people, less warlike than the tribes of the interior. Henry Hudson in 1609 first explored Delaware bay for the Dutch.

In the next year Lord De la Warr (from whom the name Delaware was derived) according to tradition is said to have entered the bay in the interest of England.

The territory was more thoroughly explored in 1615–16 by Cornelis Hendricksen. whose repcrts did much to cause the incorporation of the Dutch West India company (*q.v.*) in 1621. About the time the Puritans were establishing themselves in New England, the first settlement on Delaware soil was made by members of the Dutch company in 1631 near the site of the present Lewes. The leaders, one of whom was Capt. David P. de Vries, wished "to plant a colony for the cultivation of grain and tobacco as well as to carry on the whale fishery in that region." The settlement, however, was soon completely destroyed by the Indians (see LEWES).

A more successful effort was made under a charter or manifesto from Gustavus Adolphus by the South company of Sweden, a corporation organized in 1624 as the "Australian Company," by William Usselinx, the chief organizer of the Dutch West India company.

The privileges of the company were extended to Germans in 1633, and about 1640 the Dutch members were bought out by the Swedes.

In 1638 Peter Minuit on behalf of this company established a settlement at what is now Wilmington, naming it "Fort Christina," in honour of the child queen Christina, and naming the entire territory, bought by Minuit from the Minquas Indians and extending indefinitely westward from the Delaware river between Bombay hook and the mouth of the Schuylkill river, "New Sweden." This territory was subsequently considerably enlarged. In 1642 mature plans for colonization were adopted. A new company, officially known as the West India, American or New Sweden company, but also popularly known as the South company, was chartered, and a governor, Johan Printz (*c.* 1600–63) was sent out by the crown. He arrived early in 1643 and subsequently established settlements, including one on the island of Tinicum, near the present Chester, Pa.; another at the mouth of Salem creek, N.J.; and another near the mouth of the Schuylkill river. Printz remained governor of New Sweden for a period of ten years, his mansion, fort and church were on Tinicum island. Friction soon arose with New Netherland, although the Swedes and the Dutch, owing to their common dislike of the English, and the common interests of Sweden and Holland in the Thirty Years' War, had maintained a formal friendship. In 1651, Peter Stuyvesant, governor of New Netherland, and more aggressive than his predecessors, built Ft. Casimir, near what is now New Castle, In 1654

Printz's successor, Johan Claudius Rising, who had arrived from Sweden with a large number of colonists, expelled the Dutch from Ft. Casimir. In retaliation, Stuyvesant, in 1655, with seven vessels and as many hundred men, recaptured the fort and also captured Ft. Christina (Wilmington). New Sweden thus passed into Dutch control and became a dependency of New Netherland. In 1656, however, the Dutch West India company sold part of what had been New Sweden to the city of Amsterdam, which in the following year established a settlement called "New Amstel" at Ft. Casimir (New Castle). This settlement, badly administered, made little progress.

In 1663 the whole of the Delaware country came under the jurisdiction of the city of Amsterdam, but in the following year, with New Netherland, was seized by the English. For a brief interval, in 1673–74, the Dutch were again in control, but in the latter year, by the Treaty of Westminster, the "three counties on the Delaware" again became part of the English possessions in America held by the duke of York, later James II. His formal grant from Charles II was not received until March 1683. In order that no other settlements should encroach upon his centre of government, New Castle, the northern boundary was determined by drawing an arc of a circle 12 mi. in radius with New Castle as the centre. This accounts for the curved boundary line between Delaware and Pennsylvania. However, in Aug. 1682, the duke of York conveyed by a deed of feoffment to William Penn the entire territory, leasing it for 10,000 years, a transfer later challenged by Maryland. But differences in race and religion, economic rivalry between New Castle and Pennsylvania towns, and petty political quarrels over representation and office-holding, similar to those in the other American colonies, were so intense that Penn in 1691 appointed a special deputy governor for the "lower counties." Although reunited with the "province" of Pennsylvania in 1693, the so-called "territories" or "lower counties" secured a separate legislature in 1704 and a separate executive council in 1710; the governor of Pennsylvania, however, was the chief executive until 1776. A protracted boundary dispute with Maryland, which colony at first claimed the whole of Delaware under Lord Baltimore's charter, was not settled until 1767, when the present line separating Delaware and Maryland was adopted. In the American Revolution Delaware furnished only two regiments to the American Continental army, but they were among the best in the service. One of the companies of the first regiment carried a number of game-cocks said to have been the brood of a blue hen; hence the soldiers, and later the people of the State, have been popularly known as the "Blue Hen's Chickens," though the State itself, as already mentioned, is popularly called the "Diamond State."

Although Washington's whole army entered the State of Delaware and was encamped near Newport with a view to blocking Gen. Howe's march to Philadelphia after the landing of the latter's army at the head of the Elk in August, 1777, only a brisk skirmish at Cooch's Bridge (contemporaries called it Cooch's Mill) was fought on Sept. 3 between the American light infantry under Gen. Maxwell and some British detachments. Having encamped near Newark, Del., for five days, Howe marched through that town toward Kennett Square, Pa., in an effort to flank Washington's army, causing the American commander to march his men behind the Brandywine river in order to confront Howe at Chadd's Ford. (See BRANDYWINE.)

In 1776 a State Government was organized, and the term "Delaware State" was first adopted. In the constitution of 1792 the title was changed to "State of Delaware." One of the peculiarities of the Government under the first Constitution was that, in addition to the regular executive, legislative and judicial departments, there was a privy council without whose approval the governor's power was little more than nominal. In 1786 Delaware was one of the five States whose delegates attended the Annapolis Convention (see ANNAPOLIS; MARYLAND), and it was the first (Dec. 7, 1787) to ratify the Federal Constitution. The State was strongly Federalist for 30 years after the adoption of the Federal Constitution, and in several presidential elections stood almost alone in choosing Federalist electors. This strong Federalist influence caused the State to oppose the War of 1812, but after war was declared it loyally supported the Union. The slavery sentiment of the State was never strong, as was shown by the assembly's passing a resolution favouring the restrictions placed on further slave expansion by the Missouri Compromise and in 1845 passing a resolution against the annexation of Texas. In 1860 the State cast its electoral votes for John C. Breckinridge, as it was thought he represented the most neutral stand on the question of slavery. A further effort was made to prevent the rupture on the slave question when the general assembly, in 1861, went on record as favouring the Crittenden Compromise (see CRITTENDEN, JOHN JORDAN). In 1850 the Democrats, who had before then elected a few governors and United States Senators, secured control of the entire administration — a control unarrested, except in 1863, until the last decade of the 19th century. Although it was a slave State, the majority of the people of Delaware opposed secession in 1861, and the legislature promptly answered President Lincoln's call to arms.

In 1865, 1867 and 1869, respectively, the legislature refused to ratify the 13th, 14th and 15th amendments to the Federal Constitution. The provision of the State Constitution that restricted suffrage to those who had paid county or poll taxes and made the tax lists the basis for the lists of qualified voters, opened the way for the disfranchisement of many Negroes by fraudulent means. Consequently the levy court of New Castle county was indicted in the United States circuit court in 1872, and one of its members was convicted. Again in 1880 the circuit court, by virtue of the federal statute of 1872 on elections, appointed supervisors of elections in Delaware. The Negro vote increased in importance until 1900, when it was approximately one-fifth of the total vote of the state; since then it has declined, because of decrease in the percentage of Negro population. In 1901 the legislature ratified the three federal amendments concerning the status of the Negro rejected in former years. Another political problem has been that of representation. According to the Constitution of 1831 the unit of representation in the legislature was the county; inasmuch as the population of New Castle county has exceeded since 1870 that of both Kent and Sussex, the inequality became a cause of discontent. This was partly eradicated by the new Constitution of 1897, which reapportioned representation according to electoral districts, so that New Castle has 7 senators and 15 representatives, while each of the other counties has 5 senators and 10 representatives.

In 1889 the Republicans for the first time since the Civil War secured a majority in the legislature; Anthony J. Higgins (Republican) was elected to the United States Senate. Internal dissensions in the Republican Party, arising out of a struggle between the so-called Regular Republicans and a personal "machine" built up by J. Edward Addicks, a Wilmington capitalist, prevented the legislature from electing a Senator in 1895. The next election brought the Democrats into power, and the vacancy was filled by Richard R. Kenney. The struggle between the Republican factions continued, and with the expiration of Senator Gray's term in 1899 an election was again prevented. The State was wholly without representation in the United States Senate from the expiration of Senator Kenney's term in 1901 until 1903, when a compromise was effected whereby two Republicans, one of each faction, were chosen. Again in 1905 the legislature adjourned without being able to fill a vacancy in the Senate. The deadlock, however, was broken at a special session of the legislature called in 1906 when in June of that year Henry A. du Pont was elected Senator.

Since 1901 the Republicans have maintained their control of the State executive offices. Much of the time, however, the Democrats controlled the House of Representatives; and after the biennial elections of 1922 and 1924 they controlled the Senate also. In 1922 the Democrats elected Thomas F. Bayard to the United States Senate, the fifth successive member of that family to serve the State with credit in that body. In 1924 Gen. T. Coleman du Pont, also of a distinguished family long prominent in the State, was elected to the Senate by the Republicans to succeed Dr. L. Heisler Ball. In 1928 Coleman du Pont resigned because of ill health, being followed by Daniel O Hastings, who

continued United States senator until 1937, his successor being J. H. Hughes, a Democrat. In the presidential election of 1912 the Democrats carried the state; in 1916, 1920, 1924, 1928 and 1932 the Republicans won by a considerable margin, but in 1936 and 1940 the Democrats succeeded in overpowering them. Since 1910 the state's history has been mainly characterized by progressive legislation. In this period there were two progressive governors, Charles R. Miller and John G. Townsend. In the administration of the latter a number of important statutes were enacted, including a child labour law (1917), a workmen's compensation act (1917), laws for the regulation of labour for women, an income tax law (1917), a direct inheritance law (1917) and a thorough revision of the school laws, known as the New School code (1919). The state also passed in 1923 statutes providing for the sterilization of the feeble-minded, epileptic and insane and of those who had thrice been convicted of felonies resulting from mental abnormality. In 1938 was celebrated the 300th anniversary of the landing of the Swedes and Finns on the site of Wilmington and the founding of the first permanent settlement (Ft. Christina) in the state of Delaware.

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DELAWARE, a city of central Ohio, U.S.A., 24 mi. N. of Columbus, on the Olentangy river; the county seat of Delaware county.

The city is on federal highways 23 and 42, and is served by the Big Four, Chesapeake and Ohio and the Pennsylvania railways. The population was 8.675 in 1930; in 1940 it was 8,944. The city is built on rolling ground, 900 ft. above sea level. It is the seat of the Ohio Wesleyan university, founded in 1841 by the Ohio Conference of the Methodist Episcopal church. Delaware was laid out in 1808 and incorporated in 1815. It was the birthplace of President Hayes.

DELAWARE AND HUDSON COMPANY, THE, a holding company, formerly the oldest operating railway company in America, and a large anthracite carrier, founded by William and Maurice Wurts, Philadelphia merchants, who discovered and acquired anthracite lands in the Lackawanna valley, Pennsylvania, for replacing English coal cut off by the War of 1812. It was chartered in New York, on April 23, 1823, as "The President, Managers and Company of the Delaware and Hudson Canal Company," which built a canal, Rondout, New York, to Honesdale, Pennsylvania, in 1828, aided by a loan of credit of the State of New York in the amount of $800,000, and a railroad, Honesdale to the coal beds at Carbondale, Pennsylvania, on which the "Stourbridge Lion," the first locomotive to run on an American railroad, made its famous trial trip on August 8, 1829. The name was changed by act of the New York legislature, passed on April 28, 1899 The canal was abandoned and its cost charged off in 1898. Coal ownership was greatly enhanced by acquisition and lease, after the Civil War, of additional coal properties, at a later time transferred to a wholly-owned subsidiary.

By obtaining control of numerous railroads and some construction, the company built up a railway system extending from Plymouth, Pennsylvania, by way of Albany and Schenectady to Rouses Point, New York, at the Canadian border, with branches to Binghamton, Troy, Lake George, Lake Placid, New York, and Rutland, Vermont, and other points, a total of 857.85 miles, consisting of 324.53 owned, 440.51 leased and controlled, and 92.81 trackage rights. On April 1, 1930, the railroad operations were transferred to "The Delaware and Hudson Railroad Corporation," a wholly-owned subsidiary, chartered December 1, 1928, in New York.

The company also owns a railroad in Canada, operating 27.11 miles.

(J. H. Nu.)

DELAWARE INDIANS, tribes that occupied the drainage of the river Delaware and the shores of Delaware bay, eastern United States. They called themselves Lenape or Leni-Lenape, and were an association or confederacy of three Algonkin tribes, the Munsee, Unami and Unalachtigo. Their speech seems to have been more similar to the Algonkin dialects of Ohio valley than to the adjacent ones of the Atlantic coast, and their own tradition, in the Walam Olum, brings them out of the west. They were friendly to the whites; but, conquered in 1720 by the Iroquois and their lands more and more encroached on by the English settlers, they began to move westward, successively to central and western Pennsylvania, Ohio, Indiana, Missouri, Texas, Kansas and Oklahoma, with branches in Wisconsin and Ontario. They mixed with other Indian remnants in these migrations and the survivors contain much tribally alien blood. Though not particularly powerful or aggressive at the time of discovery, the Delaware were accorded an honorific pre-eminence by the other eastern Algonkins and were called "Grandfathers." *See* D. G. Brinton, *The Lenâpé and their Legends* (1885).

DELAWARE, LACKAWANNA AND WESTERN RAILROAD COMPANY, THE, operates 2,615 m. of track through New Jersey, Pennsylvania and New York. The main line extends from New York (Hoboken, N.J.) to Buffalo, N.Y.; branches from Scranton to Bloomsburg and Northumberland, Pa.; Binghamton to Syracuse, Oswego and Utica and Owego to Ithaca, New York. This system had its genesis in the incorporation of the Ligett's Gap railroad and in the construction of its railroad from Providence (now Scranton), Pa., to the Susquehanna river at Great Bend, Pa., to provide an outlet for the anthracite coal and the iron of the Lackawannb valley.

During its early history the road was mainly an anthracite coal carrier, but the inauguration of a comprehensive scheme of improvements subsequent to 1899 enabled the company to handle a larger volume and greater diversity of freight and passenger traffic. In 1899 anthracite coal comprised 53% of all freight traffic; in 1939 it represented but 31%. Revenue in 1899 from transportation of passengers was $3,951,051; in 1939 $6,649,041. The gross transportation revenue in 1939 was $50,454,438; the capital stock, $87,407,500. Over 60.000 passengers are transported daily over the Lackawanna's New Jersey suburban lines in and out of New York City. Electrification between Hoboken and Dover, N.J. was completed in 1931. Through service is operated to Cleveland and Chicago via the Nickel Plate road, and to Detroit and Chicago via the Michigan Central railroad.

(J. M. D.)

DELAWARE RIVER, a stream of the Atlantic slope of the United States, meeting tide-water at Trenton (N.J.), 130m. above its mouth. Its total length, from the head of the longest branch to the capes, is 410m., and above the head of the bay its length is 360m. It constitutes in part the boundary between Pennsylvania and New York, the boundary between New Jersey and Pennsylvania, and, for a few miles, the boundary between Delaware and New Jersey. The main or west branch rises in Schoharie county (N.Y.), about 1,886ft. above the sea, and flows tortuously through the plateau in a deep trough until it emerges from the Catskills. Other branches rise in Greene and Delaware counties, New York In the upper portion of its course the varied scenery of its hilly and wooded banks is exquisitely beautiful. After leaving the mountains and plateau, the river flows down broad Appalachian valleys, skirts the Kittatinny range, which it crosses at Delaware water-gap, between nearly vertical walls of sandstone, and passes through a quiet and charming country of farm and forest, diversified with plateaus and escarpments, until it crosses the Appalachian plain and enters the hills again at Easton (Pa.). From this point it is flanked at intervals by fine hills, and in places by cliffs, of which the finest are the Hockamixon rocks, three miles long and more than 200ft. high At Trenton there is a fall of eight feet.

Below Trenton the river becomes a broad, sluggish inlet of the sea, with many marshes along its side, widening steadily into its great estuary, Delaware bay. Its main tributaries in New York are Mongaup and Neversink rivers and Callicoon creek; from Pennsylvania, Lackawaxen, Lehigh and Schuylkill rivers; and from New Jersey, Rancocas creek and Musconetcong and Maurice rivers. Commerce was once important on the upper river, but only before the beginning of railway competition (1857). Of the various early canals only two are of any importance now; the canal from Trenton to New Brunswick which unites the waters of the Delaware and Raritan rivers and the Delaware and Chesapeake canal which joins the waters of the Delaware with those of Chesapeake bay. The magnitude of the commerce of Philadelphia has made the improvements of the river below that port of great importance. At a cost of many millions of dollars to the U.S. Government a 32ft. channel 600ft. wide has been opened from the deep water in Delaware bay to Philadelphia and a 12ft. channel from there to Trenton.

DELAWARE WATER GAP, a borough and summer resort of Monroe county (Pa.), U.S A., on the Delaware river, about 108m. N. of Philadelphia and about 88m. W. by N. of New York. Population (1930) 443; (1940) 410. It is served directly by the Delaware, Lackawanna and Western, and by the Belvidere division of the Pennsylvania railways. The borough is connected with the county seat, Stroudsburg, three miles distant, by a three-lane highway. The borough was named from the neighbouring gorge. On the New Jersey side of the river is Mt. Tammany (about 1,600 ft.), a cliff of which has been weather-carved into the profile of an Indian, once so common to this section. On the Pennsylvania side Mt. Minsi rises approximately 1,500 ft. The river elevation is about 300 ft. The gap, some two miles long, is the result of erosion by a river which once flowed northwards acting along a line of faulting at right angles to the strike of the tilted rock formations. The river's present course is thought to be young geologically, and the gap exposes Ordovician, Silurian and Devonian strata. One of the fine remnants of the Wisconsin terminal moraine is to be found in near-by Cherry valley along Cherry creek, extending to a height of 300 ft. at some points. The Water Gap is a popular summer resort. The borough was incorporated in 1889.

See L. W. Brodhead, ***The Delaware*** Water-Gap (Philadelphia, 2nd ed., 1870).

DE LA WARR or **DELAWARE,** an English barony, the holders of which are descended from Roger de la Warr of Isfield, Sussex, who was summoned to parliament as a baron in 1299 and the following years. He died about 1320; his great-grandson Roger, to whom the French king, John, surrendered at the battle of Poitiers, died in 1370; and the male line of the family became extinct on the death of Thomas, 5th baron, in 1426.

The 5th baron's half-sister, Joan, married Thomas West, 1st Lord West (d. 1405), and in 1415 her second son, Reginald (1394–1451) succeeded his brother Thomas as 3rd Lord West. After the death of his uncle Thomas, 5th Baron De La Warr, whose estates he inherited, Reginald was summoned to parliament as Baron La Warr, and he is thus the second founder of the family. His grandson was Thomas, 3rd (or 8th) baron (d. 1525), a courtier during the reigns of Henry VII. and Henry VIII.; and the latter's son was Thomas, 4th (or 9th) baron (c. 1472–1554). The younger Thomas was a very prominent person during the reigns of Henry VIII. and Edward VI. He died without children in Sept. 1554, when his baronies of De La Warr and West fell into abeyance. His monument may still be seen in the church at Broadwater, Sussex. He had settled his estates on his nephew William West (c. 1519–95), who was disabled by act of parliament (1549) from succeeding to his honours for having sought to poison his uncle. However, in 1570 he was created by patent Baron De La Warr. In 1596 his son Thomas (c. 1556–1602) claimed precedency in the baronage as the holder of the ancient barony of De La Warr, and his claim was admitted.

THOMAS WEST, 3rd or 12th Baron De La Warr (1577–1618), British soldier and colonial governor in America, was born on July 9, 1577, and succeeded to the title in 1602. He fought in Holland and in Ireland under the earl of Essex. He was imprisoned for complicity in Essex's revolt (1600–01), but was exonerated. He became a member of the council of the Virginia company and was appointed (1609) governor and captain-general of Virginia for life. Sailing in March 1610 with three ships, 150 settlers and supplies, he arrived at Jamestown on June 10, in time to intercept the colonists who had embarked for England and were abandoning the enterprise. Lord De La Warr's rule was strict but just; he constructed two forts near the mouth of the James river, rebuilt Jamestown, and in general brought order out of chaos. In March 1611 he returned to London, where he published, at the request of the company's council, his Relation of the condition of affairs in Virginia (reprinted 1859 and 1868). He remained in England until 1618, when the news of the tyrannical rule of the deputy, Samuel Argall, led him to start again for Virginia. He embarked in April, but died *en* route on June 7, 1618, and was buried at sea. The Delaware river and the State of Delaware were named in his honour. A younger brother, Francis (1586–*c.* 1634), was prominent in the affairs of Virginia, and in 1627–28 was president of the council, and acting-governor of the colony.

In 1761 the 3rd or 12th baron's descendant, John, 7th or 16th Baron De La Warr (1693–1766), was created Viscount Cantelupe and 1st Earl De La Warr. He was a prominent figure in the House of Lords, at first as a supporter of Sir Robert Walpole. He also served in the British army and fought at Dettingen, and was made governor of Guernsey in 1752.

George John West, 5th earl (1791–1869), married Elizabeth Sackville, and in 1843 he and his sons took the name of Sackville-West. The earl was twice lord chamberlain to Queen Victoria, and he is celebrated as "Fair Euryalus" in the *Childish* Recollections of his schoolfellow, Lord Byron. His son, Charles Richard (1815–73), 6th earl, served in the first Sikh war and in the Crimea, and being unmarried was succeeded by his brother Reginald (1817–96) as 7th Earl De La Warr. In 1896 the 7th earl's son, Gilbert George (1869–1915) became 8th Earl De La Warr. He was succeeded as 9th earl by his son, Herbrand Edward (b. 1900).

See G. E. C(okayne), *Complete Peerage* (1887–98).

DELBRÜCK, HANS (1848–1929), German historian, was born at Bergen on the island of Riigen on Nov. 11, 1848. and studied at the universities of Heidelberg and Bonn. He saw active service in the Franco-German War, and was afterward tutor to Prince Waldemar of Prussia (1874–79). In 1885 he became professor of modern history in the university of Berlin. Frorn 1884–90 he sat as a conservative in the German reichstag. Delbriick's writings are chiefly concerned with the history of the art of war, his most ambitious work being his Geschichte *der Kriegskunst im Rahmen* der *politischen Geschichte* (first section,

Das Altertum, 1900; second *Römer und Germanen,* 1902; third, *Das Mittelalter,* 1907; fourth vol., 1921). Among his other works are: *Die Perserkriege und die Burgunderkriege* (Berlin, 1887); *Historische und politische Aufsätze* (1886); *Erinnerungen, Aufsätze und Reden* (1902); *Die Strategie des Perikles erlautert durch die Strategie Friedrichs des Grossen* (1890); *Die Polenfrage* (1894); *Das Leben des Feldmarschalls Grafen Neithardt von Gneisenau* (1882 and 1894); *Krieg und Politik* (3 vols., 1919), *Ludendorff, Tirpitz, Falkenhayn* (1920), *Weltgesclzichte* (1923–26, 3 vols.) and *Vor und Nach dem Weltkrieg* (1926). Delbriick began in 1883 to edit the *Preussische Jahrbücher,* in which he has written many articles, including one on "General Wolseley iiber Napoleon, Wellington und Gneisenau," and he has contributed to the *Europäischer Geschichtskalender* of *H.* Schulthess. After the World War he was appointed member of the commission to publish German archives. He died July 14, 1929.

DELBRUCK, RUDOLF VON, Prussian statesman (1817–1903), was born at Berlin on April 16, 1817. On completing his legal studies he entered the government service in 1837; in 1848 he was transferred to the ministry of commerce. Both Germany and Austria had realized the influence of commercial upon political union. Delbruck in 1851 induced Hanover, Oldenburg and Schaumburg-Lippe to join the Zollverein; and the southern states, which had agreed to admit Austria to the union, found themselves forced in 1853 to renew the old union, from which Austria was excluded. Delbriick now began, with the support of Bismarck, to apply the principles of free trade to Prussian fiscal policy. In 1862 he concluded an important commercial treaty with France. In 1867 he became the first president of the chancery of the North German Confederation, and represented Bismarck on the federal tariff council (*Zollbundesrat*). In 1868 he became a Prussian minister without portfolio. In Oct. 1870, when the union of Germany under Prussian headship became a practical question, Delbriick was chosen to go on a mission to the South German states, and contributed greatly to the agreements concluded at Versailles in November. In 1871 he became president of the newly constituted *Reichskanzleramt.* Delbruck, however, began to feel himself uneasy under Bismarck's leanings towards protection and state control. On the introduction of Bismarck's plan for the acquisition of the railways by the state, Delbriick resigned office, nominally on the ground of ill-health (June 1, 1876). In 1879 he opposed in the *Reichstag* the new protectionist tariff, and then retired definitely from public life. In 1896 he received from the emperor the order of the Black Eagle. He died at Berlin on Feb. 1, 1903.

See his *Lebenserinnerungen 1817–1867* (2nd ed., 1905), with an additional section on the events of 1870.

DELCASSE, THEOPHILE (1852–1923), was born at Pamiers (Arikge) on March 1, 1852, his father being an *huissier* or bailiff. He was educated locally, took his degree of *licence ès lettres,* and served as tutor to the children of an official in the ministry of foreign affairs. The taste for politics was ingrained in young Delcassé. He contributed to the *République Française* under Gambetta, made friends, if not with the Tribune himself, at least with Camille Barrkre who acted as foreign editor of the paper, besides fulfilling the function of French representative on the Danube commission, and became secretary to Massip, a wealthy man who had been elected to the chamber in the Arikge department. Eventually, he married Massip's widow and, in 1889, succeeded him in the Chamber. Freed once for all from all material cares, he was able to devote himself to his new duties, and his personal integrity was never questioned by anyone. In the political struggles of the period, he ranked as a follower of Gambetta but, at the same time, was clever enough to keep a close connection with the very radical *Dépêche de Toulouse,* the most powerful electoral factor in the south of France, which supported him to the end on patriotic grounds. At that time, Delcasst. was considered, on the whole, as a man of the Left. In Jan 1898, he criticised the cabinet of Méline on account of its excessive tolerance towards clericalism. He climbed the ministerial ladder very rapidly: under-secretary for the colonies (Jan–Dec. 1893), and minister of the colonies from May 1894 to Jan. 1895, after the Colonial Office had been transformed for his sake into a separate and independent ministerial department.

But the real career of DelcassC began in June 1898, after the general election of that year and the overthrow of the Méline cabinet, with his appointment as minister of foreign affairs in the Radical cabinet headed by Brisson. He retained this office under the subsequent premierships of Dupuy, Waldeck-Rousseau, Combes and Rouvier, until June 6, 1905. In 1898, French diplomacy was roughly divided into two schools. Hanotaux, his predecessor at the Foreign Office, had been striving in an uncertain way to bring about some sort of co-operation between France, Russia and Germany, and he had rather allowed the Franco-Russian alliance to evolve in an anti-British direction. On the other hand, the French ambassadors in Rome and Constantinople, Barrkre and Paul Cambon, always insisted that the Franco-Russian alliance should be made compatible with a Franco-British rapprochement, it being absurd for a colonial power like France deliberately to cross the purposes of the supreme maritime power. The foreign office officials were amazed when they saw that the new-comer, apparently without any previous experience of practical diplomacy, resolutely cast in his lot with Barrkre and Cambon (the latter was appointed to the London Embassy in Dec. 1898) and unhesitatingly acted from the outset on the principle that the only nation France need be afraid of and guard against was Germany, snd that, therefore, alliance must be sought with Britain as well as with Russia and that the way must be paved (incredibly paradoxical as it seemed then) for a Russo-British understanding.

As a matter of fact Delcassé had inherited these views from the Gambetta school of thought through Camille Barrkre. As early as the autumn of 1898—the grand duke Vladimir happening to be in Paris—Delcassé is reported to have expounded the above policy to his advisers, protesting to them that the grand duke, who was still thinking and speaking in the terms of the Hanotaux period, had misunderstood him. In 1903, when Delcassé came back from London, where he had prepared the Franco-British treaty of April 8, 1904, he told his officials the conversation he had had with Lord Lansdowne and Joseph Chamberlain, and told them that Chamberlain had incited him to bring about a rapprochement between England and Russia. "When I heard this," he said, "I felt my brain turning I replied to Mr. Chamberlain: 'I shall refrain from making any direct approach to Russia because I should be denounced in Petersburg as having sold her in London. But I promise you I shall take every opportunity of praising the new Entente Cordiale and of inspiring our Russian ally with a desire for some sort of treaty with Great Britain.' " These details are worth stating because they may enable the historian to apply to Delcassé what Cardinal de Retz said about Richelieu: *"Il eut l'intention des choses qu'il fit."*

At the back of Delcassé's political conceptions was a very deep feeling of France's greatness and an unshakable confidence in her destiny. Not that he ever planned war. But he was of opinion (he stated it clearly at the time of the Russo-German intrigue of 1904–1905, which aimed at compelling France, under the threat of an invasion through Belgium, to enter a coalition of Germany and Russia) that if the friendship of England was not secured by French diplomacy, Berlin and London would sooner or later get together, the Triple Alliance be rendered still more formidable, and France pay the cost of that combination on the Continent and in her oversea territories. Only second in importance in Delcassé's mind, to this persistent idea of the Anglo-French-Russian Triple Entente, was the belief that his country's fate was bound up with the consolidation and extension of its North African empire. In his judgment no great nation could exist without a minimum of material power and territorial weight. France could only find that minimum by making use of her North African opportunities.

Delcassé's scheme was carried out in the seven years extending to 1905, under difficulties which seemed well-nigh insuperable. In succession, he was confronted by the incident of Fashoda; the South African war, which rekindled anti-British feeling in France; the Dreyfus affair, bringing in its train the distinct weakening of

the French army; and the Russo-Japanese war of 1904. The Minister bravely stood his ground. The recall of Captain Marchand from the Nile was announced on Nov. 4, 1898, and the Franco-British Convention of June 14, 1898, which Hanotaux had concluded before his resignation, for the delimitation of French and British interests in the region of the Niger, was completed by the fuller settlement of March 21, 1899. As regards the Far East, M. Delcassé unceasingly sought to support in Petersburg the peaceful policy of Count Lamsdorf as against the faction Alexeiev-Bezobrazov and, in Oct. 1904, when the Dogger Bank incident occurred, he was fortunate enough to mediate between London and Petersburg. As to the Dreyfus affair, he consistently observed an attitude of reserve and detachment. As a member of the Waldeck-Rousseau and Combes cabinets, he formally approved the whole anti-clerical policy, and did nothing openly to check the action of the War Minister, General André. He shut himself up in his study at the Quai d'Orsay, enjoying the hearty support of the president of the republic, Loubet, and turning a blind eye to home politics in his passionate attachment to his work. But the time was approaching when he would have to come forward and fight for what he had done. Things changed for him with the advent to power of Rouvier in Jan. 1905.

On April 8, 1904, had been signed the Convention about Morocco and Egypt, the starting point of the Entente Cordiale, the great achievement of Delcassé, Paul Cambon and Lord Lansdowne, not to speak of Edward VII. who consistently favoured it. In Berlin, the Franco-British rapprochement had to the last moment been deemed unthinkable. After some hesitation it was challenged by the Kaiser himself in his famous speech at Karlsruhe on April 27, 1904, and, on March 31, 1905 William II. paid a visit to the representative of the Sultan of Morocco in Tangier, proclaiming that he would stand by the independence of the Sherifian empire. German diplomacy acted throughout on the theory that French parliamentary opinion would not stick to the Entente Cordiale as soon as it understood that it might mean instant war with Germany. To a certain point the calculation proved true enough. Rouvier, a practical financier, who was inclined to believe that the German danger could be disposed of by means of economic co-operation between France and Germany, and that the French army was not fit to withstand the onslaught of the German Army, led the battle against his own foreign minister with the assistance of nearly the whole cabinet. In the sitting of the Chamber of April 18, Delcassé was criticized from nearly every side, and though formally supported by the premier, tendered his resignation, which, however, the president of the republic persuaded him to withdraw. But the position of Delcassé quickly became untenable. Germany was pressing for the summoning of an international conference on Morocco, and Rouvier was exchanging views with von Biilow behind the back of his colleague. Towards the end of May, the German Government was in that way acquainted with the British proposal for a military alliance in case war should ensue from the 1904 treaty, a step that immediately led von Biilow to let it be known in Paris, through Tittoni, that any advance of France towards Fez would bring about a declaration of war. Rouvier openly pressed Paul Cambon to discontinue the negotiation for the treaty of alliance with England. Vehement explanations were exchanged in the ministerial council held on June 6, 1905, which culminated in the final resignation of Delcassé.

There is no doubt that technical faults could be put to the debit side of Delcassé's account. He did not take sufficient care to communicate officially to Germany in advance the bargain he was going to make with the British Foreign Office: the information he had given to Prince Radolin on March 13, 1904, can perhaps hardly be regarded retrospectively as fully supplying the missing link in the chain of necessary diplomatic preparation. In April 1905, he evinced some vacillation, and tried to initiate a belated conversation with the German ambassador. At times, his character was not perhaps as resolute as his policy. During his whole career he was prone to make mistakes, which it is even to-day all the more difficult to explain as he usually surrounded himself with complete secrecy, confided in no one, and took care that his steps should not be easily traced. In 1902, he had been about to sign with Spain, to the amazement of his own officials, a treaty which included Fez in the Spanish zone and did not even provide for the passage of troops between Algeria and the French zone in Morocco, an accident which accounts for the hostility shown to him by Etienne, deputy for Oran and war secretary under Rouvier. However, when he left the Quai d'Orsay, the position of France in Europe had changed beyond recognition. The Triple Entente was virtually in existence, and even the foundation of the Anglo-Russian treaty of January 31, 1907, had been laid. The clauses of the Triple Alliance treaties specially directed against France since 1887 had been suppressed as a result of the Franco-Italian convention of 1902 on Tunis and Tripoli, secured by Barrère. Spain had rallied to the Franco-British treaty of April 1904 in October of the same year. On the whole, the system had withstood the test of the most trying developments. As Paul Cambon remarked in a letter of May 1905, the British alliance was perhaps in advance of what French public opinion was ready to stand at the time, and it was not well that it should be possible to denounce it as the work of one man. But what was done in 1898–1905 might perhaps not have been done later.

Having fallen from office, Delcassé remained completely silent for nearly three years but, meanwhile, he was very active in the lobbies. On Jan. 24, 1908, taking the opportunity offered by a debate on Morocco, he suddenly launched a carefully prepared speech which amounted to a vindication of his policy. He was acclaimed by the assembly. On July 20, 1909, as chairman of the marine commission, he engaged in an oratorical duel with Clemenceau, who was clumsy enough to allude to the events of 1905; the Clemenceau cabinet had to resign on the same night. The vacant premiership was not, however, offered to Delcassé, lest the Central Powers should interpret the move as a provocation. He was given the Ministry of Marine in the spring of 1911, and kept it for two years under Monis, Caillaux and Poincaré. He certainlv thought of contesting the presidency of the republic in January 1913, but his calculation that his name would be put forward at the second ballot once the other candidates, Poincaré and Pams, had spent their strength, came to nothing. He voted openly for the Radical Socialist, Pams. Notwithstanding the distant and unfriendly relations obtaining between the two men, Poincaré, as president of the republic, endeavoured to induce Delcassé to accept either the premiership or the ministry of foreign affairs. He refused, but, a few days afterwards, was persuaded by Briand and Jonnart (respectively president of the council and foreign secretary) to take charge for several years of the St. Petersburg embassy, which had fared very badly under Georges Louis, to the detriment of the Franco-Russian Alliance.

Germany was quickly increasing her armaments, and the whole machinery of the Franco-Russian alliance sadly needed mending and overhauling; it was felt that Delcassé alone would enjoy the moral authority requisite to perform the task. The hope reposed in him was fully fulfilled. With the emperor Nicolas and with Sazonov his credit was unbounded. Yet, he did not make the least attempt to live as an ambassador. His way of living was parsimonious. He stuck to the habits of a little French bourgeois, taking a stroll on the quay at 8 o'clock in the morning. As far as current affairs were concerned, he always favoured a concert of Europe, and urged moderation on Russia in the controversies over Silistria and Scutari. In December 1913, he expressed himself very pessimistically about the consequences of the Liman von Sanders mission in Constantinople. Two months before, he had asked for his recall. No satisfactory explanation of that sudden decision is available. He had not seen eye to eye with the Paris Government over the French claims to Syria and the pourparlers with Germany for the building of French railways in Armenia, as he was steadily opposed to the extension of French commitments in the Near East, which he believed dangerous and likely to resuscitate former Franco-British dissensions. But, in 1913, such matters did not loom very large on the horizon.

The word "failure" must unfortunately be written across Delcassé's last tenure of office. In June 1914, after the general election had resulted in the constitution of a radical majority, the

premiership was again pressed upon him in vain by Poincaré. He only agreed to take the War Office in the short-lived Ribot cabinet. The temper of the country was very far removed then from the impending European developments. In the midst of the invasion of France by the German army, when Viviani had to transform his ministry into a ministry of national defence, Delcassé, who was hailed by the country as the embodiment of the Russian and British alliances came back, on Aug. 27, to the Quai d'Orsay and remained there until Oct. 13, 1915, when he resigned in order to protest against the Salonika expedition. As far as the winning of Italy to the side of the Allies was concerned, he did all that could be expected of him, and, in April 1915, approved the Treaty of London with the Government of Rome. But, in the Balkans, from beginning to end, he persistently followed the wrong track, and his closest advisers are at loss to understand his conduct, which bore such a striking contrast with his former clearness of judgment and power of vision. He allowed himself to be deceived by Bulgaria, held in check the Serbian army which, left to itself, would have interfered with the mobilization of King Ferdinand's army, allowed Venizelos to be dismissed by King Constantine and, having approved of the Gallipoli campaign some nine months before, set his face against any assistance being lent to Serbia. Moreover, for unknown reasons, he delayed for fully six months the assent of the French Government to the annexation of Constantinople by Russia as a feature of the eventual peace treaties. On Sept. 16, 1916, in the secret sitting of the Chamber, he harped, for his defence, on the theme that he only wished 500,000 Germans were already encamped in Salonika, since the strength of the Kaiser's army on the western front, where the issue would be settled, could not fail to be all the more impaired. A passionate reply from Briand, then president of the council, crushed him, and he retired into private life and complete solitude. He entirely disapproved of the policy followed by the French and British cabinets in 1918 and 1919. The British Alliance and the building up of the Rhineland as a bulwark against Germany remained his motto to the end. Hardly any one ever saw him till his sudden death from arterio-sclerosis, on Feb. 21, 1923. He had been very much affected by the death of his son, Jacques, who had been seriously wounded and transferred to Switzerland. His daughter, Suzanne, married General Noguès.

He is reported to have destroyed most of his personal papers. In spite of his limitations, he remains, by general consent, the outstanding figure of the Third republic in the field of foreign affairs. (A. GÉ.)

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DEL CREDERE. A "del credere agent," in common law, is one who, in consideration of additional remuneration called a del credere commission, undertakes that persons with whom he contracts on his principal's behalf shall duly pay any sums due from them to the principal under the contracts. His position is thus that of a surety who is liable to his principal should the other contracting party make default. The agreement between him and his principal need not be reduced to or evidenced by writing, for his undertaking is not a guarantee within the Statute of Frauds. (*See* also BROKER; FACTOR; GUARANTEE.)

DELESCLUZE, LOUIS CHARLES (1809–1871), member of the Paris commune, was born at Dreux (Eure-et-Loir) on Oct. 2, 1809. Under Louis Philippe he adopted extreme republican views, fought in the insurrection of June 1832 and in 1836 was forced to leave France. In 1840 he returned, settled at Valenciennes, and took up republican journalism. On the success of the revolution of 1848 he was appointed prefect of the Nord and Pas-de-Calais departments. He was afterwards the only communard leader with administrative experience. He resigned his post on the meeting of the National Assembly, went to Paris and combated the growing conservatism of the Government by means of his journal *La Révolution Democratique et Sociale,* and by *a* society called *Republican Solidarity* intended to defend the republic in the provinces. On the failure of the radical *emeute* in June 1849 he was forced to fly to England. He returned in 1853, was betrayed by a spy and taken to a convict plantation in French Guiana. In 1859 he returned to France, broken in health, and resumed journalism. He was personally hostile to Blanqui (*q.v.*), but in reality his policy was impregnated with Blanqui's ideas; he was commonly classified neither as a socialist nor as an internationalist, but as a "jacobin." After a further imprisonment he fled to Belgium in 1870, returning on the fall of the empire. He was elected a member of the National Assembly and also of the Paris commune in 1871; he chose to sit in the latter, and his seniority, ability and high character gave him the most authoritative position. His energies were not, indeed, equal to producing order in the chaotic administration of the commune (*see* COMMUNE) in two months, but he was its most capable and disinterested leader. On May 9 he took over the department of war, but it was too late for reorganization. The Government troops broke in on May 22, and the communard forces separated into their local sections. Delescluze for the next three days attempted to combine and organize the defence, himself fighting with reckless courage; but on May 25, perceiving that defeat was certain, he dressed himself in civilian clothes, with the broad red sash of a member of the commune, and climbed, unarmed, a barricade at the Chateau d'Eau which was under heavy fire. When he reached the crest and his insignia could be seen by the Government troops, he was immediately, as he had hoped, killed by a bullet.

See his *De Paris à Cayenne, journal d'un transporté* (Eng. trans. 1872); P. Larousse, *Dicfionnaire du XIXe siècle* (1870) *s.v.* "Delescluze"; and the books cited under COMMUNE. (R. W. P.)

DELESSE, ACHILLE ERNEST (1817–1881), French geologist and mineralogist, was born at Metz Feb. 3, 1817, and educated at the École Polytechnique and the École des Mines. He was successively professor of mineralogy at Besançon, of geology in Paris, and of agriculture in Paris. In 1878 he became inspector-general of mines. In early years as *ingénieur des mines* he investigated and described various new minerals; he proceeded afterwards to the study of rocks, devising new methods for their determination, and giving particular descriptions of melaphyre, arkose, porphyry, syenite, etc. He prepared in 1858 geological and hydrological maps of Paris, with reference to the underground water, similar maps of the departments of the Seine and Seine-et-Marne and an agronomic map of the Seine-et-Marne (1880), in which he showed the relation which exists between the physical and chemical characters of the soil and the geological structure. His annual *Revue des progrès de géologie,* undertaken with the assistance (1860–65) of Auguste Laugel and afterwards (1865–78) of Albert de Lapparent, was carried on from 1860 to 1880. His observations on the lithology of the deposits accumulated beneath the sea were of special interest and importance. His separate publications were: *Recherches sur l'origine des roches* (1865); *Etude sur le métamorphisme des roches* (1869); *Lithologie des mers de France et des mers principales du globe* (2 vols. and atlas, 1871). He died in Paris on March 24, 1881.

DELESSERT, JULES PAUL BENJAMIN (1773–1847), French banker, was born at Lyons on Feb. 14, 1773, the son of Etienne Delessert (1735–1816), the founder of the first fire insurance company and the first discount hank in France. Young Delessert was travelling in England when the Revolution broke out in France, but he hastened back to join the Paris National Guard in 1790, becoming an officer of artillery in 1793. His father bought him out of the army, however, in 1795 in order to entrust him with the management of his bank He started many commercial enterprises, founding the first cotton factory at Passy in 1801, and a sugar factory in 1802, for which he was created a baron of the empire. He sat in the chamber of deputies for many years, and was a strong advocate for many humane measures, notably the suppression of the "Tours" or revolving box at the

foundling hospital, the suppression of the death penalty, and the improvement of the penitentiary system. He was made regent of the Bank of France in 1802, and founded many learned and philanthropic societies. He founded the first savings bank in France.

DELFT, town, province of South Holland, on the Schie, 5 mi. S.E. by S. of The Hague, Holland. Pop. (1940) 54,108. Delft was founded in 1075 by Godfrey III., duke of Lower Lorraine, after his conquest of Holland, passing then to the counts of Holland. In 1246 it received a charter from Count William II. In 1536 it was almost totally destroyed by fire, and in 1654 largely ruined by explosion of a powder magazine.

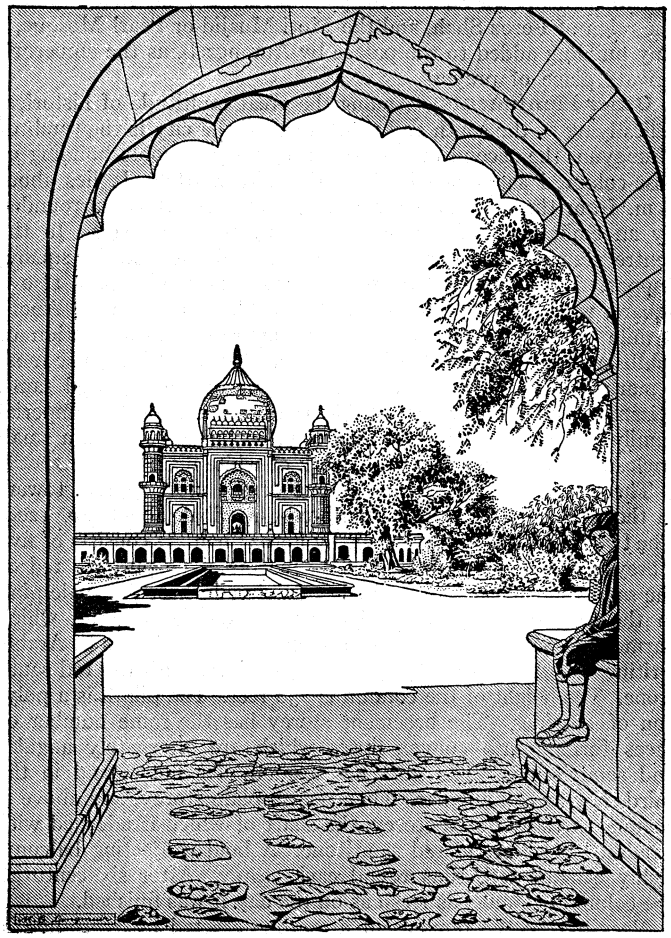
The Prinsenhof, previously a monastery, was converted into a residence for the counts of Orange in 1575; here William the Silent was assassinated. It is now the William of Orange Museum. The former church of St. Ursula (14th century) is now the New Church, where the members of the royal house of Orange-Nassau are buried. It has a fine tower and chime of bells, and contains a monument to William the Silent, executed by Hendrik de Keyser and his son about 1621, and the tomb of Hugo Grotius, whose statue stands in the market-place. The Old Church, founded in the 11th century, but in its present form dating from 1476, contains monuments erected to admirals Martin Tromp and Piet Hein, as well as the tomb of Leeuwenhoek. In the town hall (1618) are some corporation pictures, portraits of the counts of Orange and Nassau, including several by Michiel van Mierevelt (1567–1641). The Indian institute was abolished about 1900, and the civil service training for the colonies was transferred to Leyden and Utrecht. The Institute of Technology, formed in 1905 from the former Polytechnic school, became the sole qualifying university for engineers in Holland.

Delft is most intimately associated with the manufacture of the beautiful faïence pottery for which it was once famous. *(See* CERAMICS.) This industry was imported from Haarlem towards the end of the 16th century, and achieved an unrivalled position in the second half of the following century; but it did not survive the French occupation at the end of the 18th century. It has, however, been revived in modern times under the name of "New Delft." The chemical industry is very important, as is also the manufacture of tobacco. Germany occupied Delft in May 1940.

DELHI (dĕl'ĭ), old capital of the Mogul empire in India, and the new capital of British India, lies on the right bank of the Jumna, practically in the same latitude as the more ancient cities of Cairo and Canton. Since the headquarters of the government of India was transferred from Calcutta to Delhi in 1912, the district around Delhi, formerly a part of the Punjab, has for administrative reasons been constituted a minor province under a chief commissioner who is directly subordinate to the central government. The ruins of several of the older fortresses (for they were all heavily walled) strew the surrounding country.

Two of them are of special interest:—Old Delhi (about 10 m. from the present city), where stand the stately Kutb Minar with the enigmatic Iron Pillar, and Tughlakabad with its titanic walls; but there is hardly an acre in all the intervening country that does not carry some relic of the historic past. The present city, the seventh of the series, was re-constructed by the emperor Shahjahan on an older site, and is still known locally as Shahjahanabad. The greater part of it is still confined within his walls. Of its river frontage, about $2\frac{1}{4}$ m. long, one third is occupied by the battlements of his palace; and the complete circuit of the walls is $5\frac{1}{2}$ miles. Shahjahan's original fortifications were strengthened by the British by the addition of a ditch and glacis, after Delhi was captured by Lord Lake in 1803; and its strength was turned against the British at the time of the Mutiny.

The Imperial Palace (1638–48), now known as the "Fort," is disfigured by bare and ugly British barracks, among which are scattered exquisite gems of oriental architecture. The two most famous among its buildings are the Diwan-i-Am or Hall of Public Audience, and the Diwan-i-Khas or Hall of Private Audience. The Diwan-i-Am is a splendid building in the Hindu style, with 60 pillars of red sandstone supporting a flat roof. It was in the recess in the back wall of this hall that the famous Peacock Throne used to stand. "so called from its having the figures of two peacocks standing behind it, their tails being expanded and the whole so inlaid with sapphires, rubies, emeralds, pearls and other precious stones of appropriate colours as to represent life." Tavernier, the French jeweller, who saw Delhi in 1665, describes the throne as of the shape of a bed, supported by four golden feet, 20 to 25 in. high, from the bars above which rose 12 columns to support the canopy; the bars were decorated



TOMB OF NAWAB SAFFAR JANG, RULER OF OUDH, BUILT IN 1753. THE WORSHIPPERS LEAVE THEIR SLIPPERS AT THE DOOR OF THE MOSQUE

with crosses of rubies and emeralds, and also with diamonds and pearls, while the columns had rows of splendid pearls. The whole was valued at £6,000,000. This throne was carried off by the Persian invader Nadir Shah in 1739, and has been rumoured to exist still in the Treasure House of the Shah of Persia; but Lord Curzon, who examined the thrones there, found nothing except perhaps some portions worked up in a modern Persian throne.

The Diwan-i-Khas is smaller than the Diwan-i-Am, and consists of a pavilion of white marble, in the interior of which the art of the Moguls reached the perfection of its jewel-like decoration. On a marble platform rises a marble pavilion, the flat-coned roof of which is supported on a double row of marble pillars. The inner face of the arches, with the spandrils and the pilasters which support them, are covered with flowers and foliage of delicate design and dainty execution, crusted in green serpentine, blue *lapis* lazuli and red and purple porphyry; the ravages of time were repaired as far as possible by Lord Curzon.

The Chandni Chauk ("silver street"), which was once supposed to be the richest street in the world, has fallen from its high estate, though it is still a broad and imposing avenue with a double row of trees running down the centre. During the course of its history it was four times sacked, by Nadir Shah, Timur, Ahmad Shah and the Mahrattas, and its roadway has many times run with blood. The jewellers and ivory-workers now dwell there

A short distance south of the Chandni Chauk the Jamma Musjid, or Great Mosque, rises boldly from a small rocky emi-

nence It was erected in 1648–50, two years after the royal palace, by Shah Jahan. Its front court, 450 ft. square, and surrounded by a cloister open on both sides, is paved with granite inlaid with marble, and is approached by a magnificent flight of stone steps. The mosque itself is paved with marble, and three domes of white marble rise from its roof, with two tall minarets at the front corners. Two other mosques in Delhi deserve passing notice, the Kala Musjid or Black Mosque, which was built about 1380 in the reign of Feroz Shah, and the Moti Musjid or Pearl Mosque, a tiny building added to the palace by Aurangzeb, as the emperor's private place of prayer.

Other Monuments. — Among the great multitude of historical relics lying to the south and south-west of the city is the tomb of Humayun, the second of the Mogul dynasty, a noble building of rose-coloured sandstone inlaid with white marble. It lies about 3 m. from the city, in a terraced garden, the whole surrounded by an embattled wall, with towers and four gateways. In the centre stands a platform about 20 ft. high by 200 ft. square, supported by arches; and above it rises the mausoleum, also a square, with a great dome of white marble in the centre. About a mile to the west is another burying-ground, or collection of tombs and small mosques, some of them very beautiful. The most remarkable is the little chapel in honour of a celebrated saint, Nizam-ud-din, near whose shrine the members of the imperial family, up to the time of the Mutiny, lie buried, each in a small enclosure surrounded by lattice-work of white marble.

The Kutb Minar, regarded as one of the most perfect towers in the world, was begun by Kutb-ud-din Aibak about A.D. 1200. The two top storeys were rebuilt by Feroz Shah. It consists of five storeys of red sandstone and white marble. The purplish red of the sandstone at the base is finely modulated, through a pale pink in the second storey, to a dark orange at the summit, which harmonizes with the blue of an Indian sky. Dark bands of Arabic writing round the three lower storeys contrast with the red sandstone. The height of the column is 238 feet. The plinth is a polygon of 20 sides. The basement storey has the same number of faces formed into convex flutes which are alternately angular and semicircular. The next has semicircular flutes, and in the third they are all angular. Then rises a plain storey, and above it soars a partially fluted storey, the shaft of which is adorned with bands of marble and red sandstone. A bold projecting balcony, richly ornamented, runs round each storey. After six centuries the column is almost as fresh as on the day it was finished.

Near by are the remains of a mosque erected by Kutb-ud-din immediately after his capture of Delhi in 1193. The design of this mosque is Mohammedan, but the wonderfully delicate ornamentation of its western façade and other remaining parts is Hindu. In the inner courtyard stands the Iron Pillar, dating from about A.D. 400. It consists of a solid shaft of wrought iron some 16 in. in diameter and 23 ft. 8 in. in height, with an inscription eulogizing Chandragupta Vikramaditya. It was brought here, possibly from Behar, by Anang Pal, a Rajput chief, who erected it in 1052.

Modern Buildings include the temporary Vice-regal Lodge; the old Residency, now occupied by a government high school; the Protestant church of St. James, built at a cost of £10,000 by Colonel Skinner, an officer well known in the history of the East India Company; and the college and hospital of the Cambridge Mission. Behind the Chandni Chauk, to the north, lie the Queen's Gardens; beyond them the "civil lines" stretch away out to and along the well-known rocky ridge, about a mile outside the town. The old Delhi college, once famous as an oriental school, was attacked during the Mutiny, plundered of a very valuable oriental library, and the building completely destroyed.

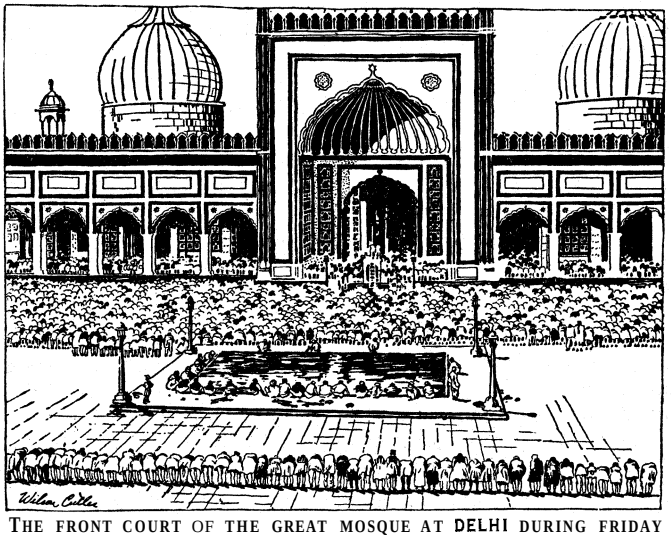
The Ridge, famous as the British base during the siege of Delhi during the Mutiny, in 1857, is a last outcrop of the Aravalli hills which rises in a steep escarpment some 60 ft. above the city. At its nearest point on the right of the British position, where the Mutiny memorial now stands, the Ridge is only 1,200 yd from the walls of Delhi; at the Flagstaff tower in the centre of the position it is a mile and a half away; and at the left near the river nearly two miles and a half. It was behind the Ridge at this point that the main portion of the British camp was pitched. The gallant Nicholson was buried just outside the Kashmir gate, near to where his statue now stands. The Kashmir gate itself bears a slab recording the gallant deed of the party under Lieutenants D. C. Home and P. Salkeld, who blew in the gate in broad daylight on the day that Delhi was taken by assault.

The Population of Delhi according to the census of 1931 was 447,442, of whom 180,018 were Mahammedans. The city is the converging point of a number of railways and occupies a central position, being 940 m. from Karachi, 950 from Calcutta, and 960 from Bombay. Owing to the advantages it enjoys as a trade centre, Delhi is recovering much of the prominence which it lost at the time of the Mutiny. It has a number of busy factories, and famous hand industries in gold and silver filigree work and embroidery, jewellery, muslins, shawls, glazed pottery and wood-carving.

The Province **of Delhi** has an area of 573 sq.m. and a population of 636,246. It consists of a strip of territory on the Jumna river which formed part of the old Delhi district, and of 65 villages on the opposite bank which were formerly in the Meerut district of the United Provinces. It is an enclosure created for administrative convenience, as a consequence of the new capital.

When Lord Lake broke the Mahratta power in 1803, and the emperor was taken under the protection of the East India Company, the districts of Delhi and Hissar were assigned for the maintenance of the royal family, and were administered by a British resident. In 1832 the office of resident was abolished, and the tract was annexed to the North-Western Provinces. After the Mutiny in 1858 it was separated from the North-Western Provinces and annexed to the Punjab. The old Division of Delhi has its headquarters now at Ambala. (ME.; X.)

History. — According to legend Delhi has from time immemorial been the site of a capital city. The actual history of Delhi, however, dates no further back than the 11th century A.D., when Anangapala (Anang Pal), a chief of the Tomara clan, built the Red Fort, in which the Kutb Minar now stands; in 1052 the same chief removed the famous Iron Pillar from its original



THE FRONT COURT OF THE GREAT MOSQUE AT DELHI DURING FRIDAY PRAYER

Although said to be one of the largest Mohammedan buildings in the world, this mosque is too small to accommodate its 15,000 congregation, with the result that worshippers overflow into the front court. The domes are of white marble, and the court is paved with marble and granite

position, probably at Muttra, and set it up among a group of temples of which the materials were afterwards used by the Muslims for the construction of the great Kutb Mosque. About the middle of the 12th century the Tomara dynasty was overthrown by Vigraha-raja, the Chauhan king of Ajmere. His nephew and successor was Prithwi-raja, the last Hindu ruler of Delhi. In 1191 came the invasion of Mohammed of Ghor. Defeated on this occasion, Mohammed returned two years later, overthrew the Hindus, and captured and put to death Prithwi-raja, Delhi became henceforth the capital of the Mohammedan

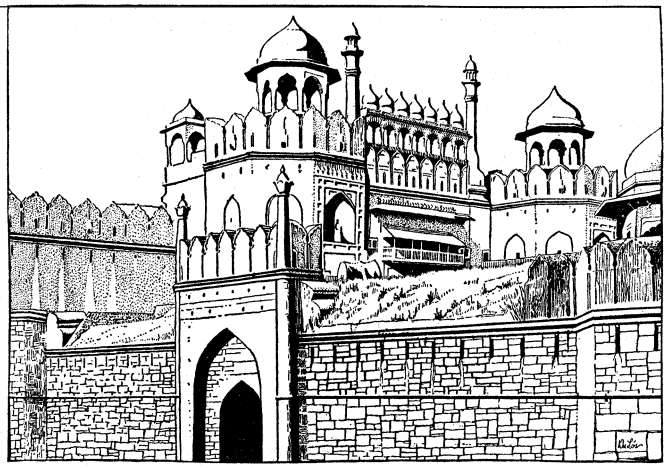
Indian empire, Kutb-ud-din (the general and slave of Mohammed of Ghor) being left in command The dynasty retained the throne till 1290, when it was subverted by Jalal-ud-din Khilji. The house of Khilji came to an end in 1321, and was followed by that of Tughlak; Ghias-ud-din Tughlak erected a new capital about 4 m. farther to the east, which he called Tughlakabad. The ruins of his fort remain. Ghias-ud-din was succeeded by his son Mohammed b. Tughlak, who reigned from 1325 to 1351. Under this monarch the Delhi of the Tughlak dynasty attained its utmost growth. His successor Feroz Shah Tughlak transferred the capital to a new town, Ferozabad, which he founded some miles away. In 1398, during the reign of Mahmud Tughlak, occurred the Tatar invasion of Timurlane. The king fled to Gujarat, his army was defeated under the walls of Delhi, and the city surrendered. At length Mahmud Tughlak regained a fragment of his former kingdom, but on his death in 1412 the family became extinct. He was succeeded by the Sayyid dynasty, which held Delhi and a few miles of surrounding territory till 1444, when the house of Lodi supervened and Agra became the capital. In 1526 Baber, sixth in descent from Timurlane, invaded India, defeated and killed Ibrahim Lodi at the battle of Panipat, entered Delhi, was proclaimed emperor, and finally put an end to the Afghan empire. Baber's capital was at Agra, but his son and successor, Humayun, removed it to Delhi. In 1540 Humayun was defeated and expelled by Sher Shah, who entirely rebuilt the city, enclosing and fortifying it with a new wall. In 1555 Humayun, with the assistance of Persia, regained the throne; but he died within six months, and was succeeded by his son, the illustrious Akbar.

During Akbar's reign and that of his son Jahangir, the capital was either at Agra or at Lahore, and Delhi once more fell into decay. Between 1638 and 1658, however, Shah Jahan rebuilt it. In 1707 came the decline. Insurrections and civil wars on the part of the Hindu tributary chiefs, Sikhs and Mahrattas broke out. Aurungzeb's grandson, Jahandar Shah, was, in 1713, deposed and strangled after a reign of one year; and Farrakhsiyyar, the next in succession, met with the same fate in 1719. He was succeeded by Mohammed Shah, in whose reign the Mahratta forces first made their appearance before the gates of Delhi, in 1736. Three years later the Persian monarch, Nadir Shah, after defeating the Mogul army at Karnal, entered Delhi in triumph. For fifty-eight days Nadir Shah remained in Delhi, and when he left he carried with him great treasure.

In 1771 Shah Alam, the son of Alamgir II., was nominally raised to the throne by the Mahrattas, the real sovereignty resting with the Mahratta chief, Sindhia. An attempt of the puppet emperor to shake himself clear of the Mahrattas, in which he was defeated in 1788, led to a permanent Mahratta garrison being stationed at Delhi. From this date, the king remained a cipher in the hands of Sindhia, until the 8th of September 1803, when Lord Lake overthrew the Mahrattas under the walls of Delhi, entered the city, and took the king under the protection of the British. Delhi, once more attacked by a Mahratta army under the Mahratta chief Holkar in 1804, was gallantly defended by Colonel Ochterlony, the British resident, who held out against overwhelming odds for eight days, until relieved by Lord Lake, and the city, together with the Delhi territory, passed under British administration.

Fifty-three years of quiet prosperity for Delhi were brought to a close by the Mutiny of 1857 (see INDIA, History). It was not till the 20th of September that the entire city and palace were occupied, and the reconquest of Delhi was complete. During the siege, the British force sustained a loss of 1,012 officers and men killed, and 3,837 wounded. On receiving a promise that his life would be spared, the last of the house of Timur surrendered to Major Hodson; he was afterwards banished to Rangoon. Delhi, thus reconquered, remained for some months under military authority. Delhi was made over to the civil authorities in January 1858, but it was not till 1861 that the civil courts were regularly reopened Since that date Delhi has settled down into a prosperous commercial town, and a great railway centre. Delhi was selected for the scene of the Imperial Proclamation on the 1st of January 1877, and for the great Durbar held in January 1903 for the proclamation of King Edward VII. as emperor of India.

New Delhi.—New Delhi, the establishment of which was first announced by His Majesty King George V. at the Imperial Durbar of 1911 in the second year of the Viceroyalty of Lord Hardinge, has been designed and built as a capital for all India. Its site, occupying at present about 5 sq.m., is on the great alluvial plain of the Jumna sloping slightly from west to east. Its centre in the Great Place at the foot of the rock on which stand the main Government buildings is about 5m. to the south of Shah Jahan's fort in Old Delhi. The site was chosen in 1912 by a commission consisting of Capt. Swinton (Chairman), Mr. Brodie, engineer to the City of Liverpool and Mr. Edwin (now Sir Edwin) Lutyens, architect. To the last of the three was given the planning of the city, after an agreement had been come to with Lord Hardinge that the main Government buildings should be placed on the rock to which reference has already been made. This rock is a spur of the main Delhi ridge of Mutiny fame and like it consists of very hard quartzite. It stood some soft. above the plain but the top 20ft. have been blasted off to make a level plateau for the great buildings and to fill in depressions.



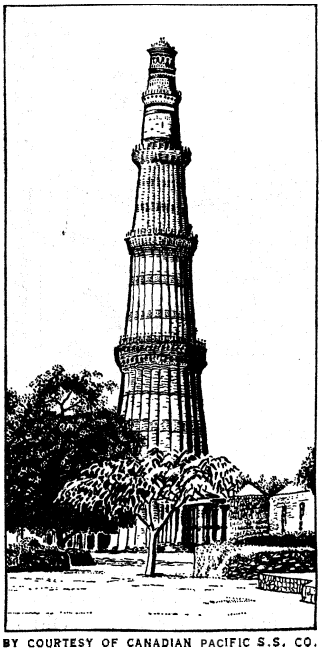
LAHORE GATE IN DELHI FORT. FACING CHANDNI CHAUK, "THE STREET OF SILVER" BY COURTESY OF THE INDIAN STATE RAILWAYS
During the siege of Delhi in the Mutiny of 1857, General John Nicholson, leader of the British storming party, was mortally wounded when advancing upon the Lahore Gate

With this low acropolis as the focus of his city Sir Edwin Lutyens laid out a very original city plan as large in scale and covering a larger area of organized planning than Washington (D.C.). His central mall and his diagonal avenues may owe something to L'Enfant's plan for that city as well as something to Sir Christopher Wren's plan for London after the Great Fire, but the total result is quite different.

It is a plan based on a series of large hexagons closed by a semicircular road to the west where the site is bounded by the ridge. This plan, with its wide central processional road and its diagonals at 30° and 60°, brings into vista all the chief landmarks of the flat landscape. The main axis leads to the old walled city of Indrapat, while one avenue is focussed on the great mosque or Jumma Musjid in Old Delhi, forming an absolutely direct route to that town, and another on the lofty tomb of the emperor Humayun. Subsidiary avenues lead to other monuments. In this way the new city is not only related to the Delhis of the past which surround it but emphasizes its peaceful and all-embracing character in distinction to their encircling walls and fortifications. In detailed planning the roads are in three classes, 150ft., 120ft. and 76ft. wide, lined with one, two or even three avenues of trees. The central mall has continuous canals of water as well. Where main roads intersect there are great round turning points showing an appreciation in the plan of the needs of motor traffic several years before that traffic had anywhere developed.

The filling in of the plan has provided sites of varying importance for every class of residence. The princes of India are to build their palaces in the great circular roads round the

triumphal arch to the Indian armies which closes the main processional way. H.H. the nizam of Hyderabad has already completed a large palace with the advice of Sir Edwin. Along the main axis are sites for Government buildings—the Record Office by Sir Edwin Lutyens is partially built—and for the residences of members of council. Along the lesser avenues are residences for officials of various grades and nationality, hostels for members of the assembly divided in like manner. In other districts are chummeries and bungalows for European and Indian clerks, circles of shops and other necessary commercial buildings. Altogether 35,000 persons are already permanently housed on the site, which has been planned so far for 65,000. All this building is in brick covered in stucco whitewashed every year after the rains. The general form of expression, which has been suggested by the few bungalows Sir Edwin has himself built, is a simplified form of Palladian classic. This has meant nearly everywhere long horizontal lines of classical porticoes having their deep shadows contrasted with the plain white wall surfaces, the whole set in lawns and surrounded with trees and flowering shrubs. The result is a garden city and in a more just sense than the term is generally used. Seen from the ridge the city is already a sea of trees (all of which have had to be planted and have water-pipes laid to them), through which long, low, white classical buildings glint.



BY COURTESY OF CANADIAN PACIFIC S.S. CO.

KUTB-MINAR

Built to commemorate the victories of the Mohammedan general Kutb-ud-din. This tower is 238 feet high and composed of sandstone ranging in colour from red, at the bottom, to orange, at the top

It remains to mention the main buildings on the acropolis of rock which form the climax of the town and overlook the plain of bungalows, trees and magnificent roads, very much as the Palace of the Popes does the plain of Avignon. These are three, the two great secretariat buildings designed by Sir Herbert Baker which line the processional way, and Government House, the palace of the viceroy, designed by Sir Edwin Lutyens, to which this great avenue leads. As an afterthought, there is also the big legislative building. It is situated on the plain at the foot of the rock on the axis of the road from Old Delhi and is a great circular structure by Sir Herbert Baker with a continuous open colonnade, half a mile in circumference. It contains the three chambers, one for the assembly, one for the council and one for the ruling princes grouped round a central library large enough to hold a durbar of the members of all three. Its circular form was dictated partly by political reasons and partly by the triangular space on which it is situated between three roads. It is hoped that some day a circular structure on a similar triangular site on the opposite side of the main axis may house supreme courts of justice for all India.

The two secretariat buildings are in the main Italian structures and present to the processional way four projecting blocks in pairs each carrying a portico of columns with recessed courts between. The idea of these projections is apparently to stand out like sentinels on the great approach. Crowning the recessed building in the centre on either side is a tall Italian dome on a drum. All these features, if not too tall and important in themselves, together with the towers which rise from the end blocks and face down the canal, being in pairs about the main axis should make a fine approach to the great palace set back behind its forecourt and itself crowned with a great dome. This latter building is (early 1928), two years from completion and though enough has been built to show that it is a true palace of great majesty and refinement with many noble courts, stairways and apartments, as well as a great durbar hall under its dome, it yet remains to be seen whether the secretariat buildings are not too lofty for full justice to be done to it. All these four great buildings, together with their steps, terraces and surrounding walls, are in red sandstone to the base of the columns and in white above, brought by a specially constructed railway from the States of Bharatpur and Dholpur, 80m. away. Two to three thousand masons have been employed continually on the work. The form of architectural expression used throughout is Palladian classic but both architects have introduced Indian features such as the Chajja or projecting stone slab to keep walls cool, the Chattri or umbrella shaped roof—Indian symbol of royalty—the Jaalis or pierced stone grilles. Sir Edwin Lutyens, however, in Government House, has deliberately gone farther than Sir Herbert Baker in the secretariat buildings in trying to marry the spirit of Indian Architecture, both Hindu and Mohammedan, to that of English and Italian classic. Because the spirit of Indian detail as far as compatible with classical motives has been absorbed by him rather than its forms copied, new and interesting character, which nevertheless seems harmonious and inevitable, has resulted.

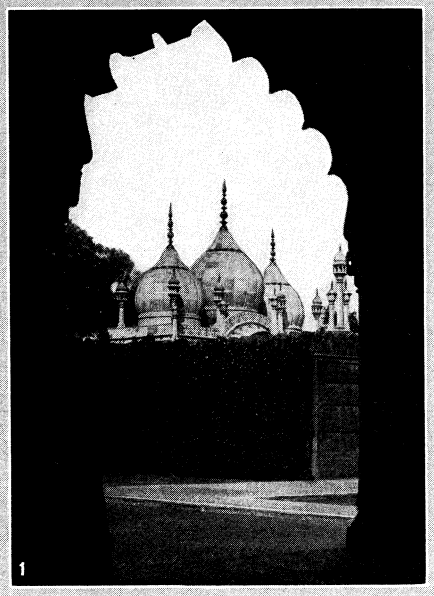
(C. H. R.)

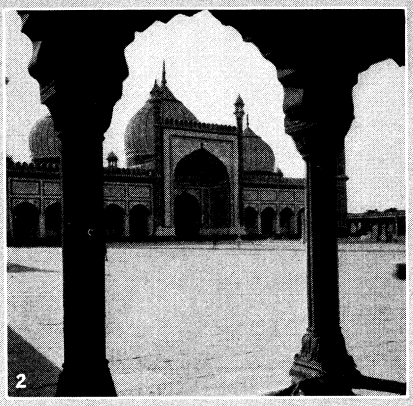
DELIA. An ancient quadrennial festival of the Ionians, held on Delos (hence the name; the local title was Apollonia, which seems to have been always used for the corresponding yearly festival). It was in honour of Apollo; after great brilliancy in early times, it declined as the political importance of Ionia did so, but was revived in 426 by the Athenians as part of their imperial policy.

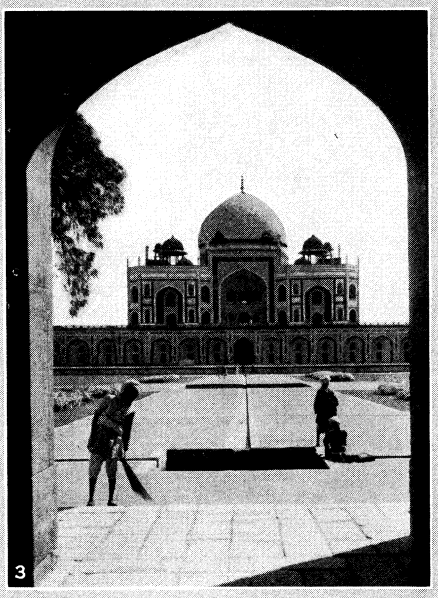
See "Homer" *Hymn,* iii., 146 ff.; Thucydides, iii. 104; and M. P. Nilsson, *Griechische Feste* (1906), p. 144 ff.

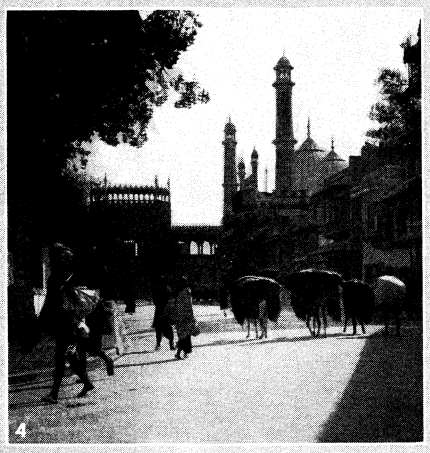
DELIAN LEAGUE or CONFEDERACY OF DELOS, a confederation of Greek states under the leadership of Athens, with its headquarters at Delos, founded in 478 B.C. after the repulse of the expedition of the Persians under Xerxes I. This confederacy, broken up by the capture of Athens by Sparta in 404, was revived in 378–377 B.C. as a protection against Spartan aggression, and lasted, until the victory of Philip II. of Macedon at Chaeroneia (338 B.C.). These two confederations are the first examples of a serious attempt at united action on the part of a number of self-governing states at a high level of political development. The first league in its later period affords the earliest example in history of imperialism in which the subordinate units enjoyed local autonomy with an organized system, financial, military and judicial

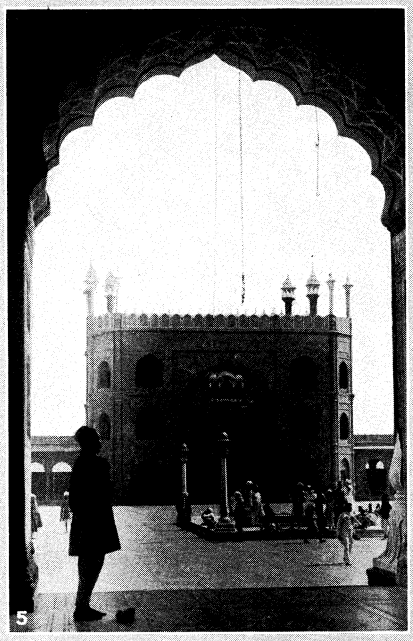
History.—During the 6th century B.C. Sparta was regarded as the chief power in Greece, including the islands of the Aegean. The Persian invasions of Darius and Xerxes, with the consequent increase in the importance of maritime strength as compared with military power, caused a loss of prestige which Sparta was unwilling to recognize. Moreover, at that time the Spartan leaders were not men of strong character. Pausanias, the victor of Plataea, soon showed himself destitute of the high qualities which the situation demanded. The Ionian allies realized that, had it not been for the Athenians, the battle of Salamis would never have been fought, and Greece would have become a Persian satrapy. The Athenian contingent sent to aid Pausanias in driving the Persians out of the Thraceward towns was under the command of Aristeides and Cimon, men of tact and probity. When Pausanias was recalled to Sparta on the charge of treasonable overtures to the Persians, the Ionian allies appealed to the Athenians, and when Sparta sent out Dorcis to supersede Pausanias he found Aristeides in unquestioned command of the allied fleet. The Spartans were relieved, in that it no longer fell to them to organize distant expeditions to Asia Minor. The Spartan system was unable to adapt itself to the spirit of the age. To Aristeides was due the organization of the new league and the adjustment of the contributions of the various allies in ships or in money. His assessment remained popular after the league of autonomous allies had become an Athenian empire. The affairs of the league were managed by a synod which met in the temple of Apollo and Artemis at Delos, sanctified by the common worship of the Ion-

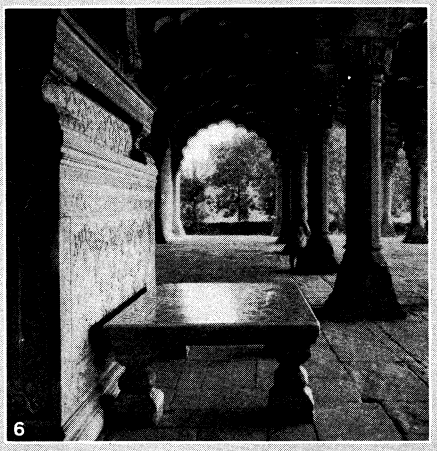


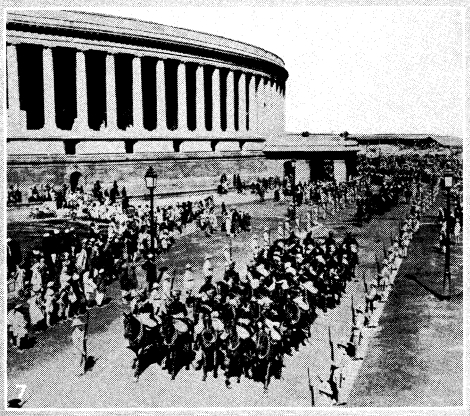


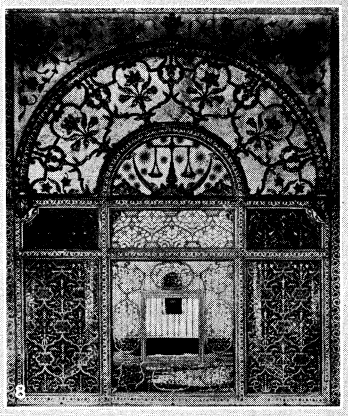


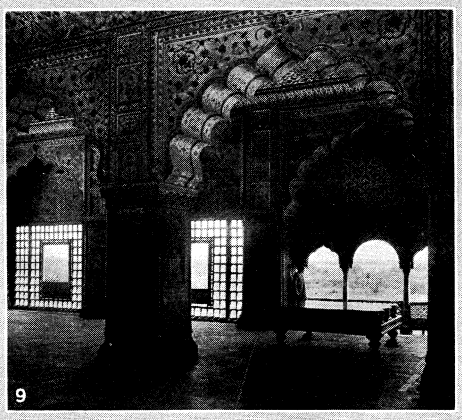












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SCENES IN OLD AND NEW DELHI

1. Moti Musjid (Pearl Mosque), built 1659 by Aurangzeb. It is of gray and white marble, the walls being decorated with low reliefs. 2. Jamma Musjid (Great Mosque) said to be the largest in world. Built 1638–1648 by Shah Jahan. It is of red sandstone and white marble, the three marble domes relieved by thin vertical strips of black marble. The mosque is 201 ft. high, to top of dome. 3. Mausoleum of Humayun (d. 1555) and shrine of Nizam-ud-din, a large central octagon surmounted by a dome, with octagonal towers of unequal sides at the angles. It stands upon a platform of red sandstone. 4. Street scene in Delhi showing Great Mosque in distance. 5. Courtyard of the Great Mosque. 6. Diwan-i-'Am, council hall in the Mughal fort and palace, built by Shah Jahan, middle of 17th century. The emperor used to take his seat in the raised recess, above the marble seat of the wazir, seen in foreground. Inlaid panels by Austin of Bordeaux have been restored. 7. Great Council House, opened at the inauguration of Delhi as the new capital of India. Procession of the viceroy, Lord Irwin, and native princes leaving after the ceremony. 8. The Scale of Justice in the Mughal fort. 9. Diwan-i-Khas (hall of private audience) in the Mughal palace, considered one of the most graceful buildings in the world; built wholly of white marble inlaid with precious stones. In background, base on which stood the famous peacock throne

ians (see AMPHICTYONY). In this synod the allies met under the presidency of Athens. Thucydides (i. 97) lays emphasis on the fact that in these meetings Athens, as head of the league, had no more than presidential authority, and the other members were called *σύμμαχοι* (allies). Athens appointed a board called the *Hellenotamiai* (*ταμίας*, steward) to administer the treasury of the league, which was kept at Delos, and to receive the contributions (*φόρος*) of the allies who paid in money.

The league was therefore a free confederation of autonomous Ionian cities founded with the object of protecting themselves by means of a "counter-offensive" (Thuc. i. 96) against the common danger from Persia, and led by Athens in virtue of her predominant naval power. It is a mistake to regard the league during the first 20 years of its existence as an Athenian empire. Thucydides (*loc. cit.*) expressly describes the predominance of Athens as *ἡγεμονία* (leadership, headship), not as *ἀρχή* (empire), and the attempts made by Athenian orators during the second period of the Peloponnesian war to prove that the attitude of Athens had not altered since the time of Aristeides are manifestly unsuccessful.

The first ten years of the league's history was a period of steady, successful activity against the few remaining Persian strongholds (see ATHENS; CIMON). In these years the Athenian sailors reached a high pitch of training, while certain of the allies became weary of incessant warfare. Athens supported by the synod (*ξύνοδος*) of the Hellenotamiai, enforced the contributions of ships and money according to the assessment. Gradually the allies began to weary of personal service, and persuaded the synod to accept a money commutation. The Ionians were averse to prolonged warfare, and in the prosperity which followed the rout of the Persians a money contribution was held a trifling burden. The result was, however, bad for the allies, whose status in the league became lower in relation to that of Athens, while at the same time their naval resources diminished. Athens became more powerful, and could afford to disregard the authority of the synod. Another new feature appeared in the coercion of cities which desired to secede. The protection of the Aegean would become impossible if some of the islands were liable to be used as piratical strongholds, and it was only right that all should contribute in some way to the security which all enjoyed. In the cases of Naxos and Thasos, the league's resources were employed, not against the Persians, but against recalcitrant Greek islands. Shortly after the capture of Naxos (*c.* 467 B.C.) Cimon proceeded with a fleet of 300 ships (only 100 from the allies), to the south-western and southern coasts of Asia Minor, and routed the Persians on land and sea at the mouth of the Eurymedon, in Pamphylia. This engagement was the final episode of the struggle between the Greeks and Persia. The very completeness of the victory raised the question of the continuance of the league now that the danger which had given rise to it was effectively removed. It remained to be seen whether Athens would permit secession, which she was theoretically unable to prevent. If she did not, her "leadership" would definitely be converted into an empire. The event proved that Athens had no intention of allowing the dissolution of a body which had brought her such an advance in power. The capture of Thasos (463 B.C.), due to trade rivalry on the Strymon, was a first indication of what the "allies" might expect. About the same time Cimon (*q.v.*), whose philo-Spartan policy was displeasing to the leaders of the new democracy, was successfully overthrown by Ephialtes and Pericles. After his fall the resources of the league were increasingly used in the prosecution of Athens' imperial designs. Between this time and the peace of Callias (449 B.C.) which put an end to the war with Persia (see CIMON) all the allies had commuted their naval service for a money payment, with the exception of Chios, Lesbos and Samos. In 454 B.C. the domination of Athens was crystallized by the transference of the federal treasury from Delos to Athens. In the meantime Athens was busy transforming her sea empire into a land and sea empire. By 448 B.C. she dominated not only her former "allies," but also Megara, Boeotia, Phocis, Locris, Achaea and Troezen. The conception of a league of independent allies was still further violated in 451 B.C. by Pericles' law under which citizenship, with all its advantages, such as the right to sit on paid juries, was restricted to those who could prove themselves the children of an Athenian father and mother. Thus the "allies" saw themselves still further excluded from recognition (see PERICLES). The resulting antipathy to Athens, and the centrifugal spirit natural to the Greek in politics, combined for the disruption of a tyranny which had become odious to all alike. The first to secede were the land powers, where the democracies established by Athens as a guarantee of her predominance were overthrown by oligarchies. The reverse of Coroneia (446 B.C.) was followed by the loss of Boeotia, and shortly afterwards by that of Phocis, Locris and Megara. By the "Thirty Years Peace" (445 B.C.) Athens abandoned Nisaea, Pegae, Troezen and Achaea. Her newly acquired land empire was irretrievably lost.

The maritime allies were not slow in attempting to follow the example of Boeotia and the land powers. The next important event is the revolt of Samos (440 B.C.), which had quarrelled with Miletus and refused the arbitration of Athens. The island was conquered with great difficulty by the whole force of the league. It is noticeable that the main body of the allies was not affected, and that the Peloponnesian league, on the advice of Corinth, recognized the right of Athens to deal with her rebellious subject allies, and refused to help the Samians.

The events which led to the Peloponnesian war are discussed in other articles. (See ATHENS: History; and PELOPONNESIAN WAR.) Two alone call for special notice. The first is the raising of the allies' tribute in 42j B.C. by a certain Thudippus. The second event belongs to 411, after the failure of the Sicilian expedition. In that year the tribute of the allies was commuted for a 5% tax on all imports and exports by sea.

The Tribute.— Thucydides is almost certainly wrong in saying (i. 96) that the amount of the original tribute was 460 talents (about £106,000); this figure cannot have been reached for at least 12 years, when new members had been enrolled (Lycia, Caria, Eion, Lampsacus). He is probably wrong, when he says that it amounted to 600 talents at the beginning of the Peloponnesian war. The moderation of the assessment is shown not only by the fact that it was paid so long without objection, but also by the individual items. Even in 42j Naxos and Andros paid only 1j talents, while Athens had just raised an *eisphora* (income tax) from her own citizens of 200 talents.

The number of tributaries some authorities give as 200; others put it as high as 290: in some cases several towns were grouped together in one payment (*συντελεῖς*). These were grouped into geographical divisions, each division represented by two elective commissioners (*τακταί*), who assisted the Boulē at Athens in the quadrennial division of the tribute. Each city sent in its own assessment before the commissioners who presented it to the Boulē. If there was any difference of opinion the matter was referred to the ecclesia for settlement. In the ecclesia a private citizen might propose another assessment, or the case might be referred to the law courts.

Government and Jurisdiction.— There is much difference of opinion regarding the attitude of imperial Athens towards her allies. Grote maintained that on the whole the allies had little ground for complaint; but he seems to leave out of account the Greeks' dislike of external discipline. The fact that the hegemony had become an empire was enough to make the new system offensive to the allies. No strong argument can be based on the paucity of revolts. The indolent Ionians had seen the result of secession; the Athenian fleet was perpetually on guard in the Aegean. Among the mainland cities revolt was frequent; Athenian domination may have been salutary in its effects, but the allies did not regard it with affection.

In the later period of the first league's history the Athenians interfered with the local autonomy of the allies. Though it appears that Athens made individual agreements with various states, and therefore that we cannot regard as general rules the terms laid down in those which we possess, it is undeniable that the Athenians planted garrisons under Athenian officers (*φρούραρχοι*) in some cities, All important cases between Athenians and citizens of allied cities were tried before the Athenian courts. Athens im-

posed democratic constitutions on her allies; indeed Isocrates takes credit for Athens on this ground. Though Chios, Lesbos and Samos retained their oligarchic governments, and Selymbria was permitted to choose its own constitution, it is clear that Athens did exercise over many of her allies an authority which extended to local administration. Thus the leadership of Athens in a harmonious league of free Greek states became an empire which proved intolerable to the autonomous states. Her failure was due partly to the commercial jealousy of Corinth working on the dull antipathy of Sparta, partly to the hatred of compromise and discipline characteristic of Greece, and partly also to the lack of tact and restraint shown by Athens and her representatives.

The Second League.—The conditions which led to the second Delian Confederacy were fundamentally different, because the enemy was no longer an oriental power, but Sparta, whose ambitious projects since the fall of Athens had shown that there could be no safety for the smaller states save in combination.

As soon as the Athenians began to recover from the victory of Lysander and the government of the Thirty, their thoughts turned to the possibility of recovering their lost empire. The first step in this direction was the recovery of their sea power, which was effected by the victory of Conon at Cnidus (Aug. 394 B.C.). Cities which had formed part of the Athenian empire returned to their alliance with Athens, until Sparta had only Sestos and Abydos of all that she had won by the battle of Aegospotami. No systematic constructive attempt at a renewal of empire was made. Athenian relations were with individual states only, and the terms of alliance were various. The whole position was changed by the successes of Thrasybulus, who set up a democracy in Byzantium and reimposed the old 10% duty on goods from the Black Sea. Many of the island towns subsequently came over, and from inscriptions at Clazomenae and Thasos we learn that Thrasybulus was deliberately aiming at a renewal of the empire, though he had no general backing in Athens.

The peace of Antalcidas (see ANTALCIDAS) in 387 B.C. was a blow to Athens. Antalcidas compelled the Athenians to give their assent to it by making himself master of the Hellespont by stratagem. By this peace all the Greek cities on the mainland of Asia with the islands of Cyprus and Clazomenae were recognized as Persian, all other cities except Imbros, Lemnos and Scyros as autonomous. Directly, this arrangement prevented an Athenian empire; indirectly, it caused the sacrificed cities and their kinsmen on the islands to look upon Athens as their protector. The selfishness of the Spartans was emphasized by their capture of the Theban citadel, and by the raid upon Attica in time of peace by Sphodrias, and his immunity from punishment at Sparta. The Athenians at once invited their allies to a conference, and the Second Athenian Confederacy was formed. Those represented at it were Athens, Chios, Mytilene, Methymna, Rhodes, Byzantium and Thebes, which joined Athens soon after the Sphodrias raid. In the spring of 377 invitations were sent out to the maritime cities. Some time in that year Tenedos, Chios, Chalcis in Euboea, and Eretria, Carystus and Arethusa gave in their adherence, followed by Perinthus, Peparethus, Sciathus and other maritime cities.

Sparta was roused to a sense of the significance of the new confederacy, and the Athenian corn supply was threatened by a Spartan fleet of 60 triremes. The Athenians fitted out a fleet under Chabrias, who gained a victory over the Spartans between Naxos and Paros (battle of Naxos 376 B.C.), both of which were added to the league. Proceeding northwards in 375 Chabrias brought over a large number of the Thraceward towns, including Abdera, Thasos and Samothrace. The successes of Timotheus in the west resulted in the addition to the league of Corcyra and the cities of Cephallenia. Sparta sent out a fleet, but Timotheus, in spite of financial embarrassment, held his ground. By this time, however, the alliance between Thebes and Athens was growing weaker, and Athens, being short of money, concluded a peace with Sparta Trouble, however, soon arose over Zacynthus, and the Spartans not only sent help to the Zacynthian oligarchs but even besieged Corcyra (373). Timotheus was sent to relieve the island, but shortness of money compelled him to search for new allies. This delay in sending help to Corcyra was condemned by the Athenians, who dismissed Timotheus in favour of Iphicrates. An expedition followed, but the absence of any positive success, the pressure of financial difficulty, and the high-handed action of Thebes in destroying Plataea (373), induced Athens to renew the peace with Sparta. An agreement was made by a congress at Sparta on the basis of the autonomy of the cities. The Thebans at first accepted the terms, but, realizing that they were baulked of their pan-Boeotian ambition, severed themselves from the league.

The peace of 371 B.C. may be regarded as the conclusion of the first period in the league's existence. The original purpose of the league—the protection of the allies from the ambitions of Sparta—was achieved. Athens was recognized as mistress of the sea; Sparta as the chief land power. The weakness of the coalition had, however, become apparent. The enthusiasm of the allies waned rapidly before the financial exigencies of successive campaigns, and it is clear that Thebes had no interest save the extension of her power in Boeotia. There were not wanting signs that the league was not destined to remain a power in the land.

The remaining history may be broken up into two periods, the first from 371 to 357, the second from 357 to 338 B.C. Throughout these two periods, which saw the decline and dissolution of the alliance, examples of corporate action are few.

Period **371–357 B.C.**—The first event in this period was the battle of Leuctra (July 371), in which, no doubt to the surprise of Athens, Thebes temporarily asserted itself as the chief land power in Greece. To counterbalance the new power Athens tried to induce the states which recognized the hegemony of Sparta to transfer their allegiance to the Delian league. It seems that the states adopted this policy with the exception of Elis. The policy of Athens was mistaken for two reasons: (1) Sparta was not entirely humiliated, and (2) alliance with the land powers of Peloponnese involved Athens in enterprises which could not awaken the enthusiasm of her maritime allies. This new coalition alarmed Sparta, which at once made overtures to Athens on the ground of their common danger from Thebes. The alliance was concluded in 369 B.C. About the same time Iphicrates was sent to take possession of Amphipolis according to the treaty of 371. Some success in Macedonia roused the hostility of Thebes, and the subsequent attempts on Amphipolis caused the Chalcidians to declare against the league. The old suspicion of the allies was now awakened, and we find Athens making great efforts to conciliate Mytilene by honorific decrees. This suspicion, due primarily, no doubt, to the agreement with Sparta, was strengthened by the exchange of compliments with Dionysius I. of Syracuse, who received the Athenian citizenship, and by the Athenian alliance with Alexander of Pherae (368–367). The maritime allies had no desire to be involved in the quarrels of Sicily, Thessaly and the Peloponnese.

In 366 Athens lost Oropus, a blow which she endeavoured to repair by forming an alliance with Arcadia and by an attack on Corinth. Timotheus was sent in 366–365 to make a demonstration against Persia. Finding Samos in the hands of Cyprothemis, a servant of the satrap Tigranes, he captured it after a ten months' siege, and established a cleruchy.

The next important event was the attempt on the part of Epameinondas to challenge Athenian naval supremacy. Though Timotheus held his ground the confederacy was undoubtedly weakened. In 362 B.C. Athens joined in the opposition to the Theban expedition which ended in the battle of Mantineia. In the next year the Athenian generals failed in the north in their attempt to control the Hellespont. In Thessaly Alexander of Pherae became hostile, and after several successes even attacked the Peiraeus. Chares was ordered to make reprisals, but instead sailed to Corcyra, where he made the mistake of siding with the oligarchs. The last event of the period was a success, the recovery of Euboea (357), which was once more added to the league.

During these 14 years the policy of Athens towards her maritime allies was shortsighted and inconsistent. Alliances with land powers, and an inability to understand the true relations

which alone could unite the league, combined to alienate the allies, who could discover no reason for the expenditure of their contributions on protecting Sparta or Corinth against Thebes. There was ground for suspecting disloyalty in many quarters. On the other hand, though the Athenian fleet became stronger and several cities were captured, the league itself did not gain any important adherents.

Period 357–338 B.C.—Chios, Rhodes, Cos, Byzantium, Erythrae and other cities were in revolt by the spring of 356 B.C., and their attacks on loyal members of the confederacy compelled Athens to take the offensive. Chabrias had been killed in an attack on Chios, and the fleet was under the command of Timotheus, Iphicrates and Chares, who sailed against Byzantium. The enemy sailed north from Samos, and in a battle off Embata (between Erythrae and Chios) defeated Chares, who, without the consent of his colleagues, had ventured to engage them in a storm. Chares sought to replenish his resources by aiding the Phrygian satrap Artabazus against Artaxerxes Ochus, but a threat from the Persian court caused the Athenians to recall him, and peace was made by which Athens recognized the independence of the revolted towns. The league was further weakened by the secession of Corcyra, and by 355 B.C. was reduced to Athens, Euboea and a few islands. By this time, moreover, Philip II. of Macedon (*q.v.*) had begun his career of conquest. In 355 his advance temporarily ceased, but the financial exhaustion of the league was such that its destruction was only a matter of time. Resuming operations in 354, Philip, in spite of temporary checks at the hands of Chares, took from the league all its Thracian and Macedonian cities. In 352–351 Philip actually received help from former members of the confederacy. In 351 Charidemus, Chares and Phocion were sent to oppose him, but no successes were gained. In 346 the peace of Philocrates was made between the league and Philip on terms which were accepted by the Athenian Boulē. It is very remarkable that, in spite of the powerlessness of the confederacy, the last recorded event in its history is the steady loyalty of Tenedos, which gave money to Athens about 340 B.C. The victory of Philip at Chaeroneia in 338 finally destroyed the league.

In spite of the precautions taken by the allies, the policy of the league was, almost throughout, directed in the interests of Athens. Founded with the object of thwarting the ambitious designs of Sparta, it was plunged by Athens into enterprises which exhausted the resources of the allies without benefiting them in any respect. There is no doubt that the cities were held to their allegiance solely by the superior force of the Athenian navy.

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See also E. A. Freeman, Federal Government and articles ARISTEIDES; THEMISTOCLES; PERICLES; CIMON, etc.; and GREECE; History, with works quoted. For the last years of the league see also PELOPONNESIAN WAR. For inscriptions, see E. L. Hicks and G. F. Hill, Greek Historical Inscriptions (Oxford, 1901); G. F. Hill, Sources of Greek History, *478–431* (2nd ed. 1907).

-- *The Second League.*—The chief modern works are G. Busolt, "Der zweite athenische Bund" in Neue *Jahrbücher für classische Philologie* (supp. vol. vii., 1873–75, pp. 641–866), and F. H. Marshall, The Second Athenian Confederacy (1905), one of the Cambridge Historical Essays (No. xiii.). The latter is based on Busolt's monograph and includes subsequent epigraphic evidence, with a full list of authorities. The meagre data given by ancient writers are collected by Busolt and Marshall.

DELIBES, CLEMENT PHILIBERT LEO (1836–1891), French composer, was born at Saint Germain du Val on Feb. 21, 1836. He studied at the Paris Conservatoire, and became accompanist at the Théâtre Lyrique. His first essay in dramatic composition was his Deux *sous* de *charbon* (1853), and during several years he produced a number of operettas. His cantata Alger was heard at the Paris opera in 1865. Having become second chorus master of the Grand Opéra, he wrote the music of a ballet entitled La *Source* (1866) for this theatre, in collaboration with Minkous, a Polish composer. The composer returned to the operetta style with Malbrouk s'en va-t-en *guerre*,—written in collaboration with Georges Bizet, Émile Jonas and Legouix, and given at the Théâtre de l'Athénée in 1867. Two years later came *L'Écossais* de *Chatou*, a one-act piece, and La Cour *du* roi *Pétaud*, a three-act opera-bouffe. The ballet *Coppélia* was produced at the Grand Opéra on May 25, 1870, with enormous success.

Delibes gave up his post as second chorus master at the Grand Opéra in 1872 when he married the daughter of Mademoiselle Denain, formerly an actress at the Comédie Française. His first important dramatic work was Le Roi *l'a* dit, a charming comic opera, produced on May 24, 1873, at the Opéra Comique. Three years later, on June 14, 1876, Sylvia, a ballet in three acts, one of the composer's most delightful works, was produced at the Grand Opéra. This was followed by La *Mort D'Orphée*, a grand scena (Trocadéro concerts in 1878); *Jean* de *Nivelle* (Opéra Comique, Mar. 8, 1880), and by *Lakmé* (Opéra Comique, April 14, 1883). Lakmk has remained his most popular opera. The composer died in Paris on Jan. 16, 1891, leaving Kassya, a four-act opera, in an unfinished state. In 1881 Delibes became a professor of advanced composition at the Conservatoire; and in 1884 he took the place of Victor Massé at the Institut de France.

See E. Guiraud Delibes (1892).

DELILAH, in the Bible, the heroine of Samson's last love-story (Judges xvi.). She was a Philistine of Sorek (mod. Sūrīk), west of Zorah, who, bribed by the "lords of the Philistines" to entrap him, coaxed him (after several failures) into telling her the secret of his strength, whereupon she took advantage of his confidence to incapacitate him and betray him to his enemies. (See SAMSON.)

DELILLE, JACQUES (1738–1813), French poet, was born at Aigue-Perse in Auvergne. He was an illegitimate child, and was descended by his mother from the chancellor De l'Hôpital. He was educated at the college of Lisieux in Paris and became an elementary teacher. He gradually acquired a reputation as a poet by his epistles, in which things are not called by their ordinary names but are hinted at by elaborate periphrases. Sugar becomes "le miel américain que du suc des roseaux exprima l'Africain." The publication (1769) of his translation of the Georgics of Virgil made him famous. Voltaire recommended the poet for the next vacant place in the Academy, but his admission was deferred until 1774 on the ground of his youth. He showed a real love of nature, of an 18th century cultivated landscape, in his other poems, *Jardins* (1782), *L'Homme* des champs (1800), Les *trois règnes* de la *nature* (2 vols., 1808).

Delille had become professor of Latin poetry at the Collège de France, and abbot of Saint-Sévérin, when the outbreak of the Revolution reduced him to poverty. He retired to St. Dié, where he completed his translation of the *Aeneid*. He emigrated first to Basle and then to Glairesse in Switzerland, and he passed some time in London, chiefly employed in translating Paradise Lost. In 1802 he was able to return to Paris, where, although nearly blind, he resumed his professorship and his chair at the Academy, but lived in retirement.

His Oeuvres (16 vols.) were published in 1824. See Sainte-Beuve, Portraits *littéraires*, vol. ii.

DELIQUESCENCE, the absorption of water from the air by a crystalline hydrate (*q.v.*) to give, finally, a solution. This formation of a liquid phase occurs when the presence of water vapour in the air is above the vapour pressure of the hydrate.

DELIRIUM, a temporary form of brain disorder apt to occur in acute fevers, diseases and injuries of brain, exhaustion and some poisons; *e.g.*, opium, Indian hemp, belladonna, chloroform and alcohol. It may vary from slight and occasional wanderings of the mind and incoherence of expression, to fixed delusions and maniacal excitement, or may be associated with insensibility. (See INSANITY and NEUROPATHOLOGY.)

Delirium tremens is an acute symptom supervening on chronic alcoholism. Nevertheless, many habitual drunkards never suffer from delirium tremens.

It was long supposed that delirium tremens only comes on when the supply of alcohol has been suddenly cut off; but there

is abundant evidence that it occurs while the patient is still continuing to drink. Even when several days have elapsed between the cessation from drinking and the seizure, premonitory symptoms, consisting in aversion to drink and food, have shown themselves. An attack is often precipitated by disease (pneumonia), accidents (burns), severe mental strain or starvation, even where the supply of alcohol is less than would have been likely to produce it otherwise.

The earliest indications of an approaching attack are sleeplessness, terrifying dreams, restlessness and irritability of manner, with trembling of the hands and a thick or tremulous articulation. The skin is perspiring, the countenance oppressed-looking and flushed, the pulse rapid and feeble. During the attack the patient is mentally confused, talks incessantly and incoherently, has a distressed and agitated or perplexed appearance, and a vague notion that he is pursued by some one seeking to injure him. His delusions are usually transient, but he is constantly troubled with visual hallucinations of disagreeable animals or insects. The trembling of the muscles from which the name of the disease is derived is a prominent but not invariable symptom. It is most marked in the muscles of the hands and arms and in the tongue. The character of the delirium is seldom wild or noisy, but is much more commonly a combination of busy restlessness and indefinite fear. When spoken to, the patient can answer correctly enough, but immediately thereafter relapses into his former condition of incoherence.

In uncomplicated cases the symptoms abate in three to six days, cessation of the attack being marked by the occurrence of sound sleep, from which the patient awakes in his right mind, although exhausted and partly or wholly oblivious of his condition during his illness. Serious and permanent impairment of intellect is common in confirmed drunkards who have suffered from frequent attacks of this disease.

Treatment.— In mild attacks entire withdrawal of stimulants, liberal supply of light food, quietude and gentle but firm control may be all that is required. In severer attacks sedatives may be necessary, but must be given only under medical supervision

DELISLE, JOSEPH NICOLAS (1688–1768), French astronomer, was born in Paris on April 4, 1688. He proposed in 1715 the "Diffraction-theory" of the sun's corona, visited England and was received into the Royal Society in 1724, and left Paris for St. Petersburg on a summons from the empress Catherine towards the end of 1725. Having founded an observatory there, he returned to Paris in 1747, was appointed geographical astronomer to the naval department, and installed an observatory in the Hôtel Cluny. Charles Messier and J. J. Lalande were among his pupils. He died of apoplexy at Paris on Sept. 12, 1768.

Delisle is chiefly remembered as the author of a method for observing the transits of Venus and Mercury by instants of contacts which was first proposed by him in a letter to J. Cassini in 1743. In his *Mémoires pour servir à l'histoire et au progrès de l'astronomie* (St. Petersburg, 1738), he gave the first method for determining the heliocentric co-ordinates of sun-spots.

See S. Newcomb, *Washington Observations* for 1875, app. ii. pp. 176–189.

DELISLE, LEOPOLD VICTOR (1826–1910), French bibliophile and historian, was born at Valognes (Manche). At the École des Chartes, where his career was remarkably brilliant, his valedictory thesis was an *Essai sur les revenus publics en Normandie au XII^e siècle* (1849), and it was to the history of his native province that he devoted his early works. Of these the *Études sur la condition de la classe agricole et l'état de l'agriculture en Normandie au moyen âge* (1851), condensing an enormous mass of facts drawn from the local archives, was reprinted in 1905, without change, and remains authoritative. In Nov. 1852 he entered the manuscript department of the Bibliothèque Impériale (Sationale), of which in 1874 he became the official head in succession to Jules Taschereau. Delisle was responsible for the catalogue of printed books in the library, and under his administration the library was enriched with numerous acquisitions, notably by the purchase of a part of the Ashburnham mss. He was elected member of the Académie des Inscriptions et Belles Lettres in 1859, and became a member of the staff of the *Recueil des historietzs de la France,* collaborating in vols. xxii. (1865) and xxiii. (1876) and editing vol. xxiv. (1904), which is valuable for the social history of France in the 13th century. After his retirement (Feb. 21, 1905) he prepared a catalogue and description of the printed books and mss. in the Musée Condé at Chantilly, left by the duc d'Aumale to the French Institute. Of his other works may be mentioned his *Mélanges de paléographie et bibliographie* (1880) with atlas; *Mémoire sur les actes d'Innocent III.* (1857), and *Mémoire sur les opérations financieres des Templiers* (1889), a collection of documents of the highest value for economic history. The 32nd volume of the *Histoire littéraire de la France,* which was partly his work, is of great importance for the study of 13th and 14th century Latin chronicles. Delisle was undoubtedly the most learned man in Europe with regard to the middle ages; and his knowledge of diplomatics, palaeography and printing was profound. His output of work, in catalogues, etc., was enormous, and his services to the Bibliothbque Nationale in this respect cannot be overestimated. His wife, a daughter of Eugbne Burnouf, was for many years his collaborator.

The *Bibliographie* des *travaux* de *L. Delisle* (1902, supplement 1911), by Paul Lacombe, may be consulted for a full list of his numerous works.

DELITZSCH, FRANZ (1813–1890), German Lutheran theologian, Hebrew scholar and orientalist, was born at Leipzig on Feb. 23, 1813. He studied in the university of his native town, becoming in 1850 professor of theology at Erlangen, and in 1867 at Leipzig, where he died on March 4, 1890. Delitzsch was a strict Lutheran. With a view to the conversion of the Jews he edited the periodical *Saat auf Hofnung* from 1863, revived the "Institutum Judaicum" in 1880, founded a Jewish missionary college, and translated the *New Testament* into Hebrew. He acquired such a mastery of post-biblical, rabbinic and talmudic literature that he has been called the "Christian Talmudist." Though never an advanced critic, his article on Daniel in Herzog's *Realencyklopädie* (2nd ed.), his *New Commentary on Genesis* and the fourth edition of his *Isaiah* show that his sympathy with higher criticism increased — much so that Prof. Cheyne has included him among its founders.

He wrote valuable commentaries on *Habakkuk* (1843), *Genesis* (1852), *Neuer Kommentar über die Genesis* (1887, Eng. trans. 1888), *Psalms* (1869, Eng. trans. 1886), *Job* (1864), *Isaiah* (4th ed., 1889, Eng. trans. 1890), *Proverbs* (1873), *Epistle to the Hebrews* (1857, Eng. trans. 1865), *Song of Songs and Ecclesiastes* (4th ed. 1875). Other works are *Lutherthum u. Lugenthunz* (1839); *Geschichte der jüd. Poesie* (1836); *Jesus und Hillel* (1867); *Handwerkerleben zur Zeit Jesu* (1868, Eng. trans. 1902); *Poesieen aus vormuhammedanischer Zeit* (1874); Iris, *Farbenstudien und Blumenstücke* (1888, Eng. trans. 1889); *Messianische Weissagungen in geschichtlicher Folge* (1890); and a popular devotional work *Das Sakrament des wahren Leibes und Blutes Jesu Christi* (1844).

DELITZSCH, FRIEDRICH, German orientalist, son of the preceding, born at Erlangen on Sept. 3, 1850, and educated at Leipzig, became professor of Semitic languages and Assyriology successively at Leipzig, Breslau and Berlin. His chief works are: *Assyrische Lesestiicke* (1876); *Wo lag das Paradies* (1881); *Assyrisches Worterbuch zur gesampten bisher veröffentlichen Keilschriftliteratur* 3 pts. (1887–90); *Assyrische Grammatik* (1889, Eng. trans. 1889); *Geschichte Babyloniens* u. *Assyriens* (1891); *Babel u. Bibel* (1902, Eng. trans. 1903); *Grundziige der Sumerischen Grammatik* (1914); *Die Welt des Islam* (1915) and *Die grosse Tauschung . . . Israels Eindringen in Kanaan* (1920). *Babel und Bibel,* two lectures delivered before the German emperor, caused a great controversy because it denied the verbal inspiration of the Old Testament and contended that it was largely inspired by Babylonian stories and that Semitic monotheism had gradually developed. While this attitude was not in itself new, the public letter of the emperor proclaiming the need of orthodoxy and of a realization of the distinction between reason and revelation brought the position of scholars before the public, and thereby aroused violent discussions.

DELITZSCH, town, in the Prussian province of Saxony, Germany, on the Lober, an affluent of the Mulde, 12 m. N. of Leipzig at the junction of the railways, Bitterfeld-Leipzig and Halle-Cottbus. Pop. (1939) 17,913. It has an old castle of the 14th century now a female penitentiary. Besides *Kuhschwanz,* a peculiar kind of beer, it manufactures tobacco, cigars, chemicals, shoes and hosiery; and coal-mining is carried on in the neighbourhood. Originally a settlement of the Sorbian Wends, and in the 12th century part of the possessions of the bishops of Merseburg, Delitzsch ultimately passed to the Saxe-Merseburg family, and, on their extinction in 1738, was incorporated with Electoral Saxony but was finally transferred to Prussia in 1815.

DELIUM, BATTLE OF, 424 B.C. This battle, in the Peloponnesian War (*q.v.*) was the outcome of the Athenians' attempt to get control of Boeotia by a converging attack at three points, helped by expected uprisings of the democratic faction. But the Boeotians were forewarned and the risings forestalled. Nevertheless the main Athenian force was duly disembarked at Delium, on the coast, whither the Boeotians advanced to dislodge it. The significance of the subsequent battle is as a foreshadowing of the great era of Theban generalship under Epameinondas (*q.v.*), and of his method at Leuctra (*q.v.*). Room for deployment being restricted, the Theban commander, Pagondas, formed his right wing in exceptional depth—25 ranks, whereas the Athenians were the customary eight deep. When the two sides clashed, Pagondas's Boeotian left wing was driven in but the concentrated punch of his massive Theban phalanx on the right crushed their opponents. At this juncture Pagondas despatched his cavalry from the right wing, where it was unnecessary, to move round behind the hill from which he had advanced and to fall upon the Athenian right wing. This, disordered by its victorious encounter, was broken by the charge of Pagondas's cavalry, all the more effective because of the rarity of mounted shock tactics at that period. The defeated Athenian army was hotly pursued back to its landing place, and there embarked for home.

DELIUS, FREDERICK (1863–1934), British musical composer, was born at Bradford, Yorks, Jan. 29, 1863, the son of Julius Delius, a German, who, in 1860, became a naturalised British subject. He was educated at Bradford Grammar School and the International College, Isleworth, London. Declining the business career offered him in Bradford he went to Florida as an orange planter, but devoted his spare time to such musical study as he could obtain from the books in his possession. In 1886 he left Florida for Leipzig and there underwent a more or less regular training from Jadassohn and came under the influence of Grieg, then living in that town. His first published work, a *Légende* for violin solo with orchestral accompaniment, was issued in 1892, since when he has gained in ever-increasing measure, though very slowly, the recognition which is his due as one of the most considerable masters of his time. His music is as a whole however too delicate and restrained in character to be likely ever to secure wide general favour. Delius might be defined indeed as a musician's musician and although general recognition has come to him so slowly, and even still in such limited measure, among the discerning few he has never lacked warm .and whole-hearted appreciation. His not very extensive output comprises examples in most of the leading forms, including no fewer than six operas, *Irmelin, The Magic Fountain, Koanga, Margot la Rouge, Fennimore and Gerda* and *A Village Romeo and Juliet,* most of these have been produced in Germany but only the last named has been heard in England. Among his other compositions may be named, in the way of choral works, *A Mass of Life, Sea Drift, A Song of the High Hills,* and a *Requiem;* for orchestra, *Over the Hills and Far Away, Paris: the Song of a Great City, Life's Dance, Brigg Fair,* the two exquisite idylles *Summer Night on the River* and *On hearing the first Cuckoo in Spring,* and four concertos (pianoforte, violin, violoncello and violin and violoncello); for the chamber, two string quartets and three sonatas for violin and piano; and a number of songs. He was created a Companion'of Honour in 1929.

DELIUS, NIKOLAUS (1813–1888), German philologist and Shakespearean scholar, was born at Bremen Sept. 19, 1813. He was educated at Bonn and Berlin, and in 1855 was appointed professor of Sanskrit, Provenqal and English literature at Bonn, a post he held until his death. His greatest literary achievement was his scholarly edition of Shakespeare (1854–61). He also edited Wace's *St. Nicholas* (1850), a volume of Provenqal songs (1853), and published a *Slzakespere-Lexikon* (1852). As a critic of Shakespeare's text he stands in the first rank.

See the biographical notice by J. Schipper in *Englische Studien,* vol. 14 (1890).

DELLA BELLA, STEFANO (1610–1664), known in France as ÉTIENNE DE LA BELLE, Italian engraver, was born at Florence. He was apprenticed to a goldsmith; but turned his attention to engraving, and studied the art under Canta Gallina. By the liberality of Lorenzo de' Medici he was enabled to spend three years in study at Rome. In 1642 he went to Paris, where Cardinal Richelicu engaged him to make drawings at Arras of the siege and taking of that town by the royal army. About 1650 he returned to Florence. His productions numbered over 1,400 separate pieces. His masterpiece is the view of the Pont Neuf in Paris.

DELLA CASA, GIOVANNI (1503–1556), Italian poet, was born at Mugello, in Tuscany. He studied at Bologna, Florence and Rome, and Pope Paul III. made him nuncio to Florence, where he was elected a member of the celebrated academy, and then to Naples. He was appointed to the archbishopric of Benevento, and it was believed that it was only his openly licentious poem, *Capitoli del forno,* and the fact that the French court seemed to desire his elevation, which prevented him from being raised to a still higher dignity. He died in Rome on Nov. 14, 1556. Casa was the leader of a reaction in lyric poetry against the universal imitation of Petrarch, and originated a style, which, if less soft and elegant, was more nervous and majestic than that which it replaced. His principal prose work is *Il Galateo* (1558), a treatise of manners, which has been translated into several languages. A reproduction of the English translation by R. Peterson (1576) was edited by H. J. Reid in 1892.

A complete edition of his works, which include translations from Thucydides, Plato and Aristotle, was published at Florence in 1707, to which is prefixed a life by Casotti. The best edition is that of Venice, 1752.

DELLA COLLE, RAFFAELLMO, Italian painter, was born at Colle, near Borgo San Sepolcro, in Tuscany, about 1490. A pupil of Raphael, whom he is held to have assisted in the Farnesina and the Vatican, Della Colle, after his master's death, was the assistant of his chief pupil, Giulio Romano, at Rome and afterwards at Mantua. In his later years Della Colle resided at Borgo San Sepolcro, where he kept a school of design; among his many pupils of note may be mentioned Gherardi and Vecchi. His works, which are to be found at Urbino, at Perugia, at Pesaro and at Gubbio, are fine examples of the Roman school of Raphael.

DELLA CRUSCANS, THE, a group of insignificant versifiers, the leaders of which were R. Merry (actually a member of the Florentine academy *della Crusca—see* ACADEMIES) and Hannah Cowley. Their first production was a *Florentine Miscellany* (1785) to which Mrs. Piozzi contributed. Returning to England in 1787 Merry began to publish verses in *The World,* and the collected poems of the group appeared in *The British Album* (1789, four editions). In 1791 William Gifford fell upon them in *The Bauiad,* giving in his footnotes quotations which amply justify the severity of his satire. He renewed the attack in *The Maeviad* (1795) and there are references to the Della Cruscans in T. J. Mathias's *Pursuits of Literature* (1794–97). The Della Cruscan manner, beyond furnishing a name for a particular kind of fantastic and insipid verse had no consequences for literature.

DELLA PORTA, GIOVANNI BATTISTA (*c.* 1538–1615), Italian natural philosopher, was born of a noble and ancient family at Naples about the year 1538. He travelled extensively in Italy, France and Spain, and was still a youth when he published *Magia naturalis, sive de miraculis rerum naturalium lib. IV.* (1558), the first draft of his *Magia naturalis,* in 20 books, published in 1589. He founded in Naples the Academia Secretorum Naturae, otherwise known as the Accademia dei Oziosi; and in 1610 he became a member of the Accademia dei Lincei at Rome.

He died at Naples on Feb. 4, 1615.

Porta is the author of a number of books on cryptography, physiology of plants, farming, gardening, optics, etc. He also wrote several Italian comedies. His most important work, the *Magia naturalis,* deals with a strange medley of subjects, including the reproduction of animals. the transmutation of metals, pyrotechny, domestic economy, statics, hunting, the preparation of perfumes. Most of his work contains descriptions of experiments which were never performed and is much exaggerated. The only portions of any great interest are the experiments on magnetism and the optical experiments which include a description of the camera obscura (*q.v.*).

DELLA QUERCIA, or DELLA FONTE, **JACOPO** (1374–1438), Italian sculptor, was born at Siena. He was the son of a goldsmith of repute, Pietro d'Agnolo. In 1394 he made an equestrian statue of Gian Tedesco. In 1402 he was one of six artists who submitted designs for the great gates of the baptistery in Florence, in which competition Ghiberti was the victor. In 1406 he executed one of his finest works, the monument of Ilaria del Caretto, wife of Paolo Guinigi, at Lucca, and received a commission for the famous Fonte Gaia, at Siena, early in 1409. This work was not seriously begun by him until 1414, and was only finished in 1419. In 1858 the remains of the fountain were removed to the Opera del Duomo, where they are now preserved; a copy of the original by Sarrocchi being erected on the site. After another visit to Lucca in 1422, he returned to Siena, and in March 1425 undertook the contract for the doors of S. Petronio, Bologna. He was known, in following years, to have gone to Milan, Verona, Ferrara, and Venice; but the rest of his life was chiefly divided between his native city and Bologna. In 1430 he finished the great font of S. Giovanni at Siena, which he had begun in 1417, contributing himself only one of the bas-reliefs, "Zacharias in the Temple," the others being by Ghiberti, Donatello, and other sculptors. Among the work known to have been done by Jacopo may be mentioned also the reliefs of the *predella* of the altar of S. Frediano at Lucca (1422); and the Bentivoglio monument which was unfinished at the time of his death on Oct. 20, 1438. Jacopo della Quercia's work exercised a powerful influence on that of the artists of the later Italian Renaissance. He himself reflects not a little of the Gothic spirit, admirably intermixed with some of the best qualities of neo-classicism. His powers have hardly yet received the recognition they deserve.

See C. Cornelius, *Jacopo della Quercia: eine Kunsthistorische Studie* (1896), and works relating generally to the arts in Siena.

(E. F. S.)

DELLA ROBBIA, the name of a family of great distinction in the annals of Florentine art. Its members are shown in the following table:

LUCA DELLA ROBBIA (1399 or 1400–1482) was the son of a Florentine named Simone di Marco della Robbia. According to Vasari he was apprenticed to the silversmith Leonardo di Ser Giovanni; this, however, appears doubtful from the great age which it would give to Leonardo, and it is more probable that Luca was the pupil of Ghiberti. During the early part of his life Luca executed many important and exceedingly beautiful pieces of sculpture in marble and bronze. No sculptured work of the 15th century ever surpassed the singing gallery which he made for the cathedral at Florence between 1431 and 1438, with its ten magnificent panels of singing angels and dancing boys. This splendid work is now in the Museo del Duomo, and there is a cast in the Victorian and Albert museum, London, which also possesses a study in *gesso duro,* apparently Luca's original sketch, for one of the panels.

In 1437 Luca received a commission from the signorina of Florence for five reliefs for the campanile, to complete the series begun by Giotto and Andrea Pisano. These panels, with representative figures typifying grammar, logic, philosophy, music and science, are much in the earlier style of Giotto. In 1439 Luca in association with Donatello received an order for two marble altars for chapels in the cathedral. The reliefs from one of them—St. Peter's Deliverance from Prison and his Crucifixion—are now in the Bargello. A tabernacle made by Luca in 1442 is now at Peretola, near Florence, in the church of S. Maria. In 1437 Donatello received a commission to cast a bronze door for one of the sacristies of the cathedral; but, as he delayed to execute this order, the work was handed over to Luca in 1446, with Michelozzo and Maso di Bartolomeo as his assistants. Part of this wonderful door was cast in 1448, and the last two panels were finished by Luca in 1467. It is divided into ten square panels, with small heads in the style of Ghiberti projecting from the framing. The subjects are the Madonna and Child, the Baptist, the four Evangelists, and the four Latin Doctors, each with attendant angels. The heads are full of life, and the treatment of the drapery in broad simple folds is worthy of a Greek sculptor of the best period of Hellenic art.

The most important existing work in marble by Luca (executed in 1455–56) is the tomb of Benozzo Federighi, bishop of Fiesole, originally in the church of S. Pancrazio at Florence, but removed to S. Francesco di Paola in 1783 and in 1898 to the church of SS. Trinita in Florence. A very beautiful effigy of the bishop lies on a sarcophagus sculptured with graceful reliefs of angels holding a wreath which contains the inscription. Above are three-quarter length figures of Christ between St. John and the Virgin. The whole is surrounded by a rectangular frame of tiles of exquisite beauty, each painted in enamel pigments, with a bunch of flowers and fruit in brilliant realistic colours.

In the latter part of his life Luca was mainly occupied with the production of enamelled terra-cotta reliefs. The *rationale* of this process was to cover the clay relief with an enamel formed of the ingredients of glass *(marzacotto),* made white and opaque by oxide of tin. *(See* POTTERY AND PORCELAIN: *Italian Majolica.)* Though Luca was not the inventor of the process he extended its application to fine sculptured work in terra-cotta, so that it is known now as Della Robbia ware. The great majority of these reliefs which in Italy and elsewhere are ascribed to Luca are really the work of some of the younger members of the family or of the *atelier* which they founded. Among the earliest of the comparatively few which can with certainty be ascribed to Luca himself are medallions of the four Evangelists in the vault of Brunelleschi's Pazzi chapel in S. Croce. These fine reliefs are coloured with various metallic oxides in different shades of blue, green, purple, yellow, and black. It has often been wrongly asserted that the polychromatic reliefs belong to Andrea or his sons, and that Luca's were all in pure white, or in white and blue. A relief in the Victoria and Albert museum furnishes a striking example that colours were used freely by Luca and is of especial value from its great size, and because its date is known. This is an enormous medallion containing the arms of René of Anjou and other heraldic devices; it is surrounded by a splendidly modelled and brilliantly coloured wreath of fruit and flowers, especially apples, lemons, oranges and fir cones. This medallion was set up on the façade of the Pazzi Palace to commemorate René's visit to Florence in 1442. Other reliefs by Luca, also in glazed terra-cotta, are those of the Ascension and Resurrection in the tympani of the doors of the sacristies in the cathedral, executed in 1442 and 1446 and the tympanum reliefs of the Madonna between two Angels in the Via dell' Agnolo, a work of exquisite beauty, and another formerly over the door of S. Pierino del Mercato Vecchio, but now removed to the Bargello. Among the few existing statues by Luca are two lovely enamelled figures of kneeling angels holding candlesticks, now in the canons' sacristy. A very fine work executed between 1449 and 1452 is the tympanum relief of the Madonna and four Monastic Saints over

the door of S. Domenico at Urbino. He also made the four coloured medallions of the Virtues set in the vault over the tomb of the young cardinal-prince of Portugal in a side chapel of S. Miniato in Florence and various polychromatic medallions outside Or San Michele. The Victoria and Albert museum possesses 12 circular plaques of majolica ware painted in blue and white with the Occupations of the Months; these have been attributed to Luca but their origin is doubtful.

In 1471 Luca refused to serve as president of the Florentine Gild of Sculptors, on account of his age and infirmity. He died on Feb. 20, 1482. His chief pupil was his nephew Andrea, and Agostino di Duccio, who executed many pieces of sculpture at Rimini, and the marble reliefs of angels on the façade of S. Bernardino at Perugia, may have been the work of one of his assistants.

ANDREA DELLA ROBBIA (1435–1525), the nephew and pupil of Luca was born Oct. 20, 1435, and died Aug. 4, 1525. He carried on the production of the enamelled reliefs on a larger scale and also extended its application to various architectural uses, such as friezes and to the making of lavabos, fountains and large retables. Though the finest reliefs from the workshop of Andrea were but little if at all inferior to those from the hand of Luca, some of those by pupils and assistants reached only a lower standard of merit. Only one work in marble by Andrea is known, an altar in S. Maria delle Grazie near Arezzo.

Andrea sometimes omitted the enamel on the face and hands (nude parts) of his figures, especially when he had treated the heads in a realistic manner; as in the noble tympanum relief of the meeting of St. Dominic and St. Francis in the loggia of the Florentine hospital of S. Paolo—a design suggested by a fresco of Fra Angelico's in the cloister of St. Mark's. One of the most remarkable works by Andrea is the series of medallions with reliefs of Infants in white on a blue ground set on the front of the foundling hospital at Florence. He produced a large number of reliefs of the Madonna and Child, varied with much invention and all of extreme beauty of pose and sweetness of expression. These are frequently framed with realistic yet decorative garlands of fruit and flowers painted with coloured enamels, while the main relief is left white. The hospital of S. Paolo, near S. Maria Novella, has also fine medallions with reliefs of saints, two of Christ Healing the Sick, and two fine portraits, under which are white plaques inscribed "DALL ANNO 1451 ALL ANNO 1495." Arezzo possesses a number of fine enamelled works by Andrea and his sons, a retable in the cathedral and in the chapel of the Campo Santo a fine relief of the Madonna and Child with four saints at the sides. In S. Maria in Grado is a very noble retable with angels holding a crown over a standing figure of the Madonna Perhaps the finest collection of works of this class is at La Verna, not far from Arezzo. The three large retables with representations of the Annunciation, the Crucifixion, and the Madonna giving her Girdle to St. Thomas are probably the work of Andrea himself, the others being by his sons. In 1489 Andrea made a beautiful relief of the Virgin and two Angels, now over the archive-room door in the Florentine Opera del Duomo. In the same year he modelled the fine tympanum relief over a door of Prato cathedral, with a half-length figure of the Madonna between St. Stephen and St. Lawrence, surrounded by a frame of angels' heads.

In 1491 he was still working at Prato, where many of his best reliefs still exist. A fine bust of S. Lino exists over the side door of the cathedral at Volterra, which is attributed to Andrea. Other late works of known date are a magnificent bust of the Protontary Almadiano, made in 1510 for the church of S. Giovanni de' Fiorentini at Viterbo, now preserved in the Palazzo Comunale there, and a medallion of the Virgin in Glory, surrounded by angels, made in 1505 for Pistoia cathedral. One of the latest works attributed to Andrea, though apparently only a workshop production of 1515, is a relief representing the Adoration of the Magi, made for a little church, St. Maria, in Pian di Mugnone, near Florence. Portions of this work are still in the church, but some fragments of it are at Oxford.

Five of Andrea's seven sons worked with their father and after his death carried on the Robbia studio (see table).

LUCA II. The chief existing work known to be by the second Luca is the very rich and beautiful tile pavement in the uppermost story of Raphael's loggie at the Vatican, made at Raphael's request and under his supervision in 1518.

GIOVANNI DELLA ROBBIA (1469–1529?) was born May 19, 1469. He worked as assistant to his father, Andrea, and in many cases the enamelled sculpture of the two cannot be distinguished. Some of Giovanni's independent works are of great merit, especially the earlier ones; during the latter part of his career his reliefs deteriorated in style, owing to the universal decadence of the time. One of his finest works is a retable representing the Last Judgment at Volterra in the church of S. Girolamo, dated 1501. Quite equal in beauty to anything of his father's is the lavabo in the sacristy of S. Maria Novella at Florence, made in 1497. In the tympanum of the arch is a very lovely white relief of the Madonna between two Adoring Angels. This part is of enamelled clay, but the basin of the fountain is of white marble. Neither Luca nor Andrea was in the habit of signing his work, but Giovanni often did so, usually adding the date, probably because otherpotters had begun to imitate the Robbia ware. Among the very numerous other works of Giovanni are a relief in the wall of a former convent in the Via Nazionale at Florence, and two reliefs in the Bargello dated 1521 and 1522. At Pisa in the Campo Santo is a relief in Giovanni's later and poorer manner dated 1520; it is a Madonna surrounded by angels, with saints below. Giovanni's largest and perhaps finest work is the polychromatic frieze on the outside of the Del Ceppo hospital at Pistoia, for which he received various sums of money between 1525 and 1529; the subjects of this frieze are the Seven Works of Mercy. Six of these reliefs are by Giovanni, the sever-th, Giving drink to the Thirsty, was made by Filippo Paladini of Pistoia in 1585. Giovanni's chief pupil was Benedetto Buglioni (1461–1521), and a pupil of his, one Santi Buglioni (b. 1494), entered the Robbia workshops in 1521, and assisted in the later works of Giovanni.

GIROLAMO DELLA ROBBIA (1488–1566), another of Andrea's sons, was an architect and a sculptor in marble and bronze as well as in enamelled clay. During the first part of his life he worked with his father, but in 1528 he went to France and spent nearly 40 years in the service of the French Royal family. Francis I. employed him to build a palace in the Bois de Boulogne called the Château de Madrid, decorated richly with terra-cotta medallions, friezes and other architectural features. For this purpose he set up kilns at Suresnes. Though the palace has been destroyed, drawings of it exist.

The best collections of Robbia ware are in the Florentine Bargello, Accademia, and Museo del Duomo; the Victoria and Albert museum (the finest out of Italy); the Louvre, the Cluny and the Berlin museums; while fine examples are to be found in New York, Boston, Leningrad and Vienna. Many fine specimens exist in private collections in England, France, Germany and the United States. The greater part of the Robbia work still remains in the churches and other buildings of Italy, especially in Florence, Fiesole, Arezzo, La Verna, Volterra, Barga, Montepulciano, Lucca, Pistoia, Prato, and Siena.

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DELMEDIGO, a Cretan Jewish family, of whom the following are the most important:

ELIJAH DELMEDIGO (1460–1497), philosopher, taught in several Italian centres of learning. He translated some of Averroes' commentaries into Latin at the instigation of Pico di Mirandola. In the sphere of religion, Delmedigo represents the tendency to depart from the scholastic attitude in which religion and philosophy were identified. His principal work, *Behinath ha-Dath* (Investigation of Religion), was devoted to this end.

JOSEPH SOLOMON DELMEDIGO (1591–1655), pupil of Galileo, wrote many books on science and philosophy, and bore a considerable part in initiating the critical movement in Judaism. He belonged to the sceptical school, and though his positive contributions to literature were not of lasting worth, Graetz includes him among the Important formative influences within the synagogue of the 17th century.

DELMENHORST, a town, *Land* of Oldenburg, Germany, on the Delme, 8 m. by rail W. from Bremen, at the junction of a line to Vechta. Pop. (1939) 38,147. It is engaged in woolcombing, weaving, jute-spinning and the manufacture of linoleum. Delmenhorst was founded in 1230, and from 1247 to 1679, when it was destroyed by the French, was protected by a strong castle.

DELOLME, JEAN LOUIS (1740–1806), Swiss jurist and constitutional writer, was born in Geneva in 1740, and died at Sewen, July 16, 1806. Having given offense to the authorities by a pamphlet entitled *Examen de trois parts de droit,* he was forced to take refuge in England, where he stayed. until 1775. During his exile Delolme made a careful study of the English constitution, the results of which he published in his *Constitution de l'Angleterre* (Amsterdam, 1771), of which an enlarged and improved edition in English appeared in 1772. Along with a translation of Hume's *History of England* it supplied the *philosophes* with most of their ideas about the English constitution. It thus was used somewhat as a political pamphlet. Several editions were published after the author's death. Delolrne also wrote in English, *Parallel between tlze English Government and the former Government of Sweden* (1772); *A History of the Flagellants* (1782), based upon a work of Boileau's; *An Essay on the Union of Scotland with England* (1787), and one or two smaller works. Notice by C. Coote prefixed to the 1807 edition of the English translation of the *Constitution.*

DELONEY (or DELONE), **THOMAS** (1543?–1607?), English ballad-writer and pamphleteer. In 1588 the coming of the Armada inspired him to write three broadsides, which were reprinted (1860) by J. O. Halliwell-Phillipps. *A* collection of *Strange Histories* (1607), known in later and enlarged editions as *The Royal Garland of Love and Delight* and *The Garland of Delight,* consists of historical ballads by Deloney, with some poems from other hands.

See the works of Thomas Deloney, ed. F. O. Mann, Oxford (1912).

DE LONG, GEORGE WASHINGTON (1844–1881), American explorer, was born in New York city on Aug. 22, 1844. He graduated at the U.S. Naval academy in 1865, entered the U.S. navy, attaining the rank of lieutenant in 1869, and lieutenant-commander in 1879. In 1873 he took part in the voyage of the "Juniata," sent to search for and relieve the American Arctic expedition in the "Polaris," which was sent out from Upernavik, Greenland. In 1879 he again set out for the Arctic in the "Jeannette." The "Jeannette" was caught in the polar ice-pack Sept. 5, 1879, and drifted helplessly until June 13, 1881, when she was finally crushed and sunk About 14 members of the expedition survived. De Long succeeded in reaching the mouth of the Lena river in one of the boats, only to die of starvation. His journal, in which he made regular entries until the day of his death, was edited by his wife and published in 1883 under the title of *Voyage of the "Jeannette."* Three years after the ship was sunk several articles belonging to the crew of the "Jeannette" were found on an ice-floe on the south-west coast of Greenland, a fact that added fresh evidence to the theory of a continuous ocean current passing along the unknown Polar regions.

DELORME, MARION (1613–1650), French courtesan, was the daughter of Jean de Lou, sieur de l'Orme, president of the treasurers of France in Champagne, and of Marie Chastelain. She was born at her father's château near Champaubert on Oct. 3, 1613. Initiated into the philosophy of pleasure by the epicurean and atheist, Jacques Vallée, sieur Desbarreaux, she soon left him for Cinq-Mars, whom she is said to have married secretly. Her salon became one of the most brilliant centres of elegant Parisian society. After the execution of Cinq-Mars she is said to have numbered among her lovers Charles de St. Evremond (1610–1703) the wit and litterateur, Buckingham (Villiers), the great Condé, and even Cardinal Richelieu. Under the Fronde her salon became a meeting place for the disaffected, and her arrest is said to have been pending when she died on July 2, 1650. Legendary accounts declared that she lived until 1706 or even 1741, after having had the most fantastic adventures, including marriage with an English lord and an old age spent in poverty in Paris. She figures in Alfred de Vigny's *Cinq-Mars,* and in Victor Hugo's *Marion Delorme.*

See P. L. Jacob, *Marion Delorme et Ninon Lenclos* (1859); J. Peladan, *Histoire et légende de Marion de Lorme* (1882).

DE L'ORME, PHILIBERT (c. 1510–1570), French architect, one of the great masters of the Renaissance, was born at Lyons, the son and pupil of the architect Jehan de L'Orme. At an early age Philibert was sent to Italy to study (1533–36) and was employed there by Pope Paul III. Returning to France he was patronized by Cardinal du Bellay at Lyons, and was sent by him about 1540 to Paris, where he began the Château de St. Maur; in 1545 he was made architect to Francis I. and given the charge of works in Brittany. In 1548 Henry II. gave him the supervision of Fontainebleau, Saint-Germain and the other royal buildings; but on his death (1559) Philibert fell into disgrace. Under Charles IX., however, he returned to favour, and was employed to construct the Tuileries, in collaboration with Jean Brillant. He died in Paris on Jan. 8, 1570. An ardent humanist and student of the antique, he yet vindicated resolutely the French tradition in opposition to Italian tendencies; he was a man of independent mind and a vigorous originality. His masterpiece was the Château d'Anet (1552–59), built for Diane de Poitiers, the plans of which are preserved in Du Cerceau's *Plus excellens bastimens de France,* and his designs for the Tuileries (also given by Du Cerceau), begun by Catherine de' Medici in 1565, were magnificent. His work is also seen at Chenonceaux and other famous châteaux; and his tomb of Francis I. at St. Denis remains a perfect specimen of his art. He wrote two books on architecture (1561 and 1567).

See Chevalier, *Lettres et devis relatifs à la construction de Chenonceaux* (1864); Pfror, *Monographie du château d'Anet* (1867); Marius Vachon, *Philibert de L'Orme* (1887); Herbet, *Travaux de P. de L'Orme à Fontainebleau* (1890).

DELOS (mod. *Mikra Dili,* or Little Delos, to distinguish it from Megali Dili, or Great Delos), an island in the Aegean, the smallest but most famous of the Cyclades, and, according to the ancient belief, the spot round which the group arranged itself in a nearly circular form. It is a rugged mass of granite, about 3 m. long and 1 m. to ½ m. broad, about ½ m. E. of Megali Dili or Rheneia, and 2 m. W. of Myconus. Towards the centre it rises to its greatest height of 350 ft. in the steep and rocky peak of Mount Cynthus, which, though overtopped by several eminences in the neighbouring islands, is very conspicuous from the surrounding sea.

Archaeology.—Excavations have been made by the French school at Athens slowly but systematically since 1877. The sacred precinct of Apollo has been recovered, as well as the commercial quarter of Hellenistic and Roman times, the theatre, the temples of the foreign gods, the temples on the top of Mount Cynthus, and interesting private houses. Sculpture of all periods has been found, and extensive series of inscriptions throwing light upon temple administration.

The ancient mole faces the channel between Delos and Rheneia. The precinct is approached by an avenue flanked by porticoes, that upon the seaside bearing the name of Philip V. of Macedon, who dedicated it about 200 B.C. This was the usual approach for sacred embassies and processions; but Nicias, on the occasion of his embassy, built a bridge from the island of Hecate to Delos, that the Athenian procession might not miss its full effect. Facing

the avenue were the propylaea, the chief entrance, with a projecting portico of four columns. The sacred road continued across an open space, with the precinct of Artemis on its west side, and, on its east side, a terrace on which stood three temples. The southernmost of these was the temple of Apollo, but only its back was visible from this side. The other two faced west and were either dedicated to heroes or minor deities or were treasuries. Beyond them the road sweeps round to the front of the temple of Apollo. The outer side of this curve is bounded by a row of treasuries, similar to those at Delphi and Olympia, to house the offerings of various islands or cities. The temple of Apollo could also be approached directly from the entrance, through a passage with a porch at either end. Just to the north of this is the basis of the colossal Apollo dedicated by the Naxians, with its well-known archaic inscription and two large fragments of the statue itself.

The temple of Apollo, the centre of the whole precinct, was of Doric style, built early in the 4th century B.C. Its sculptural decoration was but scanty; the metopes were plain: the acroteria are now in the national museum at Athens; at the one end was Boreas carrying off Oreithyia, at the other Eos and Cephalus, the centre in each case being occupied by the winged figure. To the east of the temple was an oblong Prytaneum or other official building with colonnade on each side. Beyond it is the most interesting and characteristic of all the monuments of Delos, a long narrow hall, entered by a portico at its south end. At the north end was the famous altar, built out of the horns of the victims, which was sometimes reckoned among the seven wonders of the world. The rest of the room is taken up by a paved space, surrounded by a narrow gangway; and on this it is supposed that the γέρανος or stork-dance took place. The most remarkable architectural feature of the building is the partition that separated the altar from this long gallery; it consists of two columns between *antae,* with capitals of a very peculiar form, consisting of the fore parts of bulls set back to back; from these the whole building is sometimes called the sanctuary of the bulls. Beyond it, on the east, was a sacred wood filling the space up to the mall of the precinct; and at the south end of this was a small open space with the altar of Zeus Polieus.

At the north of the precinct was a broad road, flanked with votive offerings and exedrae, and along the boundary were porticoes, reception chambers and two entrances through extensive propylaea. At the north-west corner is a building of limestone, often mentioned in the inventories of treasures. South of it is the precinct of Artemis, containing within it the old temple of the goddess; her more recent temple was to the south, opening into the precinct of Apollo. The older temple is mentioned in some of the inventories as "the temple in which were the seven statues"; and close beside it was found a series of archaic draped female statues, which was the most important of its kind until the discovery of the finer and better preserved set from the Athenian Acropolis. Outside the precinct of Apollo, on the south, was an open place; between this and the precinct was a house for the priests, and within it, in a kind of court, a set of small structures identified as the tombs of the Hyperborean maidens. To the east was the temple of Dionysus, of peculiar plan; on the other side of it was a large court, forming a commercial exchange; with a temple to Aphrodite and Hermes.

To the north between the precinct and the sacred lake, are extensive ruins of the commercial town including a sort of club or exchange and the new and the old palaestra. The shore of the channel facing Rheneia is lined with docks and warehouses, and behind them are private houses of the 2nd or 3rd century B.C. Each consists of a single court surrounded by columns and often paved with mosaic; various chambers open out of the court, including usually one of large proportions, the ἀνδρών or dining-room for guests. The theatre, set in the lower slope of Mount Gynthus, has the wings of the auditorium supported by massive substructures. The *scena* consisted of an oblong building of two storeys, surrounded by a low portico reaching to the level of the first floor. This was supported by pillars, set closer together along the front than at the sides and back. An inscription showed that this portico, or at least the front portion of it, was called the *proscenium* or *logeum,* two terms of which the identity was previously disputed. On the summit of Mount Cynthus, above the primitive cave-temple which has always been visible, is a small precinct dedicated to Zeus Cynthius and Athena Cynthia. Some way down the slope of the hill, between the cave-temple and the ravine of the Inopus, is a terrace with the temples of the foreign gods, Isis and Serapis, and a small odeum.

History. — Many alternative names for Delos are given by tradition; one of these, Ortygia, is elsewhere also assigned to an island sacred to Artemis. Of the various traditions that were current among the ancient Greeks regarding the origin of Delos, the most popular describes it as drifting through the Aegean till moored by Zeus for the wandering Leto, as a birthplace for Apollo and Artemis. The island first appears in history as the seat of a great Ionic festival to which the various Ionic States, including Athens, were accustomed annually to despatch a sacred embassy, at the anniversary of the birth of the god on the 7th of Thargelion (about May). In the 6th century B.C. the influence of the Delian Apollo was at its height; Polycrates of Samos dedicated the neighbouring island of Rheneia to his service and Peisistratus of Athens caused all the area within sight of the temple to be cleared of the tombs by which its sanctity was impaired. After the Persian wars, the predominance of Athens led to the transformation of the Delian amphictyony into the Athenian empire. *(See* DELIAN LEAGUE.) In 426 B.C., in connection with a reorganization of the festival, which henceforth was celebrated in the third year of every Olympiad, the Athenians instituted a more elaborate lustration, caused every tomb to be removed from the island, and established a law that ever after any one who was about to die or to give birth to a child should be at once conveyed from its shores. And even this was not accounted sufficient, for in 422 they expelled all its secular inhabitants, who were, however, permitted to return in the following year.

At the close of the Peloponnesian War the Spartans gave to the people of Delos the management of their own affairs; but the Athenian predominance was soon after restored, and survived an appeal to the amphictyony of Delphi in 345 B.C. During Macedonian times, from 322 to 166 B.C., Delos again became independent; and the temple and its possessions were administered by officials called ἱεροποιοί. After 166 B.C. the Romans restored the control of Delian worship to Athens, but granted to the island various commercial privileges which brought it great prosperity. In 87 B.C. Menophanes, the general of Mithradates VI. of Pontus, sacked the island, which had remained faithful to Rome. From this blow it never recovered; the Athenian control was resumed in 42 B.C., but Pausanias (viii. 33. 2) mentions Delos as deserted but for a few Athenian officials; and several epigrams of the first or second century A.D. attest the same fact, though the temple and worship were probably kept up until the official extinction of the ancient religion. A museum has now been built to contain the antiquities found in the excavations; otherwise Delos is now uninhabited, though during the summer months a few shepherds cross over with their flocks from Myconus or Rheneia. As a religious centre it is replaced by Tenos and as a commercial centre by the flourishing port of Syra.

BIBLIOGRAPHY.—The French excavations are fully published in *Fouilles de Delos* (in progress); *see* also Th. Homolle, *Les Archives de l'intendance sacrée à Délos* (with plan). For history, *see* Sir R. *C.* Jebb, *Journal of Hellenic Studies,* i. (1889), pp. 7–62, and Pauly-Wissowa. For works of art found at Delos *see* GREEK ART.

DE LOUTHERBOURG, PHILIP JAMES (1740–1812), English artist, was born at Strasbourg on Oct. 31, 1740, where his father, of Polish descent, practised miniature painting; but he spent the greater part of his life in London, where he was naturalized, and exerted a considerable influence on the scenery of the English stage. De Loutherbourg studied under Vanloo in Paris, and painted landscapes, sea storms, battles, all of which had some celebrity. He travelled in Switzerland, Germany and Italy, distinguishing himself as much by mechanical inventions as by painting. One of these, showing quite new effects produced in a model theatre, was the wonder of the day. The exhibition of lights behind canvas representing the moon and stars, the illusory

appearance oi running water produced by clear blue sheets of metal and gauze, with loose threads of silver, and so on, were his devices. In 1771 he came to London, and was employed by Garrick, who offered him £500 a year to apply his inventions to Drury Lane, and to superintend the scene painting, which he did with complete success. Garrick's own piece, the *Christmas* Tale, and the pantomime, 1781–82, introduced the novelties to the public, and the delight not only of the masses, but of Reynolds and the artists, was unbounded.

"Lord Howe's Victory off Ushant" (1794), and other large naval pictures were commissioned for Greenwich Hospital gallery; his finest work was the "Destruction of the Armada." A pamphlet published in 1789, entitled *A* List *of* a few Cures *performed* by *Mr.* and Mrs. De *Loutherbourg without Medicine,* shows that he had taken up faith-healing, and he seems to have associated at one time with Cagliostro. He died on March 11, 1812.

DELPHI (the Pytho of Homer and Herodotus; in Boeotian inscriptions Βελφοί, on coins Δαλφοί), a place in ancient Greece in the territory of Phocis, famous as the seat of the most important temple and oracle of Apollo. It was situated about 6 m. from the north shore of the Corinthian gulf, in a rugged glen, closed on the N. by the wall-like under-cliffs of Mount Parnassus known as the Phaedriades or shining rocks, and on the S. by Mount Cirphis. Between the two mountains the Pleistus stream flowing from east to west, receives the brooklet which rises as the Castalian fountain in a deep gorge in the Parnassian cliff. About 7 m. to the north, on the side of Mount Parnassus, was the famous Corycian cave, which afforded the people of Delphi a refuge during the Persian invasion. It is now called in the district the Sarant' Aulai or Forty Courts, and is said to be capable of holding 3,000 people.

I. Site.—The site of Delphi was occupied by the modern village of Castri until it was bought by the French government in 1891. Systematic excavation began in 1892. The plan of the precinct is now easily traced, and with the help of Pausanias many of the buildings have been identified.

The ancient "Hellenico" wall running east and west and the two boundary walls running up the hill at each end of it, are clear. In the eastern part was the main entrance by which Pausanias entered along the Sacred Way. This road zigzags up the hill, with treasuries and bases of offerings on both sides. First westwards to an open space, then eastwards till it reaches the eastern end of the terrace wall that supports the temple. Here it curves up north and then west towards the temple. Above this, are the Lesche and the theatre, and on a higher level still, to the west, is the stadium. In describing the monuments, the simplest plan is to follow Pausanias. Outside the entrance is a paved court flanked by a Roman colonnade. On the north side of the Sacred Way, close to the main entrance, stood the offering dedicated by the Lacedaemonians after the battle of Aegospotami, a quadrangular building with a back wall but stood open to the road. On a stepped pedestal stood statues of the gods and the admirals.

The statues of the Epigoni stood on a semicircular basis on the south side of the way; opposite them another semicircular basis carried the statues of the Argive kings. Farther west was the Sicyonian treasury south of the way, a small Doric temple in antis, with its entrance on the east. The sculptures from this treasury (in the museum) are in rough limestone, and most likely belong to an earlier building.

The Cnidian treasury (originally surmised by the excavators to be the treasury of Siphnos) stands south of the way farther west. It is a small Ionic temple of marble with two caryatids between antae on a substructure. The sculpture from its frieze and pediment is of great interest and the fragments of architectural mouldings are of great delicacy and beauty; perhaps the most perfect example of the transitional style of the early 5th century. Standing back from the path as it bends is the Theban treasury; then where the path turns again, the Athenian. This structure, a small Doric temple in *antis*, has been rebuilt with the original blocks. There can be no doubt about the identity of the building, for the basis bears the remains of the dedicatory inscription, stating that it was erected from the spoils of Marathon. The sculptured metopes are of the highest interest. The famous inscriptions with hymns to Apollo accompanied by musical notation were found on stones belonging to this treasury.

Above the Athenian treasury is the "Sybil's rock." Here, too, was placed the curious column, on which stood the colossal sphinx, dedicated by the Naxians, now in the museum.

A little farther on, but below the Sacred Way, another open space, of circular form, is perhaps the sacred threshing-floor on which the drama of the slaying of the Python by Apollo was periodically performed. Opposite, and backed against the beautifully jointed polygonal wall which supports the terrace on which the temple stands, is the colonnade of the Athenians, now assigned to the end of the 6th century. The polygonal wall at the back is covered with inscriptions concerning the manumission of slaves.

After passing the Great Altar, dedicated by the Chians, on the left the way enters the space in front of the temple, with remains of offerings by the Cyrenians and by the Corinthians. The site of the temple shows successive structures. Of that built by the Alcmaeonids in the 6th century B.C. considerable remains have been found. Sculptures assigned to this building are archaic and resemble those from the early temple of Athena at Athens. The existing foundations are of the 4th century. They give no certain information as to the sacred cleft and other matters relating to the oracle. Up in the north-eastern corner of the precinct, at the foot of the cliffs, is the interesting Cnidian clubhouse, a long narrow building; the famous paintings were probably disposed so as to meet in the middle of the north side. Scanty fragments of the frescoed walls are not enough to give information as to the work of Polygnotus.

At the north-western corner of the precinct is the theatre. The stadium lies to the north-west on a narrow plateau supported by a terrace wall. The seats are well preserved; some are hewn in the rock. An immense number of inscriptions have been found in the excavations, and many works of art, including a bronze charioteer (see GREEK ART).

II. History.---Our information as to the oracle at Delphi and how it was consulted is confused; probably ritual varied. The tale of intoxicating "mephitic" vapour has no early authority, nor is it scientifically probable. The questions had to be given in writing, and the responses were uttered by the Pythian priestess, in early times a maiden, later a woman over 50 attired as a maiden. After chewing the sacred bay and drinking of the spring Cassotis, which was conducted into the temple by artificial channels, she took her seat on the sacred tripod in the inner shrine. Her utterances were reduced to verse and edited by the prophets and the "holy men" (ὅσιοι). (See also ORACLE.)

Delphi also contained the "Omphalos," a sacred stone bound with fillets, supposed to mark the centre of the earth. It was said Zeus had started two eagles from the opposite extremities and they met there. Other tales said the stone was the one given by Rhea to Cronus as a substitute for Zeus.

For the history of the Delphic Amphictyony see under AMPHICTYONY. The oracle at Delphi was asserted by tradition to have existed before the introduction of Apollo-worship and to have belonged to the goddess Earth (Ge or Gaia). The Homeric Hymn to Apollo evidently combines two different versions, the approach of Apollo from the north by land, and the introduction of his votaries from Crete. The earliest stone temple built by Trophonius and Agamedes, was destroyed by fire in 548 B.C., and the contract for rebuilding was undertaken by the exiled Alcmaeonidae from Athens, who generously substituted marble on the eastern front for the specified limestone. Portions of the pediments of this temple have been found in the excavations; but no sign of the pediments mentioned by Pausanias, representing on the east Apollo and the Muses, and on the west Dionysus and the Thyiades (Bacchantes), and designed by Praxias, the pupil of Calanias. The temple seen by Pausanias (of which the foundations were found by the excavators) was that of which the building is recorded in inscriptions of the 4th century.

A raid on Delphi attempted by the Persians in 480 B.C. was said to have been frustrated by the god himself, by means of a storm or earthquake which hurled rocks down on the invaders; a similar tale is told of the raid of the Gauls in 279 B.C. But the

sacrilege thus escaped was inflicted by the Phocian defenders of Delphi during the Sacred War, 356–346 B.C., when many precious offerings were melted down. The Phocians were condemned to replace their value to the amount of 10,000 talents, which they paid in instalments. In 86 B.C. the sanctuary and its treasures were put under contribution by L. Cornelius Sulla for the payment of his soldiers; Nero removed no fewer than 500 bronze statues from the sacred precincts; Constantine the Great enriched his new city by the sacred tripod and its support of intertwined snakes dedicated by the Greek cities after the battle of Plataea. This still exists; with its inscription, in the Hippodrome at Constantinople. Julian afterwards sent Oribasius to restore the temple; but the oracle responded to the emperor's enthusiasm with nothing but a wail over the glory that had departed.

Provisional accounts of the excavations appeared during the excavations in the *Bulletin de correspondance hellénique*. A summary is given in J. G. Frazer, *Pausanias*, vol. v The official account is entitled *Fouilles de Delphes*. For history *see* Hiller von Gartringen in Pauly-Wissowa, *Realencyclopädie, s.v.* "Delphi." For cult *see* L. R. Farnell, *Cults of the Greek States*, iv. 179–218.

DELPHINIA, a festival of Apollo Delphinius held annually on the 6th (or 7th) of the month Munychion (April) at Athens. All that is known of the ceremonies is that a number of girls proceeded to his temple (Delphinium) carrying suppliants' branches and seeking to propitiate Apollo, probably as a god having influence on the sea. It was at this time of the year that navigation began again after the storms of winter. According to the story in Plutarch (Theseus, 18), the festival was instituted by Theseus (q.v.) to commemorate his voyage to Crete.

See A. Mommsen, *Festeder Stadt Athen* (1898); Preller-Robert, I., 260; P. Stengel, *Die griechische Kultus-altertümer* (1898); Daremberg and Saglio, *Dictionnaire des antiquitis; G.* F. Schoemann, *Griechische Altertümer* (4th ed., 1897–1902).

DELPHINIUM, a genus of herbaceous plants of the crowfoot family (Ranunculaceae), comprising 150 or more species, native to north temperate regions, several of which are widely cultivated for their irregular but very showy flowers. The rocket larkspur (D. *Ajacis*) occurs in Great Britain and is somewhat naturalized in the eastern United States and Canada. Upwards of 40 species are natives of North America, most numerous in the Rocky Mountain region and on the Pacific coast, some of which are poisonous to grazing animals. Among the best known are the dwarf larkspur (D. tricorne), the tall larkspur (D. exaltatum), and the prairie larkspur (D. *carolinianum*) of the eastern and central states; the mountain larkspur (D. *occidentale*), of the central Rockies; and the cardinal larkspur (*D. cardinale*), and the red larkspur (D. *nudicaule*), of the Pacific coast. Among the most extensively cultivated forms are the rocket larkspur, native to Europe; the field larkspur (D. *Consolida*), native to Asia; the bouquet larkspurs derived from D. *grandiflorum*, of eastern Asia; and the candle larkspurs, probably derived chiefly from D. *elatum*, of Eurasia.

DELPHINUS, a small constellation (*q.v.*) appearing in the northern hemisphere not far from Altair, the brightest star of the constellation Aquila (*q.v.*). As its name signifies, it was supposed by the ancients to represent a dolphin. γ Delphini is a double star, the yellowish component being of magnitude 4, and the bluish component of the 5th magnitude (see STAR).

DELPHOS, a city of western Ohio, U.S.A., in Allen and Van Wert counties, 70 mi. S.W. of Toledo. It is on federal highway 30, and is served by the Nickel Plate, the Northern Ohio and the Pennsylvania railways. The population was 5,745 in 1920; 1930 it was 5,672; 1940, 5,746 by federal census. The city has railroad shops, a galvanizing plant and other manufacturing industries.

DEL RIO, a city of southwestern Texas, U.S.A., on the Rio Grande, 150 mi. W. of San Antonio; county seat of Val Verde county. Del Rio is on federal highways 90 and 277 and the Southern Pacific railway.

Across the Rio Grande is the Mexican city of Villa Acuna. Population of Del Rio, 1940 census, was 13,343. Val Verde county (Del Rio) is the largest wool, sheep and lamb producing county in the United States

Shipped annually from Del Rio are 8,000,000 lb. of wool, 400,000 lambs and 3,000,000 lb. of mohair.

The city was founded in 1872 and has a commission form of government.

DELTA, the tract of coastal land bounded by the most divergent branches of a river's mouth, and traversed by other tributaries of the stream. The name comes from the shape of the delta resembling the Greek (A) letter of that name. This triangular area is formed from the fine silt brought down in suspension by a muddy river and is deposited when the river's current becomes ineffective on reaching the sea. When tidal currents are insignificant, the delta advances seawards, forming a local addition to the coastal land. The term, by analogy, is now applied to lake deltas and also to tributary river deltas. In the latter case the feature is usually small and occurs where a swift muddy tributary enters a slowly-flowing main stream. Lake deltas formed by an entering stream at the side of a lake occasionally grow outwards as far as the opposite shore and result in the lake being divided into two separate water areas, *e.g.*, Thun and Brienz in Switzerland.

DELTA RAYS, a stream of slowly moving electrons emitted when α particles impinge on matter (*see* RADIOACTIVITY).

DELUC, JEAN ANDRE (1727–1817), Swiss geologist and meteorologist, was born at Geneva on Feb. 8, 1727, and spent his early manhood in business and politics in his native city. He settled in England in 1773, and became reader to Queen Charlotte, a position which gave him a competency and leisure to travel in pursuit of his scientific studies. Deluc, who was a fellow of the Royal Society, died at Windsor on Nov. 7, 1817.

His principal geological work, *Lettres* physiques et morales *sur les* montagnes et *sur l'histoire* de la terre et de *l'homme* (1778; enl. ed. 1779), explained the six days of the Mosaic creation as so many epochs preceding the actual state of the globe. Deluc discovered many important facts relating to heat and moisture He noticed the disappearance of heat in the thawing of ice about the same time that J. Black founded on it his ingenious hypothesis of latent heat. He ascertained that water was more dense about 40° F (4° C) than at the temperature of freezing, expanding equally on each side of the maximum; and he was the originator of the theory, readvanced later by Dalton, that the quantity of aqueous vapour contained in any space is independent of the presence or density of the air, or of any other elastic fluid.

In the *Phil.* Trans., 1773, appeared his account of a new hygrometer, which resembled a mercurial thermometer, with an ivory bulb, which expanded by moisture, and caused the mercury to descend. The first correct rules ever published for measuring heights by the barometer were those he gave in the Phil. Trans., 1771, p. 158. He sent to the Royal Society, in 1809, a long paper on separating the chemical from the electrical effect of the pile, with a description of the electric column and aerial electroscope, in which he advanced opinions so little in unison with the latest discoveries of the day, that the council deemed it inexpedient to admit them to the *Transactions*. The paper was afterwards published in Nicholson's Journal (xxvi.), and the dry column described in it was constructed by various experimental philosophers. This dry pile or electric column has been regarded as his chief discovery.

His other works include: *Recherches sur les modifications de l'atmosphère* (Geneva, 2 vols., 1772), which contains accounts of many physical experiments; and *Traitt élémentaire de géologie* (1809, Eng. trans., 1809), in refutation of the Vulcanian theory of Hutton and Playfair. Many of his papers on subjects kindred to those mentioned are to be found in the *Transactions* and in the *Philosophical Magazine*. See *Philosophical Magazine* (Nov. 1817).

DELUGE is the name given to a great flood of water submerging the whole or a large part of the earth's surface. Legends of such floods occur in the traditions of many peoples. Collections of these legends have been made by several scholars, notably R. Andree (Die Flutsagen, 1891), M. Winternitz (Die *Flutsagen* des *Alterthums* und der *Naturvölker*, 1901), and J. G. Frazer (Folklore in the Old Testament, vol. i. pp. 104–361).

Hebrew Traditions. — The most familiar of these stories is that related in Genesis vi.–ix. It has long been recognized that the Biblical record consists of two distinct traditions which have been dovetailed by an editor to make a consecutive story. One of

these comes from the Yahwist document J, the other from the "priestly" source P. The matter common to the two traditions tells of God's anger at the iniquity of mankind, whom He therefore proposes to destroy by a flood. Noah, whose piety finds favour in God's eyes, is instructed to take into an "ark" his family and specimens of all beasts and birds. (In J the animals fit for sacrifice are taken by sevens, the others by twos, but in P all alike by twos.) A great flood is caused by rain—P adds also an uprush of the subterranean waters—in which all men other than those in the ark perish, but God promises that no similar flood shall ever occur again. Peculiar to the J story are the details that Noah sends out birds from the ark to test the subsidence of the waters and that Noah, after he comes out of the ark, offers a sacrifice, which God smells. Peculiar to the P story are the warning given to Noah, the elaborate instructions as to the making of the ark, and in particular the mention of bitumen, the resting of the ark upon a mountain in Ararat, and the rainbow sign. No doubt there were parallels to some features in one or other documents which have disappeared in the dovetailing process. The time notes show considerable variation. In J the flood culminates in 40 days; in P it reaches its climax in 150 days. In J the animals take seven days to enter the ark, but seemingly only one in P.

Babylonian Traditions.—Numerous traditions resembling the Genesis story have been found in Babylonia. Most of them are, unfortunately, but fragments. The best-known forming the 11th tablet of the Gilgamesh Epic, is elaborate, and the experiences of Utnapishtim, bear striking resemblances to those of Noah. The Gilgamesh story, for example, relates the sending forth from the ark of three birds in succession—dove, swallow, raven, instead of a dove three times as in Genesis (where the raven probably does not belong to the original text). It mentions the bitumen, using the same word as Genesis, and speaks of the ark grounding on a mountain. The offering of the sacrifice is mentioned, with the detail, in almost identical words, that the gods smell the savour. The Babylonian traditions reflect a higher level of civilization. Utnapishtim takes into his ark not only animals but treasure and craftsmen of all kinds, so that not only all kinds of animals but all different crafts may be preserved. One of the craftsmen was a sailor, to whom, very prudently, Utnapishtim entrusted the navigation of his vessel during the flood. The version of Berossus, a Babylonian priest who wrote at Babylon c. 300 B.C., which is doubtless much older than its recorder, shows also a care for literature in the detail that its hero buries before the flood a written account of "the beginning, middle and end of all things," disinterring it when the flood had gone. But the Biblical story reaches the higher religious and ethical levels Its majestic conception of God is in striking contrast with the many gods of the Babylonian story, who suffer from human weaknesses such as cowardice, intrigue and deceit. It is hardly fair to say that the Babylonian record is without ethical qualities. In at least one version the piety of the hero is emphasized. In the Gilgamesh version the god Ea protests that only the guilty should have been punished, from which it may be inferred that the flood was intended as a punishment for sinful men. But in any case the sense of sin is much more definitely expressed in Genesis.

Relation Between Hebrew and Babylonian Traditions.—However clear may be the moral and religious superiority of the Biblical versions it remains true that the many striking points of resemblance make it absolutely certain that they are not independent of the Babylonian traditions. Since the latter are the older—even some of the written forms in which they come to us are several centuries older than the Mosaic period—they must, if the dependence be direct, be regarded as the cruder material which the Genesis tradition has refined. It would have been possible for the early Hebrews to learn the story either from Babylon itself or, more probably, from the Canaanites, for Canaan was very much under the influence of Babylonia. This, is, indeed, the view most generally held by scholars. It is urged that the story is much more likely to have arisen in a country liable to inundations, like Babylon, than in Canaan. The elaborate description of the ark, too, seems much more plausibly to have originated in Babylonia than among a people so little accustomed to the sea and its ways as were the Hebrews. A. T. Clay, however, has effectively criticized the proposition that the descriptions of the deluge exactly fit the alluvial plain of Babylonia. In the cuneiform records the cause of the flood is invariably heavy rain, and not inundation from river or sea. Statistics seem to show that the average rainfall in Babylonia is by no means heavy, and therefore one of the main arguments for thinking the story indigenous to Babylonia is weakened. The theory of Süss, that the real cause of the flood was water driven in by a typhoon from the Persian gulf, though accepted by many scholars, has no foundation in the tradition itself. On the whole it is safer to conclude that, while there is undoubtedly a close kinship between the Biblical and the Babylonian traditions, the evidence hardly warrants a dogmatic assertion that the former are derived directly from the latter. In view of the widespread prevalence of similar traditions, and of the fact that, like the account in Genesis, the one in the Gilgamesh Epic is probably composite, it would be safer to say that both derive material from some common source.

Greek Traditions.—The most familiar of the Greek flood stories—later elaborated by Ovid—is that told by Apollodorus. It recounts how Deucalion, king of the country round Phthia, and his wife, Pyrrha, escaped from a flood caused by Zeus pouring water on the earth. The escape was made in a chest, which Deucalion had previously constructed on the advice of his father Prometheus. In this they floated for nine days over the sea, until the chest grounded on Mt. Parnassus. After the rain had ceased Deucalion emerged from the chest and offered sacrifice to Zeus. Being granted a boon by the god he chose men; Zeus bade him throw stones over his head, and these became men, while stones similarly thrown by Pyrrha became women. It is true that the story in this form is not older than the and century B.C., but Hellanicus, a historian of the 5th century B.C., has a version of it in which the chest grounds on Mt. Othrys in Thessaly, and slightly older is the version of Pindar, in which the mountain is Parnassus. A Megarian account specifies Mt. Gerania.

But the tradition varies in features more important than this: in some versions Deucalion is replaced by Ogyges, founder of Thebes in Boeotia, or by Dardanus, who was a king in Arcadia. Frazer hazards the guess that the Ogyges story may be founded on an extraordinary inundation of the Copaic lake, which formerly occupied a large part of central Boeotia, and thinks this theory may find some support from the Dardanus legend, for in one tradition the birthplace of Dardanus was Pheneus in northern Arcadia, and "no valley in Greece is known to have been from antiquity subject to inundations on so vast a scale and for such long periods as the valley of Pheneus." On the whole, however, he is more inclined to the theory that the story may have been suggested by a desire to explain the origin of the gorge of Tempe, which was thought to be the opening burst by a vast lake once dammed by the circle of the Thessalian mountains. It is not easy to trace connection between the Greek and Babylonian traditions. The most likely link would be Hittite tradition. But though it is asserted that the Hittite deluge hero Ul (l)ush is the same as Ulysses (=Odysseus) this does not help very much.

Other Traditions.—Apart from Greece flood legends are comparatively rare in Europe. Examples are found in Wales, Lithuania and Iceland; the last-named has a striking note of difference in that its deluge is caused by blood flowing from a wounded giant. India furnishes much material in the later Sanskrit literature. The earliest record goes back to the 6th century B.C. It tells how the hero, Manu, was warned by a fish of the coming flood, and advised to prepare a ship as a means of escape. When the flood came Manu's fish towed the ship to a mountain in the far north. After the waters had receded Manu offered a sacrifice, from the materials of which a woman was evolved. This story is repeated, with variations, in still later Sanskrit books, and similar stories are found in the folk-lore of existing Indian tribes. In Frazer's opinion the main theme of the legend may be aboriginal and form the source of the Sanskrit versions, He is also inclined to agree with Sir Marc Aurel

Stein that one at least of the stories may be explained as the product of imagination working on the existence of a gorge, which, like the gorge of Tempe mentioned earlier, drains an area enclosed by mountains.

Deluge stories are found in China, Burma, Cochin China, Malay, the Indian archipelago, among the aborigines of Australia, in New Guinea, and abundantly in the islands of Melanesia, Polynesia and Micronesia. They are plentiful also in South, Central and North America.

A survey of the whole field shows that deluge stories are common in Southern Asia, but not found in the rest of that continent, the examples quoted from China and Japan generally not answering to the description of universal inundations. Europe furnishes a few, Africa hardly any. It is especially noteworthy that we have none from the valley of the Nile. On the other hand, America and the islands of the Southern Seas are prolific in these stories.

Origin of **Traditions.**—Are these widespread legends connected? The Sumerian story seems to be the oldest, but it is difficult to derive the others from it. Frazer is certain that the Hebrew story descends from the Babylonian, but sees no decisive grounds for believing that the others do. He emphatically, and rightly, rejects the view that the various deluge traditions were originally myths relating to the voyages of the sun and moon in the heavens. His own view is that many of the stories may arise from the inundations caused by the far-reaching tidal waves that accompany earthquakes, and some from inundations caused by rain. Frazer's final verdict is "while many diluvial traditions are based on reminiscences of catastrophes which actually occurred, there is no good ground for holding that any such traditions are older than a few thousand years at most; wherever they appear to describe vast changes in the physical configuration of the globe they probably embody, not the record of contemporary witnesses, but the speculation of much later thinkers."

BIBLIOGRAPHY.—Besides the collections named at the beginning of the article *see* Skinner, "Genesis," *Internat. Crit. Comm.* pp. 147–181 (1910); W. L. Wardle, *Israel and Babylon,* pp. 203–235, (1925); articles "Deluge" in *Encyc. of Religion and Ethics* and *Encyclopaedia Biblica;* "Flood" in Hastings' *Dictionary of the Bible.* (W. L. W.)

DELUSION is an erroneous belief, usually rather persistent and more elaborate in character than hallucinations or illusions, inasmuch as it is commonly based on more or less elaborate, if fallacious, reasoning. Delusions may result from ignorance or prejudice, or they may be due to mental abnormality, known as "delusional insanity." In the most serious cases they are confined to a few subjects such as persecution or personal eminence, etc. See ABNORMAL PSYCHOLOGY; HALLUCINATION; ILLUSION.

DELYANNI, THEODOROS (1826–1905), Greek statesman, was born at Kalavryta, Peloponnesus, in 1826. He studied law at Athens, and entered the civil service. In 1862, he became minister for foreign affairs. In 1867 he was minister at Paris. In the so-called "Oecumenical Ministry" of 1877 he voted for war with Turkey, and on its fall he entered the cabinet of Koumoundoros as minister for foreign affairs. He was a representative of Greece at the Berlin congress in 1878. From this time forward, and particularly after 1882, when Tricoupi again came into power at the head of a strong party, the duel between these two statesmen was the leading feature of Greek politics. (See GREECE: History.) Delyanni first formed a cabinet in 188; ; but his warlike policy ended in failure. He returned to power in 1890, with a radical programme, but his failure to deal with the financial crisis produced a conflict between him and the king, and his disrespectful attitude resulted in his summary dismissal in 1892. In 1895, however, he again became prime minister, and was at the head of affairs during the Cretan crisis and the opening of the war with Turkey in 1897. The humiliating defeat which ensued—though Delyanni himself had been led into the disastrous war policy to some extent against his will—caused his fall in April 1897, the king again dismissing him from office when he declined to resign. Delyanni kept his own seat at the election of 1899, but his following dwindled to small dimensions. He was again president of the council and minister of the interior when, on June 13, 1905, he was murdered in revenge for the rigorous measures taken by him against gambling houses

DEMADES (c. 380-318 B.C.), Athenian orator. At one time a common sailor, he rose by his eloquence and unscrupulous character to a prominent position. He espoused the cause of Philip in the war against Olynthus, and thus became the enemy of Demosthenes, whom he at first supported. He fought against the Macedonians at Chaeroneia, and was taken prisoner. On his release he helped to negotiate peace between Macedonia and Athens. He continued to be a favourite of Alexander, and, prompted by a bribe, saved Demosthenes and the other obnoxious Athenian orators from his vengeance. It was also chiefly owing to him that Alexander, after the destruction of Thebes, treated Athens so leniently. His conduct in supporting the Macedonian cause, yet taking bribes from the opposite party, caused him to be heavily fined more than once; and he was finally deprived of his civil rights. He was reinstated (322) on the approach of Antipater, to whom he was sent as ambassador. Before setting out he persuaded the citizens to pass sentence of death upon Demosthenes and his followers, who had fled from Athens. The result of his embassy was the conclusion of a peace greatly to the disadvantage of the Athenians. In 318 (or earlier) he was again sent to Antipater, who, learning that he had intrigued with Perdiccas, put him to death.

A fragment of a speech (Περὶ δωδεκαετίας), bearing his name, in which he defends his conduct, is to be found in C. Müller's *Oratores Attici,* ii. 438, but its genuineness is exceedingly doubtful.

DEMAGOGUE, a leader of the popular as opposed to any other party (Gr. δημαγωγός, from ἄγειν, to lead, and δῆμος, the people). Used in an invidious sense, a mob leader or orator, one who for his own political ends panders to the passions and prejudices of the people.

DEMAND. In economics, as in trade, demand denotes the extent of the outlet or market which the wants and preferences of buyers, joined to their purchasing power, establish for particular goods or services. Demand is always relative to price, and the character of the relation is commonly exhibited in treatises on economics either arithmetically (in "demand schedules") or diagrammatically (in "demand curves") by showing in sequence the amount of a commodity which supposedly would be purchased at each price in an ordered series of prices. The inaccurate statement that "an increase of prices will diminish demand" really means that an increase in price will diminish the volume of potential sales. The statement "an increase of demand will raise the price" means that a shift to the right in the position of the demand curve tends to raise the price. The relationship between price and the amounts which buyers will purchase is generally inverse; that is, sales volume is commonly larger at lower than at higher prices. This elementary theorem rests in the first instance upon common observation of the facts of the market, but it can be explained by or related to the way in which households and individual consumers apportion their expenditures. Most goods serve a variety of purposes, and these purposes differ greatly in importance. If the price of a commodity increases, consumers generally cannot continue to buy it in undiminished quantities without cutting into their expenditures for other goods so deeply as to sacrifice some of their relatively important uses. They will prefer to give up some relatively unimportant uses of the commodity which has increased in price, and will therefore reduce their purchases of it.

The extent to which a change of price affects the quantity of a commodity which can be sold is called the elasticity of demand. The greater the ratio of the proportionate change in potential sales volume to the proportionate change in price, the greater is said to be the elasticity of demand. This ratio is called the co-efficient of elasticity. Thus if a large wheat or cotton crop will sell for less in the aggregate than a smaller crop would have sold for, within certain limits, the demand for wheat and cotton is comparatively inelastic, and the co-efficient of elasticity is less than unity. In general, the demand for necessaries, for goods for which there are no substitutes, and for goods the use of which creates a habit is relatively inelastic. The elasticity of the demand for any commodity is rarely the same over any considerable range of prices. The demand for salt

for example, would be much less elastic at high than at low prices. H. L. Moore and other scholars, by making skilful use of statistics of the production and prices of certain commodities and of the general movements of prices, have been able to find formulae which express approximately the relations (for the time being) between the prices of those commodities and the demand for them. These empirical laws of demand add materially to our economic knowledge, and promise to be useful in forecasting the probable effects of increased or decreased production upon prices.

The demand for any one commodity is dependent not only upon its own price but upon the prices of other goods as well. There are many instances of joint demand, as where a falling off of the price of fresh fruit leads to increased purchasing of sugar, and of competing demand, as where a reduction of the cost of electric lighting leads to a smaller use of illuminating gas. So far, indeed, as a change of the price of any commodity whatsoever affects the amount of money expended for it, the demand for other goods must be affected. The demands for labour, land, and productive instruments are derived from the demands for their products. In some instances the relation between the demand for consumer's goods and the derived demand for productive goods and services is fairly direct and simple. More often, however, this relation is exceedingly intricate, because productive agents can be combined in various ways and in various proportions. What the most economical combination of productive agents for any one purpose is will depend upon the demand not for one but all of their possible products.

See also ECONOMICS; SUPPLY AND DEMAND; PRICE. (W. I. K.)

DEMAND AND SUPPLY: see SUPPLY AND DEMAND.

DEMAND LOAN: see CALL MONEY.

DEMANTOID: see GARNET.

DEMARATUS, king of Sparta of the Eurypontid line, successor of his father Ariston (Doric Δαμάρατος, Ionic Δημάρητος). He is known chiefly for his opposition to his colleague Cleomenes I. (*q.v.*) in his attempts to make Isagoras tyrant in Athens and afterwards to punish Aegina for medizing. He did his utmost to bring Cleomenes into disfavour at home. Thereupon Cleomenes urged Leotychides, a relative and personal enemy of Demaratus, to claim the throne on the ground that the latter was not really the son of Ariston. The Delphic oracle, bribed by Cleomenes, pronounced in favour of Leotychides, who became king (491 B.C.). Soon afterwards Demaratus fled to Darius, who gave him the cities of Pergamum, Teuthrania and Halisarna, where his descendants were still ruling at the beginning of the 4th century (Xen. Anabasis, ii. 1. 3, vii. 8. 17; Hellenica, iii. 1.6); to these Gambreum should perhaps be added (Athenaeus i. 29 f.). He accompanied Xerxes on his expedition to Greece, but the stories told of the warning and advice which on several occasions he addressed to the king are scarcely historical.

See Herodotus v. 75, vi. 50–70, vii.; later writers either reproduce or embellish his narrative (Pausanias iii. 4, 3–5, 7, 7–8; Diodorus xi. 6; Polyaenus ii. 20; Seneca, De *beneficiis,* vi. 31, 4–12). The story that he took part in the attack on Argos which was repulsed by Telesilla, the poetess, and the Argive women, can hardly be true (Plutarch, *Mul. virt.* 4; Polyaenus, *Strat.* viii. 33; G. Busolt, *Griechische Geschichte,* ii. 563, note 4). (M. N. **T.**)

DEMAVEND, MOUNT. An extinct volcano in the Elburz mountains, Persia, with an altitude of 17,930 feet. It has supplies of sulphur and pumice.

DEMENTIA PRAECOX: see INSANITY.

DEMERARA, one of the three counties of British Guiana, taking its name from the river Demerara. (See GUIANA.)

DEMESNE, that portion of the lands of a manor not granted out in freehold tenancy, but (a) retained by the lord of the manor for his own use and occupation or (6) let out as tenemental land to his retainers or "villani." This demesne land, originally held at the will of the lord, in course of time came to acquire fixity of tenure, and developed into the modern copyhold (see MANOR). It is from demesne as used in sense (a) that the modern restricted use of the word comes, *i.e.,* land immediately surrounding the mansion or dwelling-house, the park or chase. *Demesne* of the Crown, or royal demesne, was that part of the crown lands not granted out to feudal tenants, but which remained under the management of stewards appointed by the crown. These crown lands, since the accession of George III., have been appropriated by parliament, the sovereign receiving in return a fixed annual sum (see CROWN LANDS; CIVIL LIST). Ancient demesne signified lands or manors vested in the king at the Norman Conquest. There were special privileges surrounding tenancies of these lands, such as freedom from tolls and duties, exemption from danegeld and amercement, from sitting on juries, etc. Hence, the phrase "ancient demesne" came to be applied to the tenure by which the lands were held. Land held in ancient demesne is sometimes also called customary freehold (see COPYHOLD).

DEMETER, in Greek mythology, daughter of Cronus and Rhea and sister of Zeus, goddess of agriculture. Her name has been explained as (1) "grain-mother," from δηαί, the Cretan form of ζειαί, "barley," or (2) "earth-mother," or rather "mother earth," δᾶ being regarded as the Doric form of γῆ. She is rarely mentioned in Homer, nor is she included among the Olympian gods.

The central fact of her legend was the story of her daughter Persephone. After her carrying off by Hades (see PERSEPHONE), Demeter revealed to the people of Eleusis, where she had been hospitably received, her secret rites (see TRIPTOLEMUS). This is the legendary origin of the famous Eleusinian mysteries (see MYSTERY). The Eleusinia, sometimes confused with them, were a distinct festival.

Demeter is a mother-goddess. Besides Zeus, she has a consort Iasion, who "lay with her in a thrice ploughed field" (Homer, Od. v. 125 et seq.), and to whom she bore Plutus (*q.v.*)—"Wealth," (*i.e.,* abundant produce of the soil). The story is compared by Frazer (Golden Bough, 3rd ed. vii. 207) with the West Prussian custom of the mock birth of a child on the harvest field, the object being to ensure a plentiful crop for the coming year. In Homer the scene is laid in Crete, and may well represent part of the ritual or mythology of the Cretan goddess. Erysichthon ("tearer up of the earth"), son of Triopas or Myrmidon, having cut down the trees in a grove sacred to the goddess, was punished by her with terrible hunger (Callimachus, Hymn to Demeter; Ovid, *Metam.,* viii. 738-878). Of this story no very convincing explanation has yet been put forward; perhaps Erysichthon may be explained as the personification of the labourer, who, by the systematic cultivation and tilling of the soil, endeavours to force the crops instead of allowing them to mature unmolested as in the good old times.

It is as a corn-goddess that Demeter appears most commonly. The name Ἰουλώ (? at Delos), from ἴουλος, "corn-sheaf," has been regarded as identifying the goddess with the sheaf, and as proving that the cult of Demeter originated in the worship of the corn-mother or corn-spirit, the last sheaf having a more or less divine character for the primitive husbandman. According to this view, the prototypes of Demeter and Persephone are the corn-mother and harvest maiden of northern Europe, the corn-fetishes of the field (Frazer, Golden Bough, 3rd ed. vii., p. 35 et seq.; but see Farnell, Cults of the Greek States, iii. 35). The influence of Demeter, however, was not limited to corn, but extended to vegetation generally and all the fruits of the earth, with the curious exception of the bean, the use of which was forbidden at Eleusis, and for the protection of which a special patron was invented. In this wider sense Demeter is akin to GE, with whom she has several epithets in common, and is sometimes identified with Rhea-Cybele; thus Pindar speaks of Demeter χαλκόκροτος ("bronze-rustling"), an epithet obviously more suitable to Rhea-Cybele than Demeter (see CORYBANTES).

Another important aspect of Demeter was that of a divinity of the under-world; as such she is χθονία (earth-goddess) at Sparta and especially at Hermione in Argolis where, at the festival Chthonia, a cow (representing, according to Mannhardt, the spirit of vegetation), which voluntarily presented itself, was sacrificed by three old women. Those joining in the procession wore garlands of the flower called *huakinthos.* The remarkable epithets, Ἐρινύς ("avenger") and Μέλαινα ("the black one"), as applied to Demeter, were both localized in Arcadia, the first at Thelpusa (or

rather Onkeion close by), the second at Phigaleia (see W. Immerwahr, Die Kulte *und Mythen* Arkadiens, i. 1891). According to the Thelpusan story, Demeter, during her wanderings in search of Persephone, changed herself into a mare to avoid the persecution of Poseidon. The god, however, assumed the form of a stallion, and the fruit of the union was a daughter of mystic name and the horse Areion or Arion (*q.v.*). Demeter, at first enraged, afterwards calmed down, and washed herself in the river Ladon by way of purification. An almost identical story was current in the neighbourhood of Tilphossa, a Boeotian spring, and a similar one at Phigaleia, where, in a cave still called Mavrospēlya ("black cave"), there was an image of the goddess, a female form seated on a rock, but with a horse's head and mane, to which were attached snakes and other wild animals. It was clothed in a black garment reaching to the feet, and held in one hand a dolphin, in the other a dove.

Both μέλαινα and ἐρινύς, according to Farnell, are epithets of Demeter as an earth-goddess of the under-world. The first has been explained as referring to the gloom of her abode, or the blackness of the withered corn. According to Farnell, the meaning of the epithet is to be looked for in the original conception of Erinys, which was that of an earth-goddess akin to GE, thus naturally associated with Demeter, rather than that of a wrathful avenging deity.

Various interpretations have been given of the horse-headed form of the Black Demeter: (1) that the horse was one of the forms of the corn-spirit in ancient Greece; (2) that it was an animal "devoted" to the chthonian goddess; (3) that it is totemistic; (4) that the form was adopted from *Poseidon Hippios,* who is frequently associated with the earth-goddess and is said to have received the name *Hippios* first at Thelpusa, in order that Demeter might figure as the mother of Areion (for a discussion of the whole subject see Farnell, Cults, iii. p. 50-62). In any case the association of Poseidon, representing the fertilizing element of moisture, with Demeter, who causes the plants and seeds to grow, is quite natural.

Demeter also appears as a goddess of health, of birth and of marriage; and a certain number of political and ethnic titles is assigned to her, the most important being Ἀμφικτυονίς, at Anthela near Thermopylae, as patron-goddess of the Amphictyonic league, subsequently so well known in connection with the temple at Delphi.

Brief mention may here be made of certain agrarian festivals held in honour of Demeter.

1. *Halōa,* obviously connected with ἅλως ("threshing-floor"). begun at Athens and finished at Eleusis, where there was a threshing-floor of Triptolemus, in the month Poseideon (December). This date, which is confirmed by historical and epigraphical evidence, seems inappropriate, and it is suggested (A. Mommsen, Feste der Stadt *Athen,* p. 365 et seq.) that the festival, originally held in autumn, was subsequently placed later, so as to synchronize with the winter Dionysia. Dionysus, as the god of vines, and (in a special procession) Poseidon φυτάλμιος ("god of vegetation") were associated with Demeter. In addition to being a harvest festival, marked by the ordinary popular rejoicings, the *Halōa* had a religious character. The ἀπαρχαί ("first-fruits") were conveyed to Eleusis, where sacrifice was offered by a priestess, men being prohibited from undertaking the duty. A τελετή ("initiatory ceremony") of women by a woman also took place at Eleusis, characterized by obscene jests and the use of phallic emblems. The sacramental meal on this occasion consisted of the produce of land and sea, certain things (pomegranates, honey, eggs) being forbidden for mystical reasons. Although the offerings at the festival were bloodless, the ceremony of the presentation of the ἀπαρχαί was probably accompanied by animal sacrifice; Mommsen, however, considers the offerings to have been pastry imitations. Certain games (πάτριος ἀγών), of which nothing is known, terminated the proceedings. In Roman imperial times the ephebi (*q.v.*) had to deliver a speech at the *Halōa.*

2. *Chloeia* or *Chloia,* the festival of the corn beginning to sprout, held at Eleusis in the early spring (Anthesterion) in honour of Demeter Chloë, "the green," the goddess of growing vegetation. This is to be distinguished from the later sacrifice of a ram to the same goddess on the 6th of the month Thargelion, probably intended as an act of propitiation. It has been identified with the *Procharistēria* (sometimes called *Proschairetēria*), another spring festival, but this is doubtful. The scholiast on Pindar (*Ol.,* ix. 150) mentions an Athenian harvest festival *Eucharistēria.*

3. *Proërosia,* at which prayers were offered for an abundant harvest, before the land was ploughed for sowing. It was also called Proarktouria, an indication that it was held before the rising of Arcturus. According to the traditional account, when Greece was threatened with famine, the Delphic oracle ordered first-fruits to be brought to Athens from all parts of the country, which were to be offered by the Athenians to the goddess Deo on behalf of all the contributors. The most important part of the festival was the three sacred ploughings—the Athenian ὑπὸ πόλιν, the Eleusinian on the Rharian plain, and the Soirian (a compromise between Athens and Eleusis). The festival itself took place, probably some time in September, at Eleusis. In later times the ephebi also took part in the Proërosia.

4. *Thalusia,* a thanksgiving festival, held in autumn after the harvest in the island of Cos (see Theocritus vii.)

5. The name of Demeter is also associated with the *Skirophoria* (see ATHENA). It is considered probable that the festival was originally held in honour of Athena, but that the growing importance of the Eleusinia caused it to be attached to Demeter and Korē.

The attributes of Demeter are chiefly connected with her character as goddess of agriculture and vegetation—ears of corn, the poppy, the mystic basket (kalathos) filled with flowers, corn and fruit of all kinds, the pomegranate being especially common. Of animals, the pig is her favourite, owing to its productivity and the cathartic properties of its blood. As a chthonian divinity she is accompanied by a snake; the myrtle, asphodel and narcissus (which Persephone was gathering when carried off by Hades) also are sacred to her.

In Greek art, Demeter resembles Hera, but she is more matronly and of milder expression; her form is broader and fuller. She is sometimes riding in a chariot drawn by horses or dragons, sometimes walking, sometimes seated upon a throne, alone or with her daughter. The Demeter of Cnidus in the British Museum, of the school of Praxiteles, apparently shows her mourning the loss of her daughter.

The Italians identified Demeter with their own Ceres (*q.v.*).

BIBLIOGRAPHY.—Besides authorities cited in the text, see W. Mannhardt, *Mythologische Forschungen* (1884); J. E. Harrison, Prolegomena to the *Study* of *Greek* Religion (1903); Preller-Robert, *Griechische Mythologie,* 4th ed. i., p. 747 *et seq.;* O. Gruppe, Griechische Mythologie und Religionsgeschichte, ii. (1907), and the classical dictionaries.

DEMETRIA, an obscure festival or rite of Demeter, probably Athenian, in which the participants beat each other with whips of twisted bark, a well-known fertility charm (Pollux. i. 37, Hesych. *s.v.* μόροττον). Also a name given to the Attic Dionysia in compliment to Demetrius Poliorcetes (Plut., *Demetrius,* 12).

See Stengel in Pauly-Wissowa, Realencyk., iv. 2,764.

DEMETRIUS, king of Bactria, was the son of the Graeco-Bactrian king Euthydemus, for whom he negotiated a peace with Antiochus the Great in 206 (Polyb. xi. 34). Soon afterwards he crossed the Hindu Kush and began the invasion of India (Strabo xi. 516); he conquered the Punjab and the valley of the Indus down to the sea and to Gujerat. The city of Sangala, a town of the Kathaeans in the Punjab (Arrian v. 22, 2 et seq.) he named after his father Euthydemia (Ptol. vii. i. 46). That his power extended into Arachosia (Afghanistan) is proved by the name of a town Demetrias near Kandahar (Isidor, Charac. 19, cf. Strabo xi. 516). On his coins he wears an elephant's skin with trunk and teeth on his head; on bronze coins, which have also an Indian legend in Kharoshti letters (see BACTRIA), he calls himself the unvanquished king (Βασιλέως ἀνικήτου Δημητρίου). One of his coins had already the square form used in India instead of the circular. Eventually he was defeated by the usurper Eucratides (*q.v.*), who meanwhile had risen to great power in Bactria. About

his death we know nothing; his young son Euthydemus II. (known only from coins) can have ruled only a short time. (ED. M.)

DEMETRIUS I. (337–283 B.C.), King of Macedonia, surnamed *Poliorcetes* ("Besieger"), son of Antigonus Cyclops and Stratonice. In 321 he married Phila, daughter of Antipater. At the age of twenty-two he was left by his father to defend Syria against Ptolemy the son of Lagus; he was totally defeated near Gaza (312), but soon partially repaired his loss by a victory in the neighbourhood of Myus. After an unsuccessful expedition against Babylon, and several campaigns against Ptolemy on the coasts of Cilicia and Cyprus, Demetrius sailed with a fleet of 250 ships to Athens. He freed the city from the power of Cassander and Ptolemy, expelled the garrison which had been stationed there under Demetrius of Phalerum, and besieged and took Munychia (307). After these victories he was worshipped by the Athenians as a tutelary deity under the title of *Soter* ("Preserver"). In the campaign of 306 against Ptolemy he defeated Menelaus (the brother of Ptolemy) in Cyprus, and completely destroyed the naval power of Egypt.

Demetrius and his father then adopted the royal title, thereby (and by their coinage) claiming the whole of Alexander's empire. A joint expedition into Egypt, Demetrius in command of the fleet, was a failure. In 305 he endeavoured to punish the Rhodians for having deserted his cause; and his ingenuity in devising new instruments of siege, in his unsuccessful attempt to reduce the capital, gained him the appellation of Poliorcetes. He returned to Greece to deal with Cassander again. After a riotous winter in which he even shocked Athens, he drove the Cassandrian party out of the Peloponnese, called a conference at the Isthmus, and re-organized Philip's League of Corinth, much on the same lines, except that it rested on democracies in the constituent states. It was to meet at the Great Games (6 times in 4 years), and to include tribes (ἔθνη), *i.e.*, peoples not organized into city-states. Eventually Seleucus, Cassander and Lysimachus united to destroy Antigonus and his son. The hostile armies met at Ipsus in Phrygia (301). Antigonus was killed in the battle and Demetrius retired to Ephesus, defeated. Many enemies rose up against him; even the Athenians refused to admit him to their city. Demetrius ravaged the territory of Lysimachus, and effected a reconciliation with Seleucus who married his daughter. Demetrius gained possession of Athens then oppressed by the tyranny of Lachares. In the same year (294) he established himself on the throne of Macedonia by the murder of Alexander, son of Cassander, but, expelled by the combined forces of Pyrrhus, Ptolemy and Lysimachus, he passed into Asia where he was forsaken by his troops and surrendered to Seleucus. His son Antigonus offered all his possessions and even his own liberty to have his father set free but without avail. Demetrius died in 283 after a confinement of three years.

See Life *by* Plutarch; Diod. Sic. xix., xx.; Wilamowitz-Moellendorff, *Antigonos von Karystos;* De Sanctis, *Contributi alla storia Ateniese* in Beloch's *Studi di storia antica (1893)*; Fergusson *in* Lehmann's *Beitrage z. alt. Gesch. (Klio)*, vol. v. (1905); also authorities under MACEDONIAN EMPIRE.

DEMETRIUS II., son of Antigonus Gonatas, reigned from 239 to 229 B.C. He had already during his father's lifetime distinguished himself by defeating Alexander of Epirus at Derdia and so saving Macedonia (about 260). On his accession he had to face a coalition which the two great leagues, usually rivals, the Aetolian and Achaean, formed against the Macedonian power. He succeeded in dealing this coalition severe blows, wresting Boeotia from their alliance. The revolution in Epirus, which substituted a republican league for the monarchy, gravely weakened his position. Demetrius had also to defend Macedonia against the wild peoples of the north. A battle with the Dardanians turned out disastrously, and he died shortly afterwards, leaving Philip, his son by Chryseis, still a child. Former wives of Demetrius were Stratonice, the daughter of the Seleucid king Antiochus I., Phthia, the daughter of Alexander of Epirus, and Nicaea, the widow of his cousin Alexander.

See Thirlwall, *History of Greece,* vol viii. (1847); *Ad.* Holm, *Griech, Gesch.* vol. iv. *(1894)*; B. Niese, *Gesch. d. griech. u. mnked. Staaten,* vol. ii. *(1899)*; *J.* Beloch, *Griech. Gesck.,* vol. iii. (1904).

DEMETRIUS, the name of three kings of Syria.

DEMETRIUS I. (d. 150 B.C.), surnamed *Soter,* was sent to Rome as a hostage during the reign of his father, Seleucus IV. Philopator, but after his father's death in 175 B.C. he escaped and seized the Syrian throne (162 B.C.) after murdering King Antiochus V. Eupator. He was called *Soter,* or Saviour, by the Babylonians, whom he delivered from the tyranny of the Median satrap, Timarchus, and is famous in Jewish history for his contests with the Maccabees. Demetrius fell in battle against the usurper, Alexander Balas, in 150 B.C.

DEMETRIUS II. (d. 125 B.C.), surnamed *Nicator,* son of Demetrius I., fled to Crete after the death of his father, but about 147 B.C., with the help of Ptolemy VII., Philometor, king of Egypt, regained his father's throne. In 140 B.C. he marched against Mithridates, king of Parthia, but was held captive for ten years, regaining his throne about 129 B.C. on the death of his brother, Antiochus VII., who had usurped it. But he was hated for his cruelty, and during another civil war was defeated at Damascus, and killed near Tyre. His successor was his son, Antiochus VIII. Grypus.

DEMETRIUS III. (d. 88 B.C.), called *Euergetes* and *Philometor,* was the son of Antiochus VIII. Grypus. By the assistance of Ptolemy VIII Lathyrus, king of Egypt, he recovered part of his Syrian dominions from Antiochus X. Eusebes, and held his court at Damascus. In attempting to dethrone his brother, Philip Epiphanes, he was defeated by the Arabs and Parthians, and kept prisoner in Parthia by King Mithridates until his death.

DEMETRIUS, a Cynic philosopher, born at Sunium, who lived at Corinth and in Rome during the reigns of Caligula, Nero and Vespasian. He was an intimate friend of Thrasea Paetus and Seneca. He was equally impervious to the bribes of Caligula and the anger of Vespasian who banished him. He reached the logical conclusion of Cynicism in attaching no real importance to scientific data.

DEMETRIUS, a Greek sculptor of the early part of the 4th century B.C., who is said by ancient critics to have been notable for the life-like realism of his statues. His portrait of Pellichus, a Corinthian general, was admired by Lucian. He was contrasted with Cresilas (*q.v.*), an idealizing sculptor of the generation before. Since, however, the peculiarities mentioned by Lucian do not appear in Greek portraits before the 3rd century B.C., and since the Greek art of the 4th century consistently idealizes, there would seem to be a difficulty to explain. The date of Demetrius is confirmed by inscriptions found on the Athenian Acropolis.

(P. ***G.***)

DEMETRIUS DONSKOI ("OF THE DON") (1350–1389), grand duke of Vladimir and Moscow, son of the grand duke Ivan Ivanovich by his second consort Alexandra, was placed on the grand-ducal throne of Vladimir by the Tatar khan in 1362, and married the princess Eudoxia of Nizhny Novgorod in 1364. He built the Kremlin of Moscow and waged war with Michael, prince of Tver, for supremacy. Demetrius was generally successful. In 1371 he won over the khan by a personal visit to the Horde, and in 1372 he defeated the Lithuanian supporters of Tver at Lyubutsk. Demetrius then formed a league of all the Russian princes against the Tatars, and in 1380 encountered them on the plain of Kulikovo, between the rivers Nepryadvaya and Don, where he completely routed them, the grand khan Mamai perishing in his flight from the field. But now Toktamish, the deputy of Tamerlane, organized a punitive expedition against Demetrius Moscow was taken by treachery, and the Russian lands were again subdued by the Tatars (1381). Nevertheless, while compelled to submit to the Horde, Demetrius maintained his hegemony over Tver, Novgorod and the other recalcitrant Russian principalities, and even held his own against the Lithuanian grand dukes. Demetrius was one of the greatest of the north Russian grand dukes. He was not merely a cautious and tactful statesman, but also a valiant and capable captain, in striking contrast to most of the princes of his house.

See Sergyei Solovev, *History of Russia* (Rus.), vols. i.–ii. (St. Petersburg, 1857), etc.; Nikolai Savelev, *Demetrius Ivanovich Donskoi* (Rus.) (Moscow. *1837).*

DEMETRIUS PHALEREUS (*c.* 345–283 B.C), Attic orator, statesman and philosopher, born at Phalerum, was a pupil of Theophrastus and an adherent of the Peripatetic school. He governed the city of Athens as representative of Cassander (*q.v.*) for ten years from 317. On the restoration of the old democracy by Demetrius Poliorcetes, he was condemned to death and obliged to leave the city. He escaped to Egypt, where he was protected by Ptolemy Lagus, to whom he is said to have suggested the foundation of the Alexandrian library. Having incurred the displeasure of Lagus's successor Philadelphus, Demetrius was banished to Upper Egypt, where he died (according to some, voluntarily) from the bite of an asp. Demetrius composed a large number of works on poetry, history, politics, rhetoric and accounts of embassies, all of which are lost.

The treatise Περὶ Ἑρμηνείας (on rhetorical expression), which is often ascribed to him, is probably the work of a later Alexandrian (1st century A.D.) of the same name; it has been edited by L. Radermacher (1901) and W. Rhys Roberts (1902), the last-named providing English translation, introduction, notes, glossary and complete bibliography. Fragments in C. Muller, *Frag. Hist. Graec.* ii. p. 362. *See* A. Holm, *History* of *Greece* (Eng. trans.), iv. 60.

DEMETRIUS, PSEUDO- (or **FALSE**), the name by which three Muscovite princes and pretenders, who claimed to be Demetrius, son of Ivan the Terrible, are known in history. The real Demetrius had been murdered, while still a child, in 1591, at Uglich, his widowed mother's appanage.

1. In the reign of Tsar Boris Godunov (1598–1605), the first of these pretenders, whose real name seems to have been Yury or Gregory, first appears in history *circa* 1600, when his learning and assurance impressed the Muscovite patriarch Job. Tsar Boris, however, ordered him to be seized and examined, whereupon he fled to Prince Constantine Ostrogsky at Ostrog, and subsequently entered the service of another Lithuanian, Prince Wisniwiecki, who tried to enlist the sympathy of the Polish king, Sigismund III., in his favour. The king refused to support him officially, but his cause was taken up by the Polish magnate Yury Mniszek, whose daughter Marina he afterwards married. The Jesuits also seem to have believed in the man, who was evidently an unconscious impostor brought up from his youth to believe that he was the real Demetrius: finally he set out, at the head of an army of Polish and Lithuanian volunteers, Cossacks and Muscovite fugitives, to drive out the Godunovs, after being received into the Church of Rome. At the beginning of 1604 Sigismund presented him at Cracow to the papal nuncio Rangoni. His public conversion took place on April 17. In October the false Demetrius crossed the Russian frontier, and shortly afterwards routed a large Muscovite army beneath the walls of Novgorod-Syeversk. After the sudden death of Tsar Boris (April 13, 1605) the principal Russian army, under P. E. Basmanov, at once went over to him (May 7); on June 20 he made his triumphal entry into Moscow, and on July 21 he was crowned tsar by a new patriarch, the Greek Isidore. He at once proceeded to introduce a whole series of political and economic reforms. He did his best to relieve the burdens of the peasantry; he formed the project of a grand alliance between the emperor, the pope, Venice, Poland and Muscovy against the Turk; and he displayed an amazing toleration in religious matters which made people suspect that he was a crypto-Arian. But his assumption of the title of emperor, and his predilection for Western civilization, alarmed the ultra-conservative boyars (the people were always on his side), and a conspiracy was formed against him, headed by Basil Shuisky, whose life he had saved a few months previously. On May S, 1606, when Demetrius was married to Marina Mniszek, the boyars urged the citizens to rise against the Poles who had accompanied Marina to Moscow, while they themselves attacked and slew Demetrius in the Kremlin on the night of May 17.

See Sergyei Solovev, *History of Russia* (Rus.), vol. viii. (St. Petersburg, 1857, etc.); Nikolai Kostomarov, *Historical Monographs* (Rus.) vols. iv.–vi. (St. Petersburg, 1863, etc.); Orest Levitsky, *The First False Demetrius as the Propagandist of Catholicism in Russia* (Rus.) (St. Petersburg, 1886); Paul Pierling, *Rome et Demetrius* (Paris, 1878): R. N. Bain, "Poland and Russia," *Camb.* Nod, *Hist.*, chap. 10 (Cambridge, 1907).

2. The second pretender, called "the thief of Tushino," first appeared on the scene *circa* 1607 at Starodub. He is supposed to have been either a priest's son or a converted Jew, and was well educated. He pretended at first to be the Muscovite boyarin Nagi; but confessed, under torture, that he was Demetrius Ivanovich, whereupon he was taken at his word and joined by thousands of Cossacks, Poles and Muscovites. He captured Karachev, Briansk and other towns; was reinforced by the Poles; and in the spring of 1608 advanced upon Moscow, routing the army of Tsar Basil Shuisky, at Bolkov, on his way. He entrenched himself at the village of Tushino, 12 versts from the capital, which he converted into an armed camp. In the course of the year he captured Marina Mniszek, who acknowledged him to be her husband (subsequently quieting her conscience by privately marrying this impostor who in no way resembled her first husband), and brought him the support of the Lithuanian magnates Mniszek and Sapieha so that his forces soon exceeded 100,000 men. He raised to the rank of patriarch another captive, Philaret Romanov, and won over the towns of Yaroslavl, Kostroma, Vologda, Kashin and other places to his allegiance. But subsequent disasters, and the arrival of King Sigismund III. induced him to fly his camp disguised as a peasant and go to Kostroma, where Marina joined him and he lived once more in regal state. He also made another but unsuccessful attack on Moscow, and, supported by the Don Cossacks. recovered a hold over all south-eastern Russia. He was killed, while half drunk, on Dec. 11, 1610, by a Tatar whom he had had flogged.

See Sergei Soloviev, *History of Russia* (Rus.), vol. viii. (St. Petersburg, 1857, etc.).

3. The third, a more enigmatical person than his predecessors, supposed to have been a deacon called Siderka, appeared suddenly, "from behind the river Yanza," in the Ingrian town of Ivangorod (Narva), proclaiming himself the tsarevich Demetrius Ivanovich, on March 28, 1611. The Cossacks, ravaging the environs of Moscow, acknowledged him as tsar on March 2, 1612, and under threat of vengeance in case of non-compliance, the gentry of Pskov also kissed the cross to "the thief of Pskov," as he was usually nicknamed. On May 18, 1612, he fled from Pskov, was seized and delivered up to the authorities at Moscow, and there executed.

See Sergei Soloviev, *History of Russia* (Rus.), vol. viii. (St. Petersburg, 1857, etc.).

DEMIDOV, the name of a famous Russian family, founded by Nikita Demidov (b. *c.* 1665), who was originally a blacksmith serf. He made his fortune by his skill in the manufacture of weapons, and established an iron foundry for the Government. Peter the Great, with whom he was a favourite, ennobled him in 1720. His son, Akinfiy Demidov (d. *c.* 1740), increased his inherited wealth by the discovery and working of gold, silver and copper mines. The latter's nephew, Paul Grigoryevich Demidov (1738–1821), was a great traveller who was a benefactor of Russian scientific education; he founded an annual prize for Russian literature, awarded by the Academy of Sciences. Paul's nephew, Count Nikolay Nikitich Demidov (1774–1828), raised and commanded a regiment to oppose Napoleon's invasion, and carried on the accumulation of the family wealth from mining; he contributed liberally to the erection of four bridges in St. Petersburg, and to scientific education in Moscow. Paul's son, Prince Anatoli Demidov (1813–1870), was a well-known traveller and patron of art; he married Princess Mathilde, daughter of Jerome Bonaparte.

DEMIJOHN, a glass bottle or jar with a large round body and narrow neck, encased in wicker-work and provided with handles. The word is also used of an earthenware jar, similarly covered with wicker. The capacity of a demijohn varies from two to twelve gallons, but the common size contains five gallons. According to the ***New*** English *Dictionary* the word is an adaptation of a French *Dame Jeanne*, or Dame Jane, an application of a personal name to an object which is not uncommon.

DEMING, an incorporated town of south-western New Mexico, U.S.A., in the Mimbres valley, 35m. from the Mexican border, at an altitude of 4,332ft.; the county seat of Luna county,

It is on federal highways 70, 80 and 260; is served by the Santa Fe and Southern Pacific railways and ha.; a municipal airport. Pop. was 3,377 in 1930 and 3,608 in 1940. Farming by irrigation, cattle grazing and mining of copper, manganese, fluorspar and zinc constitute the chief industries of the region. Near by are medicinal springs, and 40 mi. N. of the city is the Gila national forest, in which is the Gila Cliff Dxellings national monument.

DEMISE, an Anglo-French legal term for a transfer of an estate, especially by lease (see LAKDLORD AND TENANT). The phrase "demise of the Crown" is used in English law to signify the immediate transfer of the sovereignty, with all its attributes and prerogatives, to the successor without any interregnum in accordance with the maxim "the king never dies." At common law the death of the sovereign eo facto dissolved parliament, but this was abolished by the Representation of the People Act, 1867, s. 51. Similarly the common law doctrine that all offices held under the Crown determined at its demise has been negatived by the Demise of the Crown Act, 1901.

DEMISEMIQUAVER, in music, a note of the duration of half a semiquaver, a quarter of a quaver, and so on, represented as follows:  . In the German nomenclature, which, in English equivalents, is also that employed in the United States, it is known as a Zweiunddreissigstel, or two-and-thirtieth note, being, as it is, a thirty-second part of a semibreve.

DEMIURGE (dē'mi-urj) (Gr. *dēmiourgos,* artisan or handicraftsman). In Homer it includes hand-workers and heralds and physicians. In Attica the *demiourgoi* formed one of the three classes, with the Eupatridae (q.v.) and the *geōmoroi,* into which the early population was divided. (See EUPATRIDAE.) The word was used in the Peloponnese, with the exception of Sparta, for a higher magistrate. The *demiourgoi* represented Elis and Mantinea at the treaty of peace between Athens, Argos, Elis, and Mantinae in 420 B.C. (Thuc. v. 47). In the Achaean League (q v.) the name is given to ten officers who presided over the assembly, and Corinth sent *Epidemiourgoi* to Potidaea.

In Plato *demiourgos* is the name given to the "creator of the world" (*Timaeus,* 40) and the word was so adopted by the Gnostics. (*See* GNOSTICISM.)

DEMMIN, town in the Land of Prussia, Germany, on the navigable river Peene, 72 mi. W.N.W. of Stettin, on the Berlin-Stralsund railway. Pop. (1939) 15,745. It has manufactures of textiles, and an active trade in corn and live stock.

An ancient Slav town, it was important under Charlemagne. It was besieged by a German army in 1148, and captured by Henry the Lion in 1164. In the Thirty Years' War Demmin was the object of frequent conflicts, and even after the Peace of Westphalia was taken and retaken in the contest between the electoral prince and the Swedes. It passed to Prussia in 1720, and its fortifications were dismantled in 1759.

DEMOCHARES (c. 355–275 B.C.), nephew of Demosthenes, Athenian orator and statesman, was one of the few distinguished Athenians in the period of decline. He is first heard of in 322, when he spoke in vain against the surrender of Demosthenes and the other anti-Macedonian orators demanded by Antipater. During the next fifteen years he probably lived in exile. On the restoration of the democracy by Demetrius Poliorcetes in 307 he occupied a prominent position, but was banished in 303 for having ridiculed the decree of Stratocles, which contained a fulsome eulogy of Demctrius. He was recalled in 298, and during the next four years fortified and equipped the city with provisions and ammunition. In 296 (or 295) he was againrbanished for having concluded an alliance with the Boeotians, and did not return until 287 (or 286). According to Cicero (Brufus, 83) Democharcs was the author of a history of his own times, written in an oratorical rather than a historical style. As a speaker he was noted for his freedom of language (*Parrhesiastes,* Seneca, De *ira,* iii. 23). He was violently attacked by Timaeus, but found a strenuous defender in Polybius (xii.13).

See also Plutarch, ***Demosthenes,*** 30, *Demetrius, 24, Vitae* ***decem oratorum,*** p. 847; J. G. Droysen's essay on Democharcs in ***Zeitschrijt für die*** *Altertumswissenschaft* (1836), Nos. 20, 21.

DEMOCRACY. Historical Development.— Democracy is a form of government based upon self-rule of the people and in modern times upon freely elected representative institutions and an executive responsible to the people; and a way of life based upon the fundamental assumption of the equality of all individuals and of their equal right to life, liberty (including the liberty of thought and expression), and the pursuit of happiness. Democracy has a long and ancient history, and may be regarded as the modern fruit of western civilization and of its two component elements, the Athenian and Roman legacy and the Judaeo-Christian tradition. The word is derived from the Greek *δημοκρατία* from *δῆμος,* the people, and *κράτος,* rule. In his Politics Aristotle, critical of the decaying Athenian democracy, regarded it in one passage (Bk. III, chap. 7, 1279b) as a perverted form of that state where the citizens at large govern, because democracy considers only the poor and not the common good. In Bk. IV, chap. 4 (1290b, 1291b), he expressed his opinion differently: "We should rather say, that a democracy is when the supreme power is in the hands of the freemen; . . . a democracy is a state where the freemen and the poor, being the majority, are invested with the power of the state." And: "The most pure democracy is that which is so called principally from that equality which prevails in it: for this is what the law in that state directs; that the poor shall be in no greater subjection than the rich; nor that the supreme power shall be lodged with either of these, but that both shall share it. For if liberty and equality, as some persons suppose, are chiefly to be found in a democracy, it must be so by every department of government being alike open to all; but as the people are the majority, and what they vote is law, it follows that such a state must be a democracy."

Democracy was widespread in ancient Greece. Greek history in its most developed period may be regarded as a struggle between democratic and oligarchic states, of which Athens and Sparta were the most representative examples. The Athenians were the first people to try, in their empire, to form a democratic empire, not merely one possessed by a sovereign people but one bound together by common democratic constitutions and institutions. This experiment failed because, as a result of the nature of the ancient city-state, the franchise of Athenian citizens was not extended, as later in Rome, to men of non-Athenian descent. But ancient democracy was in several ways fundamentally different from that of modern times. It was direct democracy in which the whole people formed the legislator and in which the representative system was unknown. That was made possible by the limited size of the ancient state which was generally confined to a city and its rural surroundings, and counted almost never more than 10,000 citizens. In the ancient democracies every citizen was entitled to attend the legislative meetings and to vote. A very large number of the citizens held one of the many elective offices in the course of the years. No division between the legislative and the executive branch existed; both were in the hands of the whole active citizenry, there was no modem party organization. The inability of the ancients to develop a representative system made it impossible for them to create large democratic states. On the other hand, the political life in the ancient democracies was most intense and all citizens were actively interested in and highly conversant with all details of administration. Direct democracy of this kind was the ideal form envisaged by Jean Jacques Rousseau in his Contrat social, and it may be found, to a certain extent, in the New England town meetings and in some of the smaller Swiss cantons. The referendum and the popular initiative preserved in several modern democratic constitutions, as in that of Switzerland, can be regarded as elements of direct democracy surviving in the indirect or representative democracy, which is the generally accepted form of modern times.

Another and very important difference between ancient Greek democracy and modern democracy does not concern the form of government but the fundamental assumption of the equality of all individuals. Ancient democracy was not only compatible with slavery, it presupposed slavery, which alone permitted the necessary leisure for the citizens to devote themselves to questions

of public interest. Modern democracy has tended more and more to abolish all differences and privileges of birth, class, race and sex, and to broaden its basis so as to become all-inclusive. The ancients had a very low estimate of labour, even of highly skilled labour, which also was performed by slaves. This attitude prevailed for a long time and characterized many feudal and post-feudal societies. Only modern industrial civilization. which arose in countries where simultaneously modern democracy developed, produced the new concept of the dignity of labour which helped to break down the barriers of privilege. It should be noted, however, that in Athens slaves were very well treated, and that the main difference between their ways of life and those of other citizens of the poorer classes was the lack of political rights. The Stoic philosophy which dominated the Roman empire and pervaded Roman law, and the emphasis put by prophetic Judaism and early Christianity on the poor and the disinherited and on the equality of all men before God, created the fundamental assumptions on which democracy could develop its faith in the essential equality of all human beings.

The middle ages were not a favourable soil for the functioning of democracy, but toward the end of that period the growing power and wealth of the cities, especially in northern Italy, provided the opportunity for a more intense cultural and social life and with it the reappearance of the spirit of liberty. It is noteworthy that Niccolb Machiavelli in his *Discorsi sopra la prima deca di Tito Livio* praised the value of liberty and the superiority of republics over monarchies or tyrannies. He emphasized the fact that the common weal is observed and promoted nowhere except in republics with a free citizenry. (Bk. II, chap. 2; see also Bk. I, chap. 10.) These discourses, replete with the realistic wisdom of a statesman and a political thinker, contain a remarkable plea for democracy, assert that the people are wiser and more constant than a prince, and reject the contrary opinion, adding that this contrary opinion has its origin in the fact that everyone can speak ill of the people, freely and without fear, even while the people rule, while everyone speaks of the princes only with a thousand fears and a thousand considerations. (Bk. I, chap. 58.) Renaissance and Reformation helped to prepare the soil for the growth of democracy through their emphasis on the individual and individual conscience, and through their return to the sources of classical and Biblical antiquity. A new spirit of inquiry grew up; spurred on by the new discoveries and inventions, it raised man's stature in his own eyes and opened before him vast and unknown possibilities. This new spirit found its expression in Francis Bacon's experimental philosophy as well as in René Descartes's rationalism which proclaimed in his "I think, therefore I am," the sovereignty and maturity of the thinking individual.

It was a long and hard struggle which from 1640 to 1918 carried democracy to world-wide victory. Through a number of great revolutions, but even more through the unceasing toil, the unsparing efforts and the spiritual devotion of countless individuals in many countries during these three centuries, the ideas of liberty and equality gained more and more concrete form. Seventeenth-century England may be regarded as the birthplace of modern democracy. Christian and classical traditions could grow there into something new on a soil well prepared by the development of the Magna Carta and of common law, and fertilized by the Renaissance and Reformation. With a deeply religious enthusiasm the English revolution broke the path for liberty in the modern world. Largely under the inspiration of the Bible, a number of sects proclaimed and propagated all, and sometimes even the most radical, implications of the democratic faith. The great voice of the age was raised again and again in a passionate plea for liberty: all of John Milton's writings were imbued with the newly awakened sense of freedom, freedom of thought, freedom of the printed word, freedom of education, freedom of personal life and conduct, in addition to freedom of church and state. His outcry against censorship: "Give me the liberty to know, to utter and to argue freely according to conscience, above all liberties," *(Areopagitica)*, was matched by his declaration that "no man who knows aught can be so stupid to deny that all men naturally were born free, being the image and resemblance of God himself . . . it being thus manifest that the power of kings and magistrates is nothing else, but what is only derivative, transferred and committed to them in trust from the people, to the common good of them all" *(Defense of the People of England)*. Milton identified the English people and their cause with that of individual liberty, freedom of conscience, and the dignity of reason; but this new dispensation was to be universal, the English only preceding other nations, who were soon to follow. Macaulay in his *Essay on Milton* characterized the man and his epoch:

"He lived at one of the most memorable eras in the history of mankind, at the very crisis of the great conflict between liberty and despotism, reason and prejudice. That great battle was fought for no single generation, for no single land. The destinies of the human race were staked on the same case with the freedom of the English people. Then were first proclaimed those mighty principles which have since worked their way into the depths of the American forests, which have aroused Greece from the slavery and degradation of two thousand years, and which have kindled an unquenchable fire in the hearts of the oppressed and loosed the knees of the oppressors with an unwonted fear."

The spirit of liberalism, rationalism and optimism pervading 17th century England found its lasting expression in John Locke's *Letters on Toleration* and *Two Treatises of Government*. They were dominated by the spirit of compromise, the "live and let live" attitude of mutual respect and toleration within the common frame, which characterized liberalism and democracy. Locke formulated and expounded two basic principles: that the individual, his liberty, dignity and happiness form the foundation of all social life, and that government is a moral trust dependent upon the free consent of the governed. As a result of the two revolutions of the 17th century, England was the only country in which the power of absolutism was definitely broken, and though democracy's growth was slow, its basis had been so firmly established that England never knew any retrogression. The control of national affairs had passed into the hands of a parliament with a steadily growing preponderance of the house of commons and a steadily enlarging electorate; the liberties of the community and of the individuals were protected by a Bill of Rights; judges had become independent from the executive power; the abolition of censorship and the recognition of tolerance became acknowledged principles.

From these roots the tree of democracy grew faster in the virgin soil of the American colonies than in the mother country Locke became "America's philosopher par excellence." The colonists struggled with the mother country as Englishmen and on the basis of their freedom as Englishmen. What was a constitutional conflict within a common heritage of 17th-century liberty became the starting point for a new surge of democracy, not only as a result of the peculiar social conditions of the colonies and the absence of the classes and institutions surviving from a feudal past, but also from the influence of the new ideas of natural rights, the rule of reason, and the freedom of man, which were expressed in the pamphlets *"Common Sense"* and *"The Crisis"* of an Englishman, Thomas Paine, and which were propagated in France by the Encyclopaedists and especially by Jean Jacques Rousseau. Their spokesman in America was Thomas Jefferson nho had drafted the Declaration of Independence and whose life work in the later years was to convert the United States into a democracy under the influence of the 18th-century ideas. This ideological foundation, started in the American Revolution, was carried on and expanded in the two following great conflicts through which the United States passed—in the Civil War under Abraham Lincoln. and in World War I under Woodrow Wilson.

Meanwhile the American Revolution, deeply influenced by the "French ideas," in turn acted upon developments in France. French society idealized the events across the Atlantic. It saw in them the first example of a people which in its eagerness for liberty and justice had thrown off the yoke of an unjust monarchy, and had established a government based upon the enlightened principles of reason. Soon the French people were to find themselves involved in a similar effort. Years of unprecedented turmoil shook not only the foundations of French society, but also those of all Europe. The French Revolution introduced the symbols of a new cult of liberty and human rights and coined the

three words which expressed the essence of the new faith of democracy: the liberty of every individual, the equality of all men, and the brotherhood of all human beings. In the immense enthusiasm of its beginnings, age-old privileges were abandoned; the new feeling of the dignity of man, of his right to self-expression and self-determination, not only created new political forms but manifested itself in all fields of public and private life. The armies of the French Revolution and of Napoleon carried the new spirit all over Europe, everywhere awakening the masses from their age-old lethargy and arousing in them the will to creative participation in the political, social and cultural fields.

Though the new ideas of liberalism and democracy seemed defeated in 1814, and Europe was apparently returning to the old order of authoritarian regime, of inequality and privilege, democracy was soon to resume its growth. In the century from 1820 to 1920 it gained both in depth and in breadth. The revolution of 1830, which started in Paris in July and ended in 1832 with the English Reform bill, re-established the trend toward constitutional government with guarantees for the rights and liberties of every citizen. Its invigorating influence made itself felt in 1848, the "spring of the peoples." The new ideas penetrated into central Europe and Russia, and finally, at the beginning of the 20th century started to transform traditional life even in the Ottoman empire and in Persia, in China and in Japan. World War I was really a democratic world revolution, in which the conservative monarchies of central and eastern Europe crumbled and gave way to democratic republics, suffrage became general everywhere, and the working class began for the first time to assume the responsibilities of government. So great was the impetus which World War I gave to the development of democracy that in most nations even women received the right to vote. This democratic wave did not stop at the confines of Europe: World War I had stirred the masses of the oriental and backward countries into previously unknown demands for national self-determination and for individual rights. The victory of the democratic states of western Europe and of the United States of America over the military and conservative monarchies of central Europe, and the Russian revolution of March 1917 marked, up to that date, the highest points of development for democracy. At that time democracy for the first time seemed to fulfil its world-wide mission of a liberating message to all classes and to all peoples.

For democracy is not only a form of government, but also carries definite implications in the economic field. In their rise, liberalism and democracy were connected with the ascendancy of the middle classes and with the growth of industrial civilization. As social phenomena, the English revolutions of the 17th century, the American and the French revolutions of the 18th century, and the revolutions of 1830 and 1848 were largely middle class movements. Economically they served the fight against a feudal and rural economy to provide the necessary liberty of development for the rising urban economy of traders and industrialists. This new economy was based on essential liberties removing all the restrictions of the past which had hindered the free development of the individual and had kept him in stations of life to which he had been assigned by birth or tradition. All these movements had also their more radical wings which insisted, beyond individual liberty and equality before the law, upon equality of opportunity and sometimes even equality of income. Though little was accomplished in the field of "economic democracy" in these revolutions, and in most cases the problem was neither seen nor understood, the rise of democracy with its emphasis upon equality and upon each individual's right to the pursuit of happiness awakened the masses to the realization of their situation. and brought many members of the upper and middle classes to the conviction that the benefits and blessings of democracy must be extended to the economic field to become real and effective for the masses. Complaints about the shortcomings of purely political democracy were frequent at the beginning of the 19th century. Thus the *Mechanics Free Press* in Philadelphia declared in 1829: "There appear to exist two distinct classes, the rich and the poor; the oppressor and the oppressed; those that live by their own labors and they that live by the labor of others; the aristocratic and the democratic." The aspirations for a broadening of democracy to the economic field received a growing impetus throughout the 19th century with the progress of industrialization and of urbanization. The socialist movements in the 1830s and 1840s in France culminated in the formulation of socialist demands in the *Communist Manifesto* of Karl Marx and Friedrich Engels in 1848. It maintained that the "bourgeois" society could not develop a true democracy because it remained based on the exploitation of the wage earners by the capitalists. Some years before, the Chartists in England had tried to formulate a program of complete democracy without putting any emphasis, however, upon economic demands, confident that general and equal suffrage, annual elections to parliament, indemnities to parliamentarians and other means of making the elected representation correspond as closely as possible to the popular will, would result in economic democracy. Modern socialist movements, however, believed that political means alone were not sufficient and that economic measures were necessary. As such a measure, Henry George urged in his *Progress and Poverty* the introduction of the single tax to absorb the unearned increment in land values. Though important measures have been taken in most countries since the latter part of the 19th century to democratize the economic setup and to make the economically weaker classes participate more fully in social security and in the amenities of life, nevertheless economic democracy is still far from realization.

Ultimately, democracy in its political and economic expressions will always be determined by its strength as a moral and spiritual factor dominating the public mind. Great democratic statesmen like William Ewart Gladstone in England, or great democratic popular leaders like Giuseppe Mazzini in Italy have always understood how to instil some of their own democratic fervour and moral conviction in their people and thus to keep democracy as a live issue. For democracy does not exhaust itself in political techniques or in economic reforms. It is above all a fundamental attitude, a scale of values, a definite conception of man and his place in society. Though the institutions and forms of democracy may differ widely, and in fact do so in the various countries, there are central values which underlie all forms of democracy and determine what may be called the "democratic way of life." These values have been discussed above in the historical development. Here it is only necessary to point out what may be called the method of democracy. It is the method of discussion, of open-minded critical inquiry, and finally and frequently of compromise. Democracy presupposes the existence of opposition as a legitimate partner in the democratic process; it accepts a pluralistic view of values and associations, and it rejects any totalitarian or monolithic identification of the state with one party or with one dogma. But discussion and tolerance must always be held within the framework of the democratic faith, and that means the recognition of the fundamental values of individual liberty and of the equality of all men. Tolerance toward elements which deny the fundamental assumptions of democracy and even its right to existence, would not only be theoretically inadmissible, but also practically most dangerous to the existence of democracy. Democracy has many shortcomings, some of which are inherent in its nature; they can and must be improved and modified by constant criticism and vigilant opposition; they should not be allowed to foster a spirit of unproductive criticism which in its wish to put something "better" in the place of its "inefficiency" or "corruption" or "mediocrity" generally is not clear about the alternative which turns out to be some form of old authoritarianism or master-serf relation. however streamlined it may seem. By its own essence, democracy can never be perfect, because that would presuppose a perfect citizenry, highly educated and never swayed by blind emotion or by inertia. But with all its imperfections, democracy is so far the most human and humane form devised by the growth of western civilization which increases the dignity and the creative faculties of every individual. Its intrinsic imperfections make it the most difficult, most daring and most promising form of human organization.

With the awakening of the masses from apathy to activity, from

immaturity to full stature, democracy creates a number of complex problems which have sometimes been summed up in slogans like "the revolt of the masses" or, applied to former colonial peoples, "the revolt of the east." With the broadening of education, which only a comparatively short time ago was confined to a tiny minority and today practically everywhere tends to include everyone, the level of education necessarily had to be lowered, though the gain on the whole has been immense, not only in the breadth of education imparted but also in its quality. Since their awakening from traditional inertia, the masses have been more easily swayed by emotions; the democratic process of the formation of a collective will is cumbersome and allows the full play of demagoguery and may, in times of emergency, weaken or confuse the national resolve. All these difficulties offered to some an excuse for discarding democracy and for returning to the domination of a selected group, a self-appointed elite, convinced of its divine-grace mission over the '[eternally immature" people. Faced by the complexities of modern life, some wished to take refuge in an apparent "security" by scrapping 300 years of social and intellectual development. Since World War I a number of movements of this kind have arisen, motivated partly by a conscious return to what Oswald Spengler has called "age-old barbarism," an attitude long believed obsolete, partly by a sense of defeatism, of frustration, of discouraged cynicism. Democracy had lost its vigour to a certain extent, had become softened by a preoccupation with material progress and economic considerations. The attacks to which it found itself exposed revitalized democracy and brought about a rethinking of its fundamental values and implications. The difficulties inherent in democracy were realized, but they were understood as a challenge to which. the right response was a deepening and broadening of a regenerating democracy.

The conditions of the 20th century, with its new means of communication and the fast-growing interdependence of all people on a shrinking earth, faced democracy with the problem which is inherent in its conception of human brotherhood: that of establishing a democratic world order which would assure universal peace and the security of democracy in the different countries. The task had been foreseen by Immanuel Kant in his essay on *Perpetual Peace,* published in 1795 under the influence of the first great democratic revolutionary wave. "A state of peace among men who live side by side is not the natural state, which is rather to be described as a state of war: that is to say, although there is not perhaps always actual open hostility, yet there is a constant threatening that an outbreak may occur. Thus a state of peace must be *established."* Kant said that this peace was possible only if each state were what he called "republican," possessing representative institutions, and if the law of nations were founded on a federation of free states. "The intercourse, more or less close, which has been everywhere steadily increasing between the nations of the earth, has now extended so enormously that a violation of rights in one part of the world is felt all over it. Hence the idea of a cosmopolitan right is no fantastical, high-flown notion, but a complement of the unwritten code of law — constitutional as well as international law — necessary for the public rights of mankind in general and thus for the realization of perpetual peace." What Kant foresaw about 150 years ago, what was postulated by the democrats of 1848, became in the 20th century a matter for thoughtful consideration as a precondition for the survival of democracy anywhere. Woodrow Wilson, and with him many democrats in all democratic countries, felt the need and endeavoured to meet it by the creation of a League of Nations. Its close and fundamental connection with democracy was understood by Wilson. In his appeal for it he warned, "I think we all realize that the day has come when democracy is being put upon its final test." In the last address which he broadcast on Armistice Day, 1923, he repeated, "The faith of the world can be set straight only by the firmest and most determined exhibition of the will to lead and make the right prevail." The refusal of the democratic peoples to establish a firm international order, when the victory of 1918 gave them an opportunity, their unwillingness to shoulder responsibility for the common destiny of all nations, made possible World War II which began in 1939, in which democracy was faced with an unprecedented danger fraught with almost unimaginable consequences. Should democracy weather this danger, it will emerge from it profoundly revitalized. It will hold the hope and promise which animated Milton and Jefferson, Kant and Mill, Condorcet and Mazzini, of a peaceful world based upon the liberty of the individual and the equality of all men.

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Theory and Institutions. — Considered as a form of government, democracy usually confronts modern thinkers under two separate aspects: as democratic theory and as democratic institutions, and this division will be followed here. Even as a theory, however, it has undergone a series of developments from the earliest times. Philosophically, it has always suffered from the apparent paradox that under it the people are at the same time both the rulers and the ruled, and this, to many of the ancients, was rather a form of anarchy than of government. Hence Aristotle placed it in the lowest degree of legitimate governments, and the most likely to degenerate into tyranny. The modern concept of democracy, on the other hand, finally emerged as a result of the perennial search for the best and most equitable form of government. Largely as a result of the rediscovery of Aristotle himself, the Middle Ages summed up the qualities of good government under three headings: it must be 'rule for the common good, it must be representative of the community, and it must, in its authority, be immediately derived from the community. Still under the influence of Aristotle, however, the Middle Ages, preoccupied with the idea of unity, considered the monarchy — the rule of one — to be the best form, the one most suited to secure this unity. It is clear to us now, however, that this concept was valid only so long as the monarch was himself ruled by an interior criterion of goodness, and then only in theory. For while the absolute monarchies did not always change into tyrannies, nevertheless, in practice, and in the 15th century, in theory, as a result of the re-introduction of the Roman law, the monarch became absolute in the sense that he, and not the community, was considered as the ultimate source of law, which in turn ceased to be the expression of reason, and became the instrument of the monarch's will, or, more accurately, his arbitrary decision. It was because of this fact, that, as Harold Laski has well said, it was at last discovered that the "only way to respond to the wants of the community was to associate him with the process of authority." In other words, since it had always been agreed that government exists only because of the common good — that is, ultimately because of the perfection of the human personality in its separate individuals congregated into a definite community — it came to be seen that the essentials of good government, as listed above, could not be realized unless those who were governed themselves had a say in the government. Man, therefore, in the 18th century, looked to the community as the means by which that community's good would be achieved.

Once, however, this point of reasoning had been reached, another, and graver, question had to be settled before a sound theory of democracy could be established. If the community was to govern itself, instead of being governed by some ruler or senate, then some justification would have to be found by which the community, or an agency set up by it, would possess the moral right to impose obligations upon the citizens as a whole. The writers of the Old and New Testaments, and the fathers of the church, assumed that the authority of the ruler was in fact the authority of God Himself. Those philosophers who followed Aristotle saw the origin of authority in the natural law,

which amounted to the same thing, since the natural law was deemed to be merely the law of God as discovered in man's nature by human reason. On the other hand, the lawyers, following Ulpian, held that all authority is derived immediately from the people, while admitting that ultimately it came from God the Creator. In the early Middle Ages, following Charlemagne, the authority of the ruler arose as a result of a contract between the ruler and the people, signified by a mutual exchange of oaths. In the 13th century, a synthesis was made of these various opinions, and the community was said to possess the authority from God through the natural law and to have transferred it by a contract to the ruler. There was still no question of the community normally exercising its own authority, though democracy was always considered in theory to be a legitimate form of government. Soon, however, a distinction made between a political regime and a regal regime, one in which either the people or the king was the source of law, opened the way to the rise of the absolute monarchies. Sir John Fortescue tells us in the 15th century that in his time the political regime survived only in England, while on the continent generally it was the regal regime that held sway. The influence of Machiavelli, with his rigid concept of the absolute ruler, quite universally entered into political theory. In spite of the opposition of Richard Hooker, who looked to the older European tradition for his inspiration, England at last under the Tudors and then the Stuarts succumbed to the idea of the regal regime in an exaggerated form. It was Thomas Hobbes who made himself the philosophical protagonist of this theory. Meanwhile on the continent, a reaction against absolute rule had set in in Italy and Spain under Roberto Bellarmine and Francisco Suarez, and an attempt was made by these Jesuits to restore the mediaeval doctrine of a justification of political authority by seeking its immediate origin in the community itself. In England, in turn, the old Whigs, and the writers Algernon Sidney and John Locke (q *v.*), both frankly basing their contentions on the older European tradition, sought the justification of authority in the compact by which a number of human wills concurrently seek the common good. The Scottish school of common sense, under Buchanan and Reid revived in Great Britain the older concept of the natural law, by which man, being a social animal, derives his rights from God and sets up a society to safeguard these rights. Still later, however, we find Jean Jacques Rousseau in France resurrecting the old patristic idea that it is unworthy of man to obey another man. He gave it the subtle twist, however, that whereas the fathers of the church held that we obey only God when we obey the state's laws, Rousseau, rejecting the source of authority in God, was driven to see it in each man's own will, and so, by his concept of the general will, he held that when a man obeys the political authority he is really only obeying himself, inasmuch as his own will is contained in the general will by virtue of the social contract. On the other hand, the theorists of the American Revolution, Whigs like James Madison, James Wilson and Alexander Hamilton, trained under the Scottish school. took the stand of an objective obligation to obey arising from man's own nature as a social and political animal, and the consequent placing of sovereignty in the people itself. In this they were abetted in England by Edmund Burke. It remained for George Washington, in his farewell address, to express this idea in a lapidary sentence: "The very idea of the right and power of the people to establish government presupposes the duty of every individual to obey the established government." This is the ancient doctrine of the essential correlation between rights and duties. It implies a mutual responsibility between state and individual, in which man, by his nature as a social animal, seeks from the state his perfection as a person, and the state in its turn seeks from the individual that co-operation by which it may contribute to the perfection of every other individual. It was this concept, as expressed by George Washington and others of his time, which gave to the American system its distinctive character, for it solved once for all the problem of the moral right of the people as a sovereign to command the people as subject.

Equally important in the development of democratic theory is the evolving notion of the necessary limitations on political authority which are required if government is to realize its essential function of caring for the common good. In the early days of western civilization this limitation was purely internal and spiritual. The ruler was the representative of God and should do nothing in his regime that was contrary to the will of God; that is, nothing that God would not do if He were the direct ruler. This internal sanction was a powerful incentive as long as rulers voluntarily accepted the moral teaching of the church. It persisted, as a matter of history, only as long as did the influence of churchmen on rulers. It was a mediaeval tradition that lasted even into the American colonies, particularly Massachusetts and Virginia. In the course of time, it gradually became clear that some external sanction was necessary as well. Yet, while the need for limitation was clear, the visible means to this end were not so clearly discernible. The mediaeval contract between people and ruler was fairly efficient. In the hands of a man like Manegold of Lautenbach it became in fact a powerful instrument for holding the ruler to his duties as a servant of the people; for by his defying of the contract, the ruler became, in this theory, no longer a king, but a tyrant, and hence the people were by that very fact absolved from their allegiance to him and to his government. Outside of the imperial faction, political writers quite generally held, with Isidore of Seville, that the ruler is bound by his own laws; and the *lex regia* of the old Roman law was interpreted in the Middle Ages to be the law by which the people set up a ruler and established the precise limits within which he could rule. We have here, moreover, the first germs of constitutional rule, which was later to become so important in democratic theory. This development, however, was temporarily retarded by the rise of the absolute monarchies, but as Laski has observed, if it had been allowed to continue, it would have introduced democratic institutions much sooner in the history of western Europe. It remained for the American theorists to see the precise application of constitutionalism to self-government as the only external means to ensure that the ruler or government will be wholly devoted to the common good. According to these, it is the people who give the constitution. and the appointed ruling agency is held in its administration within the rigid limits of its letter. subject to the right of the people at any time, by appropriate means, to enlarge or constrict the powers which it has granted. In this theory, again, three things are done by a constitution: the requisite consent is granted by which a people constitutes a state; a form of government is chosen and set up; and to this government, the incumbents of which are later to be elected, certain rights are granted, and at the same time, definitely limited. Thus the ancient theory of the necessity of limitation of government within the consent of the people was made actually feasible by the democratic theory of a popular constitution. The example of the American colonists in adopting a constitution was followed in the French Revolution. On the other hand, in Great Britain, the claim is also made for a constitution, on the grounds that the commons, the ruling agency, is at any time restricted by the powers which, for the occasion, the people, through its representatives, are willing to grant. Thus, in that system, while the constitution is not written, it is nevertheless considered to exist as a definite limitation of power on the ruling agency.

Other limitations, however, had to be placed upon authority before a constitutional democracy could become possible. These, like the mediaeval one of justice in the ruler, are in the internal order; but, unlike the earlier limitations, they regard the community rather than the ruler. The principles of these are two: liberty and equality. Liberty, as a political idea, has always had to struggle between two opposing concepts of its meaning. The ancient idea, as expressed, for instance, by Aristotle, Augustine and Aquinas was that liberty is the right of the members of the community to be ruled in their own interest. This remained the controlling theoretical idea of liberty for many centuries, whatever the practice may have been at various times. Later, however, and especially after the Renaissance and Reformation, another idea came in to dispute this earlier concept. According to this idea, the autonomy of the individual in the political society is stressed, and liberty implies the right of the individual to settle his own destiny, in complete freedom from any outside influence. Liberty, therefore, is in eternal antithesis to authority, and the subsequent political problem has been how the two can be reconciled. It has been seen how Rousseau ingeniously evaded the difficulty by his concept of the general will, through and in which the individual merely obeys his own will under political authority; but his solution was not generally adopted. The American revolutionary theorists reverted to the earlier theory, by which government was accepted as a normal and necessary natural institution, but was subjected to the needs of the community. Under this theory, liberty is the complement, not the antithesis, of authority, and liberty under the law became an American slogan and legal axiom. Authority existed for the very purpose of safeguarding liberty. The citizen is free under this interpretation, when he sets up his own government and when this government operates for his own interests, not the interests of the ruler or any privileged group. Here again, the development of a traditional idea resulted in a theory that was reducible to practice, as we shall see.

Closely allied to the idea of liberty in democratic theory, is the idea of equality. The early Christian idea, inherited from the Jewish tradition, and enunciated by Jesus and elaborated by St. Paul, was that all men are equal before God, being descended from the same first parents, who were created by God, and being redeemed by the death of Christ, and hence are all brothers and can boast no inherent distinction one over the other because of race, fortune or other accidental inequalities. On the other hand, the ancient pagan tradition, both Greek and Roman, with its civilizations economically based on human slavery, maintained the existence of essential inequality between different classes of men. As the Judaeo-Christian doctrine gradually took possession, equality became a fundamental tenet in theory, and the much-quoted dictum of Pope Gregory the Great (590–604), that "all men are by nature equal," was maintained as the universal teaching for many centuries. This equality, however, remained what may be called passive equality; it meant that originally all men without exception enjoyed liberty, the right to be ruled in their own interests. It was, therefore, essentially a conscientious limitation on the power of the ruler, and was achieved only when he accepted the obligations which it laid upon him. It did not formally include the right of the individual to participation in government itself. The axiom laid down by Aquinas in the 13th century that "all should have some share in the government" was new for his time and did not bear fruit for many centuries. It took long thought before western man actually saw the implications of his own teaching, and it was a teaching, of

course, that was absolutely nonexistent in the east. For this reason, political equality, even under the enlightened English theory, remained only a partial right until the 19th century; it was an equal right shared by only a portion of the population. Once again, it remained for the republican theory originating on the American continent during the colonial period to perfect a system which would make it ultimately possible for an active equality of universal participation in government to become a reality. The equality practised by the French Revolution, while more extreme, was in reality a historical development posterior to the American experiment, and undoubtedly influenced by it. Even then, however, as we shall see, in practice it took a generation before universal suffrage became the ultimate conclusion from the postulate of equality.

Intimately connected with the notion of political equality in a democracy is that of social equality. In a negative sense, this latter is usually taken to mean that hereditary or financial distinctions do not entitle individuals to special privileges in public life or before the law; and particularly that social inequalities do not constitute a title to political power. Such an equality in the social sense was an achievement of both the American and French Revolutions, though inequalities did not disappear in Britain until the liberal reforms of the early 20th century. Social equality in a positive sense rather pertains to a consideration of democracy as a way of life, and is treated below. On the other hand, in recent times, a more fundamental question has been raised: whether a theory of political and social equality is sufficient to constitute a real democracy. It has been argued that economic equality as well is essential to the establishment of political equality, since a wide distribution of material goods is necessary to the stability of a democratic state. Those who defend this position, however, still show a broad gradation from those who look on economic equality as merely equal economic opportunity to acquire goods, all the way to those who advocate actual equal possession of goods through the medium of membership in the all-inclusive state. Actual economic inequality has persisted, even in theory, up to our day as the controlling doctrine in democratic countries, due to the quite general identification of democracy with the 19th century theory of laissez faire or economic liberalism, by which liberty is interpreted to mean that industrial entrepreneurs, owners and employers are exempt in their purely economic activities from governmental interference. This theory has necessarily resulted in the wide inequalities of possessions and even of opportunities which give one portion of the community a disproportionate share in political power. It is for this reason that many think that democracy ultimately will be preserved only on the one hand by divorcing its concept from that of economic liberalism, and on the other by finding a solution somewhere in the middle between the two extremes mentioned earlier in this paragraph; namely, by creating institutions within the democratic framework in which there would not only be equal economic opportunity for all, but in which it would be guaranteed.

A further question that has been raised on the question of equality concerns the extent to which it should be applied in a democracy. Should it be restricted only to the white populations which form the controlling groups in their respective countries, or should coloured populations, at home and in the colonies, also come under its protection? In the 19th century and the early 20th, there was no question but that the home white population considered that equality applied to it alone, so that democracy appeared as the sole monopoly of the original white democratic countries, while eastern and southern Asia and Africa were implicitly excluded from it, along with indigenous coloured groups within the other parts of the world. The inherent contradiction in this latter position has been perceived only in relatively recent times. If political equality lies at the base of democratic institutions, as most now believe, then no man, whatever his colour, is excluded from its benefits, for equality is a human relation, not an accidental one. This is a question which, as a result of the events of World War II, has become increasingly important in the world at large, but is still more crucial in the United States itself. It became clear that democratic government, like any good government, but even more because of its profession of equality, must be conducted in the interests of the whole people under it.

As the conviction emerged more and more clearly that the original concept of government for the common good was not secure in the hands of even the enlightened absolute ruler, when this ruler abandoned allegiance to an objective moral order, the question arose as to how far individuals should be associated with the process of authority. As a matter of fact, therefore, the history of democracy is largely the history of the inclusion of more and more of the inhabitants of a given country in the exercise of power through the ballot. There are various theories concerning the title of the individual to a right to a place in the electorate. While a logical theory of democracy would seem to place this title in the possession of citizenship, or even in the mere fact of membership in the state, it must be admitted that the hitherto controlling theory of the electorate looks on the right to vote as a privilege extended by those who already have that right to those whom it chooses to include in the right. Thus, while we usually look on the government of Britain as a democracy after the great revolution, and also consider the United States as a democracy after the adoption of the constitution, if not before, nevertheless in both countries for many generations the right of the ballot was restricted to property owners. It was only gradually that voting powers were extended to all citizens as by right, and even then under various restrictions. Also, nonnaturalized members of the state in all democratic countries are considered as not possessing the right to vote, though the United States has gone so far as to include the total number of inhabitants—citizens and noncitizens—in computing the size of a constituency.

Until the early 19th century the word "democracy" was usually restricted to what was properly called "pure democracy"; that is, a government in which the whole people itself exercised the direct power of legislation when gathered together at one place for that purpose. It is the town-meeting idea on a national scale. It was always clear, however, that such a kind of democracy was possible only when the group was sufficiently small to meet all at one place. In a nation of any size, it was necessary to find another means by which the people could rule without taking part in every immediate step of the process of authority. It was thus that the idea was gradually adopted of choosing a certain number of agents, or representatives, who were numerous enough to take the place of the whole people and few enough to meet at one place. The mediaeval Spanish cortes, the French estates general, the English commons, were examples of this kind of representation, but ordinarily for a relatively limited purpose, the voting of moneys to the monarch for his wars or public works. When, with the gradual overthrow of the English monarchy, the commons assumed a political function, the theory of representation took on an entirely different form. In the American constitutional convention, many speakers denounced what they called democracy, a dictatorship of the proletariat which they attributed to the Levellers. It was for this reason that the writers of the *Federalist,* who saw that what they knew as democracy was an impossibility, due to the great extent of the Atlantic coast and to the many special interests prominent in the nascent states, chose rather to give their representative system the name of republic.

The final step in the evolution of the theory of democracy, therefore, involved the settlement of the nature of representation. The mediaeval notion of the ruler as representative of the community was restricted to his internal obligation to look out for its interests, and did not include the continuing power of the people to operate through him. In other words, political equality was passive, not active; it implied the right to receive the benefits of government in an equitable way, but not the right to secure those benefits for themselves by direct action. It is true that Aquinas, in consequence of his axiom that all should have a share in government, held that both the supreme ruler in his ideal state and the subordinate governors should be elective, but his thought was not generally accepted in Europe until the 16th century. Also, while it was generally held that the ruler merely exercised the authority which was the community's, there was, as Carlyle has shown, considerable debate as to whether the community irrevocably handed over its power to the ruler, or could, under certain circumstances, recall it from him. It was not until Bellarmine and Suarez adopted the doctrine of the power of recall that continental thought generally gave hospitality to the notion, in spite of severe opposition in conservative quarters. In England, opinion was equally divided, with James I and his followers holding that power was not even derived from the people and hence could not be recalled by it, while Hooker, Coke, Sidney, Locke and the old Whigs generally held to the ancient tradition. Later, the theorists of the French Revolution, with their inherent hesitation as to whether any political authority was legitimate, except as an artificial and necessary expedient, logically restricted political power to a temporary exercise of physical force. On the other hand, the makers of the American constitution, especially James Wilson and James Madison, the latter writing in the *Federalist* papers, were of an open mind, in theory, as to whether the elected rulers should remain in power "for good behaviour," that is, for life—as long as they satisfied constitutional guarantees—or should be elected for a stated period. It was the latter theory that triumphed. Thus periodical accountability of the representative to his constituency became an essential element of American democratic theory. It was natural that this should happen, for if democracy really means that the people rule themselves, it is not sufficient that government officials simply be elected by the people, even by universal suffrage; they must, at stated intervals far enough apart to be consistent with efficient government, be recalled to account for their actions to the people.

With this point settled, however, it still could not be said that the representative principle had been thoroughly settled. There remained the further question as to the function of that representation. Was it intended to be merely a registering of the majority will of the constituency at a given period, or was the representative elected on the understanding that he be free to use his own best judgment as to the proper means to be adopted for a commonly accepted end? It was the latter theory, as expressed by Edmund Burke in the Bristol speech, which was incorporated into the American system, as it had been adopted by the English. It was the theory of the lawyer, as agent for his principal, who, in his superior knowledge, experience and opportunity, is expected to take the best means to achieve the end which his client desires. Thus, in the political field, it is the constituency which adopts the end to be achieved, while the representative is expected to choose the means which he deems the best suited for that

end. This theory, however, it must be said, is not universally accepted in the United States, especially in the west, where the initiative, referendum and recall have entered into political thinking. Under this opinion, all public officials, even judges, must at any given moment merely register the existing will of the majority of the constituency. The partnership between people and representative, therefore, under this concept, is not one of principal and agent, but of a principal and his messenger, where the principal chooses the end and means.

This question concerning the function of the representative, moreover, involves another: namely, that of the rights of a majority in a democracy. Here the continental and Anglo-American theories are again in conflict. In the third French republic, for instance, under Gambetta and his followers, the majority acquired absolute rights through election, and it was expressly declared to be a derogation of the liberty of the majority to demand that account he taken of electoral minority demands. In the United States particularly this theory has always been considered to be an essential weakness of French republicanism, a weakness that has been reflected through French influence in many Latin-American countries which have adopted democratic institutions. In the American theory, there is an implicit contract in the electorate before each balloting that the eventual minority shall abide by the results of the election, so that each election becomes, post *factum,* a unanimous one, since the whole constituency agrees to the choice of the winning candidate. The important result of this implicit contract is that after the election the representative, once elected, represents, not those who elected him as a majority, but his whole constituency, including the minority. Thus under this theory, in the American system, the whole people, at any given moment, actually governs through its elected representative. It is this theory that has protected the democratic system of the United States from periodical revolutions engineered by discontented minorities which refuse to abide by the results of the balloting and have no other recourse to secure representation except by violence in their own interest.

A final question in democratic theory concerns the right of any people, even under an absolute ruler, to change its form of government. The right of revolution has been in at least a part of the tradition of western civilization since mediaeval times. The theory of contract between people and ruler implicitly involved the right of the community to free itself from a despot who violated his part of the pact by refusing to rule for the common good and turning his government to his own personal advantage instead. The natural-law theory derived by the Schoolmen from Aristotle made justice the fundamental virtue of government and hence voided the title of any ruler whose regime turned into injustice. With the rise of the active equality of all members of the state to participation in deliberations for the common good, the right became explicit. Since both the form of government and the choice of an incumbent in office lay, by hypothesis, within the consent of the people, the community obviously possessed the right to transform itself to another form or to choose other governing officials within the existing form. However, it must be noted that various modifications of this right have been introduced as a result of the modern identification of democracy with a constitutional representative republic. Under this development a republic is intolerant of any fundamental political change which is not carried out according to constitutional provisions, and violence in the course of such a change is particularly forbidden. It is doubtful, however, if any democratic republic would countenance a change, no matter how introduced, which would make it cease to be a democracy. To this extent, any form of government, even a democracy, is totalitarian; namely, that it demands that its members accept its own essence, and will tolerate proposals of change only within the framework of that essence. While the third French republic licensed a political party which demanded a return to the monarchy, such a party would probably not be deemed constitutional in the United States, which guarantees a republican form of government even to the separate states. Here, also, the communist party creates a definite problem; for, while it calls for a revolution which would ultimately essentially transform our type of government (the "withering away" of the state), it necessarily professes to do so by constitutional means, and hence has hitherto been tolerated on this understanding. It remains true, however, that even a democracy cannot, or at least would not, tolerate a form of political agitation for naziism, for instance, which openly professes to intend to do away with democracy altogether.

Democratic Institutions. — The fundamental institution in every modern democracy is the constitution, whether this be a written one, as in the United States and many other countries, or an unwritten ope, as in Great Britain. Such a constitution really performs three functions it expresses the consent by which the people actually establish the state itself; it sets up a definite form of government; and it grants and at the same time limits the powers which that government is to possess. The British constitution, which is an unwritten one, is really at the present time the sum total of the powers which, at any given time, under the doctrine of the omnipotence of the parliament, the commons, as the direct representative of the people, considers itself to possess. It necessarily differs in content from time to time. On the other hand, a constitution of the type of a federal republic like the United States is the sum of enumerated powers of which the several sovereign states have divested themselves and which they have deposited in the central government. The several states themselves have also adopted constitutions, though it is generally held that, unlike the federal government, the state governments have all the powers which accompany sovereignty, whether they are enumerated in the constitutions or not, except those which they have surrendered to the government in Washington. Other more centralized republics possess constitutions which are not lists of enumerated powers, but which profess certain general political principles and leave a wide latitude to the legislature and the executive.

The principal functions of any government are three: legislative, executive and judicial. The concrete political institutions in any given country, therefore, will be those which exercise those functions, and also those which contribute to these three. In ancient tradition, these functions were usually combined in the person of a king or the senate, and theoretically, they could also be combined in a democracy in one institution, provided that that institution were subjected to periodical accountability to the electorate, which, as we saw, is essential to any notion of self-government. In practice, however, such a concentration of power could hardly be called a democracy, though it could be called a representative government. All modern theories of government demand that the judiciary be separated from the executive who is entrusted with the administration of the laws. Democratic theory, moreover, which considers the power of passing laws to be the heart of any government, requires that the community as a whole be, as directly as possible, associated with the process of legislation. Separation of the legislative from the executive is not considered to be an essential of democracy as such. In modern political literature in English, Locke is usually credited with pointing out the distinction between the three powers, though he himself was well aware that he was merely repeating the ancient Roman and mediaeval doctrine, while Montesquieu is probably the first who actually suggested their separation. This suggestion was followed out in the American constitution, principally as a reaction against the confusion between the three powers which had taken place in the English parliament and which was the real cause of the grievances of the colonies. As a result, in the United States, the government, properly so called, is not the president nor the congress nor the court, but all three taken together. The president and his departments in the executive function are properly denominated the administration.

The simplest form of a direct association of the people with the making of laws is that in which the whole community (usually adult male) not only chooses by vote the ends to he pursued, but actually chooses the means to achieve this end and embodies them in laws; in other words, the town meeting, as we know it, while the execution of the laws was entrusted to an elected official (bailiff, sheriff, consul, mayor). Since, however, as has been said, this type of government is feasible only when the population is so small that it can be present at the same time and place, and hence in larger communities the only practical means of giving the people control over legislation is a deliberative body which is elected as representative of the whole community and is small enough to meet at one time and place. The deliberations of such a body could thereupon be presented on each occasion to the community for its approval or rejection, or the representatives could be empowered to enact them into law immediately. It is thus that a parliamentary form of legislative body has by tradition and experience been identified in practice with democracy. Moreover, in a democracy, this parliament could also be entrusted with the execution of the laws, and this is the system which, with the rise of parliamentary supremacy, developed in Great Britain, where the executive, the cabinet, is merely a committee of the commons, and is chosen by the majority party, and also in most other democratic systems. In the United States, as in Britain, a bicameral body constitutes the legislative branch, which, however, unlike Britain's system, is completely separated from the executive branch. Moreover, once again in accord with the mediaeval tradition, the monarchical principle was deliberately preserved in the American system, and the executive of the laws was made one man, the president.

In all the various systems of representative government the obligation of periodical accountability to the electorate has been maintained, hut in varying degrees. Mostly a fixed limit of several years has been set beyond which the parliament must seek a new mandate from the people, with the intervening obligation imposed upon the cabinet, if it loses the confidence of the majority of parliament in a matter of importance, to resign, or go to the country for a new election, or both. Here again the American democratic system departed from precedent. The president is elected for four years, and is recallable only after impeachment and a trial before the senate presided over by the chief justice, with a two-thirds majority necessary to secure his removal. He is not, therefore, as in Britain, subject to a fluctuating congressional majority. In the congress, one-third of the senate is elected every two years, while the house of representatives is elected in totality every two years. It was hoped, with reason, that this overlapping recourse to the people would introduce an element of quasi-automatic stability not present in other systems. In the same way, the conception of representation has also varied in different democratic systems. In Britain, in the third French republic, and in other regimes modelled upon them, the executive is directly responsible to the legislature, since it is really only a part of the latter body, which is directly chosen by the people. In the original form of the American system, the president was chosen by a body of electors, who had

free discretion as to whom they might choose, and hence he was not the immediate choice of the people. The senate also was not immediately chosen by the general electorate of the various states, but by the state legislatures, to whom, therefore, the senators were directly responsible. Only the lower house in the American system was to be elected by popular vote. In the case of the president, and largely as a result of rigid party control, the constitutional provision has been nullified, the electors have lost their discretionary powers, and hence for all practical purposes, he is elected by a direct popular vote. Popular election of the senate was introduced by the 17th amendment (adopted 1913). Only the federal judiciary, in the American system, is theoretically independent of the will of the community, though the popular philosopher, Dooley, has expressed the current opinion, that "the supreme court follows the iliction returns." Due to the fact also that the supreme court justices have been ordinarily appointed at a relatively advanced age, the president who is elected for two terms or more is in a position to appoint incumbents who more or less adhere to the policy of the contemporary majority party. The United States supreme court, however, has been noted for maintaining the civil rights of individual citizens, no matter what general social or economic philosophy its members profess.

Electoral systems in a democracy have also varied in different circumstances and lands, and at different times in the same land, in accord with varying theories of the nature and extent of representation itself. No electoral system, apparently, has included the whole population. At different times, the electorate has been considered either as an attribute of citizenship, a vested privilege, an abstract right, a function of government or a means of expressing human personality, but in general it can be said that the modern tendrncy has been to include as far as possible all the adult population in the number of those who are entitled to express their preference for their representatives. Moreover, with the abandonment of the earlier idea that the family is the essential unit of society, it was quite in accord with this tendency that the head of the family, the husband, should lose his unique prerogative; and so woman suffrage was introduced in the United States by the 19th amendment (adopted 1920) and in its complete form by Great Britain in 1928. All electoral systems in early days, including the British and American, restricted the ballot to property owners, and it was only gradually that universal adult suffrage has been adopted. Meanwhile, also, constant attempts at restriction have been practised. For many years, the "grandfather clause," excluding from the polls those whose grandfathers had been slaves, was a disqualification in southern states in the U.S.A., and at present writing (1942) the poll-tax qualification, by which the very poor (mostly Negroes) are excluded from voting and jury duty in a dozen states, is a matter of intense controversy. Other restrictions have to do with registration, with extended periods of domicile in the respective voting precincts, and other similar forms of exclusion through legal means. Intimidation of rurai or industrial employes has also been widely practised. It has always been assumed that the electoral system should be free of all special influences, and hence that the free ballot necessarily means a secret ballot. In those countries in Europe and elsewhere with democratic regimes in which the political parties themselves supply the ballot outside the polling places, this secrecy has been necessarily absent. The United States system, in which local government itself prints and supplies the ballot or a voting machine, is probably the best way to secure secrecy. Many so-called plebiscites which in totalitarian countries the ruling regimes have designed to give a colour of legitimacy to their revolutionary movements have lacked secrecy, and hence freedom.

In modern times, the party system has been considered a necessary if not an essential element of democracy. The early history of Great Britain and the United States does not bear out this contention; but it can be said that modern practice is all in its favour. In these two countries, in the 19th and early 20th centuries opinion was also in support of the two-party system (liberal and conservative; republican and democratic). In most other democratic countries, however, a multi-party system has prevailed, through each of which not only are social and economic ends promoted, but also different means to the same end. This fractional division has the disadvantage, from the English and American point of view, of establishing "blocs" of minor parties, with a consequently excessively fluid composition of majorities, and a too frequent change of ministries. This tendency to fractional representation has been further accentuated by the movement for proportional representation, by which, in deliberative assemblies, each political group presenting candidates receives a number of representatives in proportion to the number of voters which supported it at the elections. In this way, even relatively small minorities are directly represented, instead of the constituency representation which has been customary in the United States. In some countries, for instance in Great Britain, the party secretariats, in preparing lists of candidates to be presented, take care that in the total number of them are contained specific representatives of the various profession? and branches of industry and commerce. Another type of functional representation has been proposed by some socialist groups in which regional constituencies would be abolished, and only professional and industrial groups would be represented in legislative bodies. In Great Britain for many years, and in the United States in some localities in recent years, labour parties have been created on the theory that such third parties would give the working classes a strong balance of power, since they would draw off to themselves the left wings of both major parties. As has been said, in democratic countries only those parties can in theory be tolerated which accept the democratic regime, or if they wish to change it fundamentally, aim at doing so by constitutional means. There has, however, by tacit consent been no concerted movement to test this theory, probably because such parties (Action Française in France, Communist parties in Britain and America), have never reached such proportions at the polls as to constitute a serious menace to the existing status.

A final institutional characteristic of most democracies is equal educational opportunity. While universal popular education is a relatively new institution, even in democratic countries, including the United States, it is now generally admitted that at least elementary education should keep pace with the extension of the franchise. Since theoretically the ultimate source of political power in a democracy lies in public opinion, the ability to read has always been considered a necessary qualification of the citizens of a democracy. It has usually been held, therefore, that popular education in a democracy, at least of an elementary kind, should be made compulsory by law. The democracies, however, unlike the totalitarian states, have never presumed to dictate the content of the education to be given, and so under them the schools are free.

Democracy as a way of life.—Considered as a way of life, democracy is a subjective attitude by which the members of the community are led to secure to every one his rights, to look upon all fellow citizens without distinction of colour or race as brethren in a common enterprise, and to give spontaneous support to projects which enhance civic excellence and promote the general welfare. In this sense democracy approaches the "virtue" which the old philosophers and the Founding Fathers of America considered the principal characteristic of citizenship, and is akin to the mediaeval "justice" by which all members of the community were to co-operate by joint action to give each one his due. In this sense, therefore, democracy is not necessarily allied either with democratic theory or democratic institutions, but could exist under any form of government. It is, however, one of the more valid claims of democracy that only under it can these civic virtues flourish to their full extent, because only under democracy do there exist those institutions through which those virtues may exercise themselves. These institutions are. a popular constitution, a parliament of some kind, universal suffrage and a disciplined party system. Through these an active equality of persons exists by which the individual citizen is associated with the process of authority. This equality places upon the individual that responsibility which in absolute systems is laid upon the ruler. The individual, therefore, as ruler, must himself possess and exercise all those virtues with which the ideal ruler in all political literature has been endowed. In a sense, therefore, democracy professes a philosophy of life in somewhat the same way that the totalitarian systems of modern days profess one. Implicit, however, in this philosophy is a personal freedom exempt from the dictatorship of intellect by which the total systems maintain themselves. In other words, freedom of conscience and freedom of expression are its necessary components. Along with these freedoms, is also included economic freedom, at least if by that term is understood freedom from dictation to the political process by purely economic forces, and a more nearly equal opportunity to the members of the community to acquire the goods of the earth. (W. PAS.)

DEMOCRATIC PARTY, founded by Thomas Jefferson, the third president, the oldest continuously existing political instrumentality in the United States. Though up to 1929, it had since the Civil War been successful in but four presidential elections, for more than half the 140 years since the first president was chosen it directed the destinies of the nation, and even when out of office has not been altogether out of power. Its original name was the Republican party and the day of its birth has been definitely fixed as May 13, 1792, that being the date of a letter from Jefferson to Washington in which is made the first authoritative claim of a name for the party of which the former had become the recognized head. Actually the seeds were sown in the Constitutional Convention of 1787, when the first battles were fought between those who wanted a strong, centralized, federal government and those who wanted the least possible federal government consistent with national security. In the debates of that convention can be located the Democratic germ plasm, the ultimate growth of which under Jefferson's genius was the establishment of a party whose theory aimed at direct popular control over the government; which championed the rights of the masses and was really democratic in theory and in fact; which was based on the fundamental belief that the people are capable of governing themselves; which aimed at the widest possible extension of the suffrage and the fullest measure of personal liberty consistent with law, order and the national welfare; which was against all sumptuary laws; which favoured the strictest

interpretation of the constitution and the conservation of the rights of the States; which opposed the centralization of power in the Federal Government; which believed in equal rights for all, special privileges for none, and stood militantly for religious liberty, free speech and a free press.

Though this new party was an organized and militant force in Congress in 1792 it was not until 1800 that it secured control of the government with the triumphant election of Jefferson as president and the complete rout of the Federalists under Alexander Hamilton, who typified the other political point of view as completely as Jefferson did the democratic. For 40 years from the first election of Jefferson the Democratic Party was in continuous control of the government, during most of that time almost without opposition. In 1840 it lost to the Whigs but through the death of President William Henry Harrison, Tyler succeeded to the presidency and became more of a Democrat than Whig. It regained control in 1844, lost in 1848, came back into power in 1852 and remained in until its historic split on the slavery rock in 1860, followed so quickly by the Civil War. It may therefore be said that with the exception of four years the Democratic Party was in practically complete control of the government from 1800 to 1860. During the first quarter of a century it was almost completely dominated by Thomas Jefferson, its founder. In his first inaugural address he beautifully enunciated its fundamental concepts and principles, most of which have years ago become embedded into the political institutions of the country, accepted by politicians and public men regardless of party. Jefferson, after serving two terms, selected as his successor, perhaps his closest friend, James Madison, and was chiefly instrumental in making James Monroe, undoubtedly his next closest friend and political disciple, the successor of Madison.

Though Jefferson founded the party on the principle of popular government and his influence and power as party leader lasted longer than that of any other individual in the country before or since, it was not until 1828 that the people really came into power, that the party became democratic in fact as well as in theory. With the election of Andrew Jackson, the second towering figure in Democratic party history, the people really took over the government which had up to that time been practically held in trust for them by leaders such as Jefferson and Madison, who, while democratic in political thought, were as individuals aristocratic in birth, breeding and environment. They believed in popular government but it was Jackson who really put it into effect. It is also true that beginning with Jefferson, each Democratic president of his period found it essential to depart from the strict construction principles of the party, the first instance of which was the acquisition of Louisiana, an undoubtedly wise and popular step, but one for which there was in fact no constitutional warrant. It has since that day been a not infrequent habit of the Democratic Party to repudiate at least one of its basic principles—local self-government or State's rights—and to this fact is traceable no small part of its troubles. Under Jackson, however, it swung back to its original strict construction basis. Under Jackson for the first time the people really participated in politics generally. By this time the restrictions surrounding the suffrage had been largely removed, and it was the mass sentiment favouring Jackson that swept him into power. Under Jackson for the first time the politicians began really to reach the people and to play to public sentiment. Under him the first real political machine was constructed with, for the first time, what has been called "the spoils system," by which the federal offices were distributed as a reward for party service. Though his power did not last as long, Jackson was during his two terms as completely the leader of his party as was Jefferson and long after he went out of office he remained a popular idol. He was not only the champion of the common people but he was one of them. His administrations were tempestuous and the party battles in which he engaged dramatic and bitter. The two great fights of his career as president, both of which he won, were, first, that to abolish the second United States Bank, and second, to crush the defiance of the Federal Government by South Carolina, where, under the leadership of his arch enemy, John C. Calhoun, resentment over the tariff laws led to a seditious effort to make the nullification issue a real national menace. Jackson's Nullification Proclamation, which broke the nullification movement had a ring and a fervour such as no other defence of the Union has contained. It is one of the country's imperishable documents which, like the Monroe Doctrine, the Democratic Party treasures as having been given to the nation by a Democratic President. It should be mentioned here that it was not until after Jackson's election in 1828 that the party name really changed from Republican to Democratic. During the Jackson campaign his followers began to call themselves Democrats and by his second election the name was in general use.

Between 1836 when Jackson, then an old man, retired, and 1860, though there were four Democratic presidents—Van Buren, selected by Jackson, Polk, the first "dark horse," Pierce and Buchanan—the real Party story is the story of its futile struggles to avoid by ignoring it, the slavery issue, and of the inevitability of the great smash which so badly wrecked the party that it was 24 years before it again elected a president. After the Van Buren administration the party more than ever became dominated by the South, which was unshakably convinced that its economic and social as well as political interests were bound up in the preservation of slavery. The fight of the South was for the extension of slavery into new territory as the one way of retaining its political importance and avoiding being overwhelmed by the great industrial States of the North and West. To further this end, the Democratic Party, under compulsion from the South, repudiated its basic principle. It insisted upon the broadest possible construction of the Constitution in order to force slavery on the new States or territories and then applied to them the most rigid possible State's rights doctrine in order to preserve slavery from constitutional interference. By 1850 the slavery issue had advanced too far to permit again any such tacit agreement not to discuss it as had obtained for so many years following the Missouri Compromise. The effort was, however, made in the Compromise of 1850, proposed by Henry Clay and accepted by the Whigs as well as the Democrats, and in both the 1852 and 1856 Democratic national conventions the stand was taken that the issue had been settled. But that idea was absurd. However completely the political parties might ignore it in their platforms, the one absorbing question in the country was the slavery question. The final crash came in 1860. When the delegates to the Democratic convention of that year assembled in Charleston, S.C., on April 23, they were in a highly emotional state. The fight came over the platform. The majority report of the resolutions committee setting forth the point of view of the South was as follows:—

"Resolved.—That the government of a Territory organized by an act of Congress is provisional and temporary; and during its existence, all citizens of the United States have an equal right to settle with their property in the Territory, without their rights, either of person or of property, being destroyed or impaired by congressional legislation.

"2. That it is the duty of the Federal Government, in all its departments, to protect, when necessary, the rights of persons and property in the Territories, and wherever else its constitutional authority extends.

"3. That when the settlers in a Territory, having an adequate population, form a State constitution, the right of sovereignty commences, and, being consummated by admission into the Union, they stand on an equal footing with the people of other States; and the State thus organized ought to be admitted into the Federal Union, whether its Constitution prohibits or recognizes the institution of slavery."

These resolutions were vital to the Southern delegates. When the convention, dominated by Douglas delegates, rejected these resolutions and adopted a minority report ignoring any specific slavery declaration, half the Southern delegates bolted the convention. Eventually, after adjournment and reassembling in Baltimore, Stephen A Douglas of Illinois was nominated for president by the Northern wing, left in complete control. The bolters finally met in Richmond, adopted the rejected majority

report as a platform and nominated John C. Breckinridge of Kentucky and Joseph Lane of Oregon by unanimous vote. Thus stood the party, wrecked, ruined, exhausted by internal struggle over a great moral issue and foredoomed to defeat. The newly formed Republican Party with its clear-cut stand against the extension of slavery, won its first great victory.

Though Lincoln did not get a majority of the popular vote he received a great majority in the electoral college, and the Democrats not only lost the presidency' but control of Congress as well.

From 1860 to 1940 the Democratic Party has been in power only 24 years—in complete control of Congress about half that time. With the Civil War it changed from the majority into the minority party and in the 80 years from 1860 to 1940 it has been defeated 14 times in presidential contests, successful seven. One of these defeats—that of Samuel J. Tilden in 1876—it is true was not really a defeat but a victory. though the party was deprived of its fruits. The enfranchisement of the Negro that followed the war did two things to the Democratic Party—first, it made the South unshakably Democratic; second, it gave to the Republicans an advantage in every pivotal State outside of the South in which there was a negro population. It was not until 1884 that the Democrats regained control of the government with the election of Grover Cleveland. They lost with him in 1888, but renominated and elected him again in 1892. In 1896 the party once more split disastrously—this time on the free silver rock, and its candidate—William Jennings Bryan—was overwhelmingly defeated. Through their addiction to economic heresies under the Bryan leadership the Democrats after 1896 became even more definitely the minority party, and the natural tendency of the large business interests to support the Republican ticket in national elections was strengthened. Democratic success in 1912 was due to three things—the Taft-Roosevelt feud in the Republican party; the final loosing of the Bryan grip; and the strong appeal of the Woodrow Wilson candidacy. Beyond question the two Wilson administrations stand out in Democratic history as most eventful and extraordinary. In the first administration more genuinely constructive legislation, starting with the Federal Reserve Act, was enacted than in any previous four-year period, while in the second, under Democratic leadership, the country successfully participated in the greatest of all wars. What most redounds to the credit of the Democratic Party was that despite the inevitable waste and blunders inseparable from such a conflict, there was a complete absence of any wholesale political plundering or governmental graft such as had characterized previous wars. The most rigid probe of the Republicans following the war failed to reveal any thievery not of a trivial nature. From 1920 to 1932 the party was out of office and for the most part out of power. It lacked unifying issues or leadership and suffered a diminution of support from business and the press. The question of Prohibition split its ranks worse than those of the other side and the bitterness of religious bigotry poisoned its spirit. The backwash of the World War in 1920 and the tide of prosperity in 1924 and 1928 brought it crushing national defeats although in state politics its losses were less severe. The year 1932, however, saw a complete overturn. The Democratic Party under the leadership of Franklin D. Roosevelt, aided by the natural reaction to hard times, carried all but six states. In 1934 the drift was still to the Democrats, and in 1936 the party's triumph was overwhelming—all states but Maine and Vermont casting their votes for Roosevelt and Garner. A new American political precedent was established in 1940 when Roosevelt ran for a third term. He carried all but 10 states and received a popular plurality of some 4,900,000 votes.

See Harold Rozelle Bruce, *American Parties and Politics* (1927); and Frank Richardson Kent, *The Denzocratic Party* (1928); Robert C. Brooks, *Political Parties and Electoral Problems* (1923); Arthur N. Holcombe, *Political Parties of Today* (1924); Charles E. Merriam, *The Anzerican Party System* (1922); J. P. Foley (ed.), *The Jeffersonian Cyclopaedia* (New York. 1900); W. D. Jones, *Mirror of Modern Democracy; History of the Democratic Party from 1825 to 1861* (New York, 1864); R. H. Gillet, *Democracy in the United States* (New York, 1868). (F. R. K.; X.)

Popular and Electoral Votes for Democratic Presidential Candidates, 1796–1940

Election date	Democratic Candidate (1)	Popular vote		Electoral	
		Democrat	Opponent	Democrat	Opponent
1796	Thomas Jefferson	(2)	(2)	68	71
1800	*Thomas Jefferson	(2)	(2)	73(3)	73(3)
1804	*Thomas Jefferson	(2)	(2)	162	14
1808	*James Madison	(2)	(2)	122	47
1812	*James Madison	(2)	(2)	128	89
1816	*James Monroe	(2)	(2)	184	34
1820	*James Monroe	(2)	(2)	231	1
1824	*John Quincy Adams	114,023	152,901	87	71
1828	*Andrew Jackson	647,276	508,064	178	83
1832	*Andrew Jackson	687,502	530,189	219	49
1836	*Martin Van Buren	762,978	736,250	170	98
1840	Martin Van Buren	1,129,102	1,275,016	60	234
1844	*James K. Polk	1,337,243	1,299,062	170	105
1848	Lewis Cass	1,220,544	1,360,099	127	163
1852	*Franklin B. Pierce	1,601,474	1,386,580	254	42
1856	*James Buchanan	1,838,169	1,341,264	174	114
1860	Stephen A. Douglas	1,376,957	1,866,452	12	180
1864	George B. McClellan	1,802,237	2,213,665	21	212
1868	Horatio Seymour	2,703,249	3,012,833	80	214
1872	Horace Greeley	2,834,125	3,597,132	(4)	286
1876	Samuel J. Tilden	4,300,590	4,036,298	184	185
1880	Winfield S. Hancock	4,444,952	4,454,416	155	214
1884	*Grover Cleveland	4,878,986	4,851,981	219	182
1888	Grover Cleveland	5,540,050	5,444,337	168	233
1892	*Grover Cleveland	5,554,414	5,190,802	277	145
1896	William J. Bryan	6,467,946	7,035,638	176	271
1900	William J. Bryan	6,358,071	7,219,530	155	292
1904	Alton B. Parker	5,084,491	7,628,834	140	336
1908	William J. Bryan	6,409,106	7,679,006	162	321
1912	*Woodrow Wilson	6,286,214	4,124,020	435	88
1916	*Woodrow Wilson	9,129,606	8,538,221	277	254
1920	James M. Cox	9,147,353	16,152,200	127	404
1924	John W. Davis	8,385,586	15,725,003	136	382
1928	Alfred E. Smith	15,430,718	21,943,328	87	444
1932	*Franklin D. Roosevelt	22,821,857	16,994,665	472	59
1936	*Franklin D. Roosevclt	27,752,309	16,682,524	523	8
1940	*Franklin D. Roosevelt	27,241,939	22,327,226	449	82

1. Popularly called "Republicans" up to the time of Andrew Jackson.
2. Electors chosen by legislatures in many states. *Elected.
3. Contest decided in H. of Rep Jefferson elected.
4. Greeley died before electoral vote was cast.

DEMOCRITUS, probably the greatest of the Greek physical philosophers, was a native of Abdera in Thrace, or as some say—probably wrongly—of Miletus (Diog. Laert. ix. 34). Our knowledge of his life is based almost entirely on tradition of an untrustworthy kind. He seems to have been born about 470 or 460 B.C., and was, therefore, an older contemporary of Socrates. He inherited considerable property, which enabled him to travel widely in the East in search of information. In Egypt he settled for seven years, during which he studied the mathematical and physical systems of the ancient schools. The extent to which he was influenced by the Magi and the Eastern astrologists is a matter of pure conjecture. He returned from his travels impoverished; one tradition says that he received 500 talents from his fellow-citizens, and that a public funeral was decreed him. Another tradition states that he was regarded as insane by the Abderitans, and that Hippocrates was summoned to cure him. Diodorus Siculus tells us that he died at the age of 90; others make him as much as twenty years older. His works, according to Diogenes Laërtius, numbered 72, and were characterized by a purity of style which compares favourably with that of Plato. In the variety of his knowledge, and in the importance of his influence on both Greek and modem speculation Democritus was the Aristotle of the 5th century, while the sanity of his metaphysical theory has led many to regard him as the equal, if not the superior, of Plato.

His views may be treated under the following heads:

1. The *Atoms* and *Cosmology* (adopted in part at least from the doctrines of Leucippus). While agreeing with the Eleatics on the eternal sameness of Being (nothing can arise out of nothing; nothing can be reduced to nothing). Democritus followed the physicists in denying its oneness and immobility. Movement and

plurality being necessary to explain the phenomena of the universe and impossible without space (not-Being), he asserted that the latter had an equal right with Being to be considered existent. Being is the Full (πλῆρες, *plenum*); not-Being is the Void (κενόν, vacuum), the infinite space in which moved the infinite number of atoms into which the single Being of the Eleatics was broken up. These atoms are eternal and invisible; absolutely small, so small that their size cannot be diminished (hence the name ἄτομος, "indivisible"); absolutely full and incompressible, they are without pores and entirely fill the space they occupy; homogeneous, differingonly in figure (as A from N), arrangement (as AN from NA), position (as N is Z on its side), magnitude (and consequently in weight, although some authorities dispute this). But while the atoms thus differ in quantity, their differences of quality are only apparent, due to the impressions caused on our senses by different configurations and combinations of atoms. A thing is only hot or cold, sweet or bitter, hard or soft by convention (νόμῳ); the only things that exist in reality (ἐτεῇ) are the atoms and the void. Locke's distinction between primary and secondary qualities is here anticipated. Thus, the atoms of water and iron are the same, but those of the former, being smooth and round, and therefore unable to hook on to one another, roll over and over like small globes, whereas the atoms of iron, being rough, jagged and uneven, cling together and form a solid body. Since all phenomena are composed of the same eternal atoms (just as a tragedy and a comedy contain the same letters) it may be said that nothing comes into being or perishes in the absolute sense of the words (cf. the modern "indestructibility of matter" and "conservation of energy"), although the compounds of the atoms are liable to increase and decrease, appearance and disappearance—in other words, to birth and death. As the atoms are eternal and uncaused, so is motion; it has its origin in a preceding motion, and so on ad *infinitum*. For the love and hate of Empedocles and the *nous* (intelligence) of Anaxagoras, Democritus substituted fixed and necessary laws (not chance; that is a misrepresentation due chiefly to Cicero). Everything can be explained by a purely mechanical (but not fortuitous) system, in which there is no room for the idea of a providence or an intelligent cause working with a view to an end. The origin of the universe was explained as follows. An infinite number of atoms was carried downwards through infinite space. The larger (and heavier), falling with greater velocity, overtook and collided with the smaller (and lighter), which were thereby forced upwards. This caused various lateral and contrary movements, resulting in a whirling movement (δίνη) resembling the rotation of Anaxagoras, whereby similar atoms were brought together (as in the winnowing of grain) and united to form larger bodies and worlds. Atoms and void being infinite in number and extent, and motion having always existed, there must always have been an infinite number of worlds, all consisting of similar atoms, in various stages of growth and decay.

2. The Soul.—Democritus devoted considerable attention to the structure of the human body, the noblest portion of which he considered to be the soul, which everywhere pervades it, a psychic atom being intercalated between two corporeal atoms. Although, in accordance with his principles, Democritus was bound to regard the soul as material (composed of round, smooth, specially mobile atoms, identified with the fire-atoms floating in the air), he admitted a distinction between it and the body, and is even said to have looked upon it as something divine. These all-pervading soul atoms exercise different functions in different organs; the head is the seat of reason, the heart of anger, the liver of desire. Life is maintained by the inhalation of fresh atoms to replace those lost by exhalation, and when respiration, and consequently the supply of atoms, ceases, the result is death. It follows that the soul perishes with, and in the same sense as, the body.

3. Perception.—Sensations are the changes produced in the soul by external impressions, and are the result of contact, since every action of one body (and all representations are corporeal phenomena) upon another is of the nature of a shock. Certain emanations (ἀπόρροαι, ἀπόρροιαι) or images (εἴδωλα), consisting of subtle atoms, thrown off from the surface of an object, penetrate the body through the pores and pass into the soul. At the same time Democritus distinguished between obscure (σκοτίη) cognition, resting on sensation alone, and genuine (γνησίη), which is the result of inquiry by reason, and is concerned with atoms and void, the only real existences. This knowledge, however, he confessed was exceedingly difficult to attain.

It is in Democritus first that we find a real attempt to explain colour. He regards black, red, white and green as primary. White is characteristically smooth, *i.e.*, casting no shadow, even, flat; black is uneven, rough, shadowy and so on. The other colours result from various mixtures of these four, and are infinite in number. Colour itself is not objective; it is found not in the ultimate *plenum* and *vacuum*, but only in derived objects according to their physical qualities and relations.

4. Theology.—Democritus rejected the notion of a deity taking part in the creation or government of the universe, but yielded to popular prejudice so far as to admit the existence of a class of beings, of the same form as men, grander, composed of very subtle atoms, less liable to dissolution, but still mortal, dwelling in the upper regions of air. However, according to Plutarch, Democritus recognized one god under the form of a fiery sphere, the soul of the world, but this idea is probably of later origin. The popular belief in gods was attributed by Democritus to the desire to explain extraordinary phenomena (thunder, lightning, earthquakes) by reference to superhuman agency.

5. Ethics.—Democritus's moral system—the first collection of ethical precepts which deserves the name—strongly resembles the negative side of the system of Epicurus. The *summum bonum* is the maximum of pleasure with the minimum of pain. But true pleasure is not sensual enjoyment; it has its principle in the soul. It consists not in the possession of wealth or flocks and herds, but in good humour, in the just disposition and constant tranquillity of the soul. Hence the necessity of avoiding extrenes; too much and too little are alike evils. (See ETHICS.)

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DEMOGRAPHY, the science which deals with the statistics of health and disease, of the physical, intellectual, physiological and economical aspects of births, marriages and mortality (from Gr. δῆμος, people, and γράφειν, to write). The first to employ the word was Achille Guillard in his *Éléments* de *statistique humaine ou démographie comparée* (1855), but the meaning which he attached to it was merely that of the science which treats of the condition, general movement and progress of population in civilized countries; *i.e.*, little more than what is comprised in the ordinary vital statistics, gleaned from census and registration reports. The word has come to have a much wider meaning and may now be defined as that branch of statistics which deals with the life-conditions of peoples.

DE **MOIVRE, ABRAHAM** (1667–1754), English mathematician of French Huguenot extraction, was born at Vitry, Champagne, on May 26, 1667. His eminence as a mathematician secured his admission into the Royal Society in 1697, and also led to his being appointed by the Royal Society to decide the famous contract between Newton and G. W. Leibnitz. He was an intimate personal friend of Newton. De Moivre lived a quiet and uneventful life and died in London on Nov. 27, 1754. Two important theorems in trigonometry bear his name. (See TRIGONOMETRY.) The majority of his papers appeared in Philosophical Transactions. Among his separately published works the most important are: The Doctrine *of* Chances (1716), in which he formulated the theory of recurring series, completed the theory of partial fractions, and laid down the rule for the probability of a

compound event. Miscellanea *Analytica* (1730) contains his trigonometrical theorems.

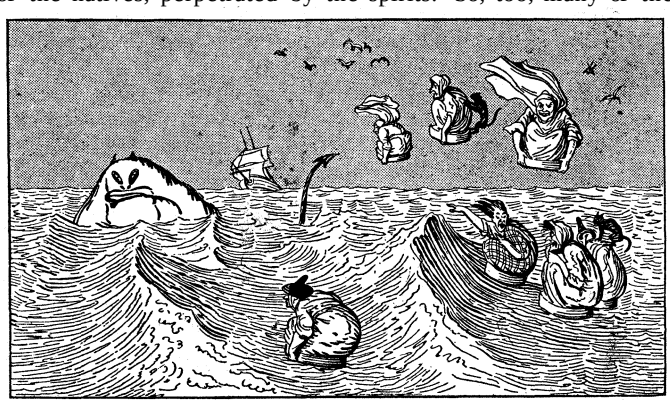
DEMONETIZATION, a term employed in monetary science in two different senses. (a) The depriving or divesting of a metal of its standard monetary value. From 1663 to 1717 silver was the standard of value in England and gold coins passed at their market value. The debasement and underrating of the silver coinage insensibly brought about the demonetization of silver in England as a standard of value, and the substitution of gold. During the latter half of the 19th century a great depreciation occurred in the value of silver, owing to increasing production, and, consequently, it was impossible to preserve any ratio of stability between it and gold. This led to the abandonment or demonetization of the metal as a standard and to its use merely as token money. (b) The withdrawal of coin from circulation, as, for example, in England that of all pre-Victorian gold coins under the provisions of the Coinage Act 1889, and the royal proclamation of Nov. 22, 1890.

DEMONOLOGY, the branch of the science of religions which relates to superhuman beings which are not gods (Δαίμων, demon, genius, spirit). Demons, when regarded as spirits, may either be human, or non-human, separable souls, or discarnate spirits which have never inhabited a body; a sharp distinction is often drawn between these two classes which are frequently conceived as producing identical results, *e.g.*, diseases.

The term includes (1) human souls regarded as genii or familiars, (2) such as receive a cult (for which see ANCESTOR WORSHIP), and (3) ghosts or other malevolent revenants; excluded are souls conceived as inhabiting another world. Demons may be regarded as corporeal, since primitive peoples do not distinguish clearly between material and immaterial beings.

Prevalence of Demons.—All the affairs of life are supposed to be under the control of spirits, each ruling a certain element or even object, and themselves in subjection to a greater spirit. A rise in culture often results in an increase in the number of spiritual beings with whom man surrounds himself.

Character of Spiritual World.—The ascription of malevolence to the world of spirits is by no means universal. Local spirits are often regarded as inoffensive in the main; true, the passer-by must make some trifling offering as he nears their place of abode; but it is only occasionally that mischievous acts, such as the throwing down of a tree on a passer-by, are, in the view of the natives, perpetrated by the spirits. So, too, many of the



FROM AN ETCHING BY GEORGE CRUIKSHANK, 1830, BY COURTESY OF THE TRUSTEES OF BRITISH MUSEUM

A WITCHES' FROLIC. SHOWING THE DEVIL AND A PARTY OF WITCHES. RIDING IN TUBS OVER A STORMY SEA. ON THEIR WAY TO WRECK A SHIP

spirits especially concerned with the operations of nature are conceived as neutral or even benevolent.

Classification.—Besides the distinctions of human and non-human, hostile and friendly, the demons in which the lower races believe are classified by them according to function, each class with a distinctive name, with extraordinary minuteness.

(*a.*) Natural causes, either of death or of disease, are hardly, if at all, recognized by the uncivilized; everything is attributed to spirits or magical influence of some sort. The spirits which cause disease may be human or non-human; they may enter the body of the victim (see POSSESSION), and either dominate his mind as well as his body, inflict specific diseases, or cause pains of various sorts. The demon theory of disease is still attested by some of our medical terms; epilepsy (Gr. ἐπίληψις, seizure) points to the belief that the patient is possessed As a logical consequence of this view of disease the mode of treatment among peoples in the lower stages of culture is marked by an endeavour to propitiate the evil spirits by sacrifice, to expel them by spells, etc. (see EXORCISM), to drive them away by blowing, etc.; and conversely to keep away smallpox by placing thorns and brushwood in the paths leading to places afflicted by that disease, in the hope of making the disease demon retrace his steps. Another way in which a demon is held to cause disease is by introducing itself into the patient's body and sucking his blood (Rivers, Medicine, Magic and Religion).

FROM SKEAT, "MALAY MAGIC" (MACMILLAN & CO.)

MODELS OF PENANGGALAN AND LANGSUIR, TWO MALAY BIRTH SPIRITS (VAMPIRES)

(b.) One of the primary meanings of δαιμων is that of genius (*q.v.*) or familiar, tutelary spirit. The animal guardian appears in the *nagual* of Central America, the yunbeai of some Australian tribes, the *manitou* of the Red Indian and the bush soul of some West African tribes. All the world over it is held that the familiars of the witch or wizard can assume the form of animals (see WITCHCRAFT).

(c.) The familiar is sometimes an ancestral spirit, and here we touch the fringe of the cult of the dead (see also ANCESTOR WORSHIP). Especially feared among many peoples are the souls of those who have committed suicide or died a violent death; the woman who dies in childbed is held to become a demon of the most dangerous kind; even the unburied, as restless, dissatisfied spirits, are more feared than ordinary ghosts These are they who cannot. be reborn and are permanently severed from their community. They are therefore hostile. Funeral rites (see DEAD, DISPOSAL OF) exhibit marked variations due to this cultural attitude. All spirits have power. Those who are or become permanent spirits have more power and more permanency than those who are due to return. The evocation of spirits, especially in the form of necromancy (*q.v.*) is an important branch of the demonology of many peoples.

(d.) The vampire is a particular form of demon which calls for some notice. In Europe the Slavonic area is the principal seat of vampire beliefs, and as a natural development, means of preventing the dead from injuring the living have been evolved. The corpse of the vampire, which may often be recognized by its unnaturally ruddy and fresh appearance, should be staked down in the grave or its head should be cut off; it is interesting to note that the cutting off of heads of the dead was a neolithic burial rite.

(*e.*) The vampire is frequently blended in popular idea with the *Poltergeist* (*q.v.*) or knocking spirit, and also with the werwolf (see LYCANTHROPY).

(f.) Dream demons are very common; in fact the word "nightmare" (A.S. maer, spirit, elf) preserves this form of belief, which is found right down to the lowest culture. Horses too are said to be subject to the persecutions of demons, which ride them at night. Another class of nocturnal demons, the incubi and succubi, are said to consort with human beings in their sleep.

(g.) Corresponding to the personal tutelary spirit (supra, b) we have the genii of buildings and places, and a snake was a frequent form for this kind of demon. The South African belief that the snakes which are in the neighbourhood of the kraal are the incarnations of the ancestors of the residents, suggests that some similar idea lay at the bottom of the Roman belief. To

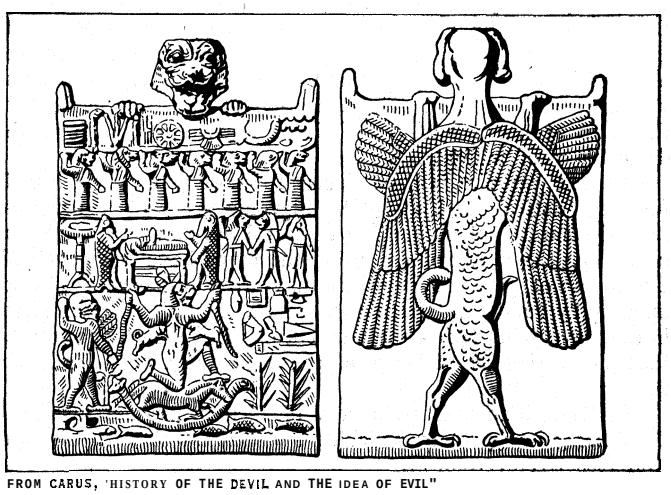
this day in European folklore the house snake or toad, which lives in the cellar, is regarded as the "life index" or other self of the father of the house; the death of one involves the death of the other, according to popular belief. The assignment of genii to buildings and gates is connected with the custom of sacrificing a human being or an animal at the foundation of a building. Sometimes a similar guardian is provided for the frontier of a country or of a tribe.

(h.) The animistic creed postulates the existence of all kinds of local spirits, which are sometimes tied to their habitats, sometimes free to wander. Especially prominent in Europe-classical, mediaeval and modern—and in East Asia is the spirit of the lake, river, spring, or well, often conceived as human, but also in the form of a bull or horse. Less specialized in their functions are many of the figures of modern folklore, some of whom have perhaps replaced some ancient goddess.

(*i.*) Certain aspects of the belief in plant souls demand more detailed treatment. Outside the European area vegetation spirits of all kinds seem to be conceived, as a rule, as anthropomorphic; in classical Europe, and parts of the Slavonic area at the present day, the tree spirit was believed to have the form of a goat, or to have goats' feet.

Of special importance in Europe is the conception of the so-called "corn spirit," by which the life of the corn is supposed to exist apart from the corn itself and to take the form, sometimes of an animal, sometimes of a man or woman, sometimes of a child. The animal identified with the corn demon is sometimes killed in the spring in order to mingle its blood or bones with the seed; at harvest-time it is supposed to sit in the last corn and the animals driven out from it are sometimes killed; in other cases the reaper who cuts the last ear is said to have killed the "wolf" or the "dog," and sometimes receives the name of "wolf" or "dog" and retains it till the next harvest. The corn spirit is also said to be hiding in the barn till the corn is threshed, or it may reappear at midwinter, when the farmer begins to think of his new year of labour and harvest. Side by side with the conception of the corn spirit as an animal is the anthropomorphic view of it; and at the same time the association of gods and goddesses of corn with animal embodiments of the corn spirit is found.

(*j.*) In many parts of the world is found the conception termed the "otiose creator"; that is to say, the belief in a great



FROM CARUS, 'HISTORY OF THE DEVIL AND THE IDEA OF EVIL"

OBVERSE AND REVERSE OF AN ANCIENT ASSYRIAN BRONZE TABLET REPRESENTING THE WORLD IN THE CLUTCHES OF AN EVIL DEMON

deity, who is the author of all that exists but is too remote from the world and too high above terrestrial things to concern himself with the details of the universe. The operations of nature are conducted by a multitude of more or less obedient subordinate deities, who shade off into demons of the usual type from whom they are hardly distinguishable.

Sometimes the gods of an older religion degenerate into the demons of the belief which supersedes it. (See WITCHCRAFT.)

Expulsion of Demons.—Mention must be made of the custom of expelling ghosts, spirits or evils generally. Primitive peoples from the Australians upwards celebrate, usually at fixed intervals, a driving out of hurtful influences. Sometimes it is merely the ghosts of those who have died in the year which are thus driven out; from this custom must be distinguished that of dismissing the souls of the dead at the close of the year and sending them on their journey to the other world; this latter custom seems to have an entirely different origin and is an essential part of the funerary ritual. In other cases it is believed that evil spirits generally or even non-personal evils such as sins are believed to be expelled. In these customs originated perhaps the scapegoat, some forms of sacrifice (*q.v.*) and other cathartic ceremonies.

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DEMONSTRATION is commonly used as the equivalent of "proof" or of "exact proof," such as is met with in mathematics or in the "exact sciences." Locke confined the possibility of demonstration to relations among abstract ideas (such as those of mathematics) and denied it to matters of fact (such as the ordinary physical events or human actions). Originally the term demonstration (or rather its Greek equivalent, ἀπόδειξις) was confined to propositions (whether inferential or not), the subject and predicate of which were seen to be intimately interconnected.

See H. W. *B.* Joseph, *Introduction to Logic* (1916).

DE MORGAN, AUGUSTUS (1806–1871), English mathematician and logician, was born at Madura in the Madras presidency. He received his early education in private schools, and before the age of 14 had learned Latin, Greek and some Hebrew, in addition to acquiring much general knowledge. At the age of 16 he entered Trinity college, Cambridge, and studied mathematics, partly under the tuition of Sir G. B. Airy. In 1825 he gained a Trinity scholarship. He was prevented from taking his M.A. degree, or from obtaining a fellowship, by his conscientious objection to signing the theological tests then required from masters of arts and fellows at Cambridge.

A career in his own university being closed against him, he entered Lincoln's Inn; but, almost at the same time, the establishment, in 1828, of the University of London, in Gower street, afterwards known as University college, gave him an opportunity of continuing his mathematical pursuits. At the early age of 22 he gave his first lecture as professor of mathematics in the college which he served with the utmost zeal and success for a third of a century. His connection with the college, indeed, was interrupted in 1831, when a disagreement with the governing body caused De Morgan and some other professors to resign their chairs simultaneously. When, in 1836, his successor was accidentally drowned, De Morgan was requested to resume the professorship. In 1837 he married Sophia Elizabeth, daughter of William Frend. They settled in Chelsea, where in later years Mrs. De Morgan had a large circle of intellectual and artistic friends.

As a teacher of mathematics De Morgan was unrivalled. He gave instruction in the form of continuous lectures delivered *extempore* from brief notes. His writings, however excellent, gave little idea of the perspicuity and elegance of his ***viva voce*** expositions. Many of his pupils distinguished themselves, and, through Isaac Todhunter and E. J. Routh, he had an important influence on the later Cambridge school. For 30 years he took an active part in the business of the Royal Astronomical Society, editing its publications, supplying obituary notices of members and for 18 years acting as one of the honorary secretaries.

De Morgan's mathematical writings contributed powerfully towards the progress of the science. His memoirs on the "Foundation of Algebra," in the 7th and 8th volumes of the *Cambridge Philosophical Transactions,* contain important contributions to the philosophy of mathematical method. The work on *Trigonometry and Double Algebra* (1849) contains in the latter part a most luminous and philosophical view of existing and possible systems of symbolic calculus. De Morgan's long series of publications began in 1828 with a translation of part of Bourdon's *Elements of Algebra.* In 1830 appeared the first edition of his well known *Elements of Arithmetic,* which is distinguished by a simple yet thoroughly philosophical treatment of the ideas of number and magnitude, and by the introduction of new abbreviated processes of computation, to which De Morgan always attributed much practical importance. His other principal mathematical works were *The Elements of Algebra* (183j), a valuable but somewhat dry elementary treatise; the *Essay on Probabilities* (1838), forming the 107th volume of *Lardner's Cyclopaedia,* which forms a useful introduction to the subject; and *The Elements of Trigonometry and Trigonometrical Analysis, preliminary to the Differential Calculus* (1837). Two of his most elaborate treatises are to be found in the *Encyclopaedia metropolitana,* namely, the articles on the "Calculus of Functions" and the "Theory of Probabilities." De Morgan's minor mathematical writings were scattered over various periodicals. A list of these and other papers will be found in the *Royal Society's Catalogue,* which contains 42 entries under the name of De Morgan.

But it is probably as a logical reformer that De Morgan will be best remembered. In this respect he stands alongside of his great contemporaries, Sir. W. R. Hamilton and George Boole, as one of several independent discoverers who enounced the principle of the quantification of the predicate. De Morgan always laid much stress upon the importance of logical training. In his admirable papers upon the modes of teaching arithmetic and geometry, originally published in the *Quarterly Journal of Education* (reprinted in *The Schoolnzaster,* vol. ii.), he remonstrated against the neglect of logical doctrine. In 1839 he produced a small work called *First Notions of Logic,* giving what he had found by experience to be much wanted by students commencing with Euclid. In Oct. 1846 he completed the first of his investigations, in the form of a paper printed in the *Transactions of the Cambridge Philosophical Society* (vol. viii., No. 29), which gave rise to a controversy with Sir W. R. Hamilton regarding the independence of De Morgan's discovery. The eight forms of proposition adopted by De Morgan as the basis of his system partially differ from those which Hamilton derived from the quantified predicate. The general character of De Morgan's development of logical forms was wholly peculiar and original on his part.

Late in 1847 De Morgan published his principal logical treatise, *Formal Logic, or The Calculus of Inference, Necessary and Probable.* This contains a reprint of the *First Notions,* an elaborate development of his doctrine of the syllogism, and of the numerical definite syllogism, together with chapters on probability, induction, old logical terms and fallacies. There followed at intervals, in the years 1850, 1858, 1860 and 1863, a series of four elaborate memoirs on the "Syllogism" printed in volumes ix. and x. of the *Cambridge Philosophical Transactions.* These papers taken together constitute a great treatise on logic, in which he substituted improved systems of notation, and developed a new logic of relations and a new onymatic system of logical expression. In 1860 De Morgan endeavoured to render their contents better known by publishing a *Syllabus of a Proposed System of Logic,* from which may be obtained a good idea of his symbolic system.

De Morgan endeavoured to reconcile the mathematicians with the logicians, and in the attempt showed how many errors an acute mathematician could detect in logical writings, and how large a field there was for discovery. But it may be doubted whether De Morgan's own system, "horrent with mysterious spiculae," as Hamilton aptly described it, is fitted to exhibit the real analogy between quantitative and qualitative reasoning, which is rather to be sought in the logical works of Boole.

In 1866 his life became clouded by the circumstances which led him to leave University college. The refusal of the council to accept the recommendation of the senate, that they should appoint an eminent Unitarian minister to the professorship of logic and mental philosophy, revived all De Morgan's sensitiveness on the subject of sectarian freedom. In 1867 he lost his son George Campbell De Morgan, a young man of the highest scientific promise, whose name, as De Morgan expressly wished, will long be connected with the London Mathematical Society, of which he was one of the founders. From this time De Morgan rapidly fell into ill-health (previously almost unknown to him), dying on March 18, 1871. An interesting and truthful sketch of his life will be found in the *Monthly Notices of the Royal Astronomical Society* for Feb. 9, 1872, vol. xxii. p. 112, written by A. C. Ranyard, who says, "He was the kindliest as well as the most learned of men—benignant to everyone who approached him, never forgetting the claims which weakness has on strength."

It is impossible to omit a reference to his witty sayings, some specimens of which are preserved in the *Diary of Henry Crabb Robinson* (1869), which also contains a humorous account of H. C. R. by De Morgan.

A very large part of De Morgan's work is contained in periodical publications, and in encyclopaedias and works of reference. His correspondence with contemporary scientific men was very extensive and full of interest. It remains unpublished, as does also a large mass of mathematical tracts which he prepared for the use of his students, treating all parts of mathematical science and embodying some of the matter of his lectures. De Morgan's library was purchased by Lord Overstone, and presented to the University of London.

See S. de Morgan, *Memoir of Augustus de Morgan (1882).*

DE MORGAN, WILLIAM FREND (1839–1917), artist and novelist, son of Augustus de Morgan, born in London on Nov. 16, 1839, and educated at Cniversity college and the Academy schools. He became a member of the circle which gathered round Rossetti, William Morris and Burne-Jones, and experimented in various forms of decorative art. After his father's death the family settled at 30 Cheyne row, and there, in the back garden, De Morgan set up a kiln and began to make pottery. He rediscovered the secret of the brilliant blue and green glazes of the old potters, and presently formed a firm to develop the manufacture of tiles and other pottery on a commercial scale. He had an inventive genius. and nearly all the appliances of the factory were designed by him. The De Morgan ware became famous; the tiles were used for the decoration of some of the great liners, and in some cases for exterior decoration of houses. There are many fine examples of his work in the ceramic galleries of the Victoria and Albert museum, London, which also possesses a collection of his sketches. In 1905, when he was over 65, he retired from business, and began his extremely successful career as a novelist. He had written stories for recreation, and *Joseph Vance,* fragments of which had been rescued from destruction by his wife, appeared in 1906. In Charles Heath of *Alice-for-Short* (1907) he put, he said, "a good deal of himself." Other novels, which had a large circulation, followed. He died in London of trench fever on Jan. 15, 1917.

See Mrs. *A. W.* M. Stirling, *William de Morgan and his Wife* (1922).

DEMOSTHENES (d. 413 B.C.), Athenian general, first appears in history in 426 B.C. In this year Demosthenes and Procles were in command of 30 ships on a cruise round the Peloponnese. The attack was first made on Leucas, but this was abandoned for a campaign against the Aetolians, which was the first step in a projected advance through central Greece to Phocis and Boeotia. The Ozolian Locrians, who knew the country, failed him, but he advanced without them. The result was the collapse of his hoplites, on ground completely unsuited to them, and a severe defeat. in which he lost 120 of the 300 Athenians with him. At this point Eurylochus arrived from Sparta to help the Aetolians and attack Naupactus. Demosthenes applied for help to the Acarnanians, and saved Naupactus. Eurylochus then slipped past the Acarnanians, who were opposed to him, and joined the Ambraciots, who had invaded Amphilochian Argos, at Olpae. Demosthenes arrived with 20 ships and defeated the joint forces at Olpae. He

then made a compact with Menedaeus to allow the Spartans to withdraw, and wiped out the remainder of the Ambraciots at Aedomenes. The result of this campaign was the complete destruction of the Corinthian sphere of influence in north-west Greece, and Demosthenes, having redeemed his early failure, could now return to Athens. In 425 he went with Eurymedon and Sophocles on an expedition towards Sicily. He was delayed at Pylos, which was fortified by the soldiers to beguile their idleness, and Demosthenes stayed there with five ships and successfully defended it against attacks from Sparta and Corcyra. The arrival of an Athenian fleet turned the besiegers into the besieged; the Spartans were blockaded in Sphacterium, and their sventual defeat and capture was really the work of Demosthenes, though Cleon had nominally superseded him. The feature of these operations was the successful use of light infantry, a lesson which Demosthenes had learned from his early campaigns, but which no other commander during the war seems to have grasped. The year 424 saw him engaged in the abortive attack on Megara and the equally unsuccessful invasion of Boeotia, which resulted in the battle of Delium. In 413 he was sent with Eurymedon to reinforce Nicias before Syracuse. As soon as he arrived he conducted a night attack on Epipolae. When this failed he advised immediate retreat, but was overruled by Nicias. When at last the retreat began, the division under Demosthenes fell behind, was cornered in an orchard and surrendered. Demosthenes was put to death. We know practically nothing of his political views, but Aristophanes (*Eq.* 242) suggests that he was leader of the party opposed to Cleon.

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DEMOSTHENES, the great Attic orator and statesman, was born in 384 (or 383) B.C. His father, who bore the same name, was an Athenian citizen belonging to the deme of Paeania. His mother, Cleobule, was the daughter of Gylon, a citizen who had been active in procuring the protection of the kings of Bosporus for the Athenian colony of Nymphaeum in the Crimea, and whose wife was a native of that region. On these grounds the adversaries of Demosthenes, in after-days, used absurdly to taunt him with a traitorous or barbarian ancestry. The boy had a bitter fore-taste of life. He was seven years old when his father died, leaving property (in a manufactory of swords, and another of upholstery) worth about £3,500, which, invested as it seems to have been (20% was not thought exorbitant), would have yielded rather more than £600 a year—a handsome, though not a great fortune. But his guardians—two nephews of his father, Aphobus and Demophon, and one Therippides—abused their trust, and handed over to Demosthenes, when he came of age, rather less than one-seventh of his patrimony, perhaps between £10 and £60 a year. Demosthenes, after studying with Isaeus (*q.v.*), brought an action against Aphobus, and gained a verdict for about £2,400. But it does not appear that he got the money; and, after some more fruitless proceedings against Onetor, the brother-in-law of Aphobus, the matter was dropped, not, however, before his relatives had managed to throw a public burden (the equipment of a ship of war) on their late ward, whereby his resources were yet further straitened. He now became a professional writer of speeches or pleas (λογογράφος) for the law courts, sometimes speaking himself. Biographers have delighted to relate how painfully Demosthenes made himself a tolerable speaker; how, with pebbles in his mouth, he tried his lungs against the waves, how he declaimed as he ran up hill, how he shut himself up in a cell, having first guarded himself against a longing for the haunts of men by shaving one side of his head, how he wrote out Thucydides eight times, how he was derided by the Assembly and encouraged by a judicious actor who met him moping about the Peiraeeus. He certainly seems to have been the reverse of athletic (the stalwart Aeschines upbraids him with never having been a sportsman), and he probably had some sort of defect or impediment in his speech as a boy. Perhaps the most interesting fact about his work for the law courts is that he seems to have continued it, in some measure, through the most exciting parts of his great political career. The speech for Phormion belongs to the same year as the plea for Megalopolis. The speech against Boeotus "Concerning the Name" comes between the First Philippic and the First Olynthiac.

Political Career and Creed.—The political career of Demosthenes, from his first direct contact with public affairs in 355 B.C. to his death in 322, has an essential unity. It is the assertion, in successive forms adapted to successive moments, of unchanging principles. Externally, it is divided into the chapter which precedes and the chapter which follows Chaeroneia. But its inner meaning, the secret of its indomitable vigour, the law which harmonizes its apparent contrasts, cannot be understood unless it is regarded as a whole. Still less can it be appreciated in all its large wisdom and sustained self-mastery if it is viewed merely as a duel between the ablest champion and the craftiest enemy of Greek freedom. The time indeed came when Demosthenes and Philip stood face to face as representative antagonists in a mortal conflict. But, for Demosthenes, the special peril represented by Philip, the peril of subjugation to Macedon, was merely a disastrous accident. Philip happened to become the most prominent and most formidable type of a danger which was already threatening Greece before his baleful star arose. As Demosthenes said to the Athenians, if the Macedonian had not existed they would have made another Philip for themselves. Until Athens recovered something of its old spirit, there must ever be a great standing danger, not for Athens only, but for Greece—the danger that sooner or later, in some shape, from some quarter, barbarian violence would break up the tradition of separate Hellenic life.

What was the true relation of Athens to Greece? The answer which he gave to this question is the key to the life of Demosthenes. Athens, so Demosthenes held, was the natural head of Greece. Not, however, as an empress holding subject or subordinate cities in a dependence more or less compulsory. Rather as that city which most nobly expressed the noblest attributes of Greek political existence. Wherever the cry of the oppressed goes up from Greek against Greek, it was the voice of Athens which should first remind the oppressor that Hellene differed from barbarian in postponing the use of force to the persuasions of equal law. Wherever a barbarian hand offered wrong to any city of the Hellenic sisterhood, it was the arm of Athens which should first be stretched forth in the holy strength of Apollo the Averter. Athens must never again seek "empire" in the sense which became odious under the influence of Cleon and Hyperbolus Athens must aim at leading a free confederacy, of which the members should be bound to her by their own truest interests.

Such, in the belief of Demosthenes, was the part which Athens must perform if Greece was to be safe. But reforms must be effected before Athens could be capable of such a part. Athens had long been suffering from the profound decay of public spirit. Since the early years of the Peloponnesian War, the separation of Athenian society from the State had been growing more and more marked. Politics were now managed by a small circle of politicians. Wars were conducted by professional soldiers whose troops were chiefly mercenaries. The mass of the citizens took no active interest in public affairs. But, though indifferent to principles, they had quickly sensitive partialities for men, and it was necessary to keep them in good humour. Pericles had introduced the practice of giving a small bounty from the Treasury to the poorer citizens, for the purpose of enabling them to attend the theatre at the great festivals,—in other words, for the purpose of bringing them under the concentrated influence of the best Attic culture. A provision eminently wise for the age of Pericles easily became a mischief when the once honourable name of "demagogue" began to mean a flatterer of the mob. Before the end of the Peloponnesian War the festival-money (theorikon) was abolished. A few years after the restoration of the democracy it was again introduced. But until 354 B.C. it had never been more than a gratuity, of which the payment depended on the Treasury having a surplus. In 354 B.C. Eubulus became steward of the Treasury. His first measure was to make the festival-money a permanent item in the budget. Thenceforth this bounty was in reality very much what Demades afterwards

called it,—the cement (κόλλα) of the democracy.

Forensic Speeches in Public Causes.—Years before the danger from Macedon was urgent, Demosthenes had begun the work of his life—the effort to lift the spirit of Athens, to revive the old civic loyalty, to rouse the city into taking that place and performing that part which her own welfare as well as the safety of Greece prescribed. His formally political speeches must never be considered apart from his forensic speeches in public causes. The Athenian procedure against the proposer of an unconstitutional law—*i.e.*, of a law incompatible with existing laws—had a direct tendency to make the law court, in such cases, a political arena. The same tendency was indirectly exerted by the tolerance of Athenian juries (in the absence of a presiding expert like a judge) for irrelevant matter, since it was usually easy for a speaker to make capital out of the adversary's political antecedents. But the forensic speeches of Demosthenes for public causes are not only political in this general sense. They are documents, as indispensable as the Olynthiacs or Philippics, for his own political career. Only by taking them along with the formally political speeches, and regarding the whole as one unbroken series, can we see clearly the full scope of the task which he set before him,—a task in which his long resistance to Philip was only the most dramatic incident, and in which his real achievement is not to be measured by the event of Chaeroneia.

A forensic speech, composed for a public cause, opens the political career of Demosthenes with a protest against a signal abuse. In 355 B.C., at the age of 29, he wrote the speech "Against Androtion." This combats on legal grounds a proposal that the out-going *Boule* should receive the honour of a golden crown In its larger aspect, it is a denunciation of the corrupt system which that *Boule* represented, and especially of the manner in which the Treasury had been administered by Aristophon. In 354 B.C. Demosthenes composed and spoke the oration "Against Leptines," who had effected a slender saving for the State by the expedient of revoking those hereditary exemptions from taxation which had at various times been conferred in recognition of distinguished merit. He answers the advocates of the retrenchment by pointing out that the public interest will not ultimately be served by a wholesale violation of the public faith. In the same year he delivered his first strictly political speech, "On the Navy Boards" (Symmories). The Athenians, irritated by the support which Artaxerxes had lately given to the revolt of their allies, and excited by rumours of his hostile preparations, were feverishly eager for a war with Persia. Demosthenes urges that such an enterprise would at present be useless; that it would fail to unite Greece; that the energies of the city should be reserved for a real emergency; but that, before the city can successfully cope with any war, there must be a better organization of resources, and, first of all, a reform of the navy.

Two years later (352 B.C.) he is found dealing with a more definite question of foreign policy. Sparta, favoured by the depression of Thebes in the Phocian War, was threatening Megalopolis. Both Sparta and Megalopolis sent embassies to Athens. Demosthenes supported Megalopolis. The ruin of Megalopolis would mean, he argued, the return of Spartan domination in the Peloponnesus. Athenians must not favour the tyranny of any one city. They must respect the rights of all the cities, and thus promote unity based on mutual confidence. In the same year Demosthenes wrote the speech "Against Timocrates" to be spoken by the same Diodorus who had before prosecuted Androtion, and who now combated an attempt to screen Androtion and others from the penalties of embezzlement. The speech "Against Aristocrates," also of 352 B.C., reproves that foreign policy of feeble makeshifts which was now popular at Athens. The Athenian tenure of the Thracian Chersonese partly depended for its security on the goodwill of the Thracian prince Cersobleptes. Charidemus, a soldier of fortune who had already played Athens false, was now the brother-in-law and the favourite of Cersobleptes. Aristocrates proposed that the person of Charidemus should be invested with a special sanctity, by the enactment that whoever attempted his rife should be an outlaw from all dominions of Athens. Demosthenes points out that such adulation is as futile as it is fulsome. Athens can secure the permanence of her foreign possessions only by being strong enough to hold them.

Thus, between 355 and 352, Demosthenes had laid down the main lines of his policy. Domestic administration must be purified. Statesmen must be made to feel that they are responsible to the State. They must not be allowed to anticipate judgment on their deserts by voting each other golden crowns. They must not think to screen misappropriation of public money by getting partisans to pass new laws about State-debtors. Foreign policy must be guided by a larger and more provident conception of Athenian interests. When public excitement demands a foreign war, Athens must not rush into it without asking whether it is necessary, whether it will have Greek support, and whether she herself is ready for' it. When a strong Greek city threatens a weak one, and seeks to purchase Athenian connivance with the bribe of a border-town, Athens must remember that duty and prudence alike command her to respect the independence of all Greeks. When it is proposed, by way of insurance on Athenian possessions abroad, to flatter the favourite of a doubtful ally, Athens must remember that such devices will not avail a Power which has no army except on paper, and no ships fit to leave their moorings.

Athens and Philip.—But the time had gone by when Athenians could have tranquil leisure for domestic reform. A danger, calling for prompt action, had at last come very near. For six years Athens had been at war with Philip on account of his seizure of Amphipolis. Meanwhile he had destroyed Potidaea and founded Philippi. On the Thracian coasts he had become master of Abdera and Maroneia. On the Thessalian coast he had acquired Methone. In a second invasion of Thessaly, he had overthrown the Phocians under Onomarchus, and had advanced to Thermopylae, to find the gates of Greece closed against him by an Athenian force. He had then marched to Heraeum on the Propontis, and had dictated a peace to Cersobleptes. He had formed an alliance with Cardia, Perinthus and Byzantium. Lastly, he had begun to show designs on the great Confederacy of Olynthus, the more warlike Miletus of the North. The First Philippic of Demosthenes was spoken in 351 B.C. The Third Philippic—the latest of the extant political speeches—was spoken in 341 B.C. Between these he delivered eight political orations, of which seven are directly concerned with Philip. The whole series falls into two great divisions. The first division comprises those speeches which were spoken against Philip while he was still a foreign Power threatening Greece from without. Such are the First Philippic and the three orations for Olynthus. The second division comprises the speeches spoken against Philip when, by admission to the Amphictyonic Council, he had now won his way within the circle of the Greek States, and when the issue was no longer between Greece and Macedonia, but between the Greek and Macedonian parties in Greece. Such are the speech "On the Peace," the speech "On the Embassy," the speech "On the Chersonese," the Second and Third Philippics.

The First Philippic, spoken early in 351 B.C., was no sudden note of alarm drawing attention to an unnoticed peril. On the contrary, the assembly was weary of the subject. For six years the war with Philip had been a theme of barren talk. Demosthenes urges that it is time to do something, and to do it with a plan. Athens fighting Philip has fared, he says, like an amateur boxer opposed to a skilled pugilist. The helpless hands have only followed blows which a trained eye should have taught them to parry. An Athenian force must be stationed in the north, at Lemnos or Thasos. Of 2,000 infantry and 200 cavalry at least one quarter must be Athenian citizens capable of directing the mercenaries.

Later in the same year Demosthenes did another service to the cause of national freedom. Rhodes, severed by its own act from the Athenian Confederacy, had since 355 been virtually subject to Mausolus, prince (δυνάστης) of Caria, himself a tributary of Persia. Mausolus died in 351, and was succeeded by his widow Artemisia. The democratic party in Rhodes now appealed to Athens for help in throwing off the Carian yoke. Demosthenes supported their application in his speech "For the Rhodians."

No act of his life was a truer proof of statesmanship. He failed. But at least he had once more warned Athens that the cause of political freedom was everywhere her own, and that, wherever that cause was forsaken, there a new danger was created both for Athens and for Greece.

Next year (350) an Athenian force under Phocion was sent to Euboea, in support of Plutarchus, tyrant of Eretria, against the faction of Cleitarchus. Demosthenes protested against spending strength, needed for greater objects, on the local quarrels of a despot. Phocion won a victory at Tamynae. But the "inglorious and costly war" entailed an outlay of more than £12,000 on the ransom of captives alone, and ended in the total destruction of Athenian influence throughout Euboea. That island was now left an open field for the intrigues of Philip. Worst of all, the party of Eubulus not only defeated a proposal, arising from this campaign, for applying the festival-money to the war-fund, but actually carried a law making it high treason to renew the proposal. The degree to which political enmity was exasperated by the Euboean War may be judged from the incident of Meidias, an adherent of Eubulus, and a type of opulent rowdyism. Demosthenes was choragus of his tribe, and was wearing the robe of that sacred office at the great festival in the theatre of Dionysus, when Meidias struck him on the face. The affair was eventually compromised. The speech "Against Meidias" written by Demosthenes for the trial (in 349) was neither spoken nor completed, and remains, as few will regret, a sketch.

Olynthiacs.—It was now three years since, in 352, the Olynthians had made peace with Athens. In 350 a second Olynthian embassy had obtained Athenian help. In 349 Philip opened war against the Chalcidic towns of the Olynthian League. The First and Second Olynthiacs of Demosthenes were spoken in that year in support of sending one force to defend Olynthus and another to attack Philip. "Better now than later," is the thought of the First Olynthiac. The Second argues that Philip's strength is overrated. The Third—spoken in 348—carries us into the midst of action[1]. It deals with practical details. The festival-fund must be used for the war. The citizens must serve in person. A few months later, Olynthus and the 32 towns of the confederacy were swept from the earth. Men could walk over their sites, Demosthenes said seven years afterwards, without knowing that such cities had existed. It was now certain that Philip could not be stopped outside of Greece. The question was, What point within Greece shall he be allowed to reach?

Demosthenes saw that Athens must have time to collect strength. Nothing could be gained, meanwhile, by going on with the war. Macedonian sympathizers at Athens, of whom Philocrates was the chief, also favoured peace. Eleven envoys, including Philocrates, Aeschines, and Demosthenes, were sent to Philip in February 346 B.C. After a debate at Athens, peace was concluded with Philip in April. Philip on the one hand, Athens and her allies on the other, were to keep what they respectively held at the time when the peace was ratified. But here the Athenians made a fatal error. Philip was now at war with the people of Halus in Thessaly. Thebes had for ten years been at war with Phocis. Here were two distinct chances for Philip's armed intervention in Greece. But if the Halians and the Phocians were included in the peace, Philip could not bear arms against them without violating the peace. Accordingly Philip insisted that they should not be included. Demosthenes insisted they should be included. They were not included. The result followed speedily. The same envoys were sent a second time to Philip at the end of April 346 for the purpose of receiving his oaths in ratification of the peace. It was late in June when he returned from Thrace to Pella—thus gaining, under the terms, all the towns that he had taken meanwhile. He next took the envoys with him through Thessaly to Thermopylae. There—at the invitation of Thessalians and Thebans—he intervened in the Phocian War. Phalaecus surrendered. Phocis was crushed. Philip took its place in the Amphictyonic Council, and was thus established as a Greek power in the very centre, at the sacred hearth, of Greece. The right of precedence in consultation of the oracle (προμαντεία) was transferred from Athens to Philip. While indignant Athenians were clamouring for the revocation of the peace, Demosthenes upheld it in his speech "On the Peace" in September. It ought never to have been made on such terms, he said. But, having been made, it had better be kept. "If we went to war now, where should we find allies? And after losing Oropus, Amphipolis, Cardia, Chios, Cos, Rhodes, Byzantium, shall we fight about the shadow of Delphi?"

Second and Third Philippic.—During the eight years between the peace of Philocrates and the battle of Chaeroneia, the authority of Demosthenes steadily grew, until it became first predominant and then paramount. He had, indeed, a melancholy advantage. Each year his argument was more and more cogently enforced by the logic of facts. In 344 he visited the Peloponnesus for the purpose of counteracting Macedonian intrigue. Mistrust, he told the Peloponnesian cities, is the safeguard of free communities against tyrants. Philip lodged a formal complaint at Athens. Demosthenes replied in the Second Philippic, "If," he said, "Philip is the friend of Greece, we are doing wrong. If he is the enemy of Greece, we are doing right. Which is he? I hold him to be our enemy, because everything that he has hitherto done has benefited himself and hurt us." The prosecution of Aeschines for malversation on the embassy (commonly known as De *falsa legatione*), which was brought to an issue in the following year, marks the moral strength of the position now held by Demosthenes. When the gravity of the charge and the complexity of the evidence are considered, the acquittal of Aeschines by a narrow majority must be deemed his condemnation. The speech "On the Affairs of the Chersonese" and the Third Philippic were the crowning efforts of Demosthenes. Spoken in the same year, 341 B.C., and within a short space of each other, they must be taken together. The speech "On the Affairs of the Chersonese" regards the situation chiefly from an Athenian point of view. "If the peace means," argues Demosthenes, "that Philip can seize with impunity one Athenian possession after another, but that Athenians shall not on their peril touch aught that belongs to Philip, where is the line to be drawn? We shall go to war, I am told, when it is necessary. If the necessity has not come yet, when will it come?" The Third Philippic ascends from the Athenian to the Hellenic view. Philip has annihilated Olynthus and the Chalcidic towns. He has ruined Phocis. He has frightened Thebes. He has divided Thessaly. Euboea and the Peloponnesus are his. His power stretches from the Adriatic to the Hellespont. Where shall be the end? Athens is the last hope of Greece. And, in this final crisis, Demosthenes was the embodied energy of Athens. It was Demosthenes who went to Byzantium, brought the estranged city back to the Athenian Alliance, and snatched it from the hands of Philip. It was Demosthenes who, when Philip had already seized Elateia, hurried to Thebes, and by his passionate appeal gained one last chance, the only possible chance, for Greek freedom, who broke down the barrier of an inveterate jealousy, who brought Thebans to fight beside Athenians, and who thus won at the eleventh hour a victory for the spirit of loyal union which took away at least one bitterness from the unspeakable calamity of Chaeroneia.

After Chaeroneia.—But the work of Demosthenes was not closed by the ruin of his cause. During the last 16 years of his life (338–322) he rendered services to Athens not less important, and perhaps more difficult, than those which he had rendered before. He was now, as a matter of course, foremost in the public affairs of Athens. In Jan. 337, he spoke the funeral oration over those who had fallen at Chaeroneia. He was member of a commission for strengthening the fortifications of the city (τειχοποιός). He administered the festival-fund. During a dearth which visited Athens between 330 and 326 he was charged with the organization of public relief. In 324 he was chief (ἀρχιθέωρος) of the sacred embassy to Olympia. Already, in 336, Ctesiphon had proposed that Demosthenes should receive a golden crown from the

[1] It is generally agreed that the Third Olynthiac is the latest; but the question of the order of the First and Second has been much discussed. *See* Grote *(History of Greece,* chap. *88,* appendix), who prefers the arrangement ii., i., iii., and Blass, ***Die attische Beredsamkeit,*** **iii., p. 319.**

State, and that his extraordinary merits should be proclaimed in the theatre at the Great Dionysia. The proposal was adopted by the senate as a bill (προβούλευγα); but it must be passed by the Assembly before it could become an act (ψήφισμα). To prevent this, Aeschines gave notice, in 336, that he intended to proceed against Ctesiphon for having proposed an unconstitutional measure. For six years Aeschines avoided action on this notice. At last, in 330, the patriotic party felt strong enough to force him to an issue. Aeschines spoke the speech "Against Ctesiphon," an attack on the whole public life of Demosthenes. Demosthenes gained an overwhelming victory for himself and for the honour of Athens in the most finished, the most splendid and the most pathetic work of ancient eloquence "On the Crown."

In the winter of 325–324 Harpalus, the receiver-general of Alexander in Asia, fled to Greece, taking with him 8,000 mercenaries, and treasure equivalent to about a million and a quarter sterling. On the motion of Demosthenes he was warned from the harbours of Attica. Having left his troops and part of his treasure at Taenarum, he again presented himself at the Peiraeeus, and was now admitted. He spoke fervently of the opportunity which offered itself to those who loved the freedom of Greece. All Asia would rise with Athens to throw off the hated yoke. Fiery patriots like Hypereides were in raptures. For zeal which could be bought Harpalus had other persuasions. But Demosthenes stood firm. War with Alexander would, he saw, be madness. It could have but one result—some indefinitely worse doom for Athens. Antipater and Olympias presently demanded the surrender of Harpalus. Demosthenes opposed this. But he reconciled the dignity with the loyalty of Athens by carrying a decree that Harpalus should be arrested, and that his treasure should be deposited in the Parthenon, to be held in trust for Alexander. Harpalus escaped from prison. The amount of the treasure, which Harpalus had stated as 700 talents, proved to be no more than 350. Demosthenes proposed that the Areopagus should inquire what had become of the other 350. Six months, spent in party intrigues, passed before the Areopagus gave in their report (ἀπόφασις). The report inculpated nine persons. Demosthenes headed the list of the accused. Hypereides was among the ten public prosecutors. Demosthenes was condemned, fined fifty talents, and, in default of payment, imprisoned. 'After a few days he escaped from prison to Aegina, and thence to Troezen. Two things in this obscure affair are beyond reasonable doubt. First, that Demosthenes was not bribed by Harpalus. The hatred of the Macedonian party towards Demosthenes, and the fury of those vehement patriots who cried out that he had betrayed their best opportunity, combined to procure his condemnation, with the help, probably, of some appearances which were against him. Secondly, it can scarcely be questioned that, by withstanding the hot-headed patriots at this juncture, Demosthenes did heroic service to Athens.

Next year (323 B.C.) Alexander died. Then the voice of Demosthenes, calling Greece to arms, rang out like a trumpet. Early in Aug. 322 the battle of Crannon decided the Lamian War against Greece. Antipater demanded, as the condition on which he would refrain from besieging Athens, the surrender of the leading patriots. Demades moved the decree of the assembly by which Demosthenes, Hypereides, and some others were condemned to death as traitors. A Macedonian garrison occupied Munychia, on the 20th of Boëdromion (Sept. 16) 322, the day on which, 13 years before, Alexander had punished the rebellion of Thebes with annihilation.

Death.—The condemned men had fled to Aegina. Parting there from Hypereides and the rest, Demosthenes went on to Calauria, a small island off the coast of Argolis. He sought asylum in an ancient sanctuary, the temple of Poseidon. Archias of Thurii, a man who, like Aeschines, had begun life as a tragic actor, and who was now in the pay of Antipater, soon traced the fugitive, landed in Calauria, and appeared before the temple of Poseidon with a body of Thracian spearmen. Archias was not the man to stick at sacrilege. In Aegina, Hypereides and the others had been taken from the shrine of Aeacus. But he hesitated to violate an asylum so peculiarly sacred as the Calaurian temple. Standing before its open door, with his Thracian soldiers around him, he endeavoured to prevail on Demosthenes to quit the holy precinct. Antipater would be certain to pardon him. Demosthenes sat silent, with his eyes fixed on the ground. At last, as the emissary persisted in his bland persuasions, he looked up and said: "Archias, you never moved me by your acting, and you will not move me now by your promises." Archias lost his temper, and began to threaten. "Now," rejoined Demosthenes, "you speak like a real Macedonian oracle; before you were acting. Wait a moment, then, till I write to my friends." With these words, Demosthenes withdrew into the inner part of the temple—still visible, however, from the entrance. He took out a roll of paper, as if he were going to write, put the pen to his mouth, and bit it, as was his habit in composing. Then he threw his head back, and drew his cloak over it. The Thracian spearmen, who were watching him from the door, began to gibe at his cowardice. Archias went in to him, encouraged him to rise, repeated his old arguments, talked to him of reconciliation with Antipater. By this time Demosthenes felt that the poison which he had sucked from the pen was beginning to work. He drew the cloak from his face, and looked steadily at Archias. "Now you can play the part of Creon in the tragedy as soon as you like," he said, "and cast forth my body unburied. But I, O gracious Poseidon, quit thy temple while I yet live; Antipater and his Macedonians have done what they could to pollute it." He moved towards the door, calling to them to support his tottering steps. He had just passed the altar of the god, when he fell, and with a groan gave up the ghost (Oct. 322 B.C.).

Political Character and Oratory.—AS a statesman, Demosthenes needs no epitaph but his own words in the speech "On the Crown,"—I *say that,* if *the event had been manifest to the whole world beforehand, not even then ought Athens to have forsaken this course,* if *Athens had any regard for her glory, or for her past, or for the ages to come.* The Persian soldier in Herodotus, following Xerxes to foreseen ruin, confides to his fellow-guest at the banquet that the bitterest pain which man can know is πολλὰ φρονέοντα μηδενὸς κρατέειν,—complete, but helpless, prescience. In the grasp of a more inexorable necessity, the champion of Greek freedom was borne onward to a more tremendous catastrophe than that which strewed the waters of Salamis with Persian wrecks and the field of Plataea with Persian dead; but to him, at least, it was given to proclaim aloud the clear and sure foreboding that filled his soul, to do all that true heart and free hand could do for his cause, and, though not to save, yet to encourage, to console and to ennoble. As the inspiration of his life was larger and higher than the mere courage of resistance, so his merit must be regarded as standing altogether outside and above the struggle with Macedon. The great purpose which he set before him was to revive the public spirit, to restore the political vigour, and to re-establish the Panhellenic influence of Athens—never for her own advantage merely, but always in the interest of Greece. His glory is, that while he lived he helped Athens to live a higher life. Wherever the noblest expressions of her mind are honoured, wherever the large conceptions of Pericles command the admiration of statesmen, wherever the architect and the sculptor love to dwell on the masterpieces of Ictinus and Pheidias, wherever the spell of ideal beauty or of lofty contemplation is exercised by the creations of Sophocles or of Plato, there it will be remembered that the spirit which wrought in all these would have passed sooner from among men, if it had not been recalled from a trance by the passionate breath of Demosthenes.

The orator in whom artistic genius was united, more perfectly than in any other man, with moral enthusiasm and with intellectual grasp, has held in the modern world the same rank which was accorded to him in the old; but he cannot enjoy the same appreciation. Sincerity and intensity are, to the modern reader, the most obvious characteristics of Demosthenes. His style is, on the whole, singularly free from what we are accustomed to regard as rhetorical embellishment. Where the modern orator would employ a wealth of imagery, or elaborate a picture in exquisite detail, Demosthenes is content with a phrase or a word.

Burke uses, in reference to Hyder Ali, the same image which Demosthenes uses in reference to Philip. "compounding all the materials of fury, havoc, desolation, into one black cloud, he hung for a while on the declivity of the mountains. Whilst the authors of all these evils were idly and stupidly gazing on this menacing meteor, which darkened all their horizon, it suddenly burst, and poured down the whole of its contents upon the plains of the Carnatic." Demosthenes forbears to amplify. "The people gave their voice, and the danger which hung upon our borders went by like a cloud." To our modern feeling, the eloquence of Demosthenes exhibits everywhere a general stamp of earnest and simple strength. But it is well to remember the charge made against the style of Demosthenes by a contemporary Greek orator, and the defence offered by the best Greek critic of oratory. Aeschines reproached the diction of Demosthenes with excess of elaboration and adornment (περιεργία). Dionysius, in reply, admits that Demosthenes does at times depart from simplicity,—that his style is sometimes elaborately ornate and remote from the ordinary usage. But, he adds, Demosthenes adopts this manner where it is justified by the elevation of his theme. The remark may serve to remind us of our modern disadvantage for a full appreciation of Demosthenes. The old world felt, as we do, his moral and mental greatness, his fire, his self-devotion, his insight. But it felt also, as we can never feel, the versatile perfection of his skill. This it was that made Demosthenes unique to the ancients. The ardent patriot, the far-seeing statesman, were united in his person with the consummate and unapproachable artist. Dionysius devoted two special treatises to Demosthenes,—one on his language and style (λεκτικὸς τόπος), the other on his treatment of subject-matter (πραγματικὸς τόπος). The latter is lost. The former is one of the best essays in literary criticism which antiquity has bequeathed to us. The idea which it works out is that Demosthenes has perfected Greek prose by fusing in a glorious harmony the elements which had hitherto belonged to separate types. The austere dignity of Antiphon, the plain elegance of Lysias, the smooth and balanced finish of that middle or normal character which is represented by Isocrates, have come together in Demosthenes. Nor is this all. In each species he excels the specialists. He surpasses the school of Antiphon in perspicuity, the school of Lysias in verve, the school of Isocrates in variety, in felicity, in symmetry, in pathos, in power.

Literary History of **Demosthenes.**—The ancient fame of Demosthenes as an orator can be compared only with the fame of Homer as a poet. Cicero, with generous appreciation, recognizes Demosthenes as the standard of perfection. Dionysius, the closest and most penetrating of his ancient critics, exhausts the language of admiration in showing how Demosthenes united and elevated whatever had been best in earlier masters of the Greek idiom. Hermogenes, in his works on rhetoric, refers to Demosthenes as ὁ ῥήτωρ, *the* orator. The writer of the treatise On Sublimity knows no heights loftier than those to which Demosthenes has risen. From his own younger contemporaries, Aristotle and Theophrastus, who founded their theory of rhetoric in large part on his practice, down to the latest Byzantines, the consent of theorists, orators, antiquarians, anthologists and lexicographers offered the same unvarying homage to Demosthenes. His work busied commentators such as Xenon, Minucian, Basilicus, Aelius, Theon, Zosimus of Gaza. Arguments to his speeches were drawn up by rhetoricians so distinguished as Numenius and Libanius. Accomplished men of letters, such as Julius Vestinus and Aelius Dionysius, selected from his writings choice passages for declamation or perusal, of which fragments are incorporated in the miscellany of Photius and the lexicons of Harpocration, Pollux and Suidas. It might have been anticipated that the purity of a text so widely read and so renowned would, from the earliest times, have been guarded with jealous care. The works of the three great dramatists had been thus protected, about 340 B.C., by a standard Attic recension. But no such good fortune befell the works of Demosthenes. Alexandrian criticism was chiefly occupied with poetry. The titular works of Demosthenes were, indeed, registered with those of the other orators, in the catalogues (ῥητορικοὶ πίνακες) of Alexandria and Pergamum. But no thorough attempt was made to separate the authentic works from those spurious works which had even then become mingled with them. Philosophical schools which, like the Stoic, felt the ethical interest of Demosthenes, cared little for his language. The rhetoricians who imitated or analysed his style cared little for the criticism of his text. Their treatment of it had, indeed, a direct tendency to falsify it. It was customary to indicate by marks those passages which were especially useful for study or imitation. It then became a rhetorical exercise to recast, adapt or interweave such passages. Sopater, the commentator on Hermogenes, wrote on μεταβολαὶ καὶ μεταποιήσεις τῶν Δημοσθένους χωρίων, "adaptations or transcripts of passages in Demosthenes." Such manipulation could not but lead to interpolations or confusions in the original text. Great, too, as was the attention bestowed on the thought, sentiment and style of Demosthenes, comparatively little care was bestowed on his subject-matter. He was studied more on the moral and the formal side than on the real side. An incorrect substitution of one name for another, a reading which gave an impossible date, insertions of spurious laws or decrees, were points which few readers would stop to notice. Hence it resulted that, while Plato, Thucydides and Demosthenes were the most universally popular of the classical prose-writers, the text of Demosthenes, the most widely used perhaps of all, was also the least pure. His more careful students at length made an effort to arrest the process of corruption. Editions of Demosthenes based on a critical recension, and called Ἀττικιανὰ (ἀντίγραφα), came to be distinguished from the vulgates, or δημώδεις ἐκδόσεις.

Among the extant manuscripts of Demosthenes—upwards of 170 in number—one is far superior, as a whole, to the rest. This is *Parisinus* Σ 2934, of the 10th century. A comparison of this ms. with the extracts of Aelius, Aristeides and Harpocration from the Third Philippic favours the view that it is derived from an Ἀττικιανόν, whereas the δημώδεις ἐκδόσεις, used by Hermogenes and by the rhetoricians generally, have been the chief sources of our other manuscripts. The collation of this manuscript by Immanuel Bekker first placed the textual criticism of Demosthenes on a sound footing. Not only is this manuscript nearly free from interpolations, but it is the sole voucher for many excellent readings. Among the other mss., some of the more important *are*—*Marcianus* 416 F, of the 10th (or 11th) century, the basis of the Aldine edition; *Augustanus I.* (N. 85), derived from the last, and containing scholia to the speeches on the Crown and the Embassy, by Ulpian, with some by a younger writer, who was perhaps Moschopulus; *Parisinus; Antverpiensis*—*the* last two comparatively free from additions. The fullest authority on the mss. is J. T. Vömel, *Notitia codicum Demosth.*, and *Prolegomena Critica* to his edition published at Halle (1856–57), pp. 175–178.

The extant scholia on Demosthenes are for the most part poor. Their staple consists of Byzantine erudition; and their value depends chiefly on what they have preserved of older criticism. They are better than usual for the Περὶ στεφάνου, Κατὰ Τιμοκράτους; best for the Περὶ παραπρεσβείας. The Greek commentaries ascribed to Ulpian are especially defective on the historical side, and give little essential aid. Editions:—C. W. Miiller, in *Orat. Att.* ii. (1847–58); *Scholia Graeca in Demosth. ex cod. aucta et emendata* (Oxon., 1851; in W. Dindorf's ed.).

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DEMOTICA or **DIDYMOTEIKHON,** a town of eastern Greece on the Maritsa valley branch of the Istanbul-Salonika railway, about 35 mi. south of Adrianople. Population about 10,000. Its mediaeval name of Didymoteichos has been revived and is now in use. Demotica is built at the foot of a conical hill on the left bank of the river Kizildeli, near its junction with the Maritsa. It was formerly the seat of a Greek archbishop, and, besides the ancient citadel and palace on the summit of the hill, contains several Greek churches, mosques and public baths. In the middle ages it was one of the principal marts of Thrace; in modern times it has regained some commerce, and exports pottery, linen, silk and grain. German troops occupied the town, 1941.

DEMOTIC LANGUAGE AND WRITING. The name demotic, "popular," is taken from Herodotus for the ordinary Egyptian handwriting of late times. The script first appears about the 6th century B C. as an improvement on the particularly obscure and unsystematic style of hieratic writing employed in business documents for some centuries before that time. It arose probably in the commercial areas of Lower Egypt at Sais or Memphis, and by the time of Darius, who apparently encouraged the reorganization of the writing schools, a neat script was everywhere in use for the above purposes. Before the Macedonian conquest the cursive ligatures of the early demotic gave birth to new symbols which were carefully and distinctly formed. In the Ptolemaic period an epigraphic variety appears, priestly decrees being engraved on stelae (such as the Rosetta Stone) in triple hieroglyphic, demotic and Greek versions; under the Romans, while religious texts continued to be written in hieratic, literary texts were in demotic, but Greek was almost universal for business documents. The use of demotic went out with or before paganism, but priests of Isis continued to use it in their graffiti at Philae as late as AD. 452.

Demotic is written from right to left in horizontal lines; the signs comprise phonograms, word-signs and determinatives, and a single demotic sign is often in origin a ligature of several hieroglyphic signs. It is difficult to transcribe with precision into hieroglyphic, and the result of such a transcription looks absurd on account of the unetymological spellings and the number of otiose signs included in the ligatures. The language of demotic may represent approximately the speech of the 26th dynasty; it approximates to Coptic (*q.v.*), but employs fewer auxiliaries and periphrastic forms, and even in its latest stages its loans from Greek are confined to a few technical words which do not affect the grammar. In the Ptolemaic age it first distinguished l from *r,* and in very late texts vocalization may be indicated to some extent.

The chief literary compositions in demotic are stories *(The Stories of Setkon Khamois, The Romance of King Petubastis, The Myth of the Eye of Re,* etc.); a prophetic work, the so-called *Demotic Chronicle;* and collections of apophthegms. *The Petition of Peteësi* (temp. Darius I.) on a papyrus in the Rylands collection takes the form of a long narrative of events covering more than a century and a half.

See F. Ll. Griffith, *Catalogue of the Demotic Papyri in the John Rylands Library, Manrhester,* 3 vols. (1909); Spiegelberg. *Demotische Grammatik,* Heidelberg (1925). (F. LL. G)

DEMPSTER, THOMAS (1570–1625), Scottish scholar and historian, was born at Cliftbog, Aberdeenshire, and sent, at ten years old, to Pembroke Hall, Cambridge. He then studied at Louvain, graduated at the English College at Douai, and in canon law in Paris. He was in turn regent of the college of Navarre in Paris, professor of the humanities at Toulouse, of rhetoric at Nîmes, tutor in Spain, and then, after a short visit to Scotland, professor in various colleges in Paris. His quarrelsome temperament led to difficulties in all these places, and in 1615 he came to London at the invitation of James I. His Roman Catholicism stood in the way of preferment in England and he returned to the Continent. He became professor of the Pandects at Pisa, and then professor of the humanities at Bologna, then the most famous of European universities. He died there on Sept. 6, 1625.

Dempster had a great reputation in his day. His principal works are: An edition of Rosinus's *Antiquitatum romanarum corpus absolutissimum* (Paris, 1613); *De Etruria regali,* posthumously published (Florence, 1723–24); *editio princeps* of Corippius (Paris, 1610); an annotated edition of Benedetto Accolti's *De bello a Christianis contra barbaros gesto* (Florence, 1623); and the famous *Historia ecclesiastica gentis Scotorum* (Bologna, 1627), in which Scottish patriotism made him claim as Scots Bernard (Sapiens), Alcuin, Boniface and Johannes Scotus Erigena. Some of his Latin verse was published in vol. i. of *Delitiae poetarum Scotorum* (Amsterdam, 1637).

DEMURRAGE, in merchant shipping the sum payable by the freighter to the shipowner for detention of the vessel in port beyond the number of days allowed for the purpose of loading or unloading. *(See* AFFREIGHTMENT: *Charter-parties.)* In railway law the charge on detention of trucks; and in banking the charge per ounce made by the Bank of England in exchanging coin or notes for bullion. The word is derived from Fr. *demewer,* to delay.

DEMURRER, in common law, an objection taken to the sufficiency, in point of law, of the pleading or written statement of the other side. *(See* PRACTICE AND PROCEDURE.)

DENAIN, a town of northern France in the department of Nord, 8 m. S.W. of Valenciennes. Coal mines and iron-smelting works caused its growth from a mere village in the early 19th century to a town of 24,275 inhabitants in 1936. Besides iron and steel works, it has breweries and manufactories of machinery and glass. Denain has a port on the left bank of the Scheldt canal. Its vicinity was the scene of the victory gained in 1712 by Marshal Villars over Prince Eugène.

DENBIGH, WILLIAM FEILDING, 1ST EARL OF (d. 1643), British naval and military officer, son of Basil Feilding and of Elizabeth Aston, was educated at Emmanuel college, Cambridge, and knighted in 1603. He married Susan Villiers, sister of the future duke of Buckingham, and on the rise of the favourite received various offices and dignities. Created baron and viscount Feilding in 1620, and earl of Denbigh on Sept. 14, 1622, he attended Prince Charles on the Spanish adventure, served as admiral in the unsuccessful expedition to Cadiz in 1625, and commanded the disastrous attempt upon Rochelle in 1628, becoming the same year a member of the council of war, and in 1633 a member of the council of Wales. In the Civil War he served under prince Rupert and was present at Edgehill. On April 3. 1643, during Rupert's attack on Birmingham, he was wounded, and died from the effectson the 8th. The descent of the Feildings from the house of Habsburg, through the counts of Laufenburg and Rheinfelden, long considered authentic, and immortalized by Gibbon, has been proved to have been based on forged documents. *See* J. H. Round, *Peerage and Family History* (1901).

See E. Lodge, *Portraits* iv. 113; (1850), J. Nichols, *Hist. of Leicestershire,* iv. pt. *1,* 273 (1807), *Hist. MSS. Comm. Ser.,* 4th Rep. app. 254; Cal. *of State Papers, Dom;* J. H. Round, *Studies in Peerage and Family History, 216* (1901).

His eldest son, BASIL FEILDING, 2nd earl of Denbigh *(c.* 1608–75), was sent in 1634 by Charles I. as ambassador to Venice, where he remained for five years. During the Civil War Feilding ranged himself among the Parliamentarians, led a regiment of horse at Edgehill, and, having become earl of Denbigh in April

1643, was made commander-in-chief of the Parliamentary Army in the Midlands and lord-lieutenant of Warwickshire. He resigned his command after the passing of the self-denying ordinance in April 1645. At Uxbridge (1645) and at Carisbrooke (1647) Denbigh was one of the commissioners appointed to treat with the king. He supported the army in its dispute with the parliament, but he would take no part in the trial of Charles I. Under the Commonwealth Denbigh was a member of the council of state, but later he came to be regarded as a royalist. He died without issue on Nov. 28, 1675.

His titles devolved on his nephew WILLIAM FEILDING (1640–85), son and heir of his brother George (created Baron Feilding of Lecaghe, Viscount Callan and earl of Desmond), and the earldom of Desmond has been held by his descendants to the present day in conjunction with the earldom of Denbigh.

DENBIGH (Dinbych), municipal borough, market and county town of Denbighshire, Wales, on a branch of the L.M.S.R. Pop. (1931) 7,249. The name suggests an early fortification Din in Dinbych means a fort and the pre-Norman fort was called *Castell* caled fryn yn *Rhôs,* or "the castle of the hard hill in Rhôs." Denbigh castle was built, in Edward I.'s reign, by Henry de Lacy, earl of Lincoln, from whom the town received its first charter. The outer wall is nearly a mile round. The castle was given to the Mortimers and to Leicester under Edward III. and Elizabeth respectively. In 1645, after the defeat of Rowton Moor, Charles I. found shelter here. The castle long resisted the Parliamentarians. There are ruins of a Carmelite priory, dating from the 13th century; a Bluecoat school (1514); a free grammar school (1527); an orphan girl school (funds left by Thomas Howel to the Drapers' Co., in Henry VII.'s reign); the town hall (built in 1572 by Robert Dudley, earl of Leicester, enlarged and restored in 1780); an unfinished church (begun by Leicester), and the old parish church of St. Marcella. The industries are mainly agricultural with a little quarrying. The borough of Denbigh has a separate commission of the peace, but no separate court of quarter sessions. Near Denbigh, at Bodelwyddan, etc., coal is worked.

DENBIGHSHIRE (DINBYCH), a county of the north coast of Wales, made up of two linked regions, north-west and south-east. Area 662 sq. miles. The north-west region is bounded west by the Conwy, along the line of which the Ordovician rocks with volcanic elements to the west (see CARNARVONSHIRE) give place to the sharp edged plateau of Silurian rocks, a part of the general Welsh plateau (see WALES). This region stretches east to the trough of the Vale of Clwyd, the west side of which is in Denbighshire, while the county has extensions up the Bodfari gap in the eastern wall of the vale (the Moel Fammau range, with Moel Fammau 1,820 ft.) and across the Clwyd farther up the valley; Flintshire borders it here on the east. The nucleus of Merionethshire is the fault-valley through Corwen, Bala and Dolgelley, and consequently valleys opening into the main fault-valley are for the most part in the latter county. The north-west region of Denbighshire is thus mainly a dissected plateau draining eastward to the Clwyd, but with small portions draining to the Conwy on the west or to the upper Dee on the south. On the north coast between Old Colwyn and Llandulas is a detached fragment of Carnarvonshire, a fact related to a change in the course of the Conwy stream.

The south-east region of Denbighshire includes the basin of the Ceiriog and its mountain frame of the Berwyn ridge, of Ordovician rock with volcanic elements, Moel Sych (2,713 ft.). Montgomeryshire lies to the south and south-west. The Ceiriog flows into the Dee near its emergence from deep, encased meanders in the Welsh plateau. Ruabon and Wrexham and their coal-measures on the borders of Cheshire are also in this region of Denbighshire, which extends up into the deep meanders of the Dee above Llangollen, until the region focussing on Corwen (see above) is reached. The two regions of Denbighshire are physically linked but humanly divided by the dissected plateau of Silurian rocks north of the Llangollen section of the Dee; to the north-east lies Flintshire. A narrow broken band of the Old Red, or what may be a conglomeratic basement bed of the Carboniferous Limestone series, crops up along the Vale of Clwyd and in Eglwyseg. Resting upon this the Carboniferous limestone extends from Llanymynach, its extreme southern point, to the Cyrnybrain fault, and there forks into two divisions that terminate respectively in the Great Orme's Head and in Talargoch, and are separated from each other by the denuded shales of the Moel Fammau range. In the Vale of Clwyd the limestone underlies the new red sandstone, and in the eastern division it is itself overlaid by the millstone grit of Ruabon and Minera, and by a long reach of the coal measures which, near Wrexham, are 43 m. in breadth. Eastward of these a broad strip of the red marly beds succeeds, and between this and the Dee the ground is occupied—as in the Vale of Clwyd—by the new red rocks. The red sandstone areas form the best agricultural land. The eastern flank of the county is less sharp as it grades down to the coalfield west of the Dee. These coal measures have been extensively worked, with Rhos, Wrexham and Ruabon as centres. From the limestone below, lead, with silver and zinc ores, have been obtained. Valuable fireclays and terra-cotta marls are also taken from the coal measures about Wrexham. As in other northern counties of Wales, the whole of the lower ground is covered more or less thickly with glacial drift. On the western side of the Vale of Clwyd, at Cefn and Plbs Heaton, the caves, a common feature in such limestone districts, have yielded the remains of the rhinoceros, mammoth, hippopotamus and other mammals now extinct in Britain.

Archaeology.— The period of earliest occupation of the region by man is still very doubtful. The high ground is dotted by tumuli, but only one beaker pot has been recorded. Finds of early gold and socketed axes dating from the late Bronze age are more numerous, indicating that the upper Dee valley and the Vale of Clwyd had become important lines of movement by this time. The native hill fortresses and Roman statues of later times show the importance of the North Wales coastal route. A great native hill-fortress was Dinorben (see Willoughby Gardner, "The Native Hill-forts of North Wales and their Defences," Archaeologia Cambrensis, vol. lxxxi. part 2, Dec. 1926). It seems clear that these native fortresses protected routes, and, whatever their original date, they received much attention during the Roman period. Roman roads ran from Chester via Flint through the north of the county to St. Asaph, and thence on to Kanovium and Segontium (Carnarvon). Another line was via Ffrith and the south of the county to the Bala cleft and the Caergai station. Clawdd Coch has traces of the Romans; so also has Penygaer and Penbarras. To their period belong the inscribed Gwytherin and Pentrefoelas (near Bettws-y-coed) stones. The Valle Crucis, "Eliseg's pillar," tells of Brochmael and the Cairlegion (Chester) struggle against Aethelfrith's invading Northumbrians, A.D. 613, while Offa's dike goes back to the Mercian advance. The south-east of the county includes a considerable section of this dike as well as of the smaller and parallel Watt's dike (see Fox, *Archaeologia* Cambrensis, vol. lxxxi., part 1, June, 1926).

History.— After the Edwardian conquest Denbigh castle was built by Henry de Lacy, earl of Lincoln, and Ruthin castle probably by Hugh, earl of Chester. The rolls of the Court of Ruthin are complete from 1294, and are now in the National Library of Wales, Aberystwyth. Owain Glyn Dwr failed to take Ruthin in 1400. In the south-east of the county Chirk castle was founded by Roger de Mortimer in the early 14th century. The county was formed by an act of Henry VIII. out of the lordships of Denbigh, Ruthin (Rhuthyn), Rhos and Rhyfoniog, which are roughly the Perfeddwlad (midland) between Conway and Clwyd and the lordships of Bromfield, Yale (*Iâl,* open land) and Chirkland, the old possessions of Gruffydd ap Madoc, arglwydd (lord) of Dinas Brân. Charles I. took refuge in this county in 1645. and the castle of Denbigh was one of the last strongholds in Wales to surrender to the parliament which "slighted" both Denbigh and Ruthin. Near Ruabon is Wynnstay, the seat of the old Watkin Williams-Wynn family of landowners. The fine church (1470) of Wrexham shows that this part of the county between the Welsh plateau and the English border had developed considerably during the middle ages. Royalist and Jacobite sympathies and continued adherence to the Roman Catholic Church on the part of some of

the great families have been features of the county, which developed considerably under the Nonconformist influences of the 18th century.

Oak wood lofts and screens, a feature of South-west England, the Welsh border and Montgomeryshire, are found at Llanrwst, Gresford and Derwen. Gresford and Llanrhaiadr (Dyffryn Llanrwst Clwyd) have stained glass.

Industries and Occupations.— The great extent of moorland area has confined the agricultural output of the county. A little wheat is grown in the lowlands but ten times as much oats. Turnips and swedes are also important crops. Large flocks of sheep are pastured on the hill-sides, and many black cattle are reared for fattening in the midlands of England and for sale in London. Large numbers of pigs are also kept. Other industries, formerly of greater importance than at present, include slate quarrying, lead-mining and woollen manufacture. Nantglyn prepares paving flags, Rhiwfelen (near Llangollen) slabs and slates, while good slates are also obtained at Glyn Ceiriog. There is plenty of limestone with china stone at Brymbo. Cefn Rhiwabon yields sandstone (for hones) and millstone grit. The great Minera Mine has produced great quantities of lead ore. Woollen manufactures centre around Llangollen and Llansantffraid (St. Bridgit's). The extensive development of coal-mining in the south-east of the county in the latter half of the 19th century has transformed the old world market towns of Chirk, Ruabon and Wrexham into coal-mining and industrial centres. The proximity of the Lancashire and Staffordshire industrial areas ensure a market for the coal, while modern developments on the Wirral and the North Wales coast and the extended interest in by-products may help in the future. The rapid development of the industrial area (south-east) with its new populations and new ideas, provides a social and political contrast over against the other section of Denbighshire (north-west) which has remained rural and agricultural. These distinct geographical and social units illustrate the difficulty of the county as an administrative unit.

Communications.— The Holyhead road to London, a one-time famous coaching route, runs down the Llangollen valley. The L.M.S. railway (Holyhead line), with the Conway and Clwyd valleys branches, together with the lines connecting Denbigh with Ruabon (Rhiwabon), via Ruthin and Corwen, Wrexham with Connah's Quay (L.N.E. railway) and Rhosllanerchrhugog with Glyn Ceiriog (for the Great Western and L.N.E. railways) have opened up the county.

The area of the ancient county is 661 sq.mi. The area of the administrative county is 668 sq.mi., with a population in 1938 of 156,840. The chief towns are: Wrexham, Denbigh, Ruthin, Llangollen, Llanrwst and Holt. The county has two parliamentary divisions. The urban districts are: Abergele and Pensarn, Colwyn Bay and Colwyn, Llangollen and Llanrwst. Denbighshire is in the north Wales circuit, assizes being held at Ruthin. Denbigh and Wrexham boroughs have separate commissions of the peace, but no separate quarter-session courts. The ancient county, which is in the diocese of St. Asaph, contains 75 ecclesiastical parishes and districts and part of a parish.

DENDERA, a village in Upper Egypt, situated in the angle of the great westward bend of the Nile opposite Kena. Here was the ancient city of Tentyra, capital of the Tentyrite nome, the sixth of Upper Egypt, and the principal seat of the worship of Hathor (Aphrodite), the cow-goddess of love and joy. The temple of Hathor was built in the 1st century B.C., being begun under the later Ptolemies and finished by Augustus, but much of the decoration is later. A great rectangular enclosure of crude bricks, measuring about 900x850ft., contains the sacred buildings; it was entered by two stone gateways, in the north and the east sides, built by Domitian. Another smaller enclosure lies to the east with a gateway, also of the Roman period.

The temple building, which is of sandstone, measures about 300ft. from front to back, and consists of two oblong rectangles; the foremost, placed transversely to the other, is the great hypostyle hall or pronaos, the broadest and loftiest part of the temple, measuring 135ft. in width, and comprising about one-third of the whole structure; the façade has six columns with heads of Hathor, and the ceiling is supported by 18 great columns. The second rectangle contains a small hypostyle hall with six columns, and the sanctuary, with their subsidiary chambers. The sanctuary is surrounded by a corridor into which the chambers open; on the west side is an apartment forming a court and kiosk for the celebration of the feast of the New Year, the principal festival of Dendera. On the roof of the temple, reached by two staircases, are a pavilion and several chambers dedicated to the worship of Osiris. Inside and out the whole of the temple is covered with scenes and inscriptions in crowded characters, of ceremonial and religious import; the decoration is even carried into a remarkable series of hidden passages and chambers or crypts made in the solid walls for the reception of its most valuable treasures. North-east of the entrance is a "Birth House" for the cult of the child Harsemteu, and behind the temple a small temple of Isis, dating from the reign of Augustus. Petrie's excavation of the cemetery behind the temple enclosures revealed burials dating from the fourth dynasty onwards, the most important being *mastabas* of the period from the sixth to the 11th dynasties; many of these exhibited a peculiar degradation of the contemporary style of sculpture.

One of the zodiacs of the temple, from a chamber on the roof, was removed in 1820 to the Bibliothèque Nationale in Paris. Figures of the celebrated Cleopatra VI. occur amongst the sculptures on the exterior of the temple, but they are purely conventional, without a trace of portraiture. Horus of Edfu, the enemy of the crocodiles and hippopotami of Set, appears sometimes as the consort of Hathor of Dendera. Juvenal, in his 17th satire, takes as his text a religious riot between the Tentyrites and the neighbouring Ombites, and Sir Flinders Petrie has shown that the Ombos in question was opposite Coptos, only about 15m. from Tentyra, where the hippopotamus sacred to Set was venerated.

DENDERMONDE: see TERMONDE.

DENDRITE. The fibrous process of a nerve-cell or neuron which conducts impulses toward the cell body. The dendrites of a given neuron differin several ways from the axon, which is the fibrous process conducting away from the cell body. There may be several dendrites, whereas ordinarily there is but a single axon fibre; and the dendrites are usually arranged in branching form (hence the derivation of the term from the Greek word, δένδρον, meaning "tree").

See also NERVOUS SYSTEM; C. J. Herrick, *Neurological Foundations of Animal Behavior.*

DENE-HOLES, the name given to certain caves or excavations in England, popularly but incorrectly attributed to the Danes. The word however is probably derived from the Anglo-Saxon den, a hole or valley. There are many underground excavations in the chalk districts of the south of England, but true dene-holes are found chiefly in those parts of Kent and Essex along the lower banks of the Thames.

The general outline is invariably the same. The entrance is a vertical shaft, some 3ft. in diameter, falling sometimes to a depth of 60ft. The depth is regulated by the depth of the chalk from the surface, but although chalk could have been obtained close at hand within a few feet, or even inches, from the surface, a depth of from 45 to 80ft., or more, is a characteristic feature. The shaft, when the chalk is reached, widens out into a domed chamber with a roof of chalk some 3ft. thick. The walls frequently contract somewhat as they approach the floor. As a rule there is only one chamber, from 16 to 18ft. in height, beneath each shaft. From this excessive height it has been inferred that the caves were not primarily intended for habitations or even hiding-places. In some cases the chamber is extended, the roof being supported by pillars of chalk left standing. In a rare specimen of a twin-chamber discovered at Gravesend, the one entrance served for both caves, although a separate aperture connected them on the floor level. Where galleries are found connecting the chambers, forming a bewildering labyrinth, they are usually the work of a people of a much later period than that of the chambers.

Isolated specimens have been discovered in various parts of Kent, Essex, Hants and Berks, but the most important groups are at Grays Thurrock, in the districts of Woolwich, Abbey Wood and

Bexley and Gravesend. Some of the Chislehurst caves may have been begun as dene-holes. but if so, they have been so enlarged and altered that their original character has been obliterated.

The tool work on the roof or ceiling is generally rougher than that on the walls, where an upright position could be maintained. Casts taken of some of the pick-holes near the roof show that, in all probability, they were made by bone or horn picks. And numerous bone picks have been discovered in Essex and Kent. These pick-holes have assisted in fixing the date of their formation to pre-Roman times. Very few relics of archaeological value have been discovered in any of the known dene-holes, to assist in fixing the date or determining their uses. Pliny mentions pits sunk to a depth of a hundred feet, "where they branched out like the veins of mines." This has been used in support of the explanation that dene-holes were wells sunk for the extraction of chalk. Chrétien de Troyes has a passage on underground caves in Britain which may refer to dene-holes, and tradition of the 14th century treated the dene-holes of Grays as the fabled gold mines of Cunobeline (or Cymbeline) of the 1st century. Vortigern's caves at Margate are possibly dene-holes adapted by later peoples to other purposes; and excellent examples of various pick-holes may be seen on different parts of the walls. Local tradition associates these caves with smugglers; and since illicit trade was common both on the coast and in the Thames up to Barking Creek, the theory is tenable.

There are three purposes for which dene-holes may originally have been excavated; (a) as hiding places or dwellings, (b) as draw-wells for the extraction of chalk for agricultural uses, and (c) as store-houses for grain. It is unlikely that they were used as habitations, although they may have been used occasionally as hiding-places. Against the theory that they were primarily designed for the extraction of chalk, it may be urged that chalk could have been obtained on the surface close by, and that known examples of chalk draw-wells do not descend to so great a depth. The discovery of a shallow dene-hole, about 14ft. below the surface, at Stone, negatives this theory still further. The view that these prehistoric excavations were designed as silos is usually accepted as the most probable. Silos, or underground storehouses, are well known in the south of Europe and Morocco. It is supposed that the grain was stored in the ear and carefully protected from damp by straw. A curious smoothness of the roof of one of the chambers of the Gravesend twin-chamber dene-hole supports this theory. The theory that the excavations were made in order to get flints for implements is quite impossible, as a careful examination of a few examples will show.

See F. C. J. Spurrell, "Deneholes and Artificial Caves," in the Archaeological Journal (1882); T. V. Holmes, "Deneholes" (1883) and many other references in the *Essex Naturalist*; Archaeologia Cantiana (vol. xviii., 1896); F. W. Reader, "Deneholes" in Old Essex, ed. A. C. Kelway (1908); W. Johnston, Folk *Memory* (1908) with bibliography.

DENGUE (děng′gĕ), an infectious fever caused by a filter-passing virus (*q.v.*), occurring in warm climates, and transmitted by mosquito agency (see ENTOMOLOGY, MEDICAL). The symptoms are a sudden attack of fever, accompanied by rheumatic pains in the joints and muscles with severe headache and erythema. After a few days a crisis is reached, and an interval of two or three days is followed by a slighter return of fever and pain and an eruption resembling measles, the most marked characteristic of the disease. The disease is rarely fatal. Dengue is nearly always epidemic, and in certain districts almost endemic. The area over which it ranges may be stated generally to be between 32° 47′ N. and 23° 23′ S. The chief epidemics have been those of 1824–26 in India, and in the West Indies and the southern states of North America, in 1870–75, extending practically over the whole of the tropical portions of the East and reaching as far as China. In 1888–89 a great outbreak spread over nearly the whole of Asia Minor, and in 1928 it occurred in Greece.

See Sir Patrick Manson, Tropical Diseases; a Manual of Diseases of *Warm Climates* (1903); J. F. Siler, M. W. Hall and A. P. Hitchens, "Dengue; Its History, Epidemiology, Mechanism of Transmission, Etiology, Clinical Manifestations, Immunity, and Prevention," *The* Philippine Journal *of* Science, vol. 29, No. 1–2, Manila (1926).

DENHAM, DIXON (1786–1828), English traveller in central Africa, was born in London. He served in the campaigns in Portugal, Spain, France and Belgium, and received the Waterloo medal. In 1821 he volunteered to join Dr. Oudney and Hugh Clapperton (*q.v.*), who had been sent by the British government via Tripoli to the central Sudan. He joined the expedition at Murzuk in Fezzan. The pasha of Tripoli did not at first provide the promised escort, but the expedition eventually left Murzuk at the end of 1822. Thence it made its way across the Sahara to Bornu, reached in Feb. 1823. Here Denham, against the wish of Oudney and Clapperton, accompanied a slave-raiding expedition into the Mandara highlands south of Bornu. The raiders were defeated, and Denham barely escaped with his life. When Oudney and Clapperton set out, Dec. 1823, for the Hausa states. Denham remained behind. He explored the western, south and southeastern shores of Lake Chad, and the lower courses of the rivers Waube, Logone and Shari. In Aug. 1824 he returned to England. He had just been appointed governor of Sierra Leone when he died of fever at Freetown on May 8, 1828.

See Narrative of Travels and Discoveries in Northern and Central Africa in the *Years 1822–24* (1826), the greater part of which is written by Denham; Dr. Robert Brown, The Story of Africa, vol. i. chap. xiii. (1892).

DENHAM, SIR JOHN (1615–1669), English poet, only son of Sir John Denham, lord chief baron of the exchequer in Ireland, was born in Dublin, entered at Trinity college, Oxford, in 1631, and at Lincoln's Inn in 1634. His first work was The Destruction of Troy, a verse paraphrase, written in 1636, of the second book of the Aeneid; but he made his reputation with The Sophy, a tragedy acted at Blackfriars in 1641, and printed in 1642. In the latter year appeared the famous descriptive poem of "Cooper's Hill," which Dryden called "the exact standard of good writing," and Pope used as a model for *Windsor* Forest. Denham fought on the king's side in the Civil War, and in 1648 had to leave England when it was suspected that he was concerned in forwarding Charles's correspondence. He remained abroad in the service of the exiled court until 1652, when he returned to England. He was for some time the guest of the earl of Pembroke at Wilton, and then obtained leave to settle at Bury St. Edmunds. At the Restoration he was rewarded with the office of surveyor-general of works. A scandal, caused by the behaviour of his second wife, who became the duke of York's mistress, is said to have driven him mad; but he recovered and survived her for two years. In addition to his poetical works, some satires on the conduct of the Dutch wars, Directions to a Painter, and Fresh Directions are attributed to him. His beautiful elegy on Abraham Cowley dates from 1667.

BIBLIOGRAPHY.—His Poems and Translations, with a dedicatory epistle to Charles 11, appeared in 1668. Other editions followed, and they are reprinted in Chalmers' (1810) and other collections of the English poets His political satires were printed with some of Rochester's and Marvell's in Bibliotheca curiosa, vol. i. (Edinburgh, 1885). See Canabridge History of *English* Literature, vol. vii., ch. iii., by A. Hamilton, Writers of the Couplet.

DENHARDT, KLEMENS (1852–1929) and his brother GUSTAV (1856–1917), German explorers, were born at Zeitz. In 1878 they explored the Tana river, and six years later were able to negotiate a friendly treaty with the sultan of Witu. Part of the territory acquired was sold to the German Witu-Gesellschaft and was later given to England in exchange for Heligoland.

DENIA, a town in east Spain in the province of Alicante; on the Mediterranean sea and on the coast-railway from Carcagente to Alicante. Pop. (1930) 13,063. Denia, built on the seaward slopes of a small hill surmounted by a ruined castle, lies between the limestone ridge of Mongo on the south and a fertile plain on the north. It makes soap, jam, nails, bicycles and woollen, linen and esparto fabrics hut is above all a fruit-port. It exports grapes, raisins. melons and oranges. tomatoes, onions and almonds, usually to Great Britain and north Europe and imports wheat, flour, guano, sulphur, from Italy. Baltic timber, and coal and tin-plates from South Wales. The harbour, sheltered by a breakwater, contains only a small area of deep anchorage and quay accommodation is limited to boats of under 12 ft. draught. Vessels therefore

load and discharge chiefly into lighters, the larger boats anchoring in the open roadstead about 1 mi. from the shore. Throughout the civil war of 1936–39, the port remained in loyalist control.

Denia was colonized by Greek merchants from Emporiae (Ampurias in Catalonia), or Massilia (Marseilles), at a very early date; the Romans named the town *Dianium,* after its temple of Diana, built, in imitation of that at Ephesus, at the foot of the castle hill. Denia was captured by the Moors in 713, and according to an ancient but questionable tradition, under them became so prosperous a trading centre that its population rose to 50,000. Many characteristic Moorish houses survive in the town though it has been largely modernized. After the city was retaken by the Christians in 1253, its prosperity dwindled, and only began to revive in the 19th century. During the War of the Spanish Succession (1701–14), Denia was thrice besieged; and in 1813 the French withstood an allied British and Spanish siege of the citadel for five months before surrendering, on honourable terms.

DENIFLE, HEINRICH SEUSE (1844–1905), Austrian historian and priest, was born on Jan. 16, 1844 at Imst. After becoming a Dominican in 1861, he studied at Graz, Rome and Marseille, and then from 1870 to 1880 taught philosophy and theology at Graz. Ten years after his first important work, *Das geistliche Leben. Eine Blumenlese aus den deutschen Mystikern des 14 Jahr.,* Denifle became in 1883 sub-archivist of the Vatican. Then came a series of erudite works which have revolutionized our knowledge of the middle ages. In 1885 appeared *Die Universitäten des Mittelalters bis 1400;* in 1889–97 the edition (together with Chatelain) of *Chartularium Univ. Pan's;* in 1894–97 *Liber Procuratorum Nationis Anglicanae 1333–46;* in 1888 *Specimina palaeographica Regestorum Pontificum ab Innocentio iii. ab Urbanum* v.; in 1889 *La guerre de cent ans et la de'solation des églises, monastères, et hôpitaux, t. I. jusqu'à la mort de Chas. v.* (1385); in 1897 *La de'solation des églises, monastères, hôpitaux, en France vers le milieu du XVe siècle* (based on some 1,300 documents). The publication in 1904 of *Luther u. Luthertum,* based on original documents, was followed in the same year by *Luther in rationalistischer u. christlicher Beleuchtung,* a reply to the defence of Luther by Harnack and Seeberg, and by a second volume posthumously in 1909. Besides short articles on various mediaeval mystics, in 1885 Denifle together with Ehrle founded the invaluable *Archiv f. Lit. u. Kirchengeschichte des Mittelalters.*

DENIKER, JOSEPH (1852–1918), French naturalist and anthropologist, was born at Astrakhan, Russia. He studied at St. Petersburg (Leningrad) and, as an engineer, travelled extensively in the petroleum districts of the Caucasus, in central Europe, Italy and Dalmatia, In 1888 he was appointed chief librarian of the Natural History museum, Paris. His valuable ethnological works include *Recherches anatomiques et embryologiques sur les singes anthropoides* (1886); *Étude sur les Kalmouks* (1883); *Les Ghiliaks* (1883); and *Rpces et peuples de la terre* (1900; Eng. trans. 1900, 2nd ed. 1926). He was one of the editors of the *Dictionnaire de géographie universelle.* He died in Paris on March 18, 1918.

DENIKIN, ANTON IVANOVICH (1872–), Russian general, was born in humble circumstances on Dec. 4, 1872. During the Russo-Japanese war he rose from captain to colonel, and in the World War became commander-in-chief of the South-Western Front. After the Revolution he followed Kornilov and was arrested and imprisoned with him in Bykov. They escaped together and joined Alexeyev, who was forming in Rostov and Xovocherkassk on the Don a small army of volunteers to fight the Bolsheviks. After Kornilov's death on March 31, 1918, Denikin became military commander of the army, whilst Alexeyev retained the political and financial leadership. They established contact with the Don Cossacks under Krasnov, and were further strengthened by the forces of General Pokrovsky and Colonel Drozdovsky. In June 1918 Denikin initiated a campaign in the Northern Caucasus; by September his army had grown from 9,000 to 40,000; and by February 1919 he had driven a Bolshevik army of 150,000 from the Northern Caucasus. Alexeyev died on Sept. 25. 1918, and early in 1919 Denikin took the name of commander-in-chief of the Armed Forces of South Russia.

In the autumn of 1919 Denikin came within measurable distance of complete victory. His forces had grown to 150,000; Kharkov, Poltava, Odessa, Kiev, and Orel were in his hands; his right wing had, through a force of Ural Cossacks. established connection with Kolchak's left wing; some 400,000 square miles of territory had been wrested from the Bolsheviks; and a South Russian Government was in being, with a "special council" of twenty-four members. But his great military ability was not alone enough to ensure the fulfillment of Denikin's aims. The rapid turn in his fortunes from victory to defeat was due to a complexity of causes, prominent among which were the general political bewilderment and diversity of purpose manifested by his supporters both within and without the boundaries of the former Russian empire, and the consequent difficulty of maintaining the effective morale of his armies. Meanwhile, largely owing to the relentless discipline introduced by Trotsky, the Bolshevik resistance had stiffened. At the beginning of Nov. 1919 Budenny's cavalry broke through the "white" lines at Kupyansk and a general retreat set in. By promising a new Government on federal lines Denikin made a final, but fruitless, attempt to weld the various Cossack units into cohesion. Early in 1920 the Bolshevik army retook Rostov and Ekaterinodar Denikin. in face of great difficulties, transferred his army from Novorossiysk to the Crimea, and shortly afterwards resigned his command to General Wrangel and retired to England.

DENILIQUIN: *see* RIVERINA.

DENIM, the name originally given to a kind of serge. It is now applied to a stout twilled cloth made in various colours, usually of cotton, and used for overalls, etc.

DENINA, CARLO GIOVANNI MARIA (1731–1813), Italian historian, was born at Revello, Piedmont, in 1731, and was educated at Saluzzo and Turin. He was professor of humanity and rhetoric in the college of Turin. His most important work is *Delle revoluzioni d'Italia* (1769–72). In 1782, at Frederick the Great's invitation, he went to Berlin, where he published his *Vie et règne de Frédéric II.* (1788) and *La Prusse littéraire sous Fre'de'ric II.* (3 vols., 1790–91). His *Delle revoluzioni della Germania* was published at Florence in 1804; in the same year he went to Paris as the imperial librarian, on the invitation of Napoleon. He died in Paris on Dec. 5, 1813.

DENIS (DIONYSIUS), **SAINT,** first bishop of Paris, patron saint of France, whose feast is celebrated on Oct. 9. According to Gregory of Tours (*Hist. Franc.* i. 30), he was sent into Gaul at the time of the emperor Decius. He suffered martyrdom at the village of Catulliacus, the modern St. Denis. His tomb was situated by the side of the Roman road, where rose the priory of St.-Denis-de-l'Estrée, which existed until the 18th century. In the 5th century a basilica was built over the tomb. About 625 Dagobert. son of Clotaire II., founded a monastery in honour of St. Denis near by where the greater number of the kings of France have been buried. A false interpretation of Gregory of Tours, apparently dating from 724, represented St. Denis as receiving his mission from Pope Clement, and as having suffered martyrdom under Domitian (81–96). Hilduin, abbot of St-Denis in the first half of the 9th century, wrongly identified Denis of Paris with Denis (Dionysius) the Areopagite. St. Denis is generally represented carrying his head in his hands.

See *Acta Sanctorum,* Octobris, iv. 696–987; Chevalier, *Bio-bibliog ;* J. Havet, Les *Origines* de *Saint-Denis,* in his collected works, i. 191–246 (Paris, 1896).

DENIS, MAURICE (1870–), French painter, born at Granville, France, on Nov. 25, 1870. The guiding influence in his artistic development was the work of Gauguin, and he joined with some fellow-students, all admirers of Gauguin, to form the group known as "Symbolists." Among them were Serusier, Vuillard, Bonnard and X. Roussel. Denis was also attracted to the pointillism of Seurat, as is shown by his use of pure pigments and of the juxtaposition of complementary colours in his pictures. He then devoted himself to decorative painting, following the example of the great Italian fresco painters of the 1 jth century. His most remarkable works are in the sphere of religious art, and mural decorations of this kind are to be seen in the churches of Le

Vésinet and of St. Paul at Geneva, as well as in the priory chapel at Saint Germain-en-Laye. Maurice Denis decorated the ceiling of the Champs Elysées theatre, Paris; he has also illustrated numerous works including a translation of the *Little Flowers of St. Francis.* He is a writer on art and has published *Thkories,* 1890–1910; *Du Symbolisme et de Gauguin, vers un nouvel ordre classique* (1912); *Nouvelles thkories sur l'art moderne, sur l'art sacrk* (1914–21); and *Aristide Maillol* (192j).

DENIS, MICHAEL (1729–1800), Austrian poet, was born at Scharding on the Inn, on Sept. 27, 1729. He was brought up by the Jesuits, entered their order, and in 1759 was appointed professor in the Theresianum in Vienna. In 1784, after the suppression of the college, he was made second custodian of the court library, and seven years later became chief librarian. He died on Sept. 29, 1800. Michael Denis is best remembered as the translator of *Ossian* (1768–69; also published together with his own poems in 5 vols. as *Ossians und Sineds Lieder,* 1784). His *Sammlung kürzerer Gedichte aus den neuern Dichtern Deutschlands,* 3 vols. (1762–66), introduced current North German literature to Austrian readers.

A selection of his poetry edited by R. Hamel will be found in vol. 48 (1884) of Kurschner's *Deutscke h'ationalliteratur.* His *Literarischer Nachlass* was published by J. F. von Retzer in 1802 (2 vols.). *See* P. von Hofmann-Wellenhof, *Michael Denis* (1881).

DENISON, GEORGE TAYLOR (1839–1925), Canadian soldier, and publicist, was born in Toronto on Aug. 31, 1839, and died there on June 6, 1925. In 1861 he was called to the bar. He saw active service during the Fenian raid of 1866, and during the rebellion of 1885. In 1877 he was appointed police magistrate of Toronto. Col. Denison was one of the founders of the "Canada First" party. He was a member of the Royal Society of Canada, and was president of the section dealing with English history and literature. His best-known military work is the *History of Modern Cavalry* (1877) which was awarded first prize by the Russian Government in an open competition and has been translated into German, Russian and Japanese. In 1900 he published his reminiscences under the title of *Soldiering in Canada.*

DENISON, a city of Grayson county, Texas, U.S.A. 75 mi. N. by E. of Dallas, and 4m. from the Red river, the boundary between Texas and Oklahoma. It is on federal highways 75 and 69 and is served by the Frisco, the Kansas. Oklahoma and Gulf, the Missouri-Kansas-Texas, the Southern Pacific and the Texas and Pacific railways. Pop. (1940) 15,581. It is an important railway centre, and the collecting and distributing point for large shipments of fruit, peanuts, wheat and cotton. The manufacturing industries include freight-car construction shops, bridge works, planing mills, cotton textile mills, a cheese factory, a large peanut plant, and a wood preserving plant. The $50,000,000 Denison dam on the Red river for hydroelectric and flood control is to be completed in 1943. Denison was settled by northerners in 1872, when the Missouri, Kansas and Texas railway reached this point, and was named after George Denison, a director of the railway. It was incorporated as a city in 1891.

DENIZEN, a dweller; a stranger admitted to certain rights in a foreign country; in England, an alien who obtains by letters patent *(ex donatione regis)* privileges of a British subject. By 12 and 13 Will. 3. Ch. 2 a denizen, unless born of English parents, cannot be a member of the privy council or of parliament, or hold any civil or military office of trust, or take a grant of land from the Croun. The British Nationality Act. 1914, provides that nothing therein contained shall affect the grant of any letters of denization by the sovereign.

DENIZLI, chief town of a vilayet of the same name of Turkey (anc. *Laodicea* [*q.v.*] *ad Lycum*), altitude 1,167 ft. Population 43,345. It is beautifully situated at the foot of Baba Dagh (Mt. Salbacus), on a tributary of the Churuk Su (Lycus), and is connected by a branch line with the station of Gonjeli on the Smyrna-Dineir railway. It took the place of Laodicea when that town was deserted during the wars between the Byzantines and Seljuk Turks, probably between 1158 and 1174. It had become a fine Muslim city in the 14th century, and was then called Ladik, being famous for the woven and embroidered products of its Greek inhabitants. The delightful gardens of Denizli have obtained for it the name of the "Damascus of Anatolia."

DENMAN, THOMAS, 1ST BARON (1779–1854), English judge, was born in London, the son of a well-known physician, on July 23, 1779. He was educated at Eton and St. John's college, Cambridge, where he graduated in 1800. He then married, and in 1806 he was called to the bar at Lincoln's Inn. In a few years he attained a position at the bar second only to that of Brougham and Scarlett (Lord Abinger). He distinguished himself by his eloquent defence of the Luddites; but his most brilliant appearance was as one of the counsel for Queen Caroline, for whom he made a great speech before the Lords which gained him the enmity of the king and retarded his career. At the general election of 1818 he was returned M.P. for Wareham in the Whig interest. In the following year he was returned for Nottingham, for which place he continued to sit till his elevation to the bench in 1832. In 1822 he was appointed common serjeant by the corporation of London. In 1830 he was made attorney-general under Lord Grey's administration. Two years later he was made lord chief justice, and in 1834 he was raised to the peerage. As a judge he is most celebrated for his decision in the important privilege case of *Stockdale v. Hansard* (9 Ad. and El. i.; 11 Ad. and El. 253), but he was never ranked as a profound lawyer. In 1850 he resigned his chief justiceship and retired into private life.

The HON. GEORGE DENMAN (1819–96), his fourth son, was also a distinguished lawyer, and a judge of the Queen's Bench from 1872 till his death in 1896.

See Memoir of *Thomas, first Lord Denman,* by Sir Joseph Arnould (1873); E. Manson, *Builders of our Law* (1904).

DENMARK *(Danmark),* a small kingdom of Europe, occupying part of the peninsula of Jutland (Jylland) and a group of islands dividing the Baltic and North seas, lying between 54° 33' and 57° 45' N. and between 8° 5′ and 12° 47' E., exclusive of the island of Bornholm. The southern part of the peninsula (Schleswig-Holstein) belongs to Germany. The northern extremity of the Danish part is actually insular, being separated from the mainland by the narrow and shallow Limfjord, which connects the North sea with the Cattegat. Though broadest in the west, its connection with the North sea dates from 1825 only. The Skagerrak bounds Jutland on the north and north-west. Between the Cattegat and the Baltic, and between the base of the peninsula and south-western Sweden, lie the Danish islands. Of the total area of the kingdom (16,575 sq.m.), Jutland covers 11,411 and the islands in the Baltic 5.136 sq. miles. These consist of the two large islands, Fünen and Zealand, with smaller islands, chiefly on their south sides, and Bornholm far to the east in the Baltic.

The solid geology is almost everywhere obscured by deposits of boulder clay lying generally on Cretaceous rocks, which outcrop for example in Moen and Aalborg, giving rise to important lime and cement industries. Much of the Danish chalk, including the well-known limestone of Faxe, belongs to the highest or "Danian" sub-division of the Cretaceous period. In the south-west a succession of strata, including lignite formations, intervenes between the chalk and the boulder clay. It is on the island of Bornholm only that older formations come to light. This island compares rather with south Sweden, and forms, in fact, the southernmost portion of the Scandinavian system; boulder clay is absent in the south-west of the island, where Cambrian, Silurian, Jurassic and Cretaceous formations appear. Some parts of Denmark are supposed to have been raised out of the sea towards the end of the Cretaceous period, and may have been above water in various subsequent periods, but the final emergence was during the formation of the Ancylus lake towards the close of the Ice age. Recent research has greatly enlarged our knowledge of the Pleistocene glaciation in its relation to early man; and its phases in the Baltic area have been correlated with the stages observed in the Alps. Successive layers of trees preserved among peat in certain small depressions found in many of the forests of Denmark show that the flora has undergone remarkable variations to be connected with changes of climate during and since the glacial epoch. The first pine forests replaced a

tundra flora during the period of the Ancylus lake, a fresh water inland sea caused by a phase of elevation in the area now occupied by the Baltic. Before the disappearance of the lake there followed a still milder climate with oak forests; while a later cooler and moister phase is represented by the beech forests which are so widely distributed in modern Denmark, and which apparently spread in the late Bronze and early Iron age. It is to the Gothiglacial and to the preceding Daniglacial retreats (equated by many respectively with the Achen and Laufer oscillations in the Alps), that the country owes its covering of morainic deposits.

PHYSIOGRAPHY

The surface of the country is uniformly low, the highest ground culminating in Ejer Bavnehoj in south-eastern Jutland, which is but 172 metres above the sea. There are, however, numerous hills between 100 and 150 metres in height. Undulating morainic formations of fertile clay, the legacy of the Pleistocene glaciation, are commonest in Zealand, Fünen and east Jutland, where they form the basis of Denmark's most characteristic landscapes of rich corn-fields, meadows and beech woods. Extensive plains are in the west, consisting of poor sandy soils washed from the western edge of an ice-sheet which lay from north to south down the peninsula. These wide expanses of heather-covered sands are broken here and there by morainic formations of an earlier glacial phase. They have been reclaimed for forest or arable land in the last 50 years, to the extent of nearly 5,000 sq kms. The dune-islands and dunes form an almost continuous line along the west coast of Jutland from Blaavahdshuk to the Skaw, and the dunes did great damage up to the end of last century by drifting in over the cultivated areas and even destroying settlements, but they are now largely planted and secured by means of groynes.

Jutland. — Bordered by this sparsely-peopled zone, with a coast dangerous to shipping, the peninsula may be said to turn its back on the North sea: and its life has tended to orient itself towards the islands, where Copenhagen provides a metropolitan centre which contains, with Frederiksberg and Gentofte, 21% of the total population of the country. Esbjerg, the home of a large fleet of fishing vessels, and the origin of daily steamship services to England and France, is the only harbour on the west coast. The need for ports has become urgent of recent years, and new harbours have been constructed at Hirtshals and Hanstholm. The drainage of the peninsula is typical of a low glaciated region. The Varde, Omme, Skjerne, Stor and Karur, sluggish and tortuous streams, flow through marshy tracts into the lagoons of the west coast, while the eastern Limfjord is flanked by the swamps known as Vildmose. The country's largest river, the Gudenaa, 80 m. in length, rises near the east coast and drains the Silkebore series of lakes, following a winding course into Randers Fjord (Cattegat). Off Slesvig (S. Jylland) is the island of Alsen in the Little Belt. Fiinen (Fyen), the main western island, is separated from the peninsula by the Little Belt, varying in width from 10 m. to the ½ m. strait which lies between the resort of Middlefart and the port of Fredericia, in Jutland. In form roughly oval, with a length from north-west to south-east of 53 m., and an area of 2,986 sq.km., Fiinen is closely allied to the mainland; and its fertile meadows among patches of woodland and boulder-strewn hills are typically Danish. An archipelago, which includes Taasinge, Avernako and Dreio, lies to the south, enclosed by the narrow islands of Aero (16 m. in length) and Langeland (32 m.). On Langeland is the 13th century castle of Tranekjaer.

Zealand (Sjaelland), the largest island in the kingdom, lies east of Fünen, from which it is separated by the Great Belt, 11 m. wide in its narrowest part. It is 82 m. N. to S. and 68 m. from E. to W., but the outline is very irregular. The area is 2,636 sq. miles. On the north lies the Cattegat; on the east the Sound, narrowing to 3 m. off Elsinore; and on the south the straits beyond which come the island of Moen, Falster and Laaland. The undulating surface is little above sea-level, save that the Cretaceous hills of the south-east, especially in Moen, reach heights of over 100 metres. Of numerous coastal indentations the most important is the Ise Fjord on the north, with its east and west branches the Roskilde and the Lamme Fjords, penetrating some 25 m. inland. Small lakes among the glacial débris are common here as elsewhere in Denmark, those of Arre and Esrom in the north-east attaining notable dimensions.

Climate. — The climate is milder than that of most countries in the same latitude, for it is profoundly modified by maritime influences. No part of the land is more than 40 m. from the open sea, while numerous indentations carry equable conditions, and their effect is noticeable on the monthly weather maps. The mean annual temperature is 45·2°; the average for July is about 61°, and for January about 32°. Frost occurs on an average on 20 days in each of the months from December to March. The eastern coasts are ice-fringed for some time, and both the Sound and the Great Belt are very occasionally impassable on account of ice. Variable winds (mainly west and south-west) of cyclonic origin lead to considerable variations from day to day, especially in the winter months. The average annual rainfall is about 24 in. showing a tendency towards a maximum from July to November. The wettest month is September (2.95 in.), and April (1·14 in.) the driest. Thunderstorms are frequent in summer. At that season rainfall is greatest in central Jutland, where the higher ground produces an increase throughout the year; more rain falls in the east of the kingdom than in the west. The reverse is true of the distribution of winter rain. The most equable climate occurs on the North sea coast, wider temperature ranges marking the higher ground of central Jutland and the interior of Zealand. On the west coast a salt mist, hindering vegetative growth, exerts its influence inland for some 15–30 miles. For the most part, climate combines with location and soil conditions in rendering Denmark an essentially agricultural and pastoral land.

The flora presents greater variety than might be anticipated. The ordinary forms of northern Europe grow freely in the islands and on the eastern coast; while the heaths and sandhills of the Atlantic side have a number of distinctive species. The native Danish forest is almost exclusively made up of beech, but it comprises only one-third of the whole timbered area, extensive coniferous plantations having been made in recent years. These are, however, confined for the most part to Jutland, so that the beech remains characteristic of the landscape in the islands. The oak and ash are now rare; in the first half of the 17th century the oak was still the characteristic Danish tree. Large oak-woods have recently been planted. As we have seen, abundant traces of ancient extensive forests of fir and pine are found. Numerous peat bogs with remains of trees supply a large proportion of the fuel locally used. In Bornholm, the flora is more like that of Sweden; not the beech, but the pine, birch and ash are the most abundant trees.

The wild animals and birds of Denmark are those of the rest of Central Europe. The larger quadrupeds are all extinct; even the red deer, formerly so abundant that in a single hunt in Jutland in 1 j93 no fewer than 1,600 head of deer were killed, is now only to be met with in preserves. The sea fisheries are important. Oysters are found, but have disappeared from many localities, where their abundance in ancient times is proved by their shell mounds on the coast. The Gudenaa is the only salmon river.

Early Man.—A fine series of prehistoric remains of various dates are preserved either in the present-day landscape or in the famous museum at Copenhagen. This it owes in no small measure to its position on the fringe of the continental mass of Eurasia, a natural peninsula termination, just as Brittany is farther west, of long lines of movement from central Europe along the loess belt and up the German rivers. If this peripheral location sometimes meant poverty it must be remembered that Denmark also lies open to maritime influences from western Europe; and the meeting of these two contrasted culture streams resulted in the notable enrichment of Denmark's long tradition of settled life. The first certain evidence of human occupation is found in the Nörre-Lyngby culture of the early Ancylus period, the distribution area of which comprises Denmark, Scania, Rügen and Northern Prussia. Its coarsely flaked flints and reindeer-horn axes give way, towards the end of the Ancylus period, to the civilization called after the famous Danish site at Maglemose, near

Mullerup, representing, in part, a northward extension of the Tardenoisian culture, but characterized by its greater use of bone implements.

But the best-known palaeolithic or epipalaeolithic survival in Denmark falls in the Littorina period, when the climatic optimum of the 4th millennium B.C., marked by the spread of the oak tree, is the time of the "kitchen-middens" or shell-mounds. The people sf the Baltic lived chiefly on the sea-shore, then some 25 ft. above its present level, feeding for the most part on fish and molluscs, the shells of which accumulated in huge mounds. This mesolithic industry represents a deterioration from a virile hunting life to a mere collecting of food, but it is marked by the introduction of the domesticated dog and, towards the close of the second (Entebolle) phase, by the use of coarse pottery, our first evidence of the potter's art in northern Europe. With these exceptions, Denmark, isolated by forest and as yet uninfluenced by western sea-borne cultures, remained in a primitive unprogressive condition until the 3rd millennium B.C.

Considerable diversity of opinion exists as to the position of Denmark in the transition period from stone technique to metal workings. The megalithic monuments seem to indicate maritime influence from the south-west and to suggest that Denmark shared in early coastal trade. Other important influences were also at work. In the single graves are found cord-ornamented beakers and perforated stone battle-axes. Some regard these as evidences of the rise of a strong native culture which later spread towards the south-east, but more emphasize the resemblances between them and similar finds in central Europe. They suggest that nomad warriors may have penetrated north-westwards along the loess, bringing with them a memory at least of metal using and possibly, in due course, some metal tools and weapons. Thus Denmark and other parts of western Europe would appear to have been on the periphery of metal-using civilizations and to have been stimulated by interactions between coastal traders, nomad warriors and the native peoples.

In the full Bronze age Denmark shared with the rest of Scandinavia a highly developed civilization. Thanks to the preserving properties of the peat bog, we have detailed information on questions for the most part unsolved elsewhere; and the famous tumuli of Treenhoi, Ribe and of Borum-Eshoi, Aarhus, have yielded woollen articles of dress from both male and female burials. The bronze sword-hafts and shields with spiral decorations are perhaps the most delicate examples of prehistoric craftsmanship found anywhere. Objects of Italian and Swiss origin are frequent, and demonstrate the wide commercial relations maintained by Scandinavia. The bronze-using civilization persisted long after iron had come into use in central Europe, but after 800 B.C. there came a decline consequent upon climatic deterioration and the formation of peat bogs. There is evidence for a southward movement of Scandinavian peoples of Wadic type through Jutland, for the proportion of long heads to broad in the graves of the Iron age (after 500 B.C.) rises remarkably. Denmark remained unaffected by the Romans; and the consequent revival, or rather survival, of pre-Roman elements in its outburst of energy in the dark ages is probably connected with this fact.

Population and Occupations. — While the farming population is thickest on the most fertile soils, *i.e.*, in the islands and in eastern Jutland, its density shows a close correlation within those regions with the forest areas and with the size of the estates and farms. Forest-free districts exploited by small holdings support the densest populations. There are indications that concentrated settlement was the rule until about 1800, but since then the villages have been greatly reduced or become industrialized, and the isolated farm is to-day a very characteristic Danish feature. The total population in 1935 was 3,706,349, with an average of 224 per sq. mile. The density in the islands is nearly twice that in the peninsula. Against greater Copenhagen's 843,168 inhabitants, the next largest town, Aarhus, has 90,898 inhabitants (1935). The only other town with over 50,000 is Odense. The provincial towns range up to 20,000. While the urban population (1935) amounted to almost half the total, in 1875 it constituted only one quarter; but the great conurbation of the capital accounts for much of this increase. Since the war of 1914–18 the rural and urban populations have grown at approximately the same rates; the respective figures for 1935 being 2,061,946 and 1,644,403.

Compared with agriculture, the natural resources of the country are of subordinate importance. Though coal is found in Bornholm, neither coal nor metals can be profitably mined anywhere. Extensive strata of bog-iron ore in Jutland are used for purifying purposes in gas works. The newer chalk is utilized in lime-burning while the limestone at Stevns is used as a building material. Chalk also forms the basis of an important cement industry. Tertiary and glacial clays are used in the tile industry, while calcareous deposits of clay have been widely utilized, particularly in Jutland, for soil-improvement. Bornholm supplies granite for building and paving, and kaolin for the china and paper manufactures. From the time of the kitchen-middens the fish of the shallow seas, belts and fiords have been exploited; and fishing contributed largely to Copenhagen's supremacy. Improved marketing facilities and the use of motor boats have greatly increased its economic importance in recent years. The value of the yield increased from 8 million kroner in 1890 to about 40 million in 1936. Coast fishing supplies mostly cod, plaice, eels, herring and mackerel, while deep-sea fishing yields cod, plaice and haddock. The fleet consists of about 16,000 boats. Numerous co-operative marketing associations and an up-to-date railway system facilitate rapid distribution and a large export.

Communications. — Regular connections with foreign countries are mainly westward by sea, via Esbjerg, with England, the Netherlands, Belgium and France. There is a German ferry passage for passengers and trains from Gedser to Warnemiinde and the Swedish services from Copenhagen to Malmö and from Elsinore to Helsingborg. The latter is also one of the main lines of communication with Norway. The main land route is the railway via Padborg and Slesvig to Hamburg. Denmark possesses some 5,000km. of railways, of which nearly one-half belong to the State, while the State and the larger towns hold nearly all the shares in the "private" lines. There are highly organized train-ferry schemes for communication among the islands and between these and Jutland. Motor transport, similarly facilitated by low land relief, is highly developed, and air traffic is progressing with Copenhagen as a centre of international lines.

Government and Constitution. — The constitution of Denmark is laid down in the Act of June 5, 1915, amended in 1920 on the restoration of North Slesvig in accordance with the treaty of Versailles. It marks, for the most part, a return to the constitution of 1849. Legislative authority rests jointly with the crown and parliament; the executive power is vested in the cro n, while the administration of justice is exercised by the courts Parliament consists of two chambers, the Landsting (senate) and the Folketing (lower house). The franchise is held by all persons over 25 years of age with a fixed place of abode. The members of the Folketing, at present 149, are elected for four years. Of the members of the Landsting, 56 (including one from the Faeroe Is.) are elected by the votes of the Folketing's electors who are over 35 years of age; while 19 members are elected by the former Landsting. The Rigsdag (parliament) must meet every year on the first Tuesday in October. The privy council is the highest executive power in the State; it deals with all new bills and all important Government measures. For administrative purposes there are 22 Amter (counties), each of which is under the superintendence of a governor. Local government is largely in the hands of the municipal councils.

Religion and Education. — The church of Denmark is Lutheran, which was introduced as early as 1536. The king must belong to it. There is complete religious toleration, but though most of the important Christian communities are represented their numbers are very small. There are nine dioceses; the primate is the bishop of Zealand, and resides at Copenhagen, but his cathedral is at Roskilde. According to the latest census there were 3,221,843 Protestants, 22,137 Roman Catholics, 535 Greek Catholics, 5,947 Jews and 17,349 of other or no confession.

Since 1814 education has been compulsory for those aged 7 to 14 years. The last school laws (1903) have made this instruction gratuitous for the greater part. However, in 1937, but 34 of these schools were government institutions; 3,899 were maintained locally, and 565 were private. Their teachers are trained in about 20 normal schools. After five years of elementary instruction, pupils may receive four years of secondary education and may then proceed to a high school, of which there are some 300. Here there is a choice between classical. modern language and scientific courses terminated by a State examination. There are some 60 popular high schools for adults, all private, but all assisted by the State. For specialized study there are 21 agricultural schools (one including veterinary courses), over 300 technical schools, and institutions for dentistry, pharmacy and art. The Royal university, in Copenhagen, was founded in 1479 and has about 5,000 students. Women are received on a parity with men in all departments. (E. E. E.; X.)

ECONOMICS AND TRADE

Two of the most significant facts of Danish economics are the high ratio of productivity of the land and the dependence of the country on foreign trade. Ninety per cent of the land is productive, and 77% is actually farmed (3,213,000 hectares). Approximately 1,200,000 of the population are directly engaged in or dependent on agriculture or fishing, and an almost equal number (1,100,000) in handicrafts and industry. Commerce, finance and transportation concern about 650,000; administrative and intellectual occupations another 210,000; domestic service about 220,000; and classed as "economically inactive" are about 350,000 (figures include children and all dependents).

Agricultural Holdings. — Denmark possesses an exceptionally high rate of freehold farms — about 94%, with only 6% leased or tenanted. During the period since 1900, while a trend toward tenantry was prominent in many countries, Denmark proceeded in the opposite direction. The conscious governmental attempt to subdivide large farms and establish agricultural workers on independent holdings began with legislation of 1899, was reinforced by the Three Land Laws of 1919 and by the Acts of 1933 and 1934. Co-operatives have aided in making small-farm operation profitable, and the adult education program has helped farmers to be good managers. Animal husbandry, a prominent feature of their activity. also lends itself to small individual enterprise.

The Small Holdings Acts and the agricultural expansion of the country have brought the subdivision of large estates, the parcelling out of glebe lands, and the abolition of leasehold for anything except small holdings (1919). The acquisition of North Schleswig (Slesvig), after a plebiscite held under the terms of the Treaty of Versailles, also added 14,364 farms. The steady growth of independent small farms under the law of 1899 and its successors is shown in Table I.

TABLE I. — *Increase of Small Farms under Act of 1899 and its Amendments*

	Number	State Loan and State Grant Mill. kr.
1900–20	9,263	58·0
1920–30	5,390	88·0
1930–31	401	6·3
1931–32	435	7·0
1932–33	64	0·9
1933–34	54	1·4
1934–35	286	4·0
1935–36	261	4·1
1936–37	274	4'4
1937–38	309	4·8
Total 1900–38	16,737	178·9

Purchasers under the Acts of 1919, of glebe lands, fiefs or estates, paid no purchase sum, but only an annual interest to the Government. This was at first a fixed sum based on the capital invested by the State, but in 1933 holders were given the option of paying this fixed charge or a variable annual charge based on average prices of butter, bacon and barley. In 1938 this was amended, the annually adjusted charge to be based on the rate of net profit of all small farms. Exactly 6,022 farms have been established under these laws, and some 2,000 tiny parcels have been added to other small holdings. In effect these holders become owners.

TABLE II. — *Distribution of Farms According to Size*

Hectares	Number		Agricultural Area	
	Total	Per cent	1,000 hectares	Per cent
0·55 to 3	27,893	13.7	52	1.6
3 " 10	77,784	38.1	472	14.9
10 " 30	72,352	35.4	1,308	41.2
30 " 60	21,406	10.5	845	26.6
60 " 120	3,769	1·8	290	9·1
120 " 240	740	0·4	119	3·8
240 and over	287	0·1	90	2·8
Total	204,231	100·0	3,176	100·0

The total farm holdings as of July 1938 numbered 205,909, and represent a notable increase over the 171,000 holdings of 1903.

Production and Marketing. — During the 30 years prior to the World War of 1914–18 Danish agricultural production was increasing rapidly. In 1913 Denmark exported agricultural produce worth about 550,000,000kr., about 97% of which was animal products. This specialization in animal husbandry necessitated importation of 181,000,000kr. worth of grain and feeding stuff. The war, especially after intensive submarine activity began in Feb. 1917, seriously injured this industrialized agricultural economy, as is indicated in the following table. (It must be remarked that the figures even before 1920 include Schleswig, so as to make comparisons more just.)

TABLE III. — *Number of Farm Animals 1909–38 (in 1,000's)*

	Horses	Cattle Total	Cows	Pigs	Sheep	Poultry
1903.	519	2,056	1,177	1,539	922	11,836
1914.	605	2,717	1,416	2,715	533	15,495
1918.	578	2,303	1,106	669	495	..
1920.	602	2,504	1,196	1,116	540	14,395
1926.	548	2,838	1,480	3,122	233	18,524
1935.	521	3,072	1,647	3,036	..	28,568
1938.	565	3,186	1,599	2,842	..	27,863

In addition to the decrease in number of cows during the latter years of the World War of 1914–18 the yield of milk per cow was drastically reduced, from 2,750kilog. in 1914 to 1,810kilog. in 1919, producing a total decrease in butter of from 143,000,000 kilog. in 1914 to 76,000,000kilog. in 1919. This decline was mainly due to the complete cessation of imports of feeding stuffs and fertilizers. It was aggravated by the poor harvests of 1917–18, due in turn partly to lack of imported fertilizer and partly to decrease of manure on account of decrease of fodder. By 1922 the milk yield had come up to the 1914 level, and by 1926 it was increased by 250kilog. per cow, the average yield passing 3,000 kilog. Production and export of other animals and animal products suffered similarly, as shown in Table IV.

Exports of fresh milk and cream have decreased, but remarkable increases have developed in condensed milk, butter, cheese, live pigs, eggs. The value of animal products exported rose to over 1,000,000,000kr. by 1926, more than double the pre-war export; by 1937 it rose further to 1,200,000,000kr.

Both change and increase in the agricultural and animal products and their export was due largely to the demand of the foreign market, especially that in Great Britain, to which Denmark shipped by far the greater portion of her produce. (See TABLE VIII.)

Crop yield has increased by expansion of area and scientific farming about 200% in the last 60 years.

Barley and oats in 1940 accounted for about two-thirds of the total grain crop, which was 35,000,000hectogr. in 1937. Fodder beets make up most of the root crops, which total over 250,000,-

TABLE IV.—*Export of Animals and Animal Products in* Certain Years*

	(1,000 head of)			Million kilog. of					
	Horses	Cattle	Pigs	Butter	Cheese	Condensed milk	Bacon	Beef	Eggs
1910–13	26·8	143.0	..	88·5	0·3	2·5	116·2	17·6	25·2
1914 .	95·7	188·9	..	95·3	0·5	2·7	147·1	17·4	27·5
1916 .	16·1	305·4	..	95·8	4·5	3·3	104·7	18·2	28·9
1918 .	29·2	113·8	..	14·7	3·2	1·4	2·7	13·9	19·7
1919 .	1·4	32·3	0·4	36·6	2·6	1·7	0·9	8·3	20·4
1920 .	24·1	61·2	53·6	74·8	9·7	6·3	42·4	17·6	32·8
1922 .	19·7	82·5	10·0	95·5	8·9	23·4	111·4	20·5	44·2
1924 .	12·6	172·9	205·7	123·4	8·8	34·2	197·2	3·8	50·0
1926 .	2·6	158·3	18·1	132·5	7·0	25·8	190·2	16·2	50·0
1937 .	12·0	172·0	167·0	153·0	9·0	18·0	178·0	22·0	81·0

*Since and including 1920 the figures also include the Slesvig part.

TABLE V.—Crop *Yield, 1875–1937*

	Crop expressed in million hectokilos of barley
Whole Country:	
1875–79 average	27·1
1910–14 "	33·5
1915–19 "	48·0
1920	53·4
(of which North Slesvig accounted for 2·9)	
1921–25 average	60·5
1926–29 "	74·0
Rural Districts:	
1929–33 average	79·4
1934	72·4
1935	82·2
1936	76·5
1937	83·6

oohectogr., including potatoes, sugar beets and a small amount of chicory root. Some 70,000,000hectogr. of hay is produced.

Of course not all of the animal products are exported and total production can only be estimated. Fair approximations indicate that Denmark produced annually in the late 1930s over 5,000,000 tons of milk, 180,000,000kilog. of butter, 315,000,000kilog. of bacon, pork fillets, etc., and about 125,000,000kilog. of eggs.

Co-operatives.—Agricultural production and marketing in Denmark undoubtedly owe much to the growth of farm organizations. Associational promotion began as far back as the founding of the Royal Agricultural Society (1769), and both it and numerous special societies stimulate breeding and other improvements. Local farmers' associations have 109,000 members and small holders' societies have 90,000; each of these groups is organized in a national federation. These two federations have established a joint organization with the Federation of Danish Co-operative Societies, known as the Agricultural Council (Landbrugsraadet). This council represents agriculture in dealings with government, industry and foreign trade. Numerous co-operative societies flourish, and in the important dairy and bacon businesses they dominate the scene. About 86% of all cows belong to the 90% of Danish dairy farms which are members of the co-operative organization; 75% of the pigs belong to the 70% of farm members of the bacon factory co-operative. Only about 25% of the egg production is co-operatively organized, but even this is of great importance in the maintenance of standards for the export trade. The extraordinary success of the Danish farmers in managing their co-operative societies, since the establishment of the first dairy co-operative society in 1882, is due largely to the spread of adult education and especially the folk high schools. Here the people have learned to know each other and to become intelligently aware of common self-interest.

Financial Returns of Agriculture. — After the long period of depression at the close of the 19th century prices improved, and the relatively few financial accounts which are available for the years 1910–13 show an average yield of interest on capital invested in well managed farms of about 4 to 5%. During the first years of the World War of 1914–18 the prices of corn and seed, as well as of live animals and meat, rose considerably, increasing the capital yield for large and middle size farms. In the later years of the war prices of eggs, bacon and dairy produce rose, increasing returns on small farm investment. Later the low rate of exchange somewhat artificially influenced prices, resulting, together with other factors, in fluctuations of interest return from under 1% to above 8% in different years.

Fisheries. — Although the backbone of Danish economy is agriculture, her fisheries are important also, and played a great part in the life of the country in mediaeval times. In the last 40 years fishing has been rejuvenated as an export industry, due to the improved means of transportation. In 1937 Denmark used in the shallow waters along her coasts many small boats: 7,700 row boats, 3,500 motor boats and 1,200 sail boats, and the picturesque fish market of Copenhagen is an olfactory memory of any visitor to the city. Over 3,000 sail and motor boats seined for plaice, haddock and cod in the deeper waters of the Baltic, the Skagerrak and the North Sea. About 19,000 persons are directly engaged in fishing, and numerous others are dependent on it: merchants, netmakers, boat builders and motor makers, for most of the motors and gear are manufactured in Denmark. Both quantity and value of total haul has increased since the opening of the 20th century.

TABLE VI.—*Total* Yield of *Fisheries in* Million *Kroner*

	1908	1918	1928	1937
North Sea.	2·3	12·	15·2	19·4
Limfjord. . . .	1 7		2·4	1·8
Inner waters (east and south of the Scaw) . . .	9.2	26·7	19·1	18·6
	13·2	41·7	36·7	39·8

This represents for 1937 a quantitative yield of 89,000,000kilog., consisting largely of plaice (flatfish), with cod, herring, mackerel, eel and haddock following in order of importance. Of this total 55,000,000kilog. were exported, usually fresh, ice-packed or live.

The fishermen are largely organized in some 200 associations, federated into two national groups. They also have marketing and purchasing co-operatives, though not on the same scale as the farmers' societies.

Industry and Employment. — Danish industry produces primarily for home consumption, though certain products, such as the Diesel motor, enjoy a large export. This is the most widely used marine motor, and is used extensively in railway service. Iron mines are non-existent, but the country does a large casting and machine building business and assembles automobiles for a large part of the Scandinavian and Baltic trade. Margarine industries and textile manufacturing are important for the home market, and the breweries not only supply the local market, but export also. Bicycles are another important manufacture to provide the most popular transportation for Copenhageners.

The metal industries employ the most workmen (95,000); food processing employs 75,000; earthworks and building 79,000; textile industries and clothing 70,000; woodworking 31,000 and chemicals 27,000. About one-fourth of all industrial workers are women. The internal wholesale trade employed about 65,000 in 1935; retail establishments 155,000; cafes and restaurants 41,700. In these three groups 89,000 of the employees were women.

Unemployment had sunk to 7·3% in 1913, but the World War of 1914–18 completely upset Danish economy. Well planned social insurance only alleviated the difficulties which were largely out of Denmark's power to control. This is illustrated by the course of later unemployment statistics. Choosing the month of May one finds 25% unemployment in 1932; reduced to 13% by 1936; up to 17% in 1938; down again to 11·5% in 1939, but up to 21% in 1940 on account of the war situation.

The development of handicraft and industry, especially the utilization of power, is indicated in the table below.

TABLE VII.—*Handicrafts and Industries*

	1897	1906	1914	1925	1935
Number of establishments	77,256	85,118	82,494	89,189	102,032
Total employees	272,456	315,219	350,194	392,475	462,361
Of mhich workmen	178,443	206,592	227,458	269,830	317,395
Works with mechanical power	3,856	6,730	15,579	26,332	43,414
Horse-power of machinery	48,060	113,270	229,843	437,616	651,138

Commerce and Shipping.— The per capita rate of Denmark's foreign commerce is exceptionally high, indicating her dependence on world conditions. Actually this dependence is especially on Great Britain. to whom the country normally sends about 60% of her exports. In the years just prior to 1940 the proportion of trade with Britain declined slightly, due to the policy begun in the United Kingdom in the early '30s and never completely overcome by the trade agreements. German trade increased somewhat during this period of military and economic preparation.

TABLE VIII.—*Imports and Exports*

	Imports, million kr.	Exports, million kr.
1913	855	721
1917	1,089	1,066
1918	946	758
1920	3,243	1,962
1924	2,366	2,154
1926	1,620	1,517
1936	1,442	1,327
1937	1,674	1,269
1938	1,641	1,551

Distribution of Imports and Exports 1937 (in percentages)

	Imports	Exports
Great Britain	37.7	51·3
Germany	23·9	18·5
Sweden	6·1	6·4
United States	5·5	1·8
Norway	2·2	4'9
Holland	3'3	1·7
Othercountries	21·3	15·4
	100·	100·

TABLE IX.—*Most Significant Products of Import and Export*

Imports	Mill. Kr. 1938	Mill. Kr. 1937	Exports	Mill. Kr. 1938	Mill. Kr. 1937
Grain	105	154	Meats products	545	412
Feeding stuffs	119	110	Dairy p	545	512
Coal, oil, electrical energy, etc.	244	269	Vehicles	105	90
Iron and steel	113	123	Live animals	70	84
Textiles, thread, etc.	172	180	Animal products	56	87
			Fish	36	34
			Machines	56	44

Finance, Exchange and Banking.— After war ended in 1918 Denmark experienced a great credit expansion, due to loans abroad and to the state internally, to the demands of a refreshed trade and the development of Slesvig. The krone fell below par and it required steady and heroic state policy to bring it up to its gold parity by Jan. 1, 1927. Agriculture suffered, but was able to weather the difficulties caused by this deflation. Then the British pound sterling collapsed in Sept. 1931, and the Danish boat found itself drawn in the wake of her great customer. From that time Denmark, along with several other states of northern and western Europe, adjusted her currency as well as possible to the British pound, as one of the so-called sterling bloc.

The old joint-stock private National Bank, successor to the Rigsbank founded in 1813, was reorganized in 1936 as Nationalbanken. It is the only bank of issue and is controlled by a board of governors (25) who are chosen by the Government, Rigsdag, the Ministry of Trade and by the board itself. Nationalbanken has five inland branches, and a foreign branch at Flensburg. There are three large pdvate banks, and 161 smaller ones, the three large ones doing about one-half the total business. There are 526 savings banks, with deposits, in 1937, of 2,200,000,000 kroner. The Bourse is in Copenhagen. Insurance companies, several dating from the 18th century, do a large business abroad as well as at home.

Shipping.— The country's favourable position for shipping encourages her to hold her No. 4 rank on the per capita basis, with 300 tons per 1,000 inhabitants. (In 1938 Norway had 1,594, Great Britain 443, Holland 334.) The number of steamships iell from 6j1 in 1915 to 509 in 1938, but motor ships more than made up the difference, increasing from 27 to 227, and combination sail-motor ships from 370 to 1,119. Sailing vessels of above 20 tons practically disappeared, dropping from 870 to 10. Denmark is one of the leaders in the modern transition to motor ships and builds them both for herself and others in her Diesel works. Danish vessels carry about two-fifths of the country's sea-borne trade, and do a large foreign business.

Defense.— The principle of national conscription has been maintained since 1849 and the most recent Army Act is of 1937. Recruits are enrolled at 17 and receive instruction of at least five months between the ages of 19 and 25. Liability to call extends over 16 years, in two classes. There are 600 permanent officers and about 700 non-commissioned officers, and the total strength of the army under war conditions is 100,000 men. The navy consists of two coast defense ships, with a number of torpedo boats, submarines, etc. There are 300 officers and 1,200 men, with a potential war-time strength of 4,000. There are 65 aeroplanes. Both navy and army are under the Ministry of War, and the king is the supreme head of the army.

Much more important than statistics of men and material is the fact that the Danes decided many years ago that military defense of the land was futile--only one country was a practical threat, and she could bring to bear at will such overwhelming forces that the most strenuous efforts would be of no avail. Hence Denmark rejected tentative proposals from her Scandinavian neighbours, especially Sweden, to fortify her boundary, and made up her mind to rely on the League of Nations, and when that bulwark crumbled, to trust to fate. Hence, except for a few "token" shots, no resistance was offered when the Germans marched in on April 9, 1940. (*See* WORLD WAR II.)

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HISTORY

Earliest Times.— Apart from the ancient traditions preserved in the Old English poem *Beowulf* (*q.v.*), little is known about Danish history before the beginning of the Viking age. The Danes were seated far beyond the sphere of interest of Roman writers, and their own traditions are coloured by a mythological element which makes their history uncertain. In the first centuries of the Christian era they were probably settled in the south of the Scandinavian peninsula, where the province of Skaane was long the centre of their power. In these early times they must have counted among the Baltic peoples rather than among those who looked towards the North sea. It is further probable that their occupation of Jutland and the adjacent islands belongs to the 5th and 6th centuries, and was made possible by the migration of the Anglian peoples to Britain in that age. Even after their establishment in these regions, it was long before they came into permanent contact with the peoples of western Europe. The Frisians (q v.) were the greatest naval power in the North sea in the 6th and 7th centuries, and the destruction of this power by the Franks probably gave to the Danes the opportunity of raids on a great scale towards the west. In the 8th century the Danes were ruled by kings claiming mythological ancestry of the kind asserted by most royal families of the age. They were in occupation of Skaane, Zealand, and the lesser islands in its neighbourhood, and the north of the Jutish peninsula. They possessed at Leire, in Zealand, a very ancient religious sanctuary, near which stood the chief residence of their kings. They were as yet hardly touched by the wave of missionary enterprise which had brought the neighbouring Frisians within the influence of the Western Church. The conversion of Denmark belongs to the 10th century.

The northward extension of Charlemagne's dominion brought him and his successors into temporary relations with individual Danish kings. In the frequent quarrels between different members of the Danish royal family it was natural for one or other of the opponents to seek the support of the emperor. But the historic facts brought to light by such negotiations are meagre. It is, in particular, doubtful whether the individuals who to Frankish writers were kings of the Danes were in reality more than local

rulers, of royal descent, but limited authority. In any case, the interest of Danish history in this age lies outside Denmark itself, in the expeditions led by Danish chiefs and in the new political communities which they founded in the west of Europe. (*See* VIKINGS.)

Mediaeval. — The consecutive history of Denmark begins early in the 10th century with the reign of Gorm, "the Old." He, like his predecessors, is a shadowy figure. But he certainly founded a permanent dynasty, and the name of his wife, Thyra, is associated with one of the greatest public works of the dark ages, the *Dannewirk,* which bounded Denmark against the German territory to the south. His son, Harald "Bluetooth," played a wider part in history. He himself claimed to have conquered Denmark and all Norway and made the Danes Christian. To him, in fact, is probably due the permanent unification of Denmark and the introduction of organized Christianity under royal authority. He also, it would seem, began the attempt at the acquisition of Norway in which much of the energy of his successors was destined to be expended, and he founded a highly organized community of Vikings at Jomsborg at the mouth of the Oder, which gave him by far the strongest military force in all the north. But it was his son, Sweyn "Forkbeard," who brought Denmark once more into the forefront of European affairs. The wide dominion of his son, Canute the Great, and his importance in English history have tended to obscure Sweyn's achievements. Nevertheless, Sweyn was the real founder of the power which Canute enjoyed, and it was he who first made the Danish kingdom a rival to the more ancient States of western Europe and laid the foundations of the power of Denmark in the early middle ages.

The careers of Canute and his sons are described elsewhere. (See ENGLISH HISTORY: Canute the Great.) In the next generation Denmark becomes once more a purely Scandinavian power, occupied in rivalry with formidable Norwegian kings and in the extension of its influence over the peoples of the southern Baltic coast line. The last king of Denmark who consistently attempted to achieve an Anglo-Danish kingdom was Sweyn Estrithson, who died in 1074. With the collapse of the great expedition planned against England by his son, Canute "the Holy," in 1085 Danish history enters upon a new phase. The kings of Denmark henceforward abandon their English ambitions and Danish history once more centres upon the Baltic. (A. M.)

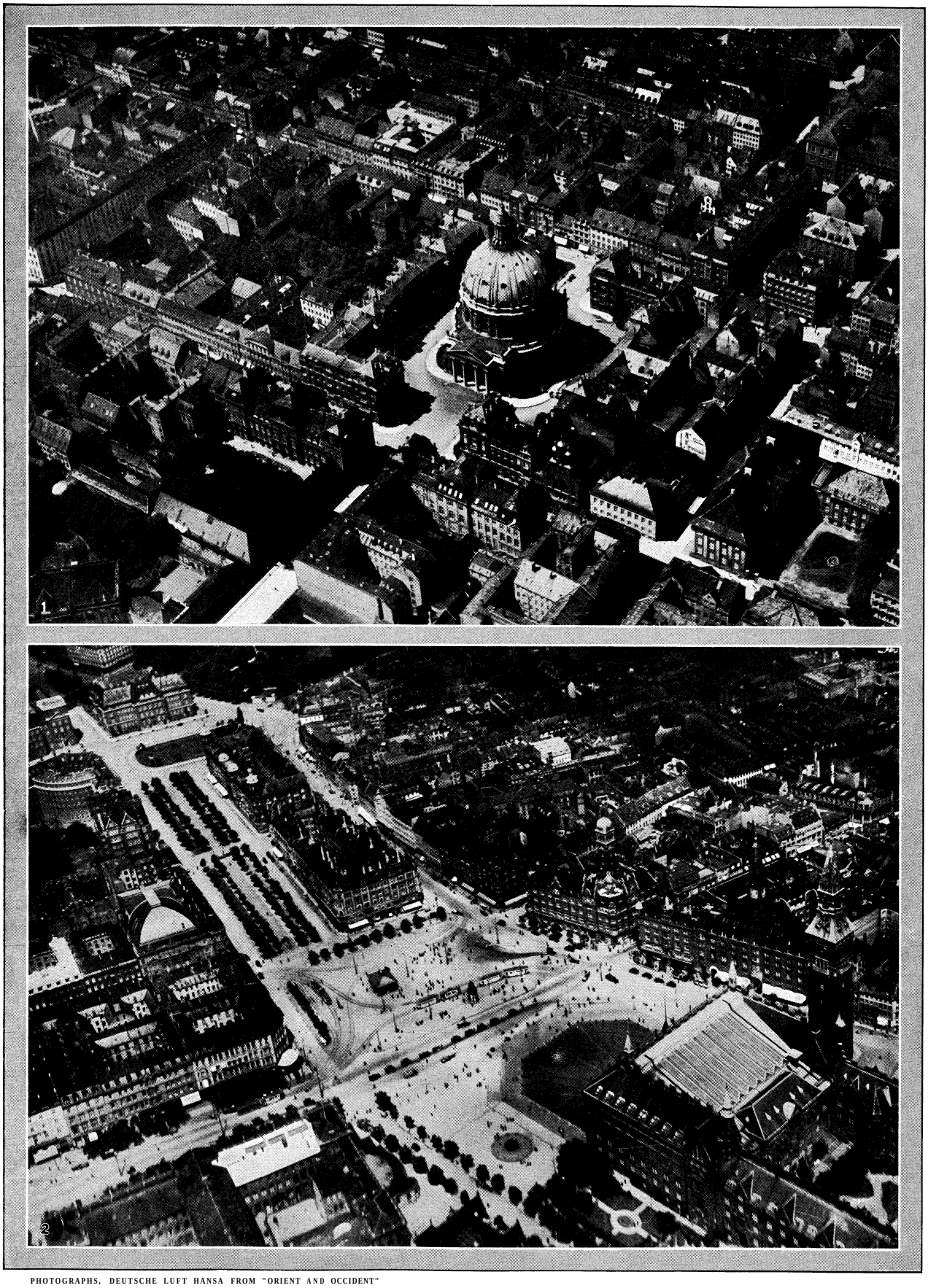
Consolidation of the Kingdom Under the Valdemars.— To the early part of this period belongs the growth and consolidation of a national church, which culminated in the erection of the archbishopric of Lund (*c.* 1104) and the consequent ecclesiastical independence of Denmark. The third archbishop of Lund was Absalon (1128–1201), Denmark's first great statesman, who materially assisted Valdemar I. (1157–82) and Canute VI. (1182–1202) to establish the dominion of Denmark over the Baltic, The policy of Absalon was continued on a still vaster scale by Valdemar II. (1202–41), at a time when the German kingdom was too weak and distracted to intervene to save its seaboard; but the treachery of a vassal and the loss of one great battle sufficed to plunge this unwieldy, unsubstantial empire in the dust. (See VALDEMAR I., II., and ABSALON.)

Yet the age of the Valdemars was one of the most glorious in Danish history, and it is of political importance as marking a turning-point. Favourable circumstances had, from the first, given the Danes the lead in Scandinavia. They held the richest and therefore the most populous lands, and geographically they were nearer than their neighbours to western civilization. Under the Valdemars, however, the ancient Danish monarchy was merging into a more complicated development of separate estates. The monarchy, now dominant, and far wealthier than before, rested upon the support of the great nobles, many of whom held their lands by feudal tenure, and constituted the royal Raad, or council. The clergy, fortified by royal privileges, had also risen to influence; but celibacy and independence of the civil courts tended to make them more and more of a separate caste. Education was spreading. Numerous Danes, lay as well as clerical, regularly frequented the University of Paris. There were signs, too, of the rise of a vigorous middle class, due to the extraordinary development of the national resources (chiefly the herring fisheries, horse-breeding and cattle-rearing) and the foundation of gilds, the oldest of which, the Edslag of Schleswig, dates from the early 12th century. The bonder, or yeomen, were prosperous and independent, with well-defined rights. Danish territory extended over 60,000 sq.km., or nearly double its present area; the population was about 700,000; and 160,000 men and 1,400 ships were available for national defence.

On the death of Valdemar II. a period of disintegration ensued. Valdemar's son, Eric Plovpenning, succeeded him as king; but his near kinsfolk also received huge appanages, and family discords led to civil wars. Throughout the 13th and part of the 14th century, the struggle raged between the Danish kings and the Schleswig dukes; and of six monarchs no fewer than three died violent deaths. Superadded to these troubles was a prolonged struggle for supremacy between the popes and the Crown, and, still more serious, the beginning of a breach between the kings and nobles, which had important constitutional consequences. The prevalent disorder had led to general lawlessness, in consequence of which the royal authority had been widely extended; and a strong opposition gradually arose which protested against the abuses of this authority. In 1282 the nobles extorted from King Eric Glipping the first *Haandfaestning,* or charter, which recognized the Danehof, or national assembly, as a regular branch of the Administration and gave guarantees against further usurpations. Christopher II. (1319–31) was constrained to grant another charter considerably reducing the prerogative, increasing the privileges of the upper classes, and at the same time reducing the burden of taxation. But aristocratic licence proved as mischievous as royal incompetence; and on the death of Christopher II. the whole kingdom was on the verge of dissolution. Eastern Denmark was in the hands of one magnate; another magnate held Jutland and Fünen in pawn; the dukes of Schleswig were practically independent of the Danish Crown; the Scandian provinces had (1332) surrendered themselves to Sweden.

It was reserved for another Valdemar (Valdemar IV., *q.v.*) to reunite and weld together the scattered members of his heritage. His long reign (1340–75) resulted in the re-establishment of Denmark as the great Baltic power. To re-establish public order he had to re-establish the royal authority by providing the Crown with a regular and certain income. This he did by recovering the alienated royal demesnes in every direction, and from henceforth the annual *landgilde,* or rent, paid by the royal tenants, became the monarch's principal source of revenue. Throughout his reign Valdemar laboured incessantly to acquire as much land as possible. Moreover, the old distinction between the king's private estate and Crown property henceforth ceases; all such property was henceforth regarded as the hereditary possession of the Danish Crown. Valdemar took a remarkable personal interest in the organization of his kingdom and the smallest detail was not beneath his notice.

The national army was also re-organized on its ancient footing. Not only were the magnates sharply reminded that they held their lands on military tenure, but the towns were also made to contribute both men and ships, and peasant levies, especially archers, were recruited from every parish. It resulted that under such a ruler law and order were speedily re-established. The popular tribunals regained their authority, and a supreme court of justice, Det Kongelige Retterting, presided over by Valdemar himself, punished the unruly and guarded the prerogatives of the Crown. He voluntarily resorted to the old practice of summoning national assemblies, the so-called *Danehof.* At the first of these assemblies held at Nyborg, Midsummer Day 1314, the bishops and councillors solemnly promised that the commonalty should enjoy all the ancient rights and privileges conceded to them by Valdemar II., and the wise provision that the Danehof should meet annually considerably strengthened its authority. The keystone to the whole constitutional system was "King Valdemar's Charter" issued in May 1360 at the Rigsmode, or parliament, held at Kalundborg. This charter was practically an act of national pacification, the provisions of which king and people together undertook to enforce for the benefit of the commonweal. (X.)



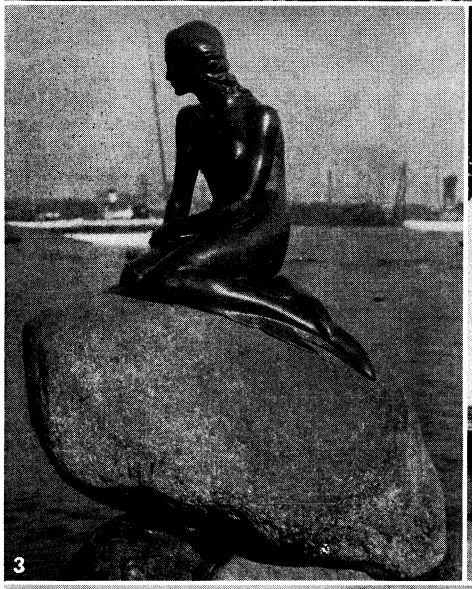
PHOTOGRAPHS, DEUTSCHE LUFT HANSA FROM "ORIENT AND OCCIDENT"

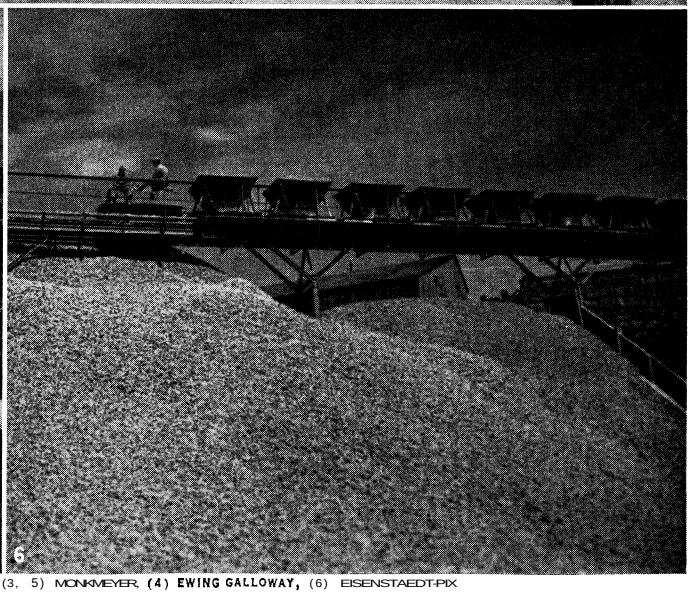
AERIAL VIEWS OF COPENHAGEN, THE DANISH CAPITAL

1. A view of the Frederikskirke, or Marble church (1875–94), situated in the finest of the residential quarters of Copenhagen

2. Raadhusplads (Town Hall square). At the lower right is the modern Renaissance town hall, built in 1901

DENMARK





PHOTOGRAPHS, (1) ROSENBERG FROM MONKMEYER, (2) CAROLA GREGOR FROM MONKMEYER, (3, 5) MONKMEYER, (4) EWING GALLOWAY, (6) EISENSTAEDT-PIX

FAMILIAR SIGHTS IN DENMARK

1. The fish market at Copenhagen
2. A small Danish girl in national costume
3. The famous "Little Mermaid" statue in Copenhagen harbour
4. The Christiansborg in Copenhagen — the Danish parliament house
5. Grundtvigs church, Copenhagen
6. Granite quarry on the island of Bornholm in the Baltic sea

1397–1625

The Union of **Kalmar.**—In 1397 all the most important magnates of the three Scandinavian kingdoms assembled at Kalmar to attend the coronation of Queen Margaret's nephew, the young Duke Erik of Pomerania, whom she had succeeded in having chosen as her successor as joint king of three kingdoms. At this meeting a committee was formed which projected an act of union; but Margaret took care that this project should not become law, for in it both the right of the inhabitants to self-government was insisted upon and great political influence Was accorded to the privy council of each kingdom. It was Margaret's intention, however, that union should be maintained under Denmark's suzerainty and a strong monarchy. To this end she set up men on whom she could rely in the Swedish and Norwegian castles and episcopal sees, and after 1412 Erik VII. pursued the union policy which she had outlined. Erik did not appreciate, however, that the strengthening of the union was the chief task which Margaret had bequeathed to him. Although he was the first Danish king who was German by birth, he held that in order that the Danish people should maintain their national individuality he had to combat Germanism in Denmark. Schleswig, which since 1386 had been ceded as a fief to the counts of Holstein, had to be regained. He proceeded against the counts first by suits laid before the German emperor, then by declaring war—a war, however, which ended by his being forced to leave the counts in possession of Schleswig except for Haderslev and the most northerly regions. He sought also to drive the German merchants out of Denmark by means of a decree of 1422 in which he gave the Danish merchants a monopoly in trade; in 1425 he began to levy what was called the Sound Dues at Helsingør on all ships sailing through the Sound. The natural consequence was that the Hanseatic League supported the Holstein counts against him. Copenhagen, which the king had taken in 1416 from the bishop of Roskild, and from this day onwards was to remain the permanent seat of the Danish Government, was attacked in 1428 by the fleet of the Hansa towns, but under the leadership of the heroic Queen Philippa, sister to England's great warrior-king, Henry V., the city defended itself successfully. When in 1435 Erik abandoned the strife with the League and the Holstein counts it was because the Swedes, who were being plagued by the Danish sheriffs and the taxation resulting from continual war, had risen in revolt. In the years that followed he repeatedly made serious efforts towards devising a different form of union from that which Margaret had established; but becoming weary of this, and discouraged by opposition even from the Danish Rigsraad (privy council), he retired to Gottland, where in 1439 he received tidings that the privy councils of the three Scandinavian kingdoms had dethroned him and set up his nephew, Duke Christopher of Bavaria as his successor. In 1449 Erik handed over Gottland to Denmark. He died in Pomerania in 1459.

With the death of Christopher, known as Christopher III., in 1448 the Kalmar Union had really come to an end. Denmark and Norway had elected Christian of Oldenburg king and in 1450 concluded a permanent union. Sweden on the other hand elected a native nobleman, Karl Knutsson, as king and this called forth strife between the different parties of the Swedish nobles; now and again one or other would seek to resume the union with a view to overcoming its opponents with the aid of the Danish king, and thus Christian I. (1448–81) was acknowledged the nominal ruler of Sweden from 1457 to 1464 and Hans (1481–1513) from 1497 to 1501. The party strife in Sweden intensified into a bitter feud between the two most powerful of the noble families, the Stures and the Trolles. The Swedish archbishop, Gustav Trolle, called in the help of Christian II. (1513–23) against the Swedish regent (Riksforestandare) Sten Sture; and when the Danish sovereign at the head of a great force had conquered Sweden, it seemed for a moment as though Queen Margaret's idea of union might be taken up again. Christian II. received allegiance as heir to the Swedish throne in 1520. But Gustav Trolle, availing himself of his triumph, instigated a wholesale massacre of his opponents, in what came to be called the "blood-bath of Stockholm," When two years later Christian II.'s enemies joined together to effect his overthrow, the peasant population of Sweden also rose against the foreign invader, and in 1523 Gustav Vasa succeeded at last in founding the national Swedish kingdom (see GUSTAVUS I. and SWEDEN).

Schleswig and Holstein.—In the meantime the Danish king had won back Schleswig and secured the alliance of Holstein, In 1459 Duke Adolf VIII., the last representative of the Holstein counts, had died, and in 1460 Christian I. of Denmark, his sister's son, had been made a member of the nobility of the country as duke of Schleswig and count of Holstein on his promising that the two lands should remain "for ever together undivided." The nobles thought that in this way they had abolished the rights of inheritance of the family of dukes from that time forward. In 1474 the emperor made Holstein also a dukedom. Ditmarsh was still at that date independent of Holstein, and when in 1500 King Hans tried to conquer it his army of nobles experienced a bloody defeat; it was not till 1559 that Frederick II. succeeded in conquering this free country of peasants.

The election of Christian I. entailed the making of heavy payments to various would-be claimants to the succession and this was one of the reasons why the king, on the marriage of his daughter Margaret to the Scottish king, James III., in 1469, was obliged, in lieu of dowry, to mortgage the Norwegian Orkneys and Shetland to Scotland, which has possessed them ever since. The question of the inheritance to the dukedoms arose afresh after the death of Christian I., and in 1490 the nobles were forced to submit to the division of the lands into a Segeberg and a Gottorp region between King Hans and his younger brother, Frederick, the unity of the country being formally maintained by the arrangement that the two dukes should reign together. United afresh through the fact that Duke Frederick in 1523 became king of Denmark, in 1544 they were once again shared in the same way, between King Christian III. and his brother Adolf who became duke of the Holstein-Gottorp.

Administration.—In the 15th century there had come into full development the differences which from this time forth were to characterize the Danish political situation down to the 19th century. The constitutional problem was, to whom should belong the chief power in the country, the king or the landowners represented in the Rigsraad, which at this time was made up of the country's seven bishops and about 20 noble landowners, whom the king indeed chose but whom he had to take from the leading families, and who thus corresponded in some degree to a privy council. This Rigsraad possessed in theory the highest constitutional powers, for it elected the king, who ever since 1481, before being elected, had to sign a charter drawn up by the Rigsraad, embodying the constitution of the country and asserting that the king should conduct no important State affairs without the sanction of the Rigsraad. But except by open revolt the Rigsraad possessed in reality no means of compelling the king, once elected, to observe the rules laid down in this charter; and further, this large assembly of men from all parts of the land, who were themselves fully preoccupied with their own concerns, had naturally to leave to the king and his chancery the actual daily management of the political affairs of the country. One landowner of noble birth as high steward, acted in some sort as a political leader, while another as chief constable was at the head of the nobles in their capacity as Denmark's armed cavalry, but their influence on the Government's conduct could always be set on one side by the king and his chancellor, the head of his chancery. Only in matters of local government was the king virtually compelled to make use of the nobles, who, insisting on their right to be appointed lord lieutenants, were in charge of the local administration in the 200 herreder (hundreds) of the provinces which were governed from the king's castles.

The Estates of **the** Realm.—In the 15th century also the Danish people became divided more sharply into distinctive estates. Denmark's principal industry, then, as at all times, was agriculture and the cultivated soil, apart from about 700 manorial estates, consisted of about 80,000 farms, from 10 to 20 of which would be clustered together in country villages. Each of these villages was administered by the peasant farmers in common.

whether these owned their farms themselves or were tenants paying a yearly rent—landgilde—to the actual owners. In the year 1500 there were about 12,000 Danish peasants who owned their farms; 18,000 were cultivators of land which belonged to the Crown, the so-called *Faestebønder* or leasehold tenants; while quite 30,000 were leasehold tenants of the church estates or of the estates belonging to the nobles, this large number being due to the freedom enjoyed by these properties from the old land taxes due to the State. In one or two respects, however, this tax exemption had other results. Thus the leasehold tenant on a manorial estate was liable to certain terms of forced labour and feudal duties, and when, as a result of the Black Death of 1348–49, many leasehold farms became vacant, there being no one willing to undertake their cultivation, a law was introduced by the lords of the manor in Zealand that the next heir to any leasehold tenant must take over his farm. This form of serfdom, therefore, which enacted that the farmers' sons who had become artisans or tradesmen in a town could be forced to abandon their occupations in order to continue the cultivation of their father's farms, had the result that an estate-owner in return for a payment would place his rights at the disposal of a neighbour; so that it is no exaggeration to speak of the actual sale of farmers' sons.

The Danish Church.—With its seven bishoprics and more than 70 monasteries the church in Denmark was immensely rich. It derived a huge income from its estates and leasehold farms, which were both exempt from the old land taxes and on which extraordinary taxes could be levied only with its consent. It drew still greater revenues from the tithes on the entire corn production of the country, one-third of such tithes going to the bishops, one-third to the parish-churches, and one-third to the parish priests. The pope, since the Council of Basle, had assumed the right to make all ecclesiastical appointments in Denmark, although he allowed the king certain nominations when he sought in 1458 to render the Vienna Concordat of 1448 applicable also to Denmark. The Danish nobles, however, considered that the ecclesiastical appointments ought to come to their younger sons, who were too poor to buy estates, so they demanded and in 1523 obtained from King Frederick a decree that to become a bishop a man must be of the Danish nobility and to obtain an important prelacy he must be either of the Danish nobility or else a doctor of theology. The result was a series of endless and costly proceedings in Rome. The enterprising place-hunters often secured for themselves these posts, including the position of parish priests. The service of religion, however, was neglected and it is not surprising therefore that the churches like the monasteries fell into decay and the people turned away from a church most of whose leaders were concerned, like Leo X. himself, in spending the riches provided for them by their high offices. The setting up of a university and school of theology in Copenhagen in 1479 had the effect of bringing about a more serious study of the principles of Christianity. Paul Helgesen, who became Lektor in 1519, vigorously attacked the malpractices in the Church, especially—as Luther did—in the matter of the sale of indulgences, but Luther's break with Rome in 1521 changed Helgesen into one of the last great champions of the Catholic Church in Denmark.

The Nobility.—The 15th century was to mark a turning-point in the history of the Danish nobility. Until then any Dane might become a noble by fulfilling the duties entailed in time of war, namely, by presenting himself well equipped for military service at his own expense. In return for this he was exempted from all taxes on his entire estate. Naturally there were estate owners and farmers on a large scale who in the course of the centuries had thus attained noble rank, but the dividing line was hard to indicate, since there were opportunities for the coming in of new families to take the place of those which had died out. But henceforward the nobility marked itself off as an estate apart: to belong to it a man had to show that his forefathers also for at least three generations had been exempted from taxation. The nobles thus put a stop to the incursion of new families into their ranks. The king sought to effect an addition on a small scale by assuming to himself the right to issue titles of nobility, but in contrast with England, where this practice secured for the nobility a continuous addition in each successive generation, the Danish nobility in the 15th century was made into something like a caste. After increasing from 242 families to 264 during the years 1400–50, the number sank from 230 families in 1500 to 140 (including at most 3,000 persons) in 1650. These figures offer the best explanation of the revolution of 1660. Of the Danish noble families in the 15th century the Gyldenstjerne and the Rosenkrans (whose names are commemorated in Shakespeare's Hamlet) were among the most important.

Trade Policy and the Burgher Struggle.—The Danish landowner of noble birth in the 15th century acquired estates in great numbers and were capable agriculturists. Their efficiency was demonstrated especially in Denmark's increased export of produce. The country had long had a market for its horses; now stall-fed bullocks were added and the landowners had to find sales not only for their own output of corn, butter, bacon, hides and meat, but also for the supplies of these goods levied by them in the form of rent from their leasehold tenants. In this way the estate-owners, lay and clerical, also became merchants; many of them owned ships on which they transported their wares to foreign merchants who were their customers. An estate-owner or a peasant-farmer who sailed over to Liibeck and Rostock with corn, butter or pork, needed to maintain his right to sell his own produce and to make purchases abroad to supply his own needs. But in this he found himself fettered by the commercial policy which had been proclaimed by King Erik VII. in 1422, and for a century had been maintained by the Danish Government, namely, the enactment that Danish merchants in the Danish mercantile towns had a monopoly in the transaction of business with other countries. Accordingly all Danish agricultural produce had to be brought to these towns and there sold to citizens who in their turn exported them, making a profit thereon; and in the same way only citizen-merchants might import the foreign goods required by Denmark, which had to be bought in the same towns. This was the theory, but in practice it was not possible to carry it out because the Danish merchants were not wealthy enough to finance the trade in question. The German merchants who had immigrated and become Danish citizens were the keenest of all to see this arrangement carried out and took up this position against the Danish estate-owners arid the Hanseatic merchants who were still doing good business in Denmark.

In 1466 a cleavage had come about between King Christian I. and the then leading Danish-Swedish family of Thott. In 1468 Christian called together at Kallundborg the first Danish assembly of the estates of the realm, consisting of representatives of the Church, the nobility, the burghers and the peasants, so that they might vote him means for waging war against Sweden. From that time on the Government was on the side of the burghers against the landowners. It sought to create competition with the Hanseatic League by concluding treaties of commerce with England and the Netherlands. Christian II. at this time was guided by the Dutch woman, Sigbrit Willemszoon, whose standing was more or less that of a controller of customs and finance, and by Hans Mikkelsen, burgomaster of Malmo, who was a kind of minister of the interior. This Government made the king, especially after the great victory in Sweden, an absolute monarch. Under the leadership of Hans Mikkelsen were formulated two great laws, the law for the land and the law for the towns, which came into force at the end of 1521. They contained many provisions which seem of a very modern nature; their tendency may best be gathered from the fact that they forbade "the evil and unchristian custom of selling the poor peasants" and strongly maintained the monopoly of the Danish towns and burghers in regard to Danish trade. Thus the landowners of noble birth and their rights were entirely set aside.

It is not surprising therefore that the Danish landowners, when Sweden was in a state of insurrection in 1522, should resolve to sweep aside this burgher Government. The nobles from Jutland co-operated with Duke Frederick and the Hanseatic League, renounced allegiance to King Christian and on March 26, 1523, acclaimed the duke as Danish king. On April 13 King Christian sailed from Copenhagen on his way to the court of his brother.

in-law, the Emperor Charles V. Some years later in 1531 he made an effort to win back his kingdom, but was taken prisoner in Norway and remained in captivity until his death in 1559.

Reformation and Reorganization. — It was not until 1524 that Frederick I. (1523–33) assured his position; when Copenhagen and Malmo, which had heroically supported King Christian, were forced to surrender by the great Holstein general, Johan Rantzau. The victory was that of the Danish landowners and the *Rigsraad;* King Christian's two great laws were abrogated and the actual documents publicly burnt; the landowners were now once more free to sell their peasants and to trade with any foreign merchants they wished. It was the *Rigsraad* that governed; Frederick I. was king only in name. He came however to exercise a considerable influence in Denmark, for he, and even to a greater extent his son, Duke Christian, gave their protection to the zealous reformers of the church, whose leader was Hans Tausen and who were striving to bring about Denmark's accession to Lutheranism. This movement secured strong support among the burghers and the peasants; nor were all the landowners blind to the fact that they might benefit by demanding back the properties which their forefathers had bestowed upon the church and the monasteries, although the majority sided with the Catholic Church. When the struggle was at its height, in 1533, King Frederick died and the *Rigsraad* decided under the leadership of the Catholic bishops, who would not have Duke Christian king at any price, that Denmark should do without a king altogether, and that the *Rigsraad* would be Government enough. The Danish burghers, however, would not agree to this. Their leader, Ambrosius Bogbinder, the burgomaster of Copenhagen, and the burgomaster of Malmo Jøzgen Kock, concluded a treaty with Lubeck — where Jurgen Wullenweber had really overthrown the old aristocratic ruling council — and they joined together to restore the burgher King Christian II. on the throne and to incorporate Copenhagen and Malmo in the Hanseatic League. The lay members of the *Rigsraad* then, in 1534, recognized the necessity of choosing Duke Christian, and a bitter civil war followed, known to history as the "Count's War" — the count in question being Christopher of Oldenburg, great nephew of King Christian I., whom Liibeck and her allies raised up to oppose Duke Christian. He acted throughout as the nominee of the captive Christian II. Everywhere the burghers and the peasants took up arms and in North Jutland they won victories over the Danish nobles. But Johan Rantzau returned with his Holstein and German troops, and the peasants suffered severely alike in Jutland and on the islands. With Swedish and Prussian assistance a fleet was formed which, under Peder Skram as admiral, defeated the citizens of Liibeck. The holstein army was conveyed over to Zealand and in July 1535 the siege of Copenhagen and Malmo began. Malmö surrendered in April, Copenhagen not until it had been besieged for a year, in July 1536. On Aug. 6 Christian III. (1534–59) made his entry into Copenhagen and soon afterwards Ambrosius Bogbinder committed suicide.

It was the king who had won the victory with the help of his Holstein troops; the effects of this decisive triumph of the monarchy became very perceptible in the future political development of the country. The most direct outcome of the conflict was the remodelling of the church. In accordance with a decision come to by the king's council of war on Aug. 22, the bishops resident in Copenhagen were imprisoned, then the others all over the country; they were released only after they had submitted to the new organization of the church. At an assembly of the estates in Copenhagen in Oct. 1536, at which representatives of the peasants were present for the last time, assent was given to the king's charter and to a statute which established the new church. The social life of the country was revolutionized. The Church became a Lutheran State Church with the king as its supreme head, while seven bishops were to exercise supervision over the parish clergy. The property of the bishops and eventually also all the property of the monasteries fell to the king, and as at the same time a half of the farms of the peasant-proprietors were confiscated, as a punishment for having sided against the king, the possessions of the Crown were trebled, so that it now owned a little over one-half the soil of the country. The bishops' tithes henceforward went into the king's coffers, the revenues of whicn were increased through the better administration of the Crown estates.

The lord lieutenants more often than not held their fiefs on a fixed rent or else only in return for feudal military service: in future they were obliged to account for the expenses and revenues of the fiefs so that the king should receive the balance. In 1533, of the country's 162 *herreder* (Schleswig not included) 43 were on the register, in 1559 there were 123; in the succeeding years efforts were made to combine the *herreder* into larger fiefs, the number of which in 1642 was 54. Centralization of Government was carried out on a firmer basis; financial matters were dealt with under an exchequer, while the chancellors took over the administrations of the interior and the exterior. The defeated estates, the burghers and the peasants, lost in 1536 their political influence, the burghers for a century, the peasants for more than three centuries. The burghers had to abandon entirely their great trade policy and to be content with sharing with the landowners the right to export bullocks, which gave the latter almost a monopoly, and generally to put up with the commercial operations of the landowners. For the peasants, of whom in the middle of the 17th century, 94% were leasehold farmers, what was of most importance was that the king and the landowners, during the second half of the 16th century had started farming on a large scale. A great many leasehold tenants were thereby turned out of their fathers' farms, and since the larger new estates called for increased labour the leasehold tenants in the parishes of the large estates were called upon to give their services three days a week. In order to compel the unwilling, both the Crown and the landowners began to make use of legal punishments, and many of the latter set up law-courts on their own estates where they themselves or their bailiff sat in judgment on the peasants. Moreover the landowners retained in 1536 all their rights as nobles and even extended them. To exemption from taxes was added exemption from tithes, to a monopoly in posts like the lord lieutenancies was added what was practically a monopoly of the Government offices and the Exchequer, together with a right to a seat in the *Rigsraad* (which now consisted often of 23 members) and the exclusive right to promotion to the chief posts, such as high steward, chancellor, chief constable, lord high admiral or lord chancellor of the kingdom.

From 1560, with the new discoveries of silver in America, agriculture became increasingly a remunerative occupation, and, further, since 1590, the Dutch had been steadily buying corn in Denmark and the Baltic provinces for shipment via Amsterdam to southern Europe. Apart from two quite fruitless wars against Sweden (1563–70, 1611–13), Denmark had enjoyed peace and was able to make full use of it. The landowners especially acquired much matter, which many of them used for the creation of beautiful dwellings, and the names of Tycho Brahe, the astronomer, Holger Rosenkrans, the theologian, and Arild Hvitfeldt, the historian, show that in the intellectual world also Denmark played its part. The burghers too were acquiring capital and were thus enabled to compete with the Hanseatic towns — for instance in the trade with Iceland. The commercial navy grew, and Christian IV. was able to found new cities like Gluckstadt and Christianshavn, nhile enlarging and beautifying Copenhagen with new edifices, notably the Bourse, and new harbour-works and fortifications. Frederik II. (1559–88) built Kronborg as a support for the collection of the Sound dues, which continued to bring in larger and larger revenues. Christian IV. (1588–1648) built in the Dutch renaissance style the heautiful castles of Frederiks. borg and Rosenborg.

The Swedish Wars. — Christian IV. was encouraged by success to think that it must be the Danish king's policy to make Denmark the leading country in northern Europe, and that it must be his duty in particular to prevent the increase of Swedish influence. This aim was unattainable, for the power of Sweden at this period was superior to that of Denmark's. Sweden had become famous both for her copper and for the finest iron in Europe, also for the firm administration and an army and navy

always ready for war which her highly-gifted kings of the Vasa line had created. Denmark could hold her own against Sweden only with her navy, to the strengthening of which Christian IV. had given special care with a view to maintaining Danish mastery over the Baltic no less than over the North Sea; and it was this which repeatedly saved Denmark from destruction.

A period of misfortune began for Denmark when Christian IV., at the behest of England, intervened in the Thirty Years' War, first as Protestant leader against the emperor (1625–29), later, when he had had to cede this position to Gustavus Adolphus, as a mediator, until prevented by a Swedish attack in the years 1643–45. Both wars resulted in bitter defeats for Denmark. While the Danish islands were defended by the navy, Jutland was pillaged and laid waste by hostile armies, first by the imperial forces under Wallenstein, then by the Swedes under Thorstenson. Denmark had to purchase peace in 1645 by surrendering the islands of Gottland and Oesel and the provinces of Norway, Herjedalen and Jemteland. In order to find the money to defray the wars, Christian had to increase greatly the Sound dues, but this evoked much ill-will on the part of the Western Powers, and although the Dutch in 1645 obtained considerable reductions they came to feel strongly that it would be a good thing if Denmark did not possess both banks of the Sound. Over and above all this, the Thorstenson conflict brought the friendship of the duke of Holstein-Gottorp to the side of Sweden, and this developed into a definite alliance when Frederick III. (1648–70) rashly declared war on Sweden in 1657. This war, famous for the advance of the Swedish king, Charles X., over the ice from Jutland to the islands, ended in 1658 with the Peace of Roskilde by which Denmark gave up Bornholm and Trondhjem and the southern provinces of the Scandinavian peninsula, while the duke of Gottorp was acknowledged as a reigning prince in part of Schleswig.

These wars were of special importance to the internal history of Denmark because they caused the Danish burghers' hatred of the nobles to break out anew more strongly than ever, without justification inasmuch as the Rigsraad had striven to the best of its ability to prevent the wars, but with justification inasmuch as the nobles had shown but little heroism and above all would not make, in common with the lower estates, the sacrifices required to remedy the poverty resulting from the wars. These differences were accentuated at the State assemblies which from 1638 onwards were now and again called together. All the proposals made, even those on behalf of the king, for the betterment of the condition of the country, were rejected by the Rigsraad, which was led by the high steward, Korfits Ulfeldt, the husband of Christian IV.'s daughter, Leonora Christina. As a condition of his accession the high steward compelled Frederick III. to sign a charter which considerably decreased the royal prerogative in nominating at his own pleasure lord lieutenants and members of the Rigsraad. With great shrewdness and firmness, Frederick III. began to work for a change in the constitution. He succeeded in overthrowing Korfits Ulfeldt, who had been found guilty of frauds; and when Charles X., vexed at not having completely conquered Denmark, recommenced the war in 1658 and soon invested Copenhagen, the burghers of the city were stimulated into a heroic defence by the offer of great privileges: Copenhagen became a free *Rigstad* (Crown city) whose assent was necessary for the settling of State affairs and whose burghers were to enjoy the same privileges as the nobles. The Dutch, who did not relish the idea of both shores of the Sound being in the hands of the Swedes any more than in the hands of the Danes, despatched a fleet to the relief of Copenhagen and on Feb. 11, 1659, the Swedish attack on the capital was repelled. Charles X.'s death was followed by the Peace of Copenhagen in 1660: Bornholm and Trondhjem, which in the meanwhile had freed themselves, were given back to Denmark, but in other respects the Treaty of Roskilde was confirmed because the Western Powers so willed it: Skaane, Halland, Blekinge and Bohuslan were forever lost to Denmark.

The Constitutional Revolution of 1660.—After peace had been declared the Estates Assembly met in Copenhagen in Sept. 1660. Measures of taxation were necessary but the nobles were as unwilling as ever to forego their exemption from taxes The church representatives under the leadership of the Bishop Hans Svane, together with the burghers, whose leader was Hans Nansen, the burgomaster of Copenhagen, then allied themselves to form an opposition party and forced the Rigsraad and the nobles to take on a share of the taxes and to enter into negotiations with the king for a change in the constitution. They constrained the Rigsraad and the nobles to confer on Frederick III. and his family the hereditary succession to the throne, and when the Rigsraad negatived this proposal the opposition submitted it on Oct. 10 direct to the king; under the pressure of threats the Rigsraad gave in on Oct. 13. The charter which had insisted on the elective nature of the monarchy was rendered void and handed over for cancellation to the king, who was acclaimed with great pomp as hereditary sovereign on Oct. 18. There were suggestions for a new constitution of the estates and when the assembly was dissolved (Dec.) it received the king's promise to institute a constitutional law for the kingdom. In Jan. 1661 the Government sent out an instrument or pragmatic sanction to be signed by all the more prominent citizens, landowners, bishops, professors, magistrates, etc., in which the king had conferred on him not merely the succession but also absolute sovereignty.

The constitution which Frederick III. had promised was at last drafted by the king's *Kabinetssekretär* (State secretary) Peder Schumacher. The king signed it on Nov. 14, 1665, but it was not made public until 1709. The king's law, as it was called, made the Danish sovereign absolute inasmuch as it imposed on him the sole duties of keeping the kingdom undivided and of maintaining the Christian religion in accordance with the Confession of Augsburg, while it further settled the succession on Frederick III.'s heirs both in the male and female lines. An absolute monarchy was, indeed, the necessary and only possible constitution for Denmark in 1660 if it was desired to deprive the nobles of their political power. For the burghers were clever enough to perceive that, however influential the nobles still were, a constitution would only have given them new power. The absolute monarchy meant that from now onwards every distinction of rank between the noble and de *ufri staender* (the unfree estates)—was done away with and from now onwards, as far as possible, all Danish citizens would be on a level under the absolute rule of the king.

The first task awaiting the monarchy was to bring about a new order in the kingdom. After the terrible misfortunes of the wars military affairs were completely separated from the civil administration. In the sphere of local government the country was divided anew into districts under superior magistrates who replaced the lord lieutenants. In the sphere of central government there were established administrative boards (*Kollegie-ordningen*); the two chanceries to which the name *kancelli* was applied and the office of the Exchequer were changed into administrative boards and other boards were instituted to deal with war and the admiralty, while yet another special board was set up apart as the supreme court of law of the kingdom. The boards laid proposals before the king, who gave his decisions soon after the matter had been dealt with by a secret council the members of which, selected chiefly from among the heads of the boards, were nominated by the king. While the old Danish nobility held aloof on their country estates their places in the administration were taken by burghers.

The Burgher Bureaucracy.—Thus there was formed a burgher bureaucracy in which the first and most significant figure was Peder Schumacher, a member of a rich and highly respected Copenhagen burgher family, who as early as Nov. 1673 was made State chancellor (rigskansler), because of his brilliant abilities, and at the same time created count of Griffenfeldt (*q.v.*). This was in accordance with a law formulated by Schumacher himself with reference to counts and barons (1671), whereby in the case of certain members of the burgher bureaucracy there might be created a nobility which should owe its existence to the king alone, to replace the old aristocracy. Griffenfeldt aimed at the removal of the old deep-rooted differences between the estates, and though he himself was overthrown in March 1676, the burgher bureaucracy remained to play an important rôle during the first period of the absolute monarchy. Not until about 1730

did there come a change; in this year once again the landowners, some of them of the old nobility, some of the new, came into power but only as servants of the absolute monarchy.

A joint code of laws for the entire kingdom was issued under the name of Christian V. (1670–99) in 1683; serfdom was abolished in 1702 and for a brief period the Zealand peasant became free; trade and industry were protected in accorddnce with mercantile principles; schools were opened in the provinces and thus a foundation was laid for a system of elementary education. But almost the most important reform of the whole period was the setting up in 1684 of a registration system throughout the kingdom whereby the land was classified in accordance with its value with the intention of attaining a more equitable distribution of taxes. For it was soon found that the absolute monarchy needed heavy taxes to cover the great expenditure involved in maintaining it. one item being the erection of a number of castles in North Zealand, another the great cost of the army and navy.

The absolute monarchy regarded it as an inherited responsibility to fight the traditional enemy Sweden and to reconquer Skaane. Hence the Skaane war of 1675–79 and the great Scandinavian wars of 1700 and 1709–20, which entailed terrible sacrifices. Skaane was not regained, but it was as a result of victories over Charles XII. and his ally, the duke of Holstein-Gottorp, that Frederick IV. (1699–1730) in 1721 was able to take possession of the ducal part of Schleswig and include it in the monarchial. In Sept. 1721 there took place in Schleswig a great ceremony in connection with the taking of an oath of fealty "in accordance with the king's law." The outcome naturally was a bitter hatred against Denmark on the part of the ducal family of Gottorp, and this grew the more dangerous in that the dukes became in 1743 heirs to the crown both in Sweden and in Russia.

When the duke himself in 1761 became emperor of Russia as Peter III., a war seemed inevitable and Denmark had to arm on a great scale. But the tsar was murdered at the instigation of his wife, who succeeded him as Catherine II., and Denmark's foreign policy, which since 1775 had been controlled by Johann Hartvig Bernstorff, took on a new aim, namely, to induce the empress to exchange the Gottorp portion of Holstein for Oldenburg which Griffenfeldt had won in 1673 for Denmark. This aim was achieved in 1773 and the Danish king once again held possession of both the dukedoms, Schleswig as a Danish, and Holstein as a German fief.

Economic and Social Conditions. — The weight of taxation was burdening the people, especially as the period preceding the year 1767 had been one of terrible depreciation for Danish agriculture. The price of corn had gone steadily down, for the Dutch could now buy wheat in England, which at this period supported her wheat exports with a premium. The exportation of bullocks had ceased, the Dutch about 1720 having instituted a heavy tax on Danish bullocks. The Danish peasant population was impoverished and Danish land sank lower and lower in value. To cover the expenditure which the war with Sweden had entailed, the Crown was obliged after 1660 to effect considerable sales of its property. Gifts from the king to ministers and favourites and continual sales resulted in a steady increase in the landowner's share of the soil. In order to collect taxes from the peasants the Crown had to make the landowner responsible for the taxes which their leasehold tenants had to pay. In return for this the owners were granted exemption for their principal estates; thus exemption for the landowners was restored, though upon a new basis of law. The new nobility of counts and barons which was created in 1671 not only acquired all the rights formerly enjoyed by the old Danish nobility, together with the exemption from taxation on a part of their peasant farms, but also the right to leave all their estates together in entail to the eldest son, although as a fief which on the extinction of the direct line should revert to the Crown. The harder the times the more the Crown had to accede to the demands of the landowners, which were, as before, that they should be able to compel occupation of their leasehold estates and obtain free labour from their tenants. One of the first acts of Christian VI. (1730–46) had been the abolition of the national militia, but in 1733 it was re-introduced, in combination with the so-called *Stavnsbaand,* which provided that all Danish farmers' sons from their 14th to their 36th year should be bound as villeins to the estates on which they were born; that is to say, any one of them, wherever he might be, might be forced by the landowners to come back either to take over a farm or else to be conscripted by the landowners as a soldier. In 1745 it was further decreed that even a soldier who had served his time was bound to return to the same estate and to take up a tenant farm. As soon as the landowners had obtained these rights over their leasehold tenants, they could screw their requirements in the matter of forced labour as high as they liked; they could have the refractory conscripted for the hated military service and could employ any bodily punishment including the so-called "timber-mare" (*traehesten*): the Government closed its eyes because it had to get the taxes.

In the middle of the 18th century, however, an economic advance became observable, when, under the leadership of France, colonial goods from the West Indies, and especially sugar, coffee and tobacco, began to find a European market. Denmark acquired three West Indian islands, of which the most important was St. Thomas. The eastern Asiatic trade also began to flourish under the leadership of England. Danish trade expanded and the new Asiatic and West Indian companies both prospered. In 1736 a Danish bank of issue was founded which supported these ventures and when the great colonial war broke out between France and England, the neutral trade of Denmark greatly benefited thereby. A. G. Moltke, the favourite of Frederick V. (1746–66), and a great landowner as the result of the king's generosity, was the first person to realize that this might also benefit Danish agriculture by opening up greater possibilities of production. But the landowners' government was thoroughly conservative and would not consider the economic freedom of the peasants. The landowners' rule was overthrown in 1770 by Struensee, an accomplished physician and a man of great gifts, who secured power through his close relation with Caroline Matilda, sister of King George III. of Britain, who had been united in an unhappy marriage with the degenerate and morbid Christian VII. (1766–1808). Struensee carried through a number of reforms, but Conservatism again revived under Høgh-Guldberg, who declared that the "yoke of the peasants could not be removed without Denmark shaking and quivering to its foundation."

Agricultural reforms were imminent, however, and when the Crown Prince Frederick in 1784 had acquired power by a *coup d'état,* he found a brilliant spokesman in a Danish landowner of old Danish stock, Christian Ditlev Reventlow, who had studied agriculture in England. Reventlow became the life and soul of a commission which brought about the liberation of the Danish peasant. The *Stavnsbaand* was ended on June 20, 1788; villeinage was stopped, compensation in money being given; the ancient agricultural associations were done away with, and the peasant was allotted his own plot of land. Many at once quitted the villages for the country. Transition to freehold ownership was the ultimate aim of this great land reform, which was carried through thoroughly and with excellent results in Denmark several years before any such reform had occurred to any other European nation.

The Napoleonic Wars. — The circumstances of the moment were helpful. By 1767 England as the result of its industrial awakening had changed from a corn-exporting to a corn-importing country. As a result Amsterdam once again had to purchase corn in the Scandinavian countries and the prices of corn and agricultural produce rose steadily during the period of the French Revolution and the Napoleonic wars. It was in this favourable period, which continued until 1807, that more than half the Danish peasants obtained ownership of their farms.

The period was favourable also for Danish trade, for the Danish foreign minister, A. G. Bernstorff, succeeded like his uncle before him in keeping Denmark out of the wars. After his death in 1797 there came, it is true, a clash with England, for Denmark together with Russia and other neutral powers was attempting to safeguard trading vessels by convoys of men-of-war. This displeased England, and Nelson was sent with a fleet

to break up the alliance of the Northern Powers. There followed the sea-fight off Copenhagen on April 2, 1801. After a gallant resistance the Danish fleet was destroyed, the capital bombarded and Denmark had to undertake to cease sending convoys. The period which followed brought great benefits to Danish agriculture and trade. Commerce had been facilitated by the toll law of 1797 which extended the principle of free trade. Wealthy businesses grew up in Copenhagen, and the bank of issue which had been founded in 1736 granted ever-increasing credit. After 1757 the bank was exempted from having to meet its notes with silver, and after it was taken over by the State in 1773 it had not only to emit as many notes as were required for the carrying on of business but also to meet in this respect the State's need of money.

In 1807 England called upon neutral Denmark to give up her considerable navy lest it should be used by Napoleon against England. Canning's demands had to be complied with, but not before an English fleet had laid large portions of Copenhagen in ruins. In anger over this, Frederick VI. (1808–39) from that time onwards attached himself politically to Napoleon. Seven burdensome war years followed, in the course of which relations between Denmark and Norway were completely broken off and Danish trade was gradually brought to a standstill. When at last victory fell to the coalition Denmark had to conclude a peace at Riel in 1814 by which Norway was handed over to Sweden and Heligoland to England; in exchange Denmark acquired Lauenburg.

1814-1914

The war had cost immense sums of money which, since neither taxes nor loans were available, the bank of issue had to meet by a limitless issue of notes. The consequence was a fall in their value to worthlessness; in 1813 the bank went bankrupt and a new National Bank was founded, which in 1818 became a private concern entirely independent of the State. Its notes first reached par in 1838 and in 1845 became payable on demand. The failure of the bank, the destruction of Danish trade and the fall of corn prices during the first ten years after the war left a period of poverty and stagnation during which, moreover, the land reforms came to a standstill.

The June Constitution. — This condition of things naturally called forth criticism of Frederick's absolute government and when he tried to keep down criticism by means of a censorship a Liberal Party came into existence which, in accordance with the growing Liberalism of other countries, set itself the task of substituting for the absolute Government a new constitutional Government representative of the people. Even Christian VIII. (1839–48), who as king of Norway in 1814 had co-operated in framing Norway's free constitution, did not seem disposed to perform the same service for Denmark. Immediately after his death on Jan. 20, 1848, came the revolution of February and the short-lived victory of Liberalism. In Copenhagen the movement had its outcome in a public procession on March 21 to the new King Frederick VII. (1848–63), who was able to reply that he intended to renounce the absolute rule and that he had already taken steps towards forming a Government responsible to the representatives of the people. This was appointed next day with A. V. Moltke as premier; among the ministers were leading National Liberals like Monrad, Tscherning and Lehmann. On Oct. 23 a national assembly met which, on the basis of a draft submitted by Monrad, prepared the constitution of the Danish kingdom of June 5, 1849. The legislature became a Rigsdag, with specified powers, consisting of a *Landsting* and a *Folketing;* the members of the former were to be elected for eight years by indirect vote and the latter for three years by direct vote.

The Schleswig-Holstein Question. — In the meantime even the question of the new constitution was thrown into the shade by the differences between Germans and Danes which was taking a more acute form. The Napoleonic wars had awakened the German national feeling and the ardent desire to see the entire German race united in one political entity. The political bonds which bad existed between Schleswig and Holstein ever since 1460 suggested that these two regions should form a single country which should be included in a united Germany. These efforts evoked a counter-movement among the Danish population in North Schleswig, and since 1838 in Denmark itself, where the Liberals especially had taken up the fight and after 1842 were insisting that Schleswig had belonged to Denmark for centuries and that the frontier between Germany and Denmark must in the future as in the past be the Eider. (See SCHLESWIG-HOLSTEIN QUESTION.) This difference between Eiderdanism, as it came to be called and Schleswig-Holsteinism led in March 1848 to an open Schleswig-Holstein revolution which was helped by the armed intervention of Prussia. The outcome of this was a three years' war (1848–50) which finished in a victory for Denmark. Great Britain, France, Russia, Norway-Sweden in 1850 recognized the integrity of the Danish monarchy and in the London Convention of 1852, together with Austria and Prussia recognized Prince Christian of Gliicksburg as heir to the whole monarchy after the death of the childless Frederick VII. In the agreement with Prussia, 1851–52, however, the Danish Government was obliged to undertake that in the ultimate framing of the constitution of the monarchy Schleswig should not be brought into closer relationship to Denmark than to Holstein. The impossibility of fulfilling this condition was soon to be seen.

In the Danish Rigsdag three parties had been formed: the Conservatives, comprising the landowners and all those who were against the free constitution, the National Liberal Burgher Party, which had carried through the June constitution, and the Left, including the Peasants and "Friends of the Peasants" (*bondevennerne*), whose chief desire was for a continuation of the land reforms. The Conservatives were in favour of restricting the June constitution as much as possible, being ready to fulfil their promise to Prussia by creating a conservative joint constitution for the whole kingdom, with a joint Rigsraad in which the Holstein landowners should also be represented. Such a constitution came into existence in 1855 but the Holsteiners promptly refused to meet in a joint Rigsraad. After 1857 the National Liberals returned to power with Carl Christian Hall (*q.v.*) as prime minister. He abolished the joint constitution for Holstein and on Nov. 18, 1863, prevailed upon the new king, Christian IX. (1863–1906) to sign a new joint constitution for Denmark and Schleswig which brought Schleswig into closer relationship to the kingdom than to Holstein. Bismarck was anxious for a popular war and desired the harbour of Kiel for Prussia; Austria agreed to join in and the two predominant Germanic Powers crushed down Denmark's heroic defence at Dybbol (Duppel) in 1864. By the Treaty of Vienna the three dukedoms were surrendered and also Danish North Schleswig; in 1866 after the Austro-Prussian War they became part of Prussia. Napoleon III. in the Treaty of Prague procured the insertion of an article (Art. V.) to the effect that North Schleswig should be reunited with Denmark when the majority of the population by a free vote should so desire; but it was in vain, for in 1878 Prussia and Austria agreed to the cancellation of the article.

The July Constitution. — The National Liberal Eider-Danish policy had brought about Denmark's defeat. The Conservatives took office and carried through in co-operation with the Peasants, who disliked the National Liberals, the new constitution of July 28, 1866, which was considerably more conservative than that of June: the general suffrage was indeed retained in the case of the Folketing, but in the composition of the *Landsting* the landowners and the most highly-taxed people were given an altogether overwhelming influence. This resulted in the two chambers entering into a state of permanent opposition to each other. In 1872 the Left severed their alliance with the Conservatives, who soon combined with the National Liberals to form a Right. This Right leaned on the Landsting and maintained the king's privilege of selecting his ministers without regard to the general voting.

In 1872 the Left secured a majority in the Folketing and insisted on the parliamentary system — the king's duty to choose his ministers from the party with a majority in the Folketing. The struggle persisted from 1873, when J. B. Estrup, the leader of the Right, became prime minister, until 1894 when he went out

of office; other and weaker ministries of the Right held power until 1901. The contest was bitter, for throughout all this period the Left had a growing majority in the *Folketing*. The election of 1884 gave them 81 seats out of 102, of which two were held by the first Social Democrats ever elected to the chamber. The Right demanded large grants for Denmark's military forces, for it always hankered after revenge against Germany in a great European war. The Left under the leadership of Hørup refused to make the grants for such a vain policy. Under the leadership of Berg the *Folketing* went so far as to negative the budget in 1876, in 1885 and again in 1894. But Estrup, like Bismarck, did not shrink from letting the king declare a "provisional budget," and by this means the Right mere able to provide for the fortifications of Copenhagen and to maintain themselves in power. Only when the election of 1901 had reduced the Government's strength in the second chamber to 8 members of the Right and 16 of the so-called Moderates, as against 76 of the Left and 14 Social Democrats, did King Christian IX request Professor Deuntzer to form the first Left ministry, of which J. C. Christensen, Hørup and Hage became members.

Economic Progress.—The period following 1848 was a period of great economic progress for Denmark as for the whole of Europe. The continual rise of prices down to 1873 had made possible a resumption of the land reforms which the "Friends of the Peasants" and the Left desired, and which were supported also by the National Liberal Government in the case of Monrad's Law of 1861 changing the leasehold tenancies into freehold land. By 1873 76% of the farms were freehold, which in 1905 had risen to 94%. The increasing exports of corn from America and Russia between 1873 and 1895 again brought Danish agriculture to a precarious state, but it bore up through this crisis and saved itself by making changes in its production. Instead of corn it produced butter and pork, and by its co-operative dairies and co-operative slaughterhouses made these goods standard commodities in the English market. Later there came co-operative export associations. When better times arrived these associations had a progressively good effect on Danish trade; the function of Danish commerce now came to be the exportation of the country's agricultural produce.

Estrup's policy had made Esbjerg an important centre for the English export trade. Tietgen founded the United Steamship Co. (whose Esbjerg-Harwich line took over the export to England) and the great Northern Telegraph Co., which acquired its greatest importance through its relations with China and Japan. New banks were founded, including the *Landmandsbank* (Agriculturists' Bank) in 1871 and the *Handelsbank* (Trade Bank) in 1873. The towns grew; in the course of the '70s Frederick III's old ramparts round Copenhagen were pulled down and new quarters arose on their site. A wage-earning class came into existence who were soon identified with the Social Democrats, which party in 1884 sent two representatives to the lower chamber. A labour conflict in 1899 led to the establishment of a court of arbitration for the settlement of labour disputes. The constitution of June had already acknowledged the full and unfettered right of association and this has never since been challenged in Denmark. During the period of development even the Government of the Right felt that its duties and responsibilities were not merely political but also social. In 1891 there was introduced an Old Age Pension Law, in 1892 an Health Insurance law, in 1899 an important law for the establishment of small farms with State help. Meanwhile the loss of Danish Northern Schleswig was a sore which the Prussian policy in that region made only more painful. Danish historians taught the Danish people to understand that the juridical question which the National Liberal party had wished to enforce was wrong, and that Denmark should no longer wish to recover Schleswig except those parts which declared themselves Danish and in a referendum would return under the principle of self-determination.

Ministries of the Left.—As a ministerial party the Left had great difficulties to overcome. It had to try to introduce universal suffrage in the election of parish councils *(sogneraad)*, county councils *(aintsraad)* and even the lower chamber itself, and for this a new fundamental law was required; it had to proceed with social legislation; the taxes—such as the tithe—which ever since the middle ages and from the period of absolute monarchy had remained upon the land of the peasants had to be changed into taxes upon the incomes and property of the citizens; it had to introduce regular budgets; and it had, generally speaking, to carry out an advanced policy. The Deuntzer ministry succeeded in carrying through the reform of the taxes in 1903; two years later J. C. Christensen became prime minister. He was anxious to demonstrate that the Left could rule, even with a hostile upper chamber, but he held that to this end it was necessary that the Left should break with the Social Democrats and declare themselves willing to carry through measures of defence adequate to the country's needs, even if it should prove impossible to effect a reduction in military expenses. The result was that a small section of the Left which would not admit the necessity of these two measures set up as an independent party, the Radical Party, under the leadership of Zahle. In the following year the military problem became the dominant issue; the prime minister endeavoured to solve it in conjunction with the Moderates, whose leaders were Klaus Berntsen and Niels Neergaard. But in 1908 the ministry was severely shaken when the minister of justice, A. Alberti, was forced to resign and subsequently confessed himself guilty of frauds. The Christensen cabinet was compelled to resign in the following October. Three short-lived cabinets followed namely, those of Neergaard, Count Holstein-Ledreborg and Zahle, whereupon Klaus Berntsen (July 5, 1910) formed a cabinet of the Left, including the Moderates, which listed until 1913. After violent conflicts on the defence problem, the Holstein cabinet carried an arrangement whereby, although the army and navy were enlarged, and Copenhagen's naval defences strengthened, the land defences of the capital were to be dismantled not later than March 31, 1922.

In 1910 the Left opened an agitation for a democratic amendment of the constitution. The Right, which was strong in the *Landsting*, opposed, and no solution had been reached when the elections were held in May 1913. The Radicals and Socialists now held 63 seats out of the 114 in the *Folketing*, and united to force the reform under a new Zahle cabinet containing Eric Scavenius (Foreign Affairs), Brandes, Rode and Munch. The Right answered by obstruction in the *Landsting* which the Government then dissolved. The new *Landsting* contained 38 supporters and 28 opponents of the constitutional amendment.

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RECENT YEARS

The World War.—The European situation in 1914 caused Denmark great anxiety. On Aug. 1 the *Rigsdag* passed a number of emergency laws and the mobilization of the emergency army, numbering in all about 70,000 men, began on the same day. All political parties agreed in maintaining the neutrality of Denmark. A difficult situation arose on Aug. 5 in consequence of an inquiry from Germany whether the Danish Government intended to block the passage of Danish waters with mines, an inquiry which could only mean that if Denmark refused Germany would lay the mines. The Government had to consider Denmark's responsibility as a neutral Power, and after some hesitation decided to lay the mines. With this Germany was satisfied, and Britain sanctioned the action in view of Denmark's precarious position. It became apparent that the war situation might have serious effects upon Danish economic life and the Government was therefore granted emergency powers. It adhered to the policy of keeping the belligerent nations constantly informed of the measures which it had adopted, thus establishing with both sides confidence in Denmark's desire for a real neutrality and an understanding of the importance of maintaining its effective industries. This in time resulted in fixed agreements with Germany and England as to exports.

After the first anxiety caused by the war had been allayed the constitutional problem was again taken up. The opposition of the Right having weakened, on June 5, 1915, the king signed the new constitution. This introduced full equal suffrage in the elections for both Houses, men and women being entitled to vote under identical conditions; the privileged suffrage of the landlords and the wealthier classes came to an end; the voting age was fixed at 35 years for the *Landsting* and was lowered successively from 30 to 25 years for the *Folketing*. Of the members of the *Folketing*, 93 were elected in individual districts, 27 in greater Copenhagen according to proportional representation, while 23 supplementary seats were divided among the parties that had received too few representatives at the other polls in proportion to their number of votes. Of the members of the *Landsting* 54 were indirectly and proportionally elected in large districts, while 18 were elected by the retiring *Landsting* according to the same prin-

ciples. In the case of a constitutional amendment a referendum must take place, and 45% of the eligible voters must vote to give it validity. The constitution came into force on April 21, 1918.

Other important legislative enactments of the first years of the war, which the Zahle Government succeeded in passing without opposition, were the Reform of the Administration of Justice (April 11, 1916), which separated the administrative and judicial systems and introduced oral proceedings and publicity, with trial by jury in criminal and political cases, and the Accident Insurance law (July 6, 1916), which made it the duty of all employers to insure their employees. The privileged suffrage in respect of the elections to the *amtsraad* (county councils) was abolished with the consent of all parties.

In the late summer of 1916 a bitter opposition arose on the Government's announcement that it had concluded a treaty with the United States ceding the Danish West Indies to that country for $25,000,000. Finally the cabinet was supplemented by representatives of each political party and a plebiscite taken on the sale. At the polls (Dec. 14, 1916) 283,670 votes were cast in favour and 158,157 against, and shortly afterwards the Rigsdag ratified the cession. A similar but less far-reaching contest arose over the rearrangement of the relation of Iceland to Denmark. Iceland demanded political independence and integrity. Despite the opposition of the Conservatives, the support of the other three parties sufficed to pass an Act of Union (Nov. 1918) in which Denmark acknowledged the independence of Iceland. The king remained joint ruler of both countries, and Denmark had charge of Iceland's foreign relations. After the German occupation of Denmark, Iceland proclaimed her independence of action "for the present" April 10, 1940. (E. AP.; X.)

Even the early years of the War of 1914–18 were disturbing to Danish economy, which had become closely related through commerce to outside countries. Intensified submarine activity in 1917, along with the more stringent British blockade, created serious difficulties. Feed could not be obtained for livestock, exports declined, prices rose and unemployment spread. The government launched an extensive relief program and attempted to control prices. In the spring of 1918 women voted for the first time in the Folketing elections (68% voted to 84% of men), and the issue was closely drawn: the government coalition of Socialists and Radicals won 72 seats, to 68 for the total opposition. The Landstzng contained 17 Conservatives, 26 Left, 13 Radicals and 15 Socialists.

Reconstruction, 1918.—Denmark moved quickly and hopefully into the era of peace by demobilizing her forces, razing the special defence works, and, on March 17, 1920, abolishing the land defence and artillery of Copenhagen.

Most important direct result of the treaties of Paris for Denmark was the opportunity to regain at least a part of Schleswig, lost to Germany in 1864. Some hoped that the central portion of the province could be internationalized rather than go to Germany, but no provision had been made for such a settlement. The plebiscite, held in the spring of 1920, gave to Denmark the purely Danish part of North Schleswig (Nord Slesvig), but the size of the area rewon disappointed most Danes. (See SCHLESWIG.)

The nationalist agitation concerning Schleswig combined with other political controversies to create the "Easter crisis" of 1920. In view of the necessity for a new electoral law, the government refused to call a new election, so the king dismissed the ministers. The king was supported by a new cabinet of non-politicians formed at the end of March, headed by Liebe, but the Socialists called the dismissal unconstitutional and threatened a general strike. Conciliation brought a new ministry on April 5, composed mostly of State officials and charged with framing an electoral law and holding elections. Proportional representation in the county districts (*amtskredse*) and slight modifications in the supplementary seats system characterized the new law.

The Folketing elections of April 26, 1920, brought a Left cabinet under Niels Neergaard on May 5. Still another election had to be held in September on account of the incorporation of Nord Slesvig, and with the voting age 25 for the first time. In the enlarged Folketzng of 149 members the Left won 52 seats, the Socialists 48, Conservatives 27, Radicals 18, the Trades Party 3 and the Germans 1. The Neergaard Ministry continued with the support of the farmers of the Left and the mercantile Conservatives. The opposition was made up of labour and smallholder interests, plus a few "liberals."

The Social Democratic Regime.—The ten years after 1920 saw a gradual decline in the power of the Liberal Left. In 1924 the Social Democrats, with Th. A. M. Stauning as premier, took office. Then, in the 1926 elections, they lost two seats, and the Left group returned under the leadership of Madsen-Mygdal. In 1929 Stauning came in again, and his party increased its strength in succeeding elections, remaining in power up to the German occupation in 1940. Financial problems and unemployment were the chief difficulties during the first part of this period, and the defeat of the Social Democrats in 1926 was due to their desire to use State funds on a large scale to meet the crisis. The country gradually adjusted its economy to the tightening world conditions, and though the krone was thrown off the gold standard by the British action in 1931, the currency was later established in relation to the pound.

The Social Democrats are moderate socialists, representing small landholders and agrarian and industrial workers. The party has been closely associated with the co-operative movement, and advocates parcelling of large estates, universal suffrage on a 21-year-old basis, abolition of the upper chamber (Landsting), progressive taxation, and government control of industry and trade; in foreign policy it has stood for disarmament and co-operation with the League of Nations. The Liberal Left (Venstre) finds itself, by the early 20th century trend in politics, actually on the Right. It represents landowners and business and professional groups, and stands for economy in social legislation, tax reduction, an adequate defence system, the retention of the constitution and the League of Nations. The third group in importance is the Conservatives, representing a great variety of interests. It emphasizes private initiative, protection of property, Christian education in the public schools, and is nationalistic with a leaning toward inter-Scandinavian agreements. The party strength in the Rigsdag is shown in the table.

TABLE X—Parties in the Rigsdag

	Landsting		Folketing	
	1936	1939	1935	1939
Social Democratic	31	35	68	64
Conservative	22	18	29	30
Radical Left	15	13	26	26
Faroe Is.	7	8	14	14
Nat'l Socialist	1	1		1
Communist			..	3
Free Peoples (Farmers)			2	3
Justice League		1	5	4
Slesvig			4	3
			1	1

Agitation for constitutional revision culminated in 1938–39 with the elaboration of a new constitution, aimed to eliminate the still aristocratic Landsttng, and to create a new Rigsdag on a more popular basis. The document was approved by both houses in the spring of 1939, and sent to a plebiscite. Those who voted approved the change overwhelmingly, but the opposition (Liberal Left and the Farmers Party) stayed away from the polls. The law required approval by 45% of the electorate, which was missed by a slight margin. The change would have lowered the voting age to 23 for all purposes, and defined individual rights more positively. The Rzgsdag was to be composed of 210 members; 175 to be chosen by direct vote, of whom 140 were to constitute the Folketing, while the entire 175 would choose 35 to go to the other house, the Rigsting. An additional 35 members of the *Rigsting* were to be chosen by proportional representation from party lists. On the failure of the constitution the Conservative leader, Christmas Moller, resigned, but Stauning remained in office, not regarding the vote as one of lack of confidence.

A series of acts known collectively as "The Social Reform" were passed in 1933, placing Denmark among the more advanced states in this type of legislation. The Minister for Social Affairs, K. K. Steincke, worked out the bills on a scientific, carefully planned basis, building on ancient Danish experience and practice. The Public Assistance Act regulates medical aid, poor relief, child welfare, etc, and helped 206,000 persons in its first year. The Accident Insurance Act requires all employers to ensure workers with a company approved by the Ministry of Social Affairs. The Labour Exchanges and Unemployment Insurance Act sets up government control of a number of separate unemployment funds, to which individuals, communes and the State contribute. The National Insurance Act requires everyone aged 21 to 60 to belong to an approved sickness benefit society, as a passive "contributing" member if he is propertied, or as a participating full member otherwise; the State contributes to these clubs also, which enrol as regular members over 2,000,000.

Relations with her great neighbour to the south were so vital to the country that the Danes, alone among the Scandinavian states, signed the non-aggression pact with Germany (May 31, 1939). With Soviet Russia, Denmark had early reached an understanding on economic relations (1923). Acrimonious discussion with Norway over the question of Greenland led to a no-year agreement (1924) giving Norwegians certain rights, but leaving open the question of sovereignty. The matter was taken to the Permanent Court for International Justice, which in 1933 decided in favour of the Danish claims.

Foreign Affairs.—Denmark took an active and optimistic part in the early days of the League of Nations. When the small neutrals were given a meagre opportunity to make suggestions as the victorious Allies drew up the Covenant, Peter Munch and other Danes obtained a hearing and won some modifications. No political party opposed entrance into the League, though some individuals abstained from voting on the question, allowing the decision to be unanimous. Denmark feared the military sanctions clause, both the passage of League troops through her territory, and the furnishing of troops. She helped obtain the change in the Covenant from "indicating" what troops should be sent to "recommending" such forces. She joined with other neutrals in demanding that all European states be admitted—thinking especially of Germany. She was deeply interested in the early establishment of the World Court, the goal of long agitation in the country,

which favoured a neutralization scheme on an international juridical basis. Within the League she co-operated without pressing her own views, yet her treaties of arbitration and judicial settlement (1926) went further than the weak Locarno type of agreements; there was no "gap in justice" in them. She stood firmly for disarmament, and actually proceeded far on this road on her own initiative.

Danish co-operation with the "Oslo Group" was sincere, but increasingly hampered by fears of German displeasure. It was at Copenhagen on July 23, 1938, that the delegates of this group, disillusioned by the attitude of the great powers and the weakness of the League, announced themselves no longer to be bound by the sanctions agreements. From 1914 to 1940 her king or foreign minister met repeatedly with the kings and foreign ministers of Sweden and Norway to consult on problems of neutrality, armament and economic relationships. This type of conference steadily spread beyond the purely political realm, coming to include social legislation and a variety of cultural matters.

When in 1939 the German invasion of Poland flared into a general war, Denmark was again placed in a precarious position. Her non-aggression treaty with Germany, only a few months old, permitted her to carry on her normal trade with Great Britain, but circumstances and treaty did not coincide. Esbjerg was accidentally bombed by the British, the waters around Denmark were mined, and submarines, too, helped make these waters dangerous for either fishing or shipping. Britain and Germany were in a bitter struggle of annihilation, and the most painstaking Danish diplomacy could not solve the essential problem of Danish geography. Trade declined, and it became increasingly difficult to get the fodder necessary for livestock. In the early morning of April 9, 1940, the Germans entered the country with military forces at a number of points. Though a handful offered heroic resistance, the Danish Government immediately issued orders that the people should accept the occupation as a *fait accompli.* The Germans said they took control because otherwise Denmark would be made a hattleground by England; and they promised to restore Danish sovereignty when the war was over. To forestall German control of other territories associated with Denmark, the British at once took over the Faroe Islands "for the duration" and sent a small force to Iceland.

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DENNERY or **D'ENNERY, ADOLPHE (PHILIPPE)** (1811–1899), French dramatist and novelist, was born in Paris on June 17, 1811. He obtained his first success in collaboration with Charles Desnoyer in *Émile, ou le fils d'un pair de France* (1831), a drama which was the first of a series of some 200 pieces written alone or in collaboration with other dramatists. *Les Deux Orphelines* (1875), perhaps his best piece, was written with Eugène Cormon. With Louis Gallet and Édouard Blan he composed the book of Massenet's *Cid* (1885); and, again in collaboration with Eugène Cormon, the books of Auber's operas, *Le Premier Jour de bonheur* (1868) and *Rêve d'amour* (1869). He died in Paris in 1899.

DENNEWITZ, a village of Germany, in the Prussian province of Brandenburg, near Jiiterbog, 40 m. S.W. from Berlin. It was the scene of a decisive battle on Sept. 6, 1813, in which Ney, with an army of 58,000 French, Saxons and Poles, was defeated with great loss by 50,000 Prussians under Bulow and Tauentzien.

DENNIS, JOHN (1657–1734), English critic and dramatist, was born in London, and educated at Harrow and Cambridge. After travelling for some time on the Continent he settled in London, and obtained, through the patronage of the duke of Marlborough, a small place in the customs, which he sold for a small charge covering a long period of years. His first successful plays were *A Plot and No Plot* (1697), *a* satire on the Jacobites, and *Rinaldo and Armida* (1699), and *Liberty Asserted* (1704). *Appius and Virginius* (written 1705 and produced at Drury Lane 1709) was satirized by Pope in the *Essay on Criticism:*

> Appius reddens at each word you speak,
> And stares tremendous, with a threatening eye,
> Like some fierce tyrant in old tapestry.

Dennis replied in 1712 with *Reflections . . .* on the *Essay,* and the quarrel was pursued in a series of pamphlets provoked by various incidents. He also quarrelled with Addison, and published *Remarks upon Cato* (1713), which drew from Pope the *Narrative of Dr. Robert Norris, concerning the strange and deplorable Frenzy* of *John Dennis* (1713). *In* the end Pope and Dennis were reconciled, and exchanged friendly letters. But Dennis's best claim to remembrance lies neither in his plays nor in his literary quarrels but in the body of his, on the whole, sane critical work. He had the prejudices of his time, and is tiresomely insistent on poetical justice.

The most important of his critical works are *The Advancement and Reformation of Modern Poetry* (1701); *The Grounds of Criticism in Poetry* (1704); and *An Essay on the Genius and Writings of Shakespeare* (1712).

Dennis's *Miscellanies in Prose and Verse* were collected in 1693. *See H.* G. Paul *John Dennis, His Life and Criticism* (New York, 1911); and Elwin and Courthope's *Works of Pope* (1871–79).

DENNISON, a village of Tuscarawas county, Ohio, U.S.A., 80 mi. S. by E. of Cleveland, on federal highways 36 and 250 and the Stone fork of the Tuscarawas river; served by the Pennsylvania railroad. The population was 4,413 in 1940. It has railroad shops, sewer-pipe factories and a steel casting foundry.

DENOMINATION, the giving of a specific name to anything, hence the name or designation of a person or thing (Lat. *denominare,* to give a specific name). In arithmetic it is applied to a unit in a system of weights and measures, currency or numbers. The most general use of "denomination" is for a body of persons holding specific opinions, usually religious, and having a common name, or for the various "sects" into which members of a common faith may be divided. "Denominationalism" is thus the principle of emphasizing the distinctions, rather than the common ground, in the faith held by different bodies professing one sort of religious belief. This use is particularly applied to that system of religious education by which children belonging to a particular religious sect are instructed in the tenets of their belief by members belonging to it and under the general control of the ministers of the denomination.

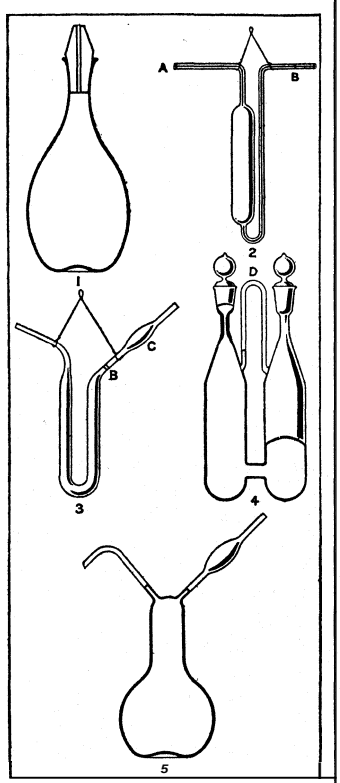
DENON, BOMINIQUE VIVANT, BARON DE (1747–1825), French artist and archaeologist, was born at Chalon-sur-Saône on Jan. 4, 1747. He studied law in Paris, and in his twenty-third year produced a comedy, *Le Bon Père,* which obtained a *succès d'estime.* Louis XV. entrusted him with the collection and arrangement of a cabinet of medals and antique gems for Madame de Pompadour, and appointed him attach6 to the French embassy at St. Petersburg. On the accession of Louis XVI. Denon was transferred to Sweden; but he returned, after a brief interval, to Paris with the ambassador de Vergennes, who had been appointed foreign minister. In 1775 Denon was sent on a special mission to Switzerland, and visited Voltaire at Ferney. He made a portrait of the philosopher, which was engraved and published on his return to Paris. He spent seven years (1780–87) at Naples, first as secretary to the embassy and afterwards as *charge' d'affaires.* After a brief interval spent in Paris he returned to Italy, living chiefly at Venice. During the Revolution he returned to Paris, where he was protected by his friend the painter David. At Bonaparte's invitation he joined the expedition to Egypt, and there made numerous sketches of the monuments of ancient art, sometimes under the very fire of the enemy. The results were published in his *Voyage dans la basse et la haute Égypte* (2 vols. fol., with 141 plates, Paris, 1802). From 1804 to 1815 he was director-general of museums. He accompanied Napoleon in his expeditions to Austria, Spain and Poland, advising the conqueror in his choice of spoils of art from the various cities pillaged. He died in Paris on April 27, 1825. He left unfinished a history of ancient and modern art, with admirable engravings, which was published posthumously, with an explanatory text by Amaury Duval, under the title *Monuments des arts du dessin chez les peuples tant anciens que modernes, recueillis par Vivant Denon* (4 vols. fol., Paris, 1829).

See J. Renouvier, *Histoire de Part pendant la Révolution;* A. de la Fizelière *L'Oeuvre originale de Vivant-Denon* (a vols., 1872–1873); Roger Portallis, *Les Dessinateurs d'illustrations au XVIIIe silcle:* D. H. Beraldi, *Les Graveurs d'illustrations au XVIIIe siècle.*

DENOTATION, in logic, a technical term used strictly as the correlative of connotation, to describe one of the two functions of a concrete term (from Lat. denotare, to mark out, specify). The concrete term "connotes" attributes and "denotes" all the individuals which, as possessing these attributes, constitute the genus or species described by the term. Thus "cricketer" denotes the individuals who play cricket, and connotes the qualities or characteristics by which these individuals are marked. In this sense, in which it was first used by J. S. Mill, denotation is equivalent to extension, and connotation to intension. It is clear that when the given term is qualified by a limiting adjective the denotation or extension diminishes, while the connotation or intension increases; *e.g.,* a generic term like "flower" has a larger extension, and a smaller intension than "rose"; "rose" than "moss-rose." In more general language denotation is used loosely for that which is meant or indicated by a word, phrase, sentence or even an action. Thus a proper name or even an abstract term is said to have denotation. (See CONNOTATION.) Some writers would confine the term denotation to real things (as distinguished from merely imaginary ones), and use "extension" in the wider sense. In that case the term "fairy" would have extension but not denotation.

DENSITY. The density of a substance is the mass of unit volume of the substance.

Density determinations are comparatively simple to carry out and a high degree of precision is often attainable. **A** knowledge of the density of a material is of considerable interest both from a theoretical and a practical standpoint. **A** few examples will indicate the wide range of problems and operations into which considerations of density enter. Accurate density determinations form a means of determining the molecular weight of gases. **A** knowledge of the density of the crystals examined is extremely valuable in the X-ray analysis of the structure of crystals. Density determinations have been used in the study of the constitution of liquids, of the dissociation of gases, and of the effects of cold work on metals. Lord Rayleigh's determination of the density of "atmospheric nitrogen" led to the discovery of argon. The very considerable revenue resulting from the duty on beer is assessed during the process of manufacture on the basis of determinations of the density of the worts. It is often specified in contracts for the supply of material that its density must be within prescribed limits, and density determinations are frequently necessary in industrial operations.



FIGS. 1–5.— FORMSOF PYKNOMETER

These examples suffice to show in how many directions a knowledge of the density of materials is of service. The widespread recurrence of density throughout the whole range of science and technology is not fortuitous, but a direct consequence of the fact that density is a fundamental physical property.

Different materials and conditions and the varying degrees of accuracy required for different purposes necessitate a number of different methods of determining density.

Units of Density.—Density, being simply mass per unit volume, may be expressed in terms of any units of mass and volume as, for example, lbs. per gallon, lbs. per cubic foot, grammes per cubic centimetre, or grammes per millilitre.

The most generally convenient unit is grammes per millilitre. The litre is defined as the volume at its temperature of maximum density (4° C) of one kilogram of pure water and the millilitre is the one-thousandth part of a litre or one cubic centimetre. It follows, therefore, that the density of water at 4° C expressed in terms of grammes per millimetre is unity.

Temperature and Pressure *Effects.*—In general, a rise in temperature causes a decrease in density and a rise in pressure causes an increase in density. With gases the changes are large and it is necessary to take both pressure and temperature into account when considering the density of gases. This is dealt with in detail later. Liquids are only slightly compressible but their density changes appreciably with change in temperature. It is therefore necessary, to secure precision, to specify the temperature at which a liquid has a stated density, but the pressure may usually be omitted. The variation in the density of solids with changes in temperature and pressure is comparatively small.

Determination of **the** Density of **Liquids.**—*Pyknometer Method.*—Given a vessel which requires a known volume of liquid to fill it, then simply by determining the weight of liquid required to fill the vessel the weight of a known volume of the liquid is determined. From this the density can be readily calculated.

A pyknometer is simply a vessel which can be filled with precision. In addition it should be easy to clean and weigh and suitable for allowing its contents to be brought to a uniform temperature.

There are numerous kinds of pyknometers, and five forms of interest in their relation to each other are shown in figs. 1 to 5.

Fig. 1 shows a small bottle having a well fitting ground glass stopper with a small hole drilled vertically through it, and in use the bottle is filled flush to the top of this hole. In fig. 2 is a type of pyknometer due to Sprengel which is finally filled by withdrawing liquid from the jet **A** with the aid of blotting paper until the liquid surface in the other horizontal tube is at a mark B. This form avoids errors which might arise in the preceding one if the stopper is not always pushed precisely the same amount inside the neck at each filling. Fig. 3 shows a more robust form of Sprengel tube which is provided with a small bulb above the graduation mark B. This bulb will accommodate any liquid which might expand from the main part of the pyknometer should the temperature rise after it has been filled, a happening which would be inconvenient in the two preceding forms. **A** pyknometer due to Bousfield (fig. 4) is still more robust, but retains all the advantages of the one shown in fig. **3** and has a glass hook D, by which it can be hung from a balance hook, thus getting rid of the wire suspensions, liable to alter in weight, required for the Sprengel type. The last pyknometer, due to Dr. C. Barr of the National Physical Laboratory, and not hitherto published, retains the advantages of the Sprengel method of filling but reverts to the bottle type of fig. 1 for the body of the instrument, and so secures the advantages of a pyknometer which will stand on its own base and not require suspension for weighing.

When using a pyknometer it is important to ensure that the contents of the pyknometer have attained a constant temperature before completing the filling, and to observe this temperature accurately. This is generally done by immersing the bulk of the pyknometer in liquid contained in a thermostat, keeping it there for a sufficient time to ensure uniformity of temperature, and then taking the temperature of the outer liquid at the time the final filling of the pyknometer is carried out as that of the liquid inside the pyknometer.

The operations in determining the density of a liquid by means of a pyknometer are to weigh the pyknometer (a) when empty (W, grammes), (b) when filled with water (W_w gms.), and (c) when filled with liquid (W_l gms.). We will assume that the same temperature $t°$ C obtains during each filling of the pyknometer and that the air density has the same value a gms./ml. during each weighing.

We must now consider how to determine the density mass per unit volume—of the liquid from the weights W_p, W_w, and W_l.

Weights are adjusted so that their mass is equal to the nominal value marked on them. When used on a balance they are subject to the buoyancy effect of the surrounding air, which is equivalent

to a reduction in mass equal to the mass of air displaced by the weights. The equilibrium obtained in the operation of weighing may therefore be represented by the equation:—(Mass of weights minus mass of air displaced by weights = Mass of body weighed *minus* mass of air displaced by body weighed).

Let M, gms. be the mass of the pyknometer and 6 gms./ml. the density at $t°$C of the glass from which it is made, M_w gms. the mass of water required to fill the pyknometer at t°C and ρ gms./ml. its density at $t°$C, M_l and d similarly refer to the liquid and finally let A gms./ml. be the density of the weights used. Then applying the equation to the weighing of the empty pyknometer we have:

$$W_p - \frac{W_p}{\Delta}\sigma = M_p - \frac{M_p}{\delta}\sigma \qquad (1)$$

for W_p/Δ is the volume of the weights and M_p/δ that of the pyknometer itself.

Equation (1) is more conveniently written

$$W_p\left(1-\frac{\sigma}{\Delta}\right) = M_p\left(1-\frac{\sigma}{\delta}\right) \qquad (2)$$

Similarly for the second weighing

$$W_w\left(1-\frac{\sigma}{\Delta}\right) = M_p\left(1-\frac{\sigma}{\delta}\right) + M_w\left(1-\frac{\sigma}{\rho}\right) \qquad (3)$$

and for the third weighing

$$W_l\left(1-\frac{\sigma}{\Delta}\right) = M_p\left(1-\frac{\sigma}{\delta}\right) + M_l\left(1-\frac{\sigma}{d}\right) \qquad (4)$$

The volume of liquid weighed is M_w/ρ millilitres and from (2) and (3)

$$\frac{M_w}{\rho} = \frac{W_w - W_p}{\rho - \sigma}\cdot\left(1-\frac{\sigma}{\Delta}\right) \qquad (5)$$

The mass of liquid weighed in M_l gms. and from (2) and (4)

$$M_l = \frac{d(W_l - W_p)}{(d-\sigma)}\left(1-\frac{\sigma}{\Delta}\right) \qquad (6)$$

The density of the liquid is

$$\frac{\text{Mass of liquid weighed}}{\text{Volume of liquid weighed}}$$

and so from (5) and (6)

$$d = \frac{W_l - W_p}{W_w - W_p}(\rho - \sigma) + \sigma \qquad (7)$$

If we write d' for $\frac{W_l - W_p}{W_w - W_p}\cdot p$ in equation (7) this becomes

$$d = d' - \sigma(d'/\rho - 1) \qquad (8)$$

For a mean value 0·0012 gms./ml. for σ the second term on the right of (8) is +0·0005 for a liquid of density of 0·6 gms./ml. and −0·0012 for a liquid of density 2 gms./ml. If errors of these magnitudes are negligible for any particular purpose it is permissible to use the simpler equation

$$d = \frac{W_l - W_p}{W_w - W_p}\cdot\rho \qquad (9)$$

for computing d.

If, contrary to our initial assumptions, the air density varied from weighing to weighing and the pyknometer was filled at different temperatures, the calculations are a little more complicated but involve no new principle. It is merely necessary to introduce individual values for the air density instead of a common value σ and to make due allowance for changes in the volume of the pyknometer with changes in temperature.

Sinker Method.—A hollow glass cylinder with closed hemispherical ends and provided with a glass ring by which it can be suspended, forms a convenient sinker for density determinations. It is necessary to load the sinker so that it will sink in any liquid whose density is to be determined by its aid.

When a sinker is weighed suspended in a liquid the buoyancy effect of the surrounding liquid is equivalent to an upward force on the sinker equal to the weight of liquid which it displaces. If this upward force is determined and the volume of the sinker is known, the weight of a known volume of the liquid is determined and hence its density also. To determine the density of a liquid the sinker is weighed (a) in air (W_a grns.), (b) suspended in water (W_w grns.), and (c) suspended in the liquid (W_l grns.). The first and second weighings serve to determine the volume of the sinker and the first and third the mass of an equal volume of liquid. By considering these weighings in precisely the same manner as the pyknometer weighings were considered it can be shown that if the water and liquid are at the same temperature

$$d = \frac{W_a - W_l}{W_a - W_w}(\rho - \sigma) + \sigma$$

which is of precisely the same form as equation (7) and may be simplified to

$$d = \frac{W_a - W_l}{W_a - W_w}\rho$$

an equation which is subject to the same limitations as equation (9).

The sinker method is much more convenient than the pyknometer method for determining the density of a liquid at a sequence of different temperatures, and if the sinker has not quite attained the temperature of the surrounding liquid, the resulting error is of much less consequence than if the liquid inside a pyknometer has not attained the temperature measured outside.

Osborne, McKelvy and Pearce carried out an extensive series of determinations of the densities of mixtures of ethyl alcohol and water, using both the pyknometer and sinker methods, and their work might be consulted for details of both methods.

The Westphal balance is an application of the sinker method in which the upward force on a sinker is directly measured on a balance of the steel-yard type. The balance is shown diagrammatically in fig. 6. With the sinker hanging in air the balance arm is adjusted so that the pointer P is at the middle of the scale S. If, now, a vessel containing a liquid of density 1 gm./ml. is placed so that the sinker hangs in the liquid there will be an upward force on the sinker amounting to 10 gms. weight, assuming the sinker to have a volume of 10 ml., and the balance arm will no longer be in equilibrium. A 10 gm. weight placed on the balance arm at the point on the scale marked 1·0, *i.e.*, immediately above the point from which the sinker is suspended, would restore the equilibrium of the balance arm and bring the pointer P back to the middle of the scale S. If the density of the liquid were 1·5 gms./ml. then a 10 gm. weight placed at 1·0 on the balance arm

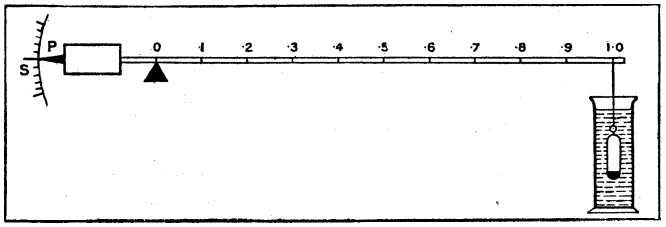


FIG. 6.—WESTPHAL BALANCE

and a second 10 gm. weight placed at 0·5 on the balance arm would counter-balance the 1j gms. weight upward force on the sinker. If the density of the liquid were 1·56 gms./ml. the second 10 gm. weight would have to be placed at a point corresponding to 0·56 on the balance arm to restore equilibrium. Alternatively the second 10 gm. weight could be placed at 0·j on the balance arm and 1 gm. weight at 0.6 on the scale, and the three weights together would then balance the 15·6 gms. buoyancy effect on the sinker. The balances are usually provided with three sizes of weights, the largest having a value in grammes numerically equal to the volume of the sinker in millilitres, the next size having one-

tenth this weight and the third one-hundredth. The positions of the heaviest weights on the balance arm give the units and first decimal place of the density, the position of the next smaller weight gives the second decimal place and that of the smallest the third decimal place.

Westphal balances are convenient when densities are required to an accuracy of about one part in a thousand, but a hydrometer *(see* HYDROMETERS) provides a more rapid and convenient means

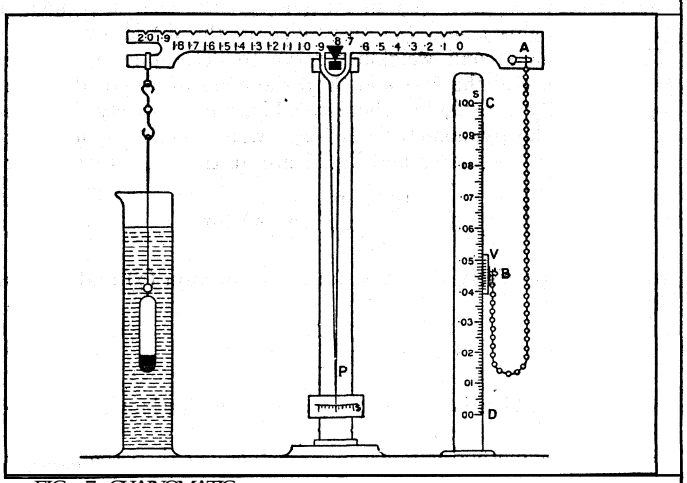


FIG. 7.—CHAINOMATIC BALANCE FOR DENSITY DETERMINATIONS

of attaining this degree of accuracy, and is replacing the Westphal balance in industry.

The principle of the Westphal balance has been applied to chainomatic balances, which can be obtained with scales indicating densities directly. In chainomatic balances the use of fractional weights is avoided by using a fine chain AB *(see* fig. 7) for the final adjustment. The end A of the chain is fixed to one end of the balance beam and the end B is attached to a hook on the Vernier V which slides along the scale CD. By lowering or raising V a greater or less fraction of the total weight of the chain is supported by the balance beam and this affords a delicate means of bringing the beam into its position of equilibrium, *i.e.,* with the pointer P central on the scale S. Such a balance obviously lends itself to adaptation for density determinations. A sinker is suspended from the end of the balance arm remote from A and hangs immersed in the liquid whose density is required. It is balanced by placing a movable weight in an appropriate notch on the beam and moving the vernier V to obtain the final adjustment. The notched beam is graduated from 0 to 2·0 and the position of the movable weight gives the unit and first decimal place of the density the subsequent decimal places being read off on the scale CD by means of the vernier V.

The sinker method is used as the basis of recording densimeters variations in the buoyancy effect on a sinker being used to operate recording mechanism.

If a sinker has precisely the same density as a liquid in which it is placed—no suspension wire being used, it will tend neither

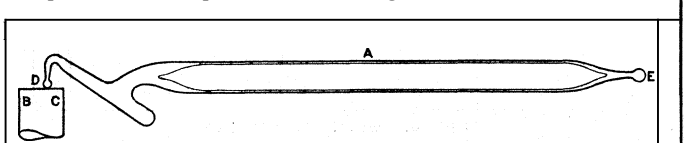


FIG. 8.—PROFESSOR A POLLARD'S TOTAL IMMERSION INDICATING HYDROMETER

to sink nor to float but will remain in suspension in the body of the liquid. The equilibrium is a very delicate one and has been made the basis of accurate density determinations.

Prof. A. Pollard has devised a total immersion instrument for density determinations, the essential portion of which is shown in fig. 8. This is a specially designed glass float A which is supported on a flat surface BC by a small sphere D fused on the float. When wnolly immersed in a liquid the float is free to rotate in a vertical plane about D and takes up a position of rest in which its inclination to the horizontal is dependent on the density of the liquid which is read off on a circular scale placed behind E.

Hare's Method. A long inverted U tube is held with one limb (A) dipping into a liquid and the other limb (B) dipping into a second liquid. By applying suction to a branch tube at the top of the U each of the limbs is partially filled with liquid. If d_1 is the density and h_1 the height of the liquid in A, d_2 and h_2 similarly referring to B, p is the pressure of the air enclosed in the U and P is the atmospheric pressure then

$$p = P - h_1 d_1 = P - h_2 d_2$$

and so

$$d_2 = d_1 \times \frac{h_1}{h_2}$$

Hence if d_1 is known the measurement of h_1 and h_2 suffices to determine d_2.

The method of balancing the pressure due to columns of liquids of different densities has been made use of in accurate density determinations.

Determination of the Density of **Solids.**—*Pyknometer Method.—In* the pyknometer method the volume of a known weight of solid is obtained by determining the diminution in the capacity of a pyknometer when the solid is placed inside it. Four weighings are involved to determine $W_p$gms. the weight of the empty pyknometer, $W_s$gms., the weight of the pyknometer and added solid, W_{sl}gms. the weight of the pyknometer, added solid, and liquid then required to fill the pyknometer, and W_l, the weight of liquid required completely to fill the pyknometer, no solid being present. If d gms./ml. is the density of the solid and gms./ml. that of the liquid then from the equations representing the equilibrium obtained in each weighing it readily follows that

$$d = \frac{W_s - W_p}{W_s + W_l - W_p - W_{sl}}(\rho - \sigma) + \sigma$$

or if the accuracy required in the determination permits it the simpler relation

$$d = \rho \cdot \frac{W_s - W_p}{W_s + W_l - W_p - W_{sl}}$$

may be used.

The method is convenient for solids available in small fragments or powders and a pyknometer such as that shown in fig. 1, into which such solids can be easily introduced is necessary. Powders are liable to entrap a quantity of air which remains in the pyknometer when filled with liquid. This is avoided by filling the pyknometer under reduced pressure.

By *Weighing the Solid in Air and also Suspended in a Liquid.* —If Ms. gms. is the mass of solid, Vs. ml. its volume, $W_a$gms. the observed weight in air and W gms. the observed weight when suspended in a liquid of density p gms./ml., then for the two weighings we have

$$W_a(1 - \sigma/\Delta) = Ms - Vs \cdot a$$

and

$$W_l(1 - \sigma/\Delta) = Ms - Vs \cdot \rho$$

the density of the solid d is given by

$$d = \frac{M_s}{V_s} = \frac{W_a}{W_a - W_l}(p - a) + \sigma \quad \text{or approximately} \quad d = \frac{W_a}{W_a - W_l}\cdot\rho.$$

If the solid has a density greater than that of the liquid in which it is weighed all that is necessary for the weighing is to suspend the solid by means of a fine wire from one arm of a balance so that it hangs suspended in a vessel of the liquid placed on a stand bridging the scale pan. The weight of the suspension wire is allowed for.

If the solid has a density less than the liquid then for the weighing in the liquid a heavier body is attached to the same suspension wire so that the two together sink in the liquid. The heavier body must also be weighed alone in the liquid and if W_3 gms. is this weight W_2 gms. the weight observed when both bodies are suspended in the liquid, and W_1 gms. the weight of the lighter solid in air then from the usual equations for each weighing it follows that—

$$d = \frac{W_1}{W_1 - W_2 + W_3} \cdot (\rho - \sigma) + \sigma$$

d gms./ml. being the required density of the solid, p gms./ml. that of the liquid in which it is weighed and a gms./ml. the density of the air.

Flotation Method.—The flotation method consists in adjusting the density of a liquid, *e.g.*, by mixing two liquids of different density in appropriate proportions, until it is equal to that of the solid. The criterion of equality is that the solid remains suspended in the liquid, neither sinking nor rising. The method is chiefly used for minerals available only in small fragments and in limited amounts. Methylene iodide (density 3·3 gms./ml.) and benzol (density 0·98 gms./ml) are convenient liquids for mixing together to obtain intermediate densities.

Direct Displacement Methods.—If a solid is added to a vessel partially filled with liquid the level of the liquid surface will be raised and the volume of liquid between the original and final levels of the liquid will be equal to the volume of the solid. This affords a means of obtaining the volume of a previously determined weight of solid, and so the density of the solid. Flasks with graduated necks having scales on which the volume corresponding to the rise in the liquid surface can be read directly are used for determining the density of fine materials such as sand and cement. Sometimes a flask with a single mark is used and the volumes required to fill it to the mark (a) when initially empty, (b) when containing a known weight of solid, are measured by means of a burette.

In Regnault's volumenometer the solid displaces air in a chamber connected to a manometer. By observing pressure changes on expanding or contracting the air by a definite amount (a) when the chamber contains air only, (b) when it contains the solid also, the volume of the solid can be determined.

Density of Gases.—Normal Temperature and Pressure.—The volume of a given mass of gas—and consequently the density of the gas—varies considerably with changes either of temperature or pressure. In order that results may be readily comparable it is desirable to quote as the density of a gas the value which it has under standard conditions of temperature and pressure. The standard temperature adopted is 0° C and the standard pressure 760 mm. of mercury. These conditions are referred to as "normal temperature and pressure" and by the corresponding abbreviation "N.T.P."

If the pressure and temperature of a given mass of gas are varied its volume alters in accordance with the relation

$$PV = RT$$

where P is the pressure, V the volume, R a constant and $T = (273 + t)$ where t is the temperature in degrees centigrade. If, therefore, V_1 is the volume of a mass m of gas at a pressure P, and temperature $t°$ C, it follows from the above relationship that its volume V_0 at N.T.P. is given by

$$V_0 = V_1 \cdot \frac{P_1}{760} \cdot \frac{273}{273 + t}$$

and the value of m/V_0 gives the density of the gas at N.T.P.

Methods of Determining the Density of Gases.—*By Weighing a Globe Filled with the Gas.*—The determination of the mass of gas required to fill a globe of known volume affords an accurate means of determining the density of gases. The method is the counterpart of the pyknometer method for determining the density of liquids, and in principle is equally simple. The volume of the globe is determined from its water content and then the globe is weighed first evacuated and secondly filled with gas at a measured temperature and pressure.

Owing, however, to the large volume occupied by a small mass of gas the mass of the globe must inevitably be large compared with that of the enclosed gas. Hence small percentage errors in the weighings involve large percentage errors in the mass of the gas. This coupled with the necessity for accurate control and measurement of both temperature and pressure render the accurate determination of the densities of gases by this method a matter calling for the utmost refinement of experimental procedure.

By Measuring the Volume of a Known Mass of Gas.—This method is the reverse of the preceding one and consists in using one or more globes, or other suitable measuring apparatus, merely to determine the volume of the gas whose mass is determined separately. For example, one of the methods used by Morley in his determination of the density of hydrogen was to weigh the hydrogen absorbed in palladium and to measure the volume of the hydrogen in three globes having a total capacity of 42 litres. Perman and Davies absorbed a measured volume of ammonia in concentrated sulphuric acid in order to obtain its mass.

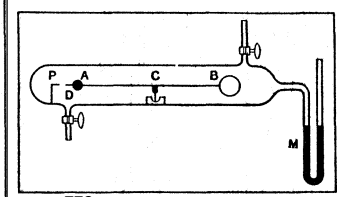


FIG. 9.— MICRO-BALANCE

By Means of the Micro-Balance.—The principle of the micro-balance may be readily seen from the diagrammatic representation in fig. 9. A very light quartz balance beam represented by AB is delicately pivoted at its centre C. At one end of the beam is a small solid sphere of quartz and at the other a larger hollow quartz sphere filled with air. The whole balance is enclosed in a vessel which can be filled with gas under any desired pressure and the pressure can be measured by a manometer M.

Suppose the balance beam is an equilibrium (*i.e.*, with the point D opposite the fixed point P) in one gas at a pressure p_1 and in a second gas at a pressure p_2, the temperature remaining constant. Since the beam is asymmetrical as regards volume, it follows that to produce equilibrium the first gas at the pressure p_1 must exert the same buoyancy effect on the beam as the second gas at the pressure p_2. The first gas must therefore have the same density at the pressure p_1 that the second gas has at the temperature p_2, and from this it follows directly that the density d of the second gas at N.T.P. is given by

$$d = \frac{p_1}{p_2} \cdot \rho$$

where p is the density of the first gas at N.T.P.

The micro-balance affords an extremely accurate means of comparing the densities of two gases and can be operated with exceedingly minute quantities of gas. It has been developed considerably in recent years and in addition to the delicate quartz micro-balances robust instruments based on the same principle have been designed for the commercial determination of gas densities.

Determination of Density of Vapours.—When a substance can exist at one and the same temperature in both a liquid and a gas-like form, the latter is termed the vapour of the liquid. By a sufficient increase in pressure all vapours can be liquefied.

In determining the density of a vapour one usually starts with the substance in its liquid form, and the vaporization of the liquid is an integral part of the density determination.

Dumas' Method.—This consists in vaporizing the liquid in a globe having a neck drawn down to a capillary. So long as any liquid remains in the globe, vapour may be seen issuing from the capillary, but ceases abruptly when the supply of liquid is exhausted. At this instant the capillary is sealed. By weighing the globe the mass of the contained vapour may be determined and its volume may be obtained by weighing the globe both when full of air and when filled with water. The resulting density is that of the vapour at the temperature and pressure prevailing when the bulb was sealed.

Schulze has recently introduced an ingenious modification of the method in which the vapour is liquefied into a small subsidiary bulb before weighing, and so the errors incident to weighing a large globe containing only a comparatively small mass of vapour are avoided.

Gay-Lussac's Method.—This consists in volatilizing a known mass of liquid over a mercury column and measuring the volume of vapour produced. By using a long vertical tube to contain the mercury the liquid can be volatilized under low pressure. A

number of modifications of the method have been introduced from time to time, two recent ones being those of Young and of Egerton.

Victor Meyer's Method.—A simple arrangement of apparatus for Victor Meyer's method of determining the density of a vapour is shown in fig. 10. The liquid in A is heated until air ceases to issue from the tube B. A jar C, filled with water, is then placed over B and a small bottle containing a known weight of liquid is dropped into the inner bulb B. The temperature in A is arranged to be high enough to ensure rapid volatilization of the liquid when introduced into D. The vapour so produced displaces air from the apparatus, and this is collected and measured in C. The volume of this air reduced to N.T.P. is equal to that of the vapour reduced to N.T.P. since before displacement from D the air was at the same temperature and pressure as the vapour.

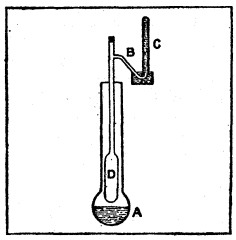


FIG. 10.—DIAGRAM OF VICTOR MEYER'S APPARATUS

The Victor Meyer method has been widely used, and details of a modern form of the apparatus having an improved method for introducing the liquid to be vaporized is described by McInnes and Kreiling.

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DENT, JOHN CHARLES (1841–1887), Canadian journalist and historian, was born at Kendal, England. He was educated in Canada, being called to the bar in 1865. After writing for the English Daily Telegraph and then for certain Boston newspapers, he joined the editorial staff of the Toronto Globe in 1870. Later he turned to history, producing The Canadian Portrait Gallery (biographical studies, 1870), Canada since the Union of *1841* (1881), Rev. Henry *Scadding* (1884) and The Upper Canada Rebellion (1885).

DENTAL RUBBER, a form of vulcanite, coloured pink to simulate the human gums, and used extensively, strengthened with metal, to form the setting of artificial teeth, for which it is admirably suited. It is manufactured from over-vulcanized rubber, *i.e.*, pure rubber which is rolled with about 40% of sulphur, and in which a considerable amount of vermilion or other suitable pigment is incorporated. It takes a high polish, is tasteless and odourless, and is comfortable in wear.

DENTATUS, MANIUS CURIUS, Roman general, conqueror of the Samnites and Pyrrhus, king of Epirus, was born of humble parents, and was possibly of Sabine origin. In 290 B.C., when consul with P. Cornelius Rufinus, he gained a decisive victory over the Samnites, which put an end to a war that had lasted fifty years. He also reduced the revolted Sabines to submission; a large portion of their territory was distributed among the Roman citizens, and the most important towns received the citizenship without the right of voting for magistrates (*civitas sine suffragio*). With the proceeds of the spoils Dentatus cut a channel to carry off the waters of Lake Velinus, so as to drain the valley of Reate. In 275, after Pyrrhus had returned from Sicily to Italy, Dentatus (again consul) took the field against him and defeated him completely near Beneventum. Dentatus was consul for the third time in 274, when he finally crushed the Lucanians and Samnites. As censor in 272 he began to build an aqueduct to carry the waters of the Anio into the city, but died (270) before its completion. Dentatus was looked upon as a model of old Roman simplicity and frugality.

Livy, epitome, ii.–14; Polybius ii. 19; Eutropius ii. 9, 14; Florus i. 18; Val. Max. iv. 3, 5, vi. 3, 4; Cicero, *De senectute*, 16; Juvenal xi. 78; Plutarch, *Pyrrhus*, 25.

DENT DU MIDI, a conspicuous peak of the Swiss Alps 6 mi. S.W. of St. Maurice in the lower valley of the Rhône, with an altitude of 10,696 ft. See ALPS.

DENTIL, in architecture, a small, rectangular block, used in a row as a decoration for the bed-moulding of a cornice. It is undoubtedly a decorative interpretation in stone of projecting beam ends in earlier wooden construction, and many of the famous rock cut tombs of Lycia, in Asia Minor, which represent wooden structures, show similar forms. Moreover, the tomb of Darius at Nakshi Rustan (c. 485 B.C.), which represents the entire front of a Persian palace, plainly shows the beam ends appearing as a dentil band. In ordinary classic usage the dentil decorates the cornices of the Ionic and Corinthian orders (see ORDER). The Attic custom, followed generally by the Romans and the Renaissance architects, kept the dentil relatively small, and spaced the dentils with an inter-space of about half the width of the block itself. Occasionally, as in the Pantheon at Rome (c. 120), an unbroken band, known as a dentil band, replaces the separate dentils. In the Hellenistic temples of Asia Minor, such as the great temple of Athena Polias at Priene (c. 350 B.C.), a special type of heavy Ionic entablature is used, in which the dentils are much enlarged, more widely spaced, and resemble brackets. The Byzantine dentil was a specific type of band ornament, possibly with little relation to the classic dentil, and was used especially as a border for panels. It consists of an alternation of projecting blocks with splayed faces between, usually arranged in a double band, with the blocks on one side of the centre, in every case opposite the splays on the other. It is so found bordering the marble panels of S. Sophia at Constantinople (6th century), and became a favourite ornament in Venice, where it was used not only as a panel mould but also as a horizontal band and even around arches.

DENTISTRY, a special department of medicine, dealing with diseases of the teeth and their treatment. (For anatomy see TEETH.)

Until well into the 19th century apprenticeship afforded the only means of acquiring a knowledge of dentistry, but in Nov. 1840 was established the Baltimore College of Dental Surgery, the first college in the world for the systematic education of dentists. This, combined with the refusal of the medical schools to furnish the desired facilities for dental instruction, placed dentistry for the time being upon a footing entirely separate from general medicine. The British medical schools later revised their policy and special courses of instruction are arranged to meet the demands of the various examining bodies. Recently an official dental register corresponding to the medical register has been instituted in Great Britain.

The most important dental research of modern times is that carried out by W. D. Miller of Berlin (1884) upon the cause of caries of the teeth, a disease said to affect the human race more extensively than any other. Miller demonstrated that, as previous observers had suspected, caries is of bacterial origin, and that acids play an important rôle in the process. This work has been given greater precision by McIntosh, James and P. Lazarus-Barlow who isolated a group of bacilli (B. *acidophilus odontolyticus*) from carious teeth which was capable of producing the characteristic changes under experimental conditions. Dental caries and septic conditions of the gums bear highly important relations to more remote or systemic diseases, furnishing avenues of entrance for pathogenic bacteria, notably those of actinomycosis and pyaemia.

Operative Dentistry.—The art of dentistry is usually divided arbitrarily into operative dentistry, the purpose of which is to preserve as far as possible the teeth and associated tissues, and prosthetic dentistry, the purpose of which is to supply the loss of teeth by artificial substitutes. The filling of carious cavities was probably first performed with lead, and was sufficiently prevalent in France during the 17th century to bring into use the word *plombage*, which is still occasionally applied in that country to the operation of filling. Gold as a filling material came into general use about the beginning of the 19th century.[1] Tin foil was also used to a limited extent.

The dental engine in its several forms is the outgrowth of the simple drill worked by the hand of the operator. It is used in

[1] The filling of teeth with gold foil is recorded in the oldest known book on dentistry, *Artzney Buchlein*, published anonymously in 1530, in which the operation is quoted from Mesue (A.D. 857), physician to the caliph Haroun al-Raschid.

removing decayed structure, and for shaping the cavity for inserting the filling. The rubber dam invented by S. C. Barnum of New York (1864) provided a means for protecting the field of operations from the oral fluids, and extended the scope of operations even to the entire restoration of tooth-crowns with cohesive gold foil. Its value has been found to be even greater than was at first anticipated. In all operations involving the exposed dental pulp or the pulp-chamber and root-canals, it is the only efficient method of mechanically protecting the field of operation from invasion by disease-producing bacteria.

The difficulty and annoyance attending the insertion of gold, its high thermal conductivity. and its objectionable colour have led to an increasing use of amalgam, gutta-percha, and cements of zinc oxide mixed with zinc chloride or phosphoric acid. Attention has also been devoted to restorations with porcelain and porcelain-like cements.

Until recent times the exposure of the dental pulp inevitably led to its death and disintegration, and, by invasion of bacteria via the pulp canal, eventually caused the loss of the entire tooth. A rational system of therapeutics, in conjunction with proper antiseptic measures, has made possible in many cases a conservative treatment of the dental pulp when exposed, and successful treatment of pulp-canals when the pulp has been devitalized either by design or disease. The conservation of the exposed pulp is effected by the operation of capping. In capping a pulp, irritation is allayed by antiseptic and sedative treatment, and a metallic cap, lined with a non-irritant sedative paste, is applied under aseptic conditions immediately over the point of pulp exposure. A filling of cement is superimposed, and this, after it has hardened, is covered with a metallic or other suitable filling. The utility of arsenious acid for devitalizing the dental pulp was discovered by J. R. Spooner of Montreal, and first published in 1836. The painful action of arsenic upon the pulp was avoided by the addition of various sedative drugs — morphia, atropia, iodoform, etc.—and its use soon became universal. Of late years immediate surgical extirpation under novocaine is in use, and by novocaine also the pain incident to excavating and shaping of cavities in tooth structure may be controlled. To fill the pulp-chamber and canals of teeth after loss of the pulp, all organic remains of pulp tissue should be removed, and then, in order to prevent the entrance of bacteria, and consequent infection, the canals should be perfectly filled. Upon the exclusion of infection depends the future integrity and comfort of the tooth. Numerous methods have been invented for the operation. Pulpless teeth are thus preserved through long periods of usefulness, and even those remains of teeth in which the crowns have been lost are rendered comfortable and useful as supports for artificial crowns, and as abutments for assemblages of crowns, known as bridge-work.

Malposed teeth are not only unsightly but prone to disease, and may be the cause of disease in other teeth, or of the associated tissues. By the use of springs, screws, vulcanized caoutchouc bands, elastic ligatures, etc., as the case may require, practically all forms of dental irregularity may be corrected, even such protrusions and retrusions of the front teeth as cause great disfigurement of the facial contour.

The extraction of teeth, an operation which until quite recent times was one of the crudest procedures in minor surgery, has been reduced to exactitude by improved instruments, designed with reference to the anatomical relations of the teeth and their alveoli, and therefore adapted to the several classes of teeth. The operation has been rendered painless by the use of anaesthetics.

Dental Prosthesis. — The fastening of natural teeth or carved substitutes to adjoining sound teeth by means of thread or wire preceded their attachment to base-plates of carved wood, bone or ivory, which latter method was practised until the introduction of swaged metallic plates in the latter part of the 18th century. An impression of the gums was taken in wax, from which a cast was made in plaster of Paris. With this as a model, a metallic die of brass or zinc was prepared, upon which the plate of gold or silver was formed, and then swaged into contact with the die by means of a female die or counter-die of lead. The process is essentially the same to-day, with the addition of numerous improvements in detail, particularly that of using vulcanite in place of metal. The discovery, by Gardette of Philadelphia in 1800, of the utility of atmospheric pressure in keeping artificial dentures in place led to the abandonment of spiral springs. A later device for enhancing the stability is the vacuum chamber, a central depression in the upper surface of the plate, which, when exhausted of air by the wearer, materially increases the adhesion. The base-plate is used also for supporting one or more artificial teeth, being kept in place by metallic clasps fitting to, and partially surrounding, adjacent sound natural teeth, the plate merely covering the edentulous portion of the alveolar ridge. It may also be kept in place by atmospheric adhesion, in which case the palatal vault is included, and the vacuum chamber is utilized in the palatal portion to increase the adhesion.

Metallic bases were used exclusively as supports for artificial dentures until in 1855–56 Charles Goodyear, Jr., patented in England a process for constructing a denture upon vulcanized caoutchouc as a base. Several modifications followed, each the subject of patented improvements. Though the cheapness and simplicity of the vulcanite base has led to its abuse in incompetent hands, it has on the whole been productive of much benefit. It has been used with great success as a means of attaching porcelain teeth to metallic bases of gold, silver and aluminium. It is extensively used also in correcting irregular positions of the teeth, and for making interdental splints in the treatment of fractures of the jaws. For the mechanical correction of palatal defects causing imperfection of deglutition and speech, which comes distinctly within the province of the prosthetic dentist, the vulcanite base produces the best-known apparatus. Two classes of palatal mechanism are recognized — the obturator, a palatal plate, the function of which is to close perforations or clefts in the hard palate, and the artificial velum, a movable attachment to the obturator or palatal plate, which closes the opening in the divided natural velum and, moving with it, enables the wearer to close off the nasopharynx from the oral cavity in the production of the guttural sounds. Vulcanite is also used for extensive restorations of the jaws after surgical operations or loss by disease, and in the majority of instances wholly corrects the deformity.

The progress of dentistry since 1900 has been more rapid and more radical than in any previous period. The cause of this progress was the general advancement in knowledge due to the accumulation of data from scientific investigation and the application of the knowledge thus acquired to the prevention and treatment of disease.

Septic Foci. — In several communications on septic dentistry, notably in an address delivered in 1910 at McGill university, Montreal, Dr. William Hunter, of London, criticized badly conceived and unskilfully executed dental restorative operations, especially in crown and bridge work, and the treatment of pulpless teeth, which was performed without regard to surgical asepsis. He showed that operations so performed leave septic foci that cause septicaemic conditions, as well as infections in remote parts of the body.

Hunter's criticisms immediately bore fruit. Bacteriological and X-ray examination of teeth and jaws, particularly in so-called pyorrhoea alveolaris, quickly became the rule.

Change of Interest and Development. — The total effect of this evidence, both clinical and scientific, upon the development of dentistry has been little short of revolutionary. Hitherto, the major feature of dental interest, upon which the attention of the profession was concentrated, had been the development and perfection of manipulative procedure in restorative operations. The ingenuity expended and the excellence of the results attained became the outstanding characteristics of dental practice; and the restoration by prosthetic or operative means of the masticatory mechanism damaged by partial or total loss of teeth was its dominating ideal. There is now an enforced recognition in the professional, as well as in the lay mind, of the importance of the welfare of the tissues and organs of the mouth. In the dental

profession the consequent changes of technical procedure and objectives have been fundamental. The ideal of mechanical perfection in the methods and appliances by which the dental surgeon restores the patient's power to masticate, is now regarded as a remedial measure subservient to the larger ideal of normal mouth health.

Oral Hygiene in Schools.--One of the principal factors which extended and popularized this knowledge is the oral hygiene movement, an effort to demonstrate practically that school children, relieved of the disabilities arising from infected mouths and diseased teeth which handicap normal development, show improved physical and mental efficiency. The Cambridge experiment, inaugurated in 1907 by the late George Cunningham, of Cambridge, England, was perhaps the earliest practical test. The analogous work of Dr. Ernst Jessen, of Strasbourg, introduced oral hygiene into the public schools of a number of towns in Germany. In the United States the utility of the movement was tested in the Marion school of Cleveland, O., in 1910, and in 1919 there was completed, under conditions yielding accurate figures, a five years' test of applied mouth hygiene in the public schools of Bridgeport, under the direction of Dr. A. C. Fones.

In this test 20,000 children of the first five school grades were under observation and treatment. The average number of carious cavities was found to be over 7% per child; 30% claimed that they brushed their teeth occasionally; 60% stated that they did not use a tooth-brush and 10% had fistulous openings on the gums from abscesses at the roots of decayed teeth. Systematic application of oral hygiene, the intelligent and systematic use of the tooth-brush and the elimination of accretions, dental decay and suppurative conditions were followed by great improvement in general health and mental efficiency. Whatever may be the full explanation it is certain that deaths of Bridgeport children ffom diphtheria, measles and scarlet fever were fewer after oral hygiene had prevailed (1919) than they were before (1914). This is seen from the following table:—

Disease	1919.	1914.
	%	%
Diphtheria	18·7	36.6
Measles	4·1	20·0
Scarlet fever	0·5	14·1

(E. C. K.)

Under the direction of Supt. Willis A. Sutton, a dental clinic was installed in a school of 987 pupils in Atlanta and a hygienist, a dentist, a dietitian and a visiting teacher were selected. The number of days the children had been absent, in the past year, causes of the absences, the number of subject failures and the physical condition of each child as to weight and general appearance were all carefully noted. Each child's mouth was then put in good condition and after three weeks new records were kept. All other factors entering into improvement were as carefully eliminated as possible. Upon comparison of the two records many significant deductions were made. First, the 987 children had 3,364 less absences than the preceding year. Second, whereas the preceding year practically 20% had failed in one or more subjects, the year following the experiment less than 6% had failed. Third, every child in the entire group had gained in weight, ranging from 6 lbs. for the 9 months' period to 22 lbs., with an average of 11·2 pounds. Normally an average gain of about 8 lb. would have been expected. Fourth, the general appearance of the children had improved remarkably, and they were far more spontaneous and happy than before. The dental clinics were then installed in other schools, with the result that of the 60,000 children enrolled, 6,000 more per day attended school than formerly. The percentages of failures were reduced in the elementary schools by 8% and in the junior and senior high schools by 6%. The direct saving in money was $150,000–$200,000 per year in a budget of $3,000,000.

(W. A. S.)

Dental Disease and Mental Efficiency.—An improvement in mental efficiency is deduced from the reduction in the percentage of retarded children, *i.e.*, children who are not less than two years older than the normal age for the school grade to which they should belong. The percentage of retarded children before and after the introduction of mouth hygiene in the Bridgeport schools is shown in the following table:—

Grade.	Sept. 1912.	Nov. 1918.	Drop in retardation.
	%	%	%
I	16·5	8·1	51·0
II	37·0	15·3	58·0
III	53·0	24·7	53·0
IV	59'5	31·7	47·0
V	61·0	33·1	45·0
VI	54·0	30·4	44·0
VII	39·0	19·3	50·0
VIII	27·0	12·5	54·0
Average	43·3	21·1	50·2

Retardation represents inability of the child to advance with his class, necessitates repetition of his grade work, and becomes an economic question of serious importance to the ratepayer. The cost of re-education in Bridgeport in 1912 was 42% of the entire budget, and for 1918 only 17%. Among the 20,900 children under observation in the schools of Bridgeport, 98% had various forms and degrees of malocclusion of the dentures, a condition now generally recognized as associated with asymmetrical development of the bones of the face and the brain case. Many children with malocclusion owing to the arrested development of the facial and cranial bones suffer from impeded nasal respiration, and develop adenoids and tonsilar hypertrophy, leading to infection with its systemic sequelae and the interferences with bodily nutrition incident to insufficient oxidation of the blood. Orthodontic treatment for the correction of malocclusion in children is a therapeutic and prophylactic measure having an important health relation rather than a procedure for the relief of deformity.

During the World War bad teeth were so serious a bar to recruiting that the matter called for attention in all armies. Everywhere the dental service was increased. In 1921 Great Britain created a definite Army Dental Corps, but in the United States such a corps had been formed some years earlier.

National Dental Service.—Undoubtedly the most notable example of comprehensive planning for the national extension of dentistry and oral hygiene as a factor of the public health service is that proposed in the interim report on the Future Provision of Medical and Allied Services, made to the British Ministry of Health by the Consultative Council on Medical and Allied Services, May 1920. This report recognizes oral hygiene and dental service as factors of public health and as proper subjects for control and development by the State.

Personal Hygiene.—To establish the habit of personal care of the mouth in school children is a field of activity that has developed the specially trained dental nurse or hygienist as an adjuvant to dental service, whose calling is now legalized in the principal States of the United States. The work of the dental nurse is limited to the treatment of the exposed surfaces of the teeth, in the removal of deposits and accretions thereon, the training of school children in the systematic use of the tooth-brush and their education in the importance of mouth cleanliness.

War Surgery.—The many head, face and jaw wounds during the World War created a new field for oral surgery and surgical prosthesis. Surgical measures alone were insufficient for successful treatment, as the loss of tissue from gunshot wounds of the head and face, and scars resulting from extensive lesions left the patient in many instances with repulsive deformities. The resources of surgery and dentistry were called into co-operation and the aid of dental prosthetic technique was often necessary.

Oral Prophylaxis.—Oral prophylaxis, in so far as it has been instrumental in securing cleanliness of the mouth and teeth, has undoubtedly prevented dental disease to a considerable degree, but has not been wholly effective. As research has thrown light upon dental disease, attention has been increasingly focused upon means for its prevention. The factors of susceptibility and immunity are undergoing active investigation, with strong indica-

tions that nutritional errors and faulty metabolism play a role of primary importance in the causation of dental disease. Correction of faulty food habits and a rational hygiene should contribute materially toward the prevention of caries and periodontal necrosis, the most common and widely distributed of human disorders. Because of the recognition of the vital relations of the teeth, the dental educational system, through a rapid reorganization, is proceeding toward a more efficient adaptation of the knowledge of health relations of the teeth to the ends of dental practice.

A systematic survey of the whole field of dental education has been made by the Carnegie Foundation for the Advancement of Teaching, with a view to recommending such adjustments as will bring systematic dental education fully up to the standard of present requirements from a public health standpoint.

General Developments.— While the most conspicuous progress in dentistry since 1910 has been in the direction of its vital and hygienic relations, its technical and engineering features have shown a similar development. Until this period the construction of artificial dentures for the prosthetic restoration of lost teeth was almost wholly an empirical procedure depending on the judgment, manual skill and good taste of the operator. Scientific studies of the engineering principles underlying the mechanism of the human masticatory function, initiated about 1866 by F. H. Balkwill, have since then been prosecuted by numerous followers, who have brought the knowledge of masticatory movements and of the relations of the teeth and their morsal surfaces thereto to a state of completeness that enables the prosthetist, by the aid of mechanical articulating devices, to reproduce in the artificial denture a mechanism with possibilities approximating, both functionally and artistically, those of natural dentures.

The entire development of modern dentistry dates from the 19th century, and mainly from its latter half. Beginning with a few practitioners and no organized professional basis, educational system or literature, many thousands of its practitioners are, at the present time, to be found in all civilized communities. Its educational institutions are numerous and well equipped. It possesses a large periodical and standard literature in all languages. Its practice is regulated by legislative enactment in all countries in the same way as medical practice. The business of manufacturing and selling dentists' supplies represents an enormous industry, in which millions of capital are invested.

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DENTON, urban district, Mossley parliamentary division, Lancashire, England, 4½ mi. N.E. from Stockport, on the L.M.S. railway. Pop. (1938), 21,700. In the township are reservoirs for Manchester's water supply. The leading industry is the manufacture of felt hats. Coal occurs in the district.

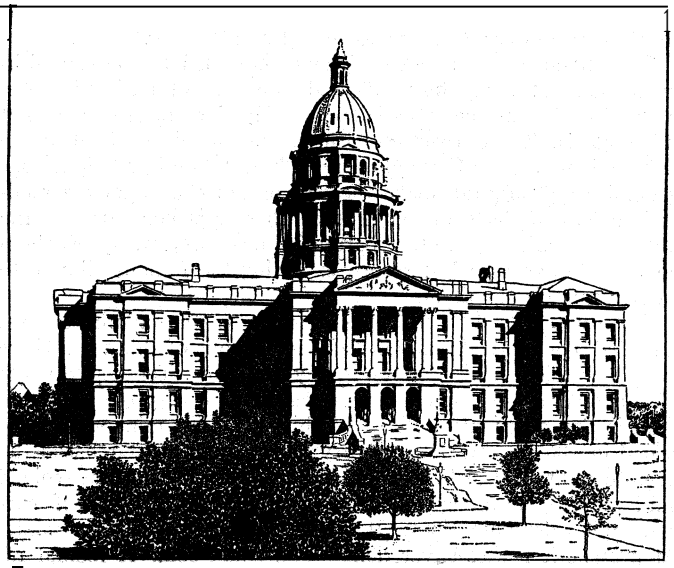
DENTON, a city of Texas, U.S.A., 35 mi. N.W. of Dallas and N.E. of Fort Worth; the county seat of Denton county. It is on federal highways 77 and 377, and is served by the Missouri-Kansas-Texas and the Texas and Pacific railways. Pop. (1940) 11,192. Wheat, oats, corn, cotton, peanuts, grain sorghums, fruit, truck are raised in this region. It is a livestock, dairy and poultry centre. Industries include flour mills, a brick plant, a food products plant, a cheese plant, a garment factory, bottling plants and a pottery plant. It is the seat of the North Texas State Teachers college and the Texas State college for women. Denton was settled in 1857 and incorporated in 1866.

D'ENTRECASTEAUX ISLANDS, a group of islands in the Pacific ocean about 2 mi. S.W. of New Guinea. They comprise three large islands, Ferguson, Goodenough and Formanby and a number of islets separated by narrow channels with a total area of 12,000 sq.mi. There are traces of extinct volcanoes, and gold has been discovered in certain parts. They were discovered by Bruni D'Entrecasteaux in 1792 and are now part of the dependency of New Guinea (*q.v.*).

DENVER, capital of Colorado, U.S.A., on the South Platte river, in the centre of "the west." Population in 1920 was 256,491 (84% native white); 287,861 in 1930; 322,412 in 1940 by the federal census.

It is on federal highways 40 and 85; is served by the Burlington, the Rock Island, the Santa Fe, the Union Pacific, the Denver and Rio Grande Western, the Colorado and Southern and the Denver and Salt Lake railways; and has airmail and commercial air service. There are five aviation fields. The Moffat tunnel of the Denver and Salt Lake railway through James peak in the continental divide, built by the city of Denver in co-operation with parts of several counties in northwestern Colorado (opened 1928), has eliminated 27 mi. of 4% grade and made possible shortening the distance to Salt Lake City and other points west by 173 miles.

The altitude of Denver, at the state capitol, is exactly one mile above the sea. Its area, coextensive with that of the county of Denver, is 58.75 square miles. It lies at the edge of the great plains, in the river valley running north and south, 12 mi. E. of the main range of the Rocky mountains, which stretches in a snow-capped background visible for 1jo mi. from Pikes peak on the south to Longs peak on the north. The climate, with a low degree of humidity throughout the year and a high percentage of sunshine, is favourable alike to health, industry and recreation. The city is well planned, with broad streets and a system of boulevards and parkways. Because of severe restrictions against wooden structures adopted in the early days, most of the residences, as well as the business and public buildings, are of brick, stone, tile or cement. All trains except those of the Denver and Salt Lake railway enter the Union station, a fine and commodious structure built in 1914 at a cost of over $3,000,000. There are 35 parks and 17 supervised playgrounds within the city limits,



THE COLORADO STATE CAPITOL, BUILT 1887–95, IN THE CENTRE OF DENVER. SHOWING THE DOME WHICH IS OVERLAID WITH NATIVE GOLD

comprising 1,563 ac.; and the city owns a chain of 30 mountain parks (in one of which is the grave of "Buffalo Bill"), aggregating 25,000 ac. in area, and connected with one another and with the city by 100 mi. of boulevard.

In the centre of the city is a stretch of half a mile (40 ac.) devoted to public buildings set in landscaped grounds. The massive state capitol of native granite (built in 1887–95, at a cost of $3,000,000), topped by a dome overlaid with gold from Colorado mines, stands on a terraced hill, flanked by the state office building, state capitol annex and the state historical museum, which

contains exhibits of prehistoric and Indian life and of pioneer days. Immediately west of the capitol grounds is the beautiful civic centre (due to the initiative of the late Robert W. Speer, who was mayor 1904–12 and 1916–18) including the public library, a Greek theatre and the new $5,000,000 city and county building; and beyond this group is the U.S. mint. In City park, a tract of 408 ac. set aside at an early date, is the Colorado museum of natural history. There is a municipal auditorium, seating 12,000, where the Democratic national convention which nominated William J. Bryan met in 1908. The water supply, taken from the river at a point 23 mi. above (*i.e.*, southwest of) the city, is supplemented by a system of reservoirs in the mountains and in, or adjacent to, the city, which have a capacity of 74,000,000,000 gal., enough to supply the city for three years without replenishing. The 8 ft. pioneer bore of the Moffat tunnel, paralleling the main bore, brings water from the western slope of the continental divide, supplementing the South Platte watershed supply. The assessed valuation of property for 1940 was $364,942,960.

Education. — The public-school system includes 66 elementary, g junior high, 5 senior high and several special schools, including one for deaf children, one for crippled children and the Emily Griffith Opportunity school. Illiteracy and child labour are low. Among the institutions for higher education are the University of Denver (Methodist), chartered in 1864 as Colorado seminary, Colorado Woman's college (1889), Regis college (1886), the Iliff School of Theology (Methodist Episcopal), the medical school of the University of Colorado, Loretto Heights college and the Westminster law school.

Tourist Amenities and Climate. — As a recreation centre Denver has so many attractions that providing for tourists is one of the leading industries. Motorbuses for sightseeing run in every direction. The tourist bureau lists 60 excursions to points of beauty and interest which can be made in a day or less each. Sports include glacier climbing, skiing, bathing in pools of hot mineral water, trout fishing and yachting on Grand lake (8,389 ft. above sea level), where an annual regatta is held in August. A mountain highway to the top of Mt. Evans, 14,260 ft., is the highest automobile road in the world. It is estimated that tourists spend over $15,000,000 annually in the city.

The climatic advantages of Denver have led to the establishment there of many hospitals and sanatoria of national scope, philanthropic and commercial, especially for the treatment of tuberculosis. These, together with the new medical school of the state university, the Colorado general hospital and the Fitzsimons general army hospital, make the city one of the important medical centres of the country. The death rate is kept high by the influx of invalids from other parts of the country, many of whom go to Colorado as a last resort, expecting the famous climate to work a miracle for them.

Commerce and Industry. — Denver is the administrative, financial, commercial and industrial metropolis of the west. There is no large city within 500 mi. in any direction. Ten departments of the federal government are represented by 145 offices — more than in any other city outside Washington. The mint was established in 1862, when the secretary of the treasury purchased the private mint of Clark, Gruber and company, which had coined gold pieces containing 1% more gold than U.S. coins of corresponding denominations. It is one of the three coinage mints. At present it makes silver dollars and small coin. A federal reserve branch bank is located in Denver. Bank clearings in 1940 amounted to $1,627,431,420, and deposits on Dec. 31 totalled $223,665,900.

Denver's trade territory embraces parts of 14 states, besides Colorado, and has a population of about 6,000,000. There are some 993 wholesalers in the city, who have agents and distributing warehouses at many points. Administrative headquarters of the beet sugar, metal-mining and coal industries of the state are located in Denver. It is the distributing centre of the automobile industry in the Rocky mountain region, and ranks fourth among the cities of the country as an administrative centre for the insurance business. The Denver stockyards is the largest cattle market in the west and it is the largest sheep market in the world. At the National Western stock show (held annually in January since 1907) pedigree breeding cattle are bought and sold in carload lots, feeder stock by the trainload. The annual value of wholesale transactions in 1939 was $340,989,000; of the city's retail trade, $177,963,000.

Distance from the manufacturing centres of the east forced Denver in its early days to develop industries to supply the needs of the mining and frontier population for wagons and harness, mining machinery, meat, flour and other necessities. On this foundation, utilizing the raw materials — mineral, animal and vegetable — at its doors, developing its specialties, but also diversifying its products, and gradually extending its markets, the manufactures of the city have grown until in 1939 there were 781 establishments within the city limits, employing a daily average of 16,239 wage earners, paying $20,910,625 in wages, and producing goods valued at $144,613,574. An estimate for 1937, including some plants in the suburbs, indicated an output valued at $115,847,646. A favourable factor is the abundant supply of coal and fuel oil from mines and refineries within a very short haul. In 1928 natural gas was piped in from the Amarillo district of Texas.

The leading industry, in point of value of product, is slaughtering and meat packing. Receipts at the stockyards in 1940 included 583,031 cattle, 568,231 hogs and 2,662.582 sheep. The average receipts for the five years 1936–40 were nearly $2\frac{1}{4}$ times as many cattle, $3\frac{1}{2}$ times as many hogs and $9\frac{1}{2}$ times as many sheep, as in 1900. Other manufactures of importance are mining machinery, which is marketed all over the world; sugar mill equipment, which goes as far as Hawaii and the Philippines; and luggage that is sold in every state of the union. A rubber manufacturer sells some 2,000 products in the domestic market as well as in all foreign countries. The manufacture of candy is favoured by the dry atmosphere. Because of its distance from the ports, Denver had no great volume of World War (1914–18) business, and consequently suffered less than most cities from the postwar deflation. Export business was (in 1940) estimated at $15,000,000 yearly.

History. — John Simpson Smith, trapper and trader, with his Sioux wife Wapoola, settled on the site of Denver in the autumn of 1857. The following summer, after traces of gold were found in the sands of Cherry creek by W. Green Russell of Georgia, rival settlements grew up on opposite sides of the creek, near its confluence with the South Platte river (at Fourteenth street in the present city plan): Auraria on the west bank, and on the east bank St. Charles, which was almost immediately renamed Denver, after the territorial governor, Gen. James W. Denver. The two settlements, with a population of about 1,000, were consolidated in 1860, and in 1861 received a charter from the first territorial legislature of Colorado. In 1868 Denver was made the capital of the territory, and in 1881, five years after Colorado became a state, the choice was confirmed by popular vote.

On Oct. 29, 1858, in a blinding snowstorm, two men drove in with a wagon train and opened the first "store." A second was opened on Christmas day, and a jewellery store a few days later. At the opening of 1859 lumber sold for $100 per 1,000 ft.; flour for $20 to $40 per 100 lb.; and sugar, coffee and tobacco, for almost their weight in gold dust, the currency of the region for some years. The first hotel ("The Eldorado") was opened in a large log house on Feb. 1, 1859. On April 23 the first number of the *Rocky Mountain* News was issued. On May 9, arrived the first coach of the Leavenworth and Pike's Peak Express company, which carried letters at 25 cents an ounce. News of Lincoln's election was brought from St. Joseph, Mo., nearly 700 mi. by the Pony express in 69 hours. Letter postage by Pony express was $5 per letter. Telegraph connection with the east ($9 for 10 words) was established in 1863. A private mint and a bank were opened in 1860. In 1863 there was a severe fire, and in 1864 a terrible flood came down Cherry creek and washed away many buildings. The first school teacher, dressed in a black broadcloth frock coat and a silk hat, drove into town late in the summer of 1859, behind a team of oxen which he apostrophized with Greek and Latin oaths that won him infinite respect from the local masters of profanity. In October he opened a school in a log cabin, after $250 had been

subscribed for its "endowment." In 1864 Colorado seminary was established, largely through the efforts of Gov. John Evans, who had been one of the founders of Northwestern university at Evanston, Illinois. When the Union Pacific passed through 106m. to the north of Denver, a local company was organized to connect the city with it by a line to Cheyenne, and on June 23, 1870, the first passenger train arrived. On Aug. 15, the Kansas Pacific was completed to Denver, and other transportation facilities soon followed.

By 1870 there were 1,500 buildings in the city, and the population was 4,759. In the next 20 years it grew to 106,713. All the facilities of a modern city were introduced in the '70s, and the '80s were a period of great activity in real estate. Since 1890 growth has been steady, though less spectacular. In the early days Denver had its problems with "squatters" and "land jumpers." There were the social conditions usually found in new mining communities, including crimes of violence and some exercise of extra-legal methods of administering justice. At the Palace gambling hall and variety theatre, celebrated the world over, fortunes were won and lost in a night. A flood in 1878 and the famous strike in Denver and Leadville in 1879–80 were temporary checks to prosperity. In 1880 there was a memorable election riot, under the guise of an anti-Chinese demonstration. A serious street-car strike in 1920 involved the loss of seven lives, the importation of armed strike-breakers, the intervention of Federal troops, and military rule for a month. Denver was the first city to undertake to finance its charitable agencies by a joint "community chest." Its juvenile court, under Judge Ben B. Lindsey (1869–1943), who served from 1901 to 1927, was a pioneer in its field. In 1902 a city-and-county of Denver was created, with power to frame its own charter, and the charter was adopted in 1904, but dual sets of officers served until 1912. A commission form of government was in force for four years from 1912, but in 1916 the mayor-and-council form was resumed.

DENVER AND RIO GRANDE WESTERN RAILROAD, incorporated in 1870, was conceived as a narrow gauge (3′0″) trunk line from Denver, Colo., to Mexico City, Mex., The route was projected along the Rio Grande del Norte; hence the first name, Denver and Rio Grande railway. Course of the railroad was turned westward through the Royal Gorge to tap the Leadville mining district; by 1883 the narrow gauge line was completed between Denver and Ogden, Utah, with branches reaching into the mountains wherever mining development demanded transportation. The Royal Gorge route, a through standard gauge (4′8½″) line, Denver to Ogden, via Tennessee Pass (10,240ft.), 782mi., supplanted the narrow gauge line in 1890, as the Rio Grande became an integral part of several transcontinental systems. Remaining narrow gauge are 686mi. of track, all in southwest Colorado; longest in the U.S., these lines are the model for all similar operations in the world. The Moffat Tunnel route, shortening Rio Grande's Denver-Salt Lake City distance to 57omi., in 1934 strengthened the road's position as a transcontinental route by utilizing the 6·2mi. bore through the Continental Divide 5omi. from Denver. The Rio Grande operates 2,566mi. in Colorado, Utah and New Mexico.

DEODAND, in English law, any personal chattel which. having moved ad *mortem* or been the immediate cause of the death of any reasonable creature, was forfeited to the king for pious uses. It was originally designed as an expiation for the souls of those suddenly snatched away by violent death, and was abolished by 9/10 Vict. C. 62. This imputation of homicidal guilt to inanimate objects or the lower animals is of great antiquity and led in the middle ages to the judicial trial of animals or things for manslaughter. In England, subsequent to the Reformation, deodands were distributed as alms by the king's high almoner, though more recently they were regarded as mere forfeitures.

If a horse or other animal in motion killed a person, whether infant or adult, or if a cart ran over him or a tree fell upon him, it was forfeited as a deodand and its value was appraised by the jury. It was at one time held that if death were caused by falling from a cart or a horse at rest, the law made the chattel a deodand only if the person killed were an adult, not if he were below years of discretion; but in later times this distinction was abolished. Blackstone says "where a thing not in motion is the occasion of a man's death, that part only which is the immediate cause is forfeited; as if a man be climbing up the wheel of a cart, and is killed by falling from it, the wheel alone is deodand." Whereas, if the cart were in motion, not only the wheel but all that moves along with it (as the cart and loading) are forfeited. On the other hand, if a man riding on the shafts of a wagon fall to the ground and break his neck, the horses and wagon only are forfeited, and not the loading, because it in no way contributed to his death. Where a man is killed by a vessel at rest, in fresh water, the cargo is not deodand; where the vessel is under sail, hull and cargo are both deodand. But accidents on the high seas, or on an arm of the sea, did not cause forfeiture "because mariners are continually exposed to so many perils that the law imputes misfortunes happening there rather to them than to the ship." The finding of a jury was necessary to constitute a deodand, and the death must take place within a year and a day of the accident. The investigation of the value of the instrument by which death was caused at one time occupied an important place among the provisions of English criminal law. More recently these forfeitures became extremely unpopular; and jurors, with the connivance of judges, found deodands of trifling value, so as to defeat what was regarded as an inequitable claim.

DEODAR. The deodar or "god tree" (Cedrus Deodara) is a species of coniferous evergreen tree closely allied to the cedar, the timber obtained therefrom being of considerable value. It forms extensive forests in the Himalayas at elevations of from 7,000 ft. and is also found in Afghanistan and north Baluchistan. The wood is durable and light-red in colour and is used particularly for cabinetwork as it can be highly polished. *See* also CEDAR.

DEODORIZER, a disinfectant which acts by oxidizing or otherwise changing the chemical constitution of volatile substances disseminated in the air. It also prevents noxious exhalations from organic substances, and in virtue of its properties is an effective disinfectant in certain diseases. See also DISINFECTANTS.

DEOGHAR (known in Bengal as Baidyanath, also called Baidyanath-Deoghar), a town in the Santal Parganas district of Behar and Orissa, India. Pop. (1921) 12,355. It has a famous temple dedicated to Baidyanath or Siva, the resort of numerous pilgrims. It also enjoys a reputation as a health resort among Bengalis, many of whom have country houses here.

DÉOLS, a suburb of the French town of Chbteauroux, in the department of Indre. Pop. (1936), 3,057. Déols lies to the north of Châteauroux, from which it is separated by the Indre. It preserves a fine Romanesque tower and other remains of the church of a famous Benedictine abbey, the most important in Berry, founded in 917 by Ebbes the Noble, lord of Déols. A gateway flanked by towers survives from the old ramparts of the town. The parish church of St. Stephen (15th and 16th centuries) has a Romanesque façade and a crypt containing the ancient Christian tomb of St. Ludre and his father St. Leocade, who according to tradition were lords of the town in the 4th century. The pilgrimage to the tomb of St. Ludre gave importance to Déols, which under the name of Vicus *Dolensis* was in existence in the Roman period. In 468 the Visigoths defeated the Gauls there, the victory carrying with it the supremacy over the district of Berry. In the middle ages the head of the family of Déols enjoyed the title of prince and held sway over nearly all Lower Berry, of which the town itself was the capital. In the 10th century Raoul of Déols gave his castle to the monks of the abbey and transferred his residence to Châteauroux. The abbey church was burnt by the Protestants during the religious wars and in 1622 the abbey was suppressed by the agency of Henry II., prince of Condé and of Déols.

DEONTOLOGY is the title of a book by Jeremy Bentham (*q.v.*), who introduced the term to denote a utilitarian system of ethics. The name has since then come to be applied to a system of ethics in which prominence is given to ideas of *duty* rather than to those of right or goodness.

DEPARTMENT, a division or part of a system; one of the branches of the Administration in a State or municipality. In Great Britain it is commonly applied to the subordinate divisions of the chief executive offices of State, such as the savings bank or other department of the Post Office, the mines department of the Board of Trade, etc.; in the United States these subordinate divisions are known as "bureaux," while "department" is used of the chief branches of the executive.

In France the word is also used for a territorial division corresponding loosely to an English county. Previous to the French Revolution the local unit in France was the military *gouvernement,* roughly corresponding to the old provinces, such as Franche Comté, Provence, Bourgogne, Bretagne, etc., but this division being too closely bound up with the administrative mismanagement of the old régime, at the suggestion of Mirabeau, the "provinces" were divided into departments, as nearly as possible equal to a certain average of size and population, and deriving their names principally from rivers, mountains or other prominent geographical features. In 1860 three new departments were created out of the newly annexed territory of Savoy and Nice. The three departments of Bas-Rhin, Haut-Rhin and Moselle, which were lost after the Franco-German war in 1871, were restored in 1919. Each department is presided over by an officer called a prefect (*q.v.*) and is subdivided into *arrondissements* each in charge of a sub-prefect. Arrondissements are again subdivided into *cantons* and these into *communes,* somewhat equivalent to the English parish. *(See* FRANCE: *Government and Administration.)*

DEPARTMENT STORE, the name given in the United States to a retail establishment which sells goods of all kinds and in which the merchandise is divided into classes, each one of which is handled as a department, distinct as to management and location within the store, and is carried in the accounts as a separate entity. The purpose of department store organization is to apply the principles of large-scale production to the problems of retail selling and to consolidate the ownership and management of many lines of merchandise under one roof. The original idea of this method was that the combining of overhead and service facilities would offer increased sales attraction and that such an enterprise could be carried on with many economies and efficiencies.

Of the total volume of sales by retail stores, which approximated in 1938 $35,719,000,000, department store sales represented 16%, or $5,715,040,000. The largest per cent of the total retail sales is done by small, independent specialty and neighbourhood stores, and next to the department store in percentage is the volume done in retail sales by chain and variety stores.

As compared with the unit or individual store, the most direct competitor, the department store offers important conveniences to its customers. It is pre-eminently the shopping store. It has secured so much of the shopping trade which involves the careful comparison of style, quality and price that the smaller unit dry goods stores have almost abandoned that trade and have confined themselves to a large extent to selling convenience goods. The department store is generally located in a central retail-shopping district with every provision for convenience and comfort. Within the store itself, two types of service are usually available: (1) services which assist the customer such as credits, deliveries, store directories, personal shopping services, etc.; and (2) services which attract trade to the store, such as restaurants, rest rooms, musical programs, classes in embroidery, etc.

The most serious problems with which the department store has to contend are the high operating expense as a retail outlet and susceptibility to losses through poor salesmanship. This difficulty is greater with the department store than with the chain store, which caters more largely to convenience goods, or the mail-order house, in which the personality of the employees is not in evidence. Although the total department store sales still show a trend to increase, the rate of increase is declining, since the department stores are losing ground to newer and different competitors such as the non-service chain stares and the numerous neighbourhood stores that have been developed in recent years in suburban communities.

The cost of operation of department stores in 1938 approached 36% of their sales. This is much higher than the cost of operating chain stores and neighbourhood stores. The primary causes for the increase in the operating expenses of department stores have been (1) a marked increase in wage rates, due in some localities to the unionization of stores, (2) a substantial increase in taxes, including Social Security and unemployment contributions, (3) the reduction in store hours, and (4) the drop in demand for merchandise in the higher brackets, due to a reduction in the consumers' buying power, which has tended to increase the cost of handling each transaction. Yet department store costs are divided over very large volumes of trade which tend to lessen the unit charge. Furthermore, even large unit costs are not a positive disadvantage if they are offset by, or are the means of securing, a rapid rate of turnover. (P. J. R.)

DE PERE, a city of Brown county, Wisconsin, 109m. N. of Milwaukee, on the Fox river, 6m. from its mouth. It is served by the Chicago and North Western and the Chicago, Milwaukee, St. Paul and Pacific railways and by lake and river steamers. The population was 5,521 in 1930; in 1940 it was 6,373.

De Pere is a shipping and transfer point; has grain elevators, foundries and machine shops; manufactures boats, flour, paper, boilers and farm implements; and is the seat of St. Norbert college (Roman Catholic), established in 1902. The state reformatory is just north of the city. In 1634–5 Jean Nicolet found here, at the first rapids of the Fox river, a polyglot village of several thousand Indians, and here in 1670 Father Allouez established the mission of St. Francis Xavier, the second in the territory that is now Wisconsin. The French called the place *Rapides des Pères.* Nicolas Perrot, the first French commandant in the north-west, made it his headquarters, and here Father Marquette wrote the account of his journey to the Mississippi. A few miles south of the city lived for many years Eleazer Williams (*c.* 1787–1857), who claimed to be the "lost dauphin," Louis XVII. of France, and was an authority on Indians, especially the Iroquois. De Pere was incorporated as a village in 1857 and as a city in 1883.

DEPEW, CHAUNCEY MITCHELL (1834–1928), American lawyer and politician, was born in Peekskill, N.Y., on April 23, 1834, of a Huguenot family (originally Du Puis or De Puy). He graduated at Yale in 1856, entered politics as a Republican—his father had been a Democrat—was admitted to the bar in 1858, was a member of the New York Assembly (1861–62) and was secretary of State of New York (1864–65). Through his friendship with Cornelius and William H. Vanderbilt he became in 1866 attorney for the New York and Harlem railway, in 1869 was appointed attorney of the newly consolidated New York Central and Hudson River railway, of which he soon became a director, and in 1875 was made general counsel for the entire Vanderbilt system of railways. He became second vice president of the New York Central and Hudson River railway in 1869; president (1885–98), and chairman, in 1898, of the board of directors of the Vanderbilt system. In 1872 he joined the Liberal Republican movement and was nominated and defeated for the office of lieutenant governor of New York. In 1899 he was elected U.S. senator from New York State, and in 1904 was re-elected for the term ending in 1911. His orations and speeches have been compiled in 12 volumes; in 1922 he published *My Memories of Eighty Years.* He died on April 5, 1928.

See C. M. Depew, One *Hundred Years of American Progress;* "Leaves from my Autobiography," in *Scribner's Magazine,* lxx. (Nov.–Dec. 1921), 515–530, 664–676; *My Memories of Eighty Years* (1922).

DEPEW, a manufacturing village of Erie county, New York, U.S.A., 9 mi. E. of Buffalo on federal highway 20; served by the Erie, the Lackawanna, the Lehigh Valley and the New York Central railways. Pop. (1940) 6,084. Incorporated in 1894.

DEPHLOGISTICATED AIR, the name formerly given to air from which the oxygen has been extracted; this consists chiefly of nitrogen (*q.v.; see* also ARGON and CHEMISTRY, *History of).*

DEPLOY, a military term signifying to extend a force or unit of troops into a more open formation, *e.g.,* from column, the marching and approach (*q.v.*) formation, into line, whereby the

greatest number of its weapons can be brought to bear.

DEPORTATION or **TRANSPORTATION,** a system of punishment for crime, of which the essential factor is the removal of the criminal to a penal settlement outside his own country. It is to be distinguished from mere expulsion (*q.v.*) from a country, though the term "deportation" is now used in that sense in English law under the Aliens Act 1905 (see ALIEN). Strictly, the deportation or transportation system has ceased to exist in England, though the removal or exclusion of undesirable persons from British territory, under various Orders in Council, is possible in places subject to the Foreign Jurisdiction Acts, and in the case of criminals under the Extradition Acts.

English Practice.—At a time when the British statute-book bristled with capital felonies, when the pickpocket or sheep-stealer was hanged out of hand, when Sir Samuel Romilly, to whose strenuous exertions the amelioration of the penal code is in a great measure due, declared that the laws of England were written in blood, another and less sanguinary penalty came into great favour. The deportation of criminals beyond the seas grew naturally out of the laws which prescribed banishment for certain offences. The Vagrancy Act, 39 Eliz., c. 4, contained in it the germ of transportation, by empowering justices in quarter sessions to banish offenders and order them to be conveyed into such parts beyond the seas as should be assigned by the privy council. Full effect was given to this statute in the next reign, as is proved by a letter of James I., dated 1619, in which the king directs "a hundred dissolute persons" to be sent to Virginia. The statute, 18 Car. II., c. 3, gave power to transport to America notorious thieves in Cumberland and Northumberland. Transportation to the American colonies ceased with the achievement of their independence in 1776.

The British legislature, however, discovered that transportation to the colonies was bound to be attended by various inconveniences, particularly by depriving the kingdom of many subjects whose labour might be useful to the community; and an Act was accordingly passed which provides that convicts sentenced to transportation might be employed at hard labour at home. At the same time the consideration of some scheme for their disposal was entrusted to three eminent public men—Sir William Blackstone, Mr. Eden (afterwards Lord Auckland) and John Howard. The result of their labours was an act for the establishment of penitentiary houses, dated 1778. This act is of peculiar importance. It contains the first public enunciation of a general principle of prison treatment, and shows that even at that early date the system since nearly universally adopted was fully understood. The object in view was thus stated. It was hoped "by sobriety, cleanliness and medical assistance, by a regular series of labour, by solitary confinement during the intervals of work and by due religious instruction to preserve and amend the health of the unhappy offenders, to inure them to habits of industry, to guard them from pernicious company, to accustom them to serious reflection and to teach them both the principles and practice of every Christian and moral duty." However, the new and vast territories of Australasia promised an unlimited field for convict colonization, and for the moment the scheme for penitentiary houses fell to the ground. "There was general confidence," says Merivale in his work on colonization, "in the favourite theory that the best mode of punishing offenders was that which removed them from the scene of offence and temptation, cut them off by a great gulf of space from all their former connections, and gave them the opportunity of redeeming past crimes by becoming useful members of society." These views so far prevailed that an expedition consisting of nine transports and two men-of-war, the "first fleet" of Australian annals, sailed in March 1787 for New South Wales. A few free families also were encouraged to emigrate, but they were lost in the mass they were intended to leaven, swamped and outnumbered by the convicts, shiploads of whom continued to pour in year after year. When the influx increased, difficulties as to their employment arose. Free settlers were too few to give work to more than a small proportion. Moreover, a new policy was in the ascendant, initiated by Governor Macquarie, who considered the convicts and their rehabilitation his chief care, and steadily discouraged the immigration of any but those who "came out for their country's good." The great bulk of the convict labour thus remained in government hands.

Some change in system was inevitable, and the plan of "assignment" was introduced; in other words, that of freely lending the convicts to any who would relieve the authorities of the burdensome charge; but this system in its turn developed its own abuses. The story of effort and failure and scandal is too long to be told here. Sufficient to say that, chiefly owing to Australian protests, the system was abandoned in 1840 and finally abolished by the Penal Servitude Acts, 1855 and 1857. The measures taken to substitute other methods of secondary punishment are set forth in the article PRISON (*q.v.*).

French Practice.—France adopted deportation for criminals during the course of the eighteenth century. In 1797, during the French Revolution a small group of political prisoners, most of them priests, were deported from France to French Guiana by the revolutionary government. In the following year some 500 prisoners were likewise deported to French Guiana. In 1823 the philanthropist, Baron Milius, formed an expedition consisting of a company of military workers, some 50 orphan apprentices, and others, making a total of 164 people, who settled on the banks of the Mana. Disorders followed, necessitating the presence of a detachment of gendarmes. The principle of deportation was formally condemned by publicists and government until suddenly in 1854 it was reintroduced into the French penal code with many high-sounding phrases, but in practice the system again failed with deplorable results. Deportation to Guiana was not abandoned, but instead of native-born French exiles, convicts of subject races, Arabs, Annamites and Asiatic blacks, were sent exclusively, with no better success as regards colonization.

In 1864, however, it was possible to divert the stream elsewhere. New Caledonia in the Australian Pacific was annexed to France in 1853. Ten years later it became a new settlement for convict emigrants. A first shipload was disembarked in 1864 at Noumea, and the foundations of the city laid. Prison buildings were the first erected and were planted upon the island of Nou, a small breakwater to the Bay of Noumea. Outwardly all went well under the fostering care of the authorities. The population steadily increased; an average total of 600 in 1867 rose in the following year to 1,554. In 1874 the convict population exceeded 5,000; in 1880 it had risen to 8,000; the total reached 9,608 at the end of Dec. 1883. But from that time forward the numbers transported annually fell, for it was found that this South Pacific island, with its fertile soil and fairly temperate climate, by no means intimidated the dangerous classes; and the French administration therefore resumed deportation of French-born whites to Guiana, which was known as notoriously unhealthy and was likely to act as a more positive deterrent. The authorities divided their exiles between the two outlets, choosing New Caledonia for the convicts who gave some promise of regeneration, and sending criminals with the worst antecedents and presumably incorrigible to the settlements on the equator. This was in effect to hand over a fertile colony entirely to criminals. Free immigration to New Caledonia was checked, and the colony became almost exclusively penal. The natural growth of a prosperous colonial community made no advance, and convict labour did little to stimulate it, the public works, essential for development, and construction of roads were neglected; there was no extensive clearance of lands, no steady development of agriculture. From 1898 simple deportation practically ceased, but the islands were full of convicts already sent, and they still received the product of the latest invention in the criminal code known as "relegation," a punishment directed against the recidivist or incorrigible criminal whom no penal retribution had hitherto touched and whom the French law felt justified in banishing for ever to the "back of beyond." A certain period of time spent in a hard labour prison preceded relegation, but the convicts on arrival were generally unfitted to assist in colonization. They were for the most part decadent, morally and physically; their labour was of no substantial value to colonists or themselves, and there was small

hope of profitable result when they gained conditional liberation, with a concession of colonial land and a possibility of rehabilitation by their own efforts abroad. Thus, the punishment of relegation was not long in favour, and it has now been practically abandoned.

Russia.—Penal exile has been practised by some other countries as a method of secondary punishment. From 1823 onwards Russia directed a stream of offenders, mainly political, upon Siberia, and at one time the yearly average sent was 18,000. The Siberian exile system belongs only in part to penitentiary science, but it was punitive and aimed at regeneration of the individual and the development of the soil by new settlements. Although the journey was made mostly on foot and not by sea transport, the principle of deportation (or more exactly of removal) was the essence of the system. The later practice, however, has been exactly similar to transportation as originated by England and afterwards followed by France. The penal colonization of the island of Sakhalin reproduced the preceding methods, and the Russian convicts were conveyed by ships through the Suez canal to the Far East. Sakhalin was hopefully intended as an outlet for released convicts and their rehabilitation by their own efforts, precisely in the manner tried in Australia and New Caledonia. The result repeated previous experiences. There was land to reclaim, forests to cut down, marshes to drain, everything but a temperate climate and a good will of the felon labourers to create a prosperous colony. But the convicts would not work; a few sought to win the right to occupy a concession of soil, but the bulk were pure vagabonds, wandering to and fro in search of food. The agricultural enterprise was a complete failure. The wrong sites for cultivation were chosen, the labourers were unskilled and they handled very indifferent tools. Want amounting to starvation was a constant rule; the rations were insufficient and unwholesome—very little meat eked out with salt fish and with entire absence of vegetables. The general tone of morals was inconceivably low, and a universal passion for alcohol and card-playing prevailed According to one authority the life of the convicts at Sakhalin was a frightful nightmare, "a mixture of debauchery and innocence mixed with real sufferings and almost inconceivable privations, corrupt in every one of its phases." The prisons hopelessly ruined all who entered them, all classes being indiscriminatingly herded together. It is now generally allowed that deportation, as practiced, had utterly failed, the chief reasons being the unmanageable numbers sent and the absence of outlets for their employment, even at great cost.

Italy.—Italy has practised deportation in planting various agricultural colonies upon the islands to be found on her coast. They were meant to imitate the intermediate prisons of the Irish system, where prisoners might work out their redemption, when provisionally released. Two were established on the islands of Pianoso and Gorgona, and there were settlements made on Monte Cristo and Capraia. They were used also to give effect to the system of enforced residence or domicilio *coatto*.

Portugal.—Portugal also has tried deportation to the African colony of Angola on a small scale with some success, and combined it with free emigration. The settlers have been represented as well disposed towards the convicts, gladly obtaining their services or helping them in the matter of security. The convict element is orderly, and, although their treatment is *"peu repressive* et *relativement débonnaire,"* few commit offences.

India.—The Andaman islands have been utilized by the Indian government since the mutiny (1857) for the deportation of heinous criminals. (See ANDAMAN ISLANDS.)

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DEPOSIT, anything laid down or separated; as in geology, any mass of material accumulated by a natural agency (see BED), and in chemistry, a precipitate or matter settling from a solution or suspension. Deposit is also used in the sense of earnest or security for the performance of a contract (see CONVEYANCING) in the law of contract, deposit or simple bailment is delivery or bailment of goods in trust to be kept without recompense, and re-delivered on demand (see BAILMENT). (For banking deposits, see BANK.)

DEPOT, a place where goods may be stored or deposited, such as a furniture or forage depot, the accumulation of military stores, especially in the theatre of operations (from the Fr. *Dépôt*, Lat. *depositum,* laid down). In America the word is used of a railway station, whether for passengers or goods; in Great Britain on railways the word, when in use, is applied to goods stations A particular military application is to a depot, situated as a rule, in the centre of the recruiting district of the regiment or other unit, where recruits are received and undergo the necessary preliminary training before joining the active troops. Such depots are maintained in peace time by all armies which have to supply distant or oversea garrisons; in an army raised by compulsory service and quartered in its own country, the regiments are usually stationed in their own districts, and on their taking the field for war leave behind a small nucleus for the formation and training of drafts to be sent out later. These nucleus troops are generally called depot troops.

DEPRECIATION. In accounting, the term "depreciation" is applied to that inevitable wastage in the value of assets due to some cause inherent in the thing itself, as distinct from fluctuations in value that arise from external causes. Depreciation may arise owing to the operation of (a) human, or (b) natural laws. Leaseholds and copyrights have, by the operation of the law, a limited duration of life, on the expiration of which no proprietory rights survive. Whatever may have been expended on such rights is accordingly expenditure to be recouped (if at all) out of the advantages derived from the use of the property during a definite known period. If due provision be made for depreciation it will take the form of charging against the profits of each successive year its due proportion of the total outlay, so that when the working life has expired the whole of the outlay will have been charged against profits. When depreciation takes place as the result of natural laws, it is caused by wear and tear, natural decay, or obsolescence. Its effect is very similar to that of depreciation from legal causes, save that the period of utility—the working life—is not precisely known, but has to be estimated. Moreover, in many cases, the effect of wear and tear is to impair the efficiency of the equipment gradually, with the result that its value as a profit-earner tends to diminish year by year. Nevertheless, the problem is essentially the same; the whole of the original outlay (minus its residual value, if the latter be worth considering) is a proper charge against the profits earned during the period that the article is in use. Due provision for depreciation during that extended period will involve each successive year's profits being charged with its due proportion of the total sum to be provided

As a matter of calculation, the total sum may be distributed over the required series of years by (*a*) equal, (*b*) gradually diminishing, (*c*) gradually increasing, or (d) irregular instalments. In practice all four methods are in use; they are often called respectively the straight-line, fixed percentage, annuity, and revaluation methods.

When expenditure upon renewals is more or less continual, there is ordinarily no difficulty about financing such expenditure out of revenue, but where relatively large sums have to be found infrequently, it is usually desirable to supplement the accounting provision for depreciation by a physical accumulation of funds available to meet the cost of renewals. This is done by investing year by year a sum equal to the amount charged against profits for depreciation and reinvesting any income derived from such investments, thus building up what is called a sinking fund.

Theoretically, provision for the depreciation of every wasting asset should be effected as the result of a separate calculation. In practice, however, assets are usually grouped into a comparatively small number of separate accounts, and the provision in

respect of each group is based upon the average life of the items composing it. The success of such a device as this depends entirely upon the adequacy of the grouping arrangements. Very often the grouping is overdone.

There should be no real difficulty about calculating in advance due provision for depreciation proper, but it is not, of course, possible to calculate with equal precision the effect of obsolescence. All that can be done is to keep the estimate of the working life low. Successful undertakings often deliberately underestimate the working life, as a sort of insurance against obsolescence. If this be over-done a secret reserve is created.

(L. R. D.)

DEPRETIS, AGOSTINO (1813–1887), Italian statesman, was born at Mezzana Corte, in the province of Stradella, on Jan. 31, 1813. He belonged to the *Giovane Italia*, and was nearly captured by the Austrians while smuggling arms into Milan. Elected deputy in 1848 he founded the journal *Il Diritto*. In 1860 he was sent on an abortive mission to Sicily to find a compromise between the Cavour and the Garibaldi policies. As a member of the Rattazzi cabinet of 1862 he arranged with Garibaldi the expedition which ended in disaster at Aspromonte. He was a member of the Ricasoli cabicet of 1866, and on the death of Rattazzi (1873) became the leader of the Left, and was premier in 1876–78, and for a brief period in 1879. Minister of the interior in the Cairoli cabinet of 1879, he was again prime minister from 1881 until his death on July 29, 1887. He reconstituted his cabinet four times alternately bestowing portfolios upon Ricotti, Robilant and other Conservatives, so as to complete the political process known as *trasformismo*. A few weeks before his death he repented of his transformist policy, and again included Crispi and Zanardelli in his cabinet. During his long term of office he abolished the grist tax, extended the suffrage, completed the railway system, aided Mancini in forming the Triple Alliance, and initiated colonial policy by the occupation of Massawa; but, at the same time, he vastly increased indirect taxation, corrupted and destroyed the fibre of the several parliamentary parties, and, by his uttter extravagance in public works, impaired the stability of Italian finance.

See Breganze, *Agostino Depretis e suoi tempi* (1894).

DEPTFORD, a south-eastern metropolitan borough of London, England, bounded by Bermondsey, the river Thames, Greenwich, Lewisham and Camberwell. The name is connected with a ford over the Ravensbourne, a stream entering the Thames through Deptford creek. The borough (pop. 1938, 95,460) comprises only the parish of Deptford St. Paul, that of Deptford St. Nicholas being included under Greenwich. All the northern part of Deptford adjoining the Thames is low-lying, but the southern, on a low gravel terrace, rises to 154 ft. in Telegraph hill. It is a district of poor streets inhabited by a large industrial population employed chiefly in railway, engineering and other riverside works. On the river front is the royal victualling yard which supplies the navy with provisions, medicines, furniture, etc., manufactured there or stored in the large warehouses. Henry VIII. established a royal naval dockyard at Deptford, and the shipbuilding industry flourished for a long time, persisting when wooden ships gave place to iron, and is still carried on. The old dockyard, however, ceased to be used in 1869, and was filled up and converted into a foreign cattle market by the City corporation. At the present time engineering and boiler-making are among the more important industries of Deptford.

Deptford shares in the great timber import of the adjoining district of Rotherhithe and the New Baltic and other timber wharves front the Surrey canal. In connection with this timber trade furniture, casks and packing cases are made. There are also works for tar, chemicals, asphalt, oil and whiting, a tea warehouse, cocoa and coffee works, bronze, brass and copper, galvanized iron and zinc works. Deptford creek, with coal and timber wharves, is 1,560 yd. long, and is crossed by a road bridge near the entrance. Of public buildings the chief are St. Paul's church, the Municipal buildings and the hospital for master mariners, maintained by the Corporation of the Trinity house. Other institutions are the Goldsmith's college, New Cross; and the South-eastern fever hospital. Sayes Court, demolished 1729, was the residence of the duke of Sussex in the reign of Elizabeth, was occupied in the next century by John Evelyn, and in 1698 by Peter the Great during his stay in Deptford. The site of its gardens is occupied by Deptford park, 11 ac. in extent, and Sayes Court gardens. Other open spaces are on Telegraph hill.

DEPTH, in military language, the space over which a body of troops is distributed from front to rear. In a tactical sense it is used to express the idea of, and need for, so distributing a force or unit as to have adequate reserves behind the fighting line to exploit initial success or to meet an emergency. In World War 1 the tendency was for the distribution of a force or unit to attain an ever-increasing depth in proportion to, and with a proportionate reduction of, its frontage.

DEPTH CHARGE: *see* MINES, MINELAYING AND MINESWEEPING.

DEPUTY, one appointed to act or govern instead of another; one who exercises an office in another man's right, a substitute; in representative government a member of an elected chamber. Various officials are empowered by statute to appoint deputies. Thus, a clerk of the peace, in case of illness, incapacity or absence, may appoint a fit person to act as his deputy. While judges of the supreme court cannot act by deputy, county court judges and recorders can, in cases of illness or unavoidable absence, appoint deputies. So can registrars of county courts and returning officers at elections. In many countries, *e.g.*, France and Spain, members of the lower house of parliament are called deputies.

DE QUINCEY, THOMAS[1] (1785–1859), English author, was born at Greenheys, Manchester, the fifth child in a family of eight (four sons and four daughters). His father left his wife and six children a clear income of £1,600 a year. Thomas was from infancy a shy, sensitive child, with a constitutional tendency to dreaming by night and by day; and, under the influence of an elder brother, a lad "whose genius for mischief amounted to inspirations," who died in his 16th year, he spent much of his boyhood in imaginary worlds of their own creating. The amusements and occupations of the whole family, indeed, seem to have been mainly intellectual; and in De Quincey's case, emphatically, "the child was father to the man." "My life has been," he affirms in the *Confessions*, "on the whole the life of a philosopher; from my birth I was made an intellectual creature, and intellectual in the highest sense my pursuits and pleasures have been." He received a rather desultory education, though at 15 he could speak Greek fluently. He ran away from his last school, Manchester Grammar school, and was sent into the country in Wales. Then he again ran away, this time to London, where, he says, commenced "that episode, or impassioned parenthesis of my life, which is comprehended in *The Confessions* of *an English Opium Eater.*" This London episode extended over a year or more; his money soon vanished, and he was in the utmost poverty; he obtained shelter for the night in Greek street, Soho, from a moneylender's agent, and spent his days wandering in the streets and parks; finally the lad was reconciled to his guardians, and in 1803 was sent to Worcester college, Oxford, being by this time about 19. It was in the course of his second year at Oxford that he first tasted opium—having taken it to allay neuralgic pains. De Quincey's mother had settled at Weston Lea, near Bath, and on one of his visits to Bath, De Quincey made the acquaintance of Coleridge; he took Mrs. Coleridge to Grasmere, where he became personally acquainted with Wordsworth.

After finishing his career of five years at college in 1808 he kept terms at the Middle Temple; but in 1809 visited the Wordsworths at Grasmere, and in the autumn returned to Dove cottage, which he had taken on a lease. His choice was of course influenced partly by neighbourhood to Wordsworth, whom he early appreciated, having been, he says, the only man in all Europe who quoted Wordsworth so early as 1802. His friendship with

[1]The following account has been abbreviated for this ed. Its original author, John Ritchie Findlay (1824–1898), proprietor of The *Scotsman* newspaper, and the donor of the Scottish National Portrait gallery in Edinburgh, had been intimate with De Quincey, and in 1886 published his *Personal Recollections* of him.

Wordsworth decreased within a few years, and when in 1834 De Quincey published in *Tait's Magazine* his reminiscences of the Grasmere circle, the indiscreet references to the Wordsworths contained in the article led to a complete cessation of intercourse. Here also he enjoyed the society and friendship of Coleridge, Southey, and especially of Prof. Wilson, as in London he had of Charles Lamb and his circle. He continued his classical and other studies, especially exploring the, at that time, almost unknown region of German literature, and indicating its riches to English readers. Here also, in 1816, he married Margaret Simpson, the "dear M———" of whom a charming glimpse is accorded to the reader of the Confessions; his family came to be five sons and three daughters.

For about a year and a half he edited the *Westmorland* Gazette. He left Grasmere for London in the early part of 1820. The Lambs received him with great kindness and introduced him to the proprietors of the London Magazine. It was in this journal in 1821 that the Confessions appeared. De Quincey also contributed to Blackwood, to Knight's Quarterly Magazine, and later to *Tait's* Magazine. His connection with Blackwood took him to Edinburgh in 1828, and he lived there for 12 years, contributing from time to time to the Edinburgh Literary Gazette. His wife died in 1837, and the family eventually settled at Lasswade, but from this time De Quincey spent his time in lodgings in various places, staying at one place until the accumulation of papers filled the rooms, when he left them in charge of the landlady and wandered elsewhere. After his wife's death he gave way for the fourth time in his life to the opium habit, but in 1844 he reduced his daily quantity by a tremendous effort to six grains, and never again yielded. He died in Edinburgh on Dec. 8, 1859, and is buried in the West Churchyard.

During nearly 50 years De Quincey lived mainly by his pen. His patrimony seems never to have been entirely exhausted, and his habits and tastes were simple and inexpensive; but he was reckless in the use of money, and had debts and pecuniary difficulties of all sorts. The famous Confessions of an English Opium Eater was published in a small volume in 1822, and attracted attention, not simply by its personal disclosures, but by the extraordinary power of its dream-painting. No other literary man of his time, it has been remarked, achieved so high and universal a reputation from such merely fugitive efforts. The only works published separately (not in periodicals) were a novel Klosterheim (1832), and The Logic of Political Economy (1844). After his works were brought together, De Quincey's reputation was not merely maintained, but extended. For range of thought and topic, within the limits of pure literature, no like amount of material of such equality of merit proceeded from any eminent writer of the day. However profuse and discursive, De Quincey is always polished, and generally exact—a scholar, a wit, a man of the world and a philosopher, as well as a genius. He looked upon letters as a noble and responsible calling; in his essay on Oliver Goldsmith he claims for literature the rank not only of a fine art, but of the highest and most potent of fine arts; and as such he himself regarded and practised it. He drew a broad distinction between "the literature of knowledge and the literature of power," asserting that the function of the first is to teach, the function of the second to move—maintaining that the meanest of authors who moves has pre-eminence over all who merely teach, that the literature of knowledge must perish by supersession, while the literature of power is "triumphant for ever as long as the language exists in which it speaks." It is to this class of motive literature that De Quincey's own works essentially belong; it is by virtue of that vital element of power that they have emerged from the rapid oblivion of periodicalism, and live in the minds of later generations. But their power is weakened by their volume.

De Quincey fully defined his own position and claim to distinction in the preface to his collected works. These he divides into three classes: "*first,* that class which proposes primarily to amuse the reader," such as the Narratives, Autobiographic Sketches, *etc.;* second, "papers which address themselves purely to the understanding as an insulated faculty, or do so primarily," such as the essays on Essenism, the Caesars, Cicero, etc.; and finally, as a third class, "and, in virtue of their aim, as a far higher class of compositions," he ranks those "modes of impassioned prose ranging under no precedents that I am aware of in any literature," such as the Confessions and *Suspiria* de Profundis. The high claim here asserted has been questioned; and short and isolated examples of eloquent apostrophe, and highly wrought imaginative description, have been cited from Rousseau and other masters of style; but De Quincey's power of sustaining a fascinating and elevated strain of "impassioned prose" is allowed to be entirely his own. Another obvious quality of all his genius is its overflowing fullness of allusion and illustration, recalling his own description of a great philosopher or scholar—"Not one who depends simply on an infinite memory, but also on an infinite and electrical power of combination, bringing together from the four winds, like the angel of the resurrection, what else were dust from dead men's bones into the unity of breathing life."

In politics, in the party sense of that term, he would probably have been classed as a Liberal Conservative or Conservative Liberal—at one period of his life perhaps the former, and at a later the latter. As he advanced in years his views became more and more decidedly liberal, but he was always as far removed from Radicalism as from Toryism, and may be described as a philosophical politician, capable of classification under no definite party name or colour. Of political economy he had been an early and earnest student, and projected, if he did not so far proceed with, an elaborate and systematic treatise on the science, of which all that appears, however, are his fragmentary *Dialogues* on the system of Ricardo, published in the London Magazine in 1824, and *The* Logic of Political Economy (1844). How wide and varied was the region he traversed a glance at the titles of the papers which make up his collected (or more properly, selected) works (for there was much matter of evanescent interest not reprinted), sufficiently shows. Some things in his own line he has done perfectly; he has written many pages of magnificently mixed arguments, irony, humour and eloquence, which, for sustained brilliancy, richness, subtle force and purity of style and effect, have simply no parallels; and he is without peer the prince of dreamers. The use of opium no doubt stimulated this remarkable faculty of reproducing in skilfully selected phrase the grotesque and shifting forms of that "cloudland, gorgeous land," which opens to the sleep-closed eye.

It has been complained that, in spite of the apparently full confidences of the Confessions and Autobiographic Sketches, readers are left in comparative ignorance, biographically speaking, of the man De Quincey. Two passages in his Confessions afford sufficient clues to this mystery. In one he describes himself "as framed for love and all gentle affections," and in another confesses to the "besetting infirmity" of being "too much of an eudaemonist." "I hanker," he says, "too much after a state of happiness, both for myself and others; I cannot face misery, whether my own or not, with an eye of sufficient firmness, and am little capable of surmounting present pain for the sake of any recessionary benefit." His sensitive disposition dictated the ignoring in his writings of traits merely personal to himself, as well as his ever-recurrent resort to opium as a doorway of escape from present ill; and prompted those habits of seclusion, and that apparently capricious abstraction of himself from the society not only of his friends, but of his own family, in which he from time to time persisted. He confessed to occasional accesses of an almost irresistible impulse to flee to the labyrinthine shelter of some great city like London or Paris—there to dwell solitary amid a multitude, buried by day in the cloister-like recesses of mighty libraries, and stealing away by night to some obscure lodging. Long indulgence in seclusion, and in habits of study the most lawless possible in respect of regular hours or any considerations of health or comfort—the habit of working as pleased himself without regard to the divisions of night or day, of times of sleeping or waking, even of the slow procession of the seasons—had latterly so disinclined him to the restraints, however slight, of ordinary social intercourse, that he very seldom submitted to them. On such rare occasions, however, as he did appear, per-

haps at some simple meal with a favoured friend, or in later years in his own small but refined domestic circle, he was the most charming of guests, hosts or companions. A short and fragile, but well-proportioned frame; a shapely and compact head; a face beaming with intellectual light, with rare, almost feminine beauty of feature and complexion; a fascinating courtesy of manner; and a fullness, swiftness and elegance of silvery speech — such was the, irresistible "mortal mixture of earth's mould" that men named De Quincey. It was impossible to deal with or judge him by ordinary standards — not even his publishers did so. Much no doubt was forgiven him, but all that needed forgiveness is covered by the kindly veil of time, while his merits as a master in English literature are still gratefully acknowledged. (J. R. F.)

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DERA GHAZI KHAN, a town and district of British India, in the Punjab. The original town was founded at the close of the 15th century and named after Ghazi Khan, son of Haji Khan, a Baluch chieftain, who after holding the country for the Langah sultans of Multan had made himself independent. The greater part of this town was washed away by the Indus in 1908–09 and the new town, built near by, is now the headquarters of the District.

The district, which consists of an area of 5,325 sq.m., is a long narrow strip of country, 198 m. in length, sloping gradually from its western boundary hills to the river Indus on the east. Although liable to great extremes of temperature, and to a very scanty rainfall, the district is not unhealthy. The population in 1931 was 491,044, the great majority being Baluch Mohammedans. The principal exports are wheat and indigo. The only manufactures are for domestic use. There is no railway in the district. In the hills beyond the limit of the district is an area occupied by Biloch tribes which is administered by the deputy commissioner of Dera Ghazi Khan. The frontier tribes here include the Kasranis, Bozdars, Khosas, Lagharis, Khetrans, Gurchanis, Mazaris, Marris and Bugtis. The chief of these are described under their separate names.

DERAIL, a device used mainly on the sidings of railways to prevent a car that has been moved by wind, gravity or by the error of trainmen from running foul of the main track. It is also frequently used to protect men at work under a car. The derail is variously designed, but generally acts by providing a surface on which the flange of one wheel mounts and crosses over the head of the rail, dragging the wheel at the other end of the axle off its rail. Each pair of wheels follows in turn and, being forced over the irregularities of the road-bed, soon bring the car to a full stop. Some derails are portable, but most are fixed definitely in place and are operated by hand, in unison with a switch or mechanically from a central point. The illustration shows a manual derail with signal target, in operating position.

DERAIN, ANDRE (1880–), French painter, was born at Chatou (France), on June 10, 1880. For a considerable time he shared a studio with the landscape painter Vlaminck; he then made the acquaintance of Picasso, Georges Braque and the poet Guillaume Apollinaire. It was from this small group that Cubism developed. Yet Derain cannot be considered as a representative of the Cubist school; his best works adhere to the great traditions of the classic landscapes, and are formal in character and restrained in colour, while his figures exhibit a grandeur and serenity, which reveal an admirer of the great masters.

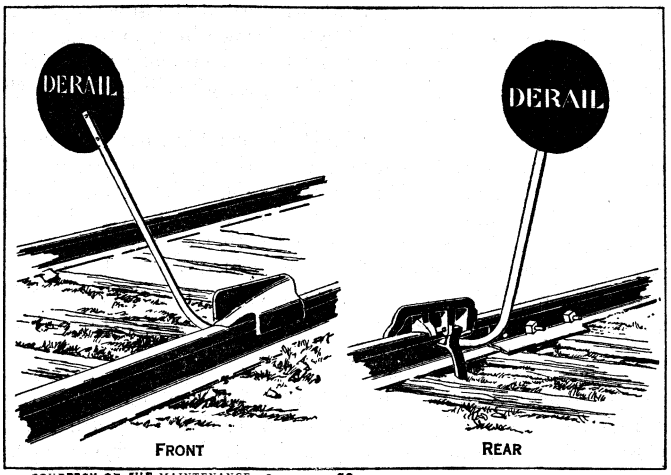
DERA ISMAIL KHAN, a town, cantonment and district in the Derajat division of the North-West Frontier Province of India. The town is situated near the right bank of the Indus, here crossed by a bridge of boats during half the year. Pop. (1921) 39,341. It takes its name from Ismail Khan, a Baluch chief who settled here towards the end of the 15th century, and whose descendants ruled for 300 years. The old town was swept away by a flood in 1823. The main channel of the Indus which often changes, was in 1927 2 m. from the town. The town contains a large bazaar for Afghan traders and is the residence of many Mohammedan gentry. Since the occupation of Waziristan the garrison has been reduced to half a brigade. There is considerable through trade with Afghanistan by the Gomal pass.

The district—area 3,403 sq.m., pop. (1921) 260,767—was formerly divided by the Indus, which intersected it from north to south. To the west of the Indus the country resembles Dera Ghazi Khan. To the east of the present bed of the river a wide tract, the Kachi, is exposed to river action. Beyond this, the country rises abruptly, and a barren, almost desert plain stretches eastwards, sparsely cultivated, and inhabited only by nomadic tribes In 1901 the trans-Indus tract was allotted to the newly formed North-West Frontier Province, the cis-Indus tract remaining in the Punjab jurisdiction. The former cis-Indus portions of the Dera Ismail Khan and Bannu districts is now the Punjab district of Mianwali.

The district is the junction of Pathan and Baluch tribes, the Pathan element predominating. The chief frontier tribes are the Sheranis and Ustaranas and Bhittanis.

DERAIYEH or **DERAYAH.** A city of Arabia formerly the capital of the Wahhabis and of considerable importance prior to 1819 when it was captured by Ibrahim Pasha. It now consists of five walled villages amongst the ruins, with a population of about 1,500 inhabitants, the Wahhabi capital is now Riad.

DERBENT or **DERBEND,** a town in the A.S.S.R. of Daghestan, on the western shore of the Caspian, 42° 4′ N., 48° 15′ E. Pop. (1926) 23,111. It occupies a narrow strip of land beside the sea, from which it climbs up the steep heights inland. The environs are occupied by vineyards, gardens and orchards, in which madder, saffron and tobacco, as well as figs, peaches, pears and other fruits, are cultivated. Earthenware, weapons and silk and



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FRONT AND REAR VIEWS OF THE "BLUE FLAG" PORTABLE DERAIL

cotton fabrics are the principal products of the manufacturing industry. Recently a wool spinning factory has been built; and steamers call at the port, which has a lighthouse and cold storage accommodation for the fruit and fish industry. To the north of the town is the monument of the *Kirk-lar*, or "forty heroes," who fell defending Daghestan against the Arabs in 728; and to the south lies the seaward extremity of the Caucasian wall (50 m. long), otherwise known as Alexander's wall, blocking the narrow

pass of the Iron Gate or Caspian Gates (Portae Albanae or Portae *Caspiae*). This, when entire, had a height of 29 ft. and a thickness of about 10 ft., and with its iron gates and numerous watch-towers formed a valuable defence of the Persian frontier. Derbent is usually identified with Albana, the capital of the ancient Albania. The modern name, a Persian word meaning "iron gates," came into use when the city was refounded by Kavadh of the Sassanian dynasty of Persia. The walls and the citadel are believed to belong to the time of Kavadh's son, Khosrau (Chosroes) Anosharvan. In 728 the Arabs entered into possession, and established a principality in the city, which they called Bab-el-Abwab ("the principal gate"), Bab-el-Khadid ("the iron gate"), and Seraill-el-Dagab ("the golden throne"). The celebrated caliph, Harun-al-Rashid, lived in Derbent at different times, and brought it into great repute as a seat of the arts and commerce. In 1220 it was captured by the Mongols, and in the course of the succeeding centuries it frequently changed masters. In 1722 Peter the Great of Russia wrested the town from the Persians, but in 1736 the supremacy of Nadir Shah was again recognized. In 1796 Derbent was besieged by the Russians, and in 1813 incorporated in the Russian empire. During the Civil War 1917 to 1921, the greater part of the town was destroyed.

DERBY, EARLS OF. The 1st earl of Derby was probably Robert de Ferrers (d. 1139), who is said by John of Hexham to have been made an earl by King Stephen after the battle of the Standard in 1138. Robert and his descendants retained the earldom until 1266, when Robert (c. 1240–*c.* 1279), probably the 6th earl, having taken a prominent part in the baronial rising against Henry III., was deprived of his lands and practically of his title. These earlier earls of Derby were also known as Earls Ferrers, or de Ferrers, from their surname; as earls of Tutbury from their residence; and as earls of Nottingham because this county was a lordship under their rule. The large estates which were taken from Earl Robert in 1266 were given by Henry III. in the same year to his son, Edmund, earl of Lancaster; and Edmund's son, Thomas, earl of Lancaster, called himself Earl Ferrers. In 1337 Edmund's grandson, Henry (c. 1299–1361), afterwards duke of Lancaster, was created earl of Derby, and this title was taken by Edward III.'s son, John of Gaunt, who had married Henry's daughter, Blanche. John of Gaunt's son and successor was Henry, earl of Derby, who became king as Henry IV. in 1399.

In October 1485 Thomas, Lord Stanley, was created earl of Derby, and the title has since been retained by the Stanleys. It is derived, not from Derbyshire, but from the hundred of West Derby in Lancashire. Thomas also inherited the sovereign lordship of the Isle of Man, granted by the crown in 1406 to his great-grandfather, Sir John Stanley; and this sovereignty remained in possession of the earls of Derby till 1736, when it passed to the duke of Atholl.

The earl of Derby is one of the three "catskin earls," the others being the earls of Shrewsbury and Huntingdon. The term "catskin" is possibly a corruption of quatre-skin, derived from the fact that in ancient times the robes of an earl (as depicted in some early representations) were decorated with four rows of ermine, as in the robes of a modern duke, instead of the three rows to which they were restricted in later centuries. The three "catskin" earldoms are the only earldoms now in existence which date from creations prior to the 17th century.

THOMAS STANLEY, 1st earl of Derby (c. 1435–1504), was the son of Thomas Stanley, who was created Baron Stanley in 1456 and died in 1459. His grandfather, Sir John Stanley (d. 1414), had founded the fortunes of his family by marrying Isabel Lathom, the heiress of a great estate in the hundred of West Derby in Lancashire; he was lieutenant of Ireland in 1389–1391, and again in 1399–1401, and in 1405 received a grant of the lordship of Man from Henry IV. The future earl of Derby was a squire to Henry VI. in 1454, but not long afterwards married Eleanor, daughter of the Yorkist leader, Richard Neville, earl of Salisbury. At the battle of Blore Heath in Aug. 1459 Stanley, though close at hand with a large force, did not join the royal army, whilst his brother William fought openly for York. In 1461 Stanley was made chief justice of Cheshire by Edward IV., but ten years later he sided with his brother-in-law Warwick in the Lancastrian restoration. Nevertheless, after Warwick's fall, Edward made Stanley steward of his household. Stanley served with the king in the French expedition of 1475, and with Richard of Gloucester in Scotland in 1482. About the latter date he married, as his second wife, Margaret Beaufort, mother of the exiled Henry Tudor. Stanley was one of the executors of Edward IV., and was at first loyal to the young king Edward V. But he acquiesced in Richard's usurpation, and retaining his office as steward avoided any entanglement through his wife's share in Buckingham's rebellion. He was made constable of England in succession to Buckingham, and was granted possession of his wife's estates with a charge to keep her in some secret place at home. Richard could not well afford to quarrel with so powerful a noble, but early in 1485 Stanley asked leave to retire to his estates in Lancashire. After Henry of Richmond had landed, Stanley made excuses for not joining the king. On the morning of Bosworth (Aug. 22), Richard summoned Stanley to join him, and when he received an evasive reply ordered his son, George, Lord Strange, whom Stanley had given as a hostage, to be executed. In the battle it was William Stanley, his brother, who turned the scale in Henry's favour, but Thomas, who had taken no part in the fighting, was the first to salute the new king. Henry VII. confirmed Stanley in all his offices, and on Oct. 27, created him earl of Derby. As husband of the king's mother Derby held a great position, which was not affected by the treason of his brother William in Feb. 1495. In the following July the earl entertained the king and queen with much state at Knowsley. Derby died on July 29, 1504. Strange had escaped execution in 1485, but he died before his father in 1497, and his son Thomas succeeded as second earl. An old poem called The Song of the Lady *Bessy,* which was written by a retainer of the Stanleys, gives a romantic story of how Derby was enlisted by Elizabeth of York in the cause of his wife's son.

For fuller narratives *see* J. Gairdner's *Richard III.* and J. H. Ramsay's *Lancaster and York;* also Seacome's *Memoirs of the House of Stanley* (1741).

EDWARD STANLEY, 3rd earl of Derby (1508–1572), was a son of Thomas Stanley, 2nd earl and grandson of the 1st earl, and succeeded to the earldom on his father's death in May 1521. During his minority Cardinal Wolsey was his guardian, and as soon as he came of age he began to take part in public life. He helped to quell the rising known as the Pilgrimage of Grace in 1536; but remaining true to the Roman Catholic faith he disliked and opposed the religious changes made under Edward VI. Under Elizabeth his younger sons, Sir Thomas (d. 1576) and Sir Edward Stanley (d. 1609), were concerned in a plot to free Mary, queen of Scots, and he himself was suspected of disloyalty. He died at Lathom House, near Ormskirk, on Oct. 24, 1572

Derby's first wife was Katherine, daughter of Thomas Howard, duke of Norfolk, by whom he had, with other issue, a son Henry, the 4th earl (c. 1531–1593), who was a member of the council of the North, and like his father was lord-lieutenant of Lancashire. Henry was one of the commissioners who tried Mary, queen of Scots, and was employed by Elizabeth on other high undertakings both at home and abroad. He died on Sept. 25, 1593. His wife Margaret (d. 1596), daughter of Henry Clifford, 2nd earl of Cumberland, was descended through the Brandons from King Henry VII. Two of his sons, Ferdinando (c. 1559–1594), and William (c. 1561–1642), became in turn the 5th and 6th earls of Derby. Ferdinando, the 5th earl (d. 1594), wrote verses, and is eulogized by Spenser under the name of Amyntas.

JAMES STANLEY, 7th earl of Derby (1607–1651), sometimes styled the Great Earl of Derby, eldest son of William, 6th earl, and Elizabeth de Vere, daughter of Edward, 17th earl of Oxford, was born at Knowsley on Jan. 31, 1607. During his father's life he was known as Lord Strange. He was elected M.P. for Liverpool in 1625, received high officesin the North of England, and on March 7, 1628, entered the House of Lords as Baron Strange. When the Civil War broke out in 1642, Lord Strange devoted himself to the king's cause. His plan of securing Lancashire at the beginning and raising troops there, which promised success, was however dis-

couraged by Charles, who was said to be jealous of his power and royal lineage and who commanded his presence at Nottingham. His subsequent attempts to recover the county were unsuccessful. After several defeats he left for the Isle of Man in June 1643 to attend to affairs there, and in the summer of 1644 he took part in Prince Rupert's successful campaign in the north, when Lathom House, where Lady Derby had heroically resisted the attacks of the besiegers, was relieved, and Bolton Castle taken. He followed Rupert to Marston Moor, and after the complete defeat of Charles's cause in the north withdrew to the Isle of Man, where he held out for the king and offered an asylum to royalist fugitives. His administration of the island imitated that of Strafford in Ireland. It was strong rather than just. In July 1649 he refused scornfully terms offered to him by Ireton. By the death of his father on Sept. 29, 1642 he had succeeded to the earldom, and on Jan. 12, 1650, he obtained the Garter. On Aug. 1j, 1651, he landed at Wyre Water in Lancashire in support of Charles's invasion, and met him on the 17th. Proceeding to Warrington he failed to obtain the support of the Presbyterians through his refusal to take the Covenant, and on the 25th was totally defeated at Wigan, being severely wounded and escaping with difficulty. He joined Charles at Worcester; after the battle he accompanied him to Boscobel, and while on his way north alone was captured near Nantwich and given quarter. He was tried by court-martial at Chester on Sept. 29, his quarter was disallowed and he was condemned to death. When his appeal for pardon to parliament was rejected, though supported by Cromwell, he endeavoured to escape; but was recaptured and executed at Bolton on Oct. 15, 1651. He was buried in Ormskirk church. According to Clarendon Derby was "a man of great honour and clear courage," and his defects the result of too little knowledge of the world. Lord Derby left in ms. "A Discourse concerning the Government of the Isle of Man" (printed in the *Stanley Papers* and in F. Peck's *Desiderata Curiosa,* vol. ii.) and several volumes of historical collections, observations, devotions *(Stanley Papers)* and a commonplace book. He married on the 26th of June 1626 Charlotte de la Trémoille (1599–1664), daughter of Claude, duc de Thouars, and granddaughter of William the Silent, prince of Orange, by whom besides four daughters he had five sons, of whom the eldest, Charles (1628–1672), succeeded him as 8th earl.

Charles's two sons, William, the 9th earl (c. 1655–1702), and James, the 10th earl (1664–1736), both died without sons, and consequently, when James died in February 1736, his titles and estates passed to Sir Edward Stanley (1689–1776), a descendant of the 1st earl. From him the later earls were descended, the 12th earl (d. 1834) being his grandson.

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The 14th earl is noticed separately *(see* below).

EDWARD HENRY STANLEY, 15th earl of Derby (1826–1893), eldest son of the 14th earl, was educated at Rugby and Trinity college, Cambridge, where he took a high degree and became a member of the society known as the Apostles. In March 1848 he unsuccessfully contested the borough of Lancaster and then made a long tour in the West Indies, Canada and the United States. During his absence he was elected member for Ring's Lynn, which he represented till October 1869, when he succeeded to the peerage. He delivered his maiden speech in May 1850 on the sugar duties. Just before, he had made a very brief tour in Jamaica and South America. In 1852 he went to India, and while traveling in that country he was appointed under-secretary for foreign affairs in his father's first administration. From the outset of his career he was known to be a most Liberal Conservative, and in 1855 Lord Palmerston offered him the post of colonial secretary. He was much tempted by the proposal, and hurried down to Knowsley to consult his father, who called out when he entered the room, "Hallo, Stanley! what brings you here?—Has Dizzy cut his throat, or are you going to be married?" The offer was declined. In his father's second administration Lord Stanley held, at first, the office of secretary for the colonies, but became president of the Board of Control on the resignation of Lord Ellenborough. He had the charge of the India Bill of 1858 in the House of Commons, became the first secretary of state for India, and left behind him in the India Office an excellent reputation. When the Greeks were looking round for a king after the death of King Otho, and the crown was refused by Queen Victoria for her son Alfred, there was some idea of inviting Stanley to take the vacant throne, but the offer was never formally made. After the fall of the Russell government in 1866 he became foreign secretary in his father's third administration. He compared his conduct in that great post to that of a man floating down a river and fending off from his vessel, as well as he could, the various obstacles it encountered. He thought that that should be the normal attitude of an English foreign minister, and probably under the circumstances of the years 1866–1868 it was the right one. He arranged the collective guarantee of the neutrality of Luxemburg in 1867, negotiated a convention about the "Alabama," which, however, was not ratified, and refused to take any part in the Cretan troubles. In 1874 he again became foreign secretary in Disraeli's government. He acquiesced in the purchase of the Suez canal shares; he accepted the Andrássy Note, but declined to accede to the Berlin Memorandum. His part in the later phases of the Russo-Turkish struggle has never been fully explained, for he declined to gratify public curiosity at the cost of some of his colleagues. He resigned, and was prepared to explain in the House of Lords the course he had taken if those whom he had left challenged him to do so, but from that course they consistently refrained. By Oct. 1879 it was clear enough that he had thrown in his lot with the Liberal party, but it was not till March 1880 that he publicly announced this change of allegiance. He did not at first take office in the second Gladstone government, but became secretary for the colonies in Dec. 1882, holding this position till the fall of that government in the summer of 1885. In 1886 Derby joined the Liberal Unionists, and took an active part in the general management of that party, leading it in the House of Lords till 1891, when Lord Hartington became duke of Devonshire. In 1892 he presided over the labour commission. He died at Knowsley on April 21, 1893.

During a great part of Derby's life he was deflected from his natural course by the accident of his position as the son of the leading Conservative statesman of the day. From first to last he was at heart a moderate Liberal. In one of the highest qualities of a statesman, "aptness to be right," he was surpassed by none of his contemporaries, or—if by anybody—by Sir George Cornewall Lewis alone. His chief defect as a statesman was that in his anxiety to arrive at the right conclusions he sometimes turned and turned and turned a subject over till the time for action had passed. Although he cared but little for what is commonly known as society—the society of crowded rooms and fragments of sentences—he very much liked conversation. During the many years in which he was a member of "The Club" he was one of its most assiduous frequenters, and his loss was acknowledged by a formal resolution. His talk was generally grave, but every now and then was lit up by dry humour. The late Lord Arthur Russell once said to him, after he had been buying some property in southern England: "So you still believe in land, Lord Derby." "Hang it," he replied, "a fellow must believe in something!" He did much work outside politics. He was lord rector of the University of Glasgow from 1868 to 1871, and later held the same office in that of Edinburgh. From 1875 to 1893 he was president of the Royal Literary Fund, and attended most closely to his duties there. He succeeded Lord Granville as chancellor of the University of London in 1891, and remained in that position till his death. He lived much in Lancashire, managed his enormous estates with great skill, and did a great amount of work as a local magnate. He married in 1870 Maria Catharine, daughter of the 5th earl de la Warr, and widow of the and marquess of Salisbury.

The best account of the 15th Lord Derby is that which was prefixed by W. E. H. Lecky, who knew him very intimately, to the edition of his speeches outside parliament, published in 1894.

The earl left no children and he was succeeded as 16th earl by his brother FREDERICK ARTHUR STANLEY (1841–1908), who had been made a peer as Baron Stanley of Preston in 1886. He was secretary of state for war and for the colonies and president of the board of trade; and was governor-general of Canada from 1888 to 1893. He died on June 14, 1908.

EDWARD GEORGE VILLIERS STANLEY, 17th earl of Derby (1865–), was educated at Wellington college, and served in the Grenadier Guards from 1885 to 1895. During the South African War he acted first as press-censor, then as A.D.C. to Lord Roberts. He sat in the House of Commons for West-Houghton, was a Lord of the treasury (1895–1900), financial secretary to the War Office (1900–03) and postmaster general (1903–05). He was the recipient of many honours, including the Garter (1914). In Oct. 1915 he became director of recruiting for the army, and as such was responsible for a new scheme for a final effort on behalf of voluntary service known as the Derby scheme. In Feb. 1916 Lord Derby became chairman of the naval and military air service joint committee, but resigned in April, becoming under-secretary for war in July. On the formation of D. Lloyd George's Government in Dec. 1916 he became secretary for war, and in April 1918 was appointed British ambassador to France. He retired from the latter office in Nov. 1920. In Oct. 1922 he became secretary for war in Bonar Law's cabinet, retaining this position under Baldwin until Jan. 1924.

DERBY, EDWARD GEOFFREY SMITH STANLEY, 14th earl of Derby (1799–1869), the "Rupert of debate," born at Knowsley in Lancashire on March 29, 1799, grandson of the 12th earl and eldest son of Lord Stanley, subsequently (1834) 13th earl of Derby (1775–1851). He was educated at Eton and at Christ Church, Oxford, and in 1819 he obtained the chancellor's prize for Latin verse, the subject being "Syracuse." As a boy he practised elocution under the instruction of Lady Derby, his grandfather's second wife, the actress, Elizabeth Farren. In 1820 he was returned for Stockbridge in Hampshire, one of the nomination boroughs whose electoral rights were swept away by the Reform Bill of 1832, Stanley being a warm advocate of their destruction.

His maiden speech was delivered early in the session of 1824 in the debate on a private bill for lighting Manchester with gas. On May 6, 1824 he delivered a vehement and eloquent speech against Joseph Hume's motion for a reduction of the Irish Church establishment, maintaining in its most conservative form the doctrine that church property is as sacred as private property. From this time he was acknowledged to be one of the most powerful speakers in the House. In the autumn of 1824 Stanley went on an extended tour through Canada and the United States with Henry Labouchere, afterwards Lord Taunton, and Evelyn Denison, afterwards Lord Ossington. In 1825 he married the second daughter of Edward Bootle-Wilbraham, created Baron Skelmersdale in 1828, by whom he had a family of two sons and one daughter who survived.

At the general election of 1826 Stanley was returned for borough of Preston, where the Derby influence was paramount. The change of seats left him free to speak against the system of rotten boroughs with great force during the Reform Bill debates, without laying himself open to the charge of personal inconsistency as the representative of a place where, according to Gay, cobblers used to "feast three years upon one vote." In 1827 Derby and other Whigs made a coalition with Canning on the defection of the more unyielding Tories, and he became under-secretary for the colonies. The coalition was broken up by Canning's death in August. During the administration of the duke of Wellington (1828–1830), Stanley and those with whom he acted were in opposition. His robust and assertive Liberalism about this period seemed curious afterwards to a younger generation who knew him only as the very embodiment of Conservatism.

On the advent of Lord Grey to power in Nov. 1830, Stanley was appointed to the chief secretaryship of Ireland. On accepting office he had to vacate his seat for Preston and seek re-election: and he had the mortification of being defeated by the Radical, "Orator" Hunt. The contest was a peculiarly keen one, and turned upon the question of the ballot, which Stanley refused to support. He re-entered the House as one of the members for Windsor, Sir Hussey Vivian having resigned in his favour. In 1832 he again changed his seat, being returned for North Lancashire.

Stanley was one of the most ardent supporters of the Reform Bill. Reference may be made especially to his eloquent speech on March 4, 1831 on the adjourned debate on the second reading of the bill. Apart from his connection with the general policy of the government, Stanley had a difficult task in his own office. Ireland was in a very unsettled state. The concession of Catholic emancipation had excited the people to make all sorts of demands, reasonable and unreasonable. "Scorpion Stanley," as O'Connell called him, discharged with determination the ungrateful task of carrying a coercion bill through the House. It was generally felt that O'Connell, powerful though he was, had fairly met his match in Stanley, who, with invective scarcely inferior to his own, evaded no challenge, ignored no argument, and left no taunt unanswered. The title "Rupert of debate" is peculiarly applicable to him in connection with the fearless if also often reckless method of attack he showed in his parliamentary war with O'Connell. It was first applied to him, however, 13 years later by Sir Edward Bulwer Lytton in *The New Timon:*—

> One after one the lords of time advance;
> Here Stanley meets—here Stanley scorns the glance!
> The brilliant chief, irregularly great,
> Frank, haughty, rash,—the Rupert of debate.

The best answer, however, to the attacks of the great agitator was the beneficial legislation which Derby secured for Ireland. He introduced and carried the first national education act for Ireland, one result of which was the remarkable and to many almost incredible phenomenon of a board composed of Catholics, Episcopalians and Presbyterians harmoniously administering an efficient education scheme. In 1833, just before the introduction of the Irish Church Temporalities Bill, Stanley had been appointed secretary for the colonies, with a seat in the cabinet. In this capacity he introduced the bill for freeing the slaves in the West Indies, on May 14, 1833, in one of his most eloquent speeches.

The Irish Church question determined more than one turning-point in his political career. In 1834 the proposal of the government to appropriate the surplus revenues of the church to educational purposes led to his secession from the cabinet, and, as it proved, his complete and final separation from the Liberals. Sir James Graham, the earl of Ripon and the duke of Richmond, also left the cabinet on the same issue. O'Connell, speaking in the House, described the secession in a couplet from Canning's *Loves of the Triangles:*—

> Still down thy steep, romantic Ashbourne, glides
> The Derby dilly carrying six insides.

Stanley spoke against the bill and against its authors with a bitterness that he himself is understood to have afterwards admitted to have been unseemly towards those who had so recently been his celleagues. The course followed by the government was "marked with all that timidity, that want of dexterity, which led to the failure of the unpractised shoplifter." His late colleagues were compared to "thimble-riggers at a country fair," and their plan was "petty larceny, for it had not the redeeming qualities of bold and open robbery."

In the end of 1834, Lord Stanley, as he was now styled by courtesy, his father having succeeded to the earldom in October, was invited by Peel to join the short-lived Conservative ministry which he formed after the resignation of Melbourne. Though he declined the offer for reasons stated in a letter published in the Peel memoirs, he acted from that date with the Conservative party, and on its next accession to power, in 1841, he accepted the office of colonial secretary, which he had held under Lord Grey. His position and his temperament alike, however, made him a thoroughly independent supporter of any party to which he attached himself. When, therefore, consideration of health

arising from the late hours in the Commons led him in 1844 to seek elevation to the Upper House in the right of his father's barony, Peel was rid of a too candid friend in the Commons and was assured of strong debating power in the Lords. But when Peel accepted the policy of free trade in 1846, the breach between him and Stanley was, as might have been anticipated, instant and irreparable. Stanley at once became the recognized leader of the Protectionist party, having Lord George Bentinck and Disraeli for his lieutenants in the Commons. They did all that could be done when the logic of events was against them, though Protection was never to become more than their watchword.

Lord Derby, who had succeeded to the earldom on the death of his father in June 1851, was called upon to form his first administration in Feb. 1852. He was in a minority, but the circumstances were such that no other than a minority government was possible, and he resolved to dissolve parliament and appeal to the country at the earliest opportunity. The election did not materially alter the position of parties. Parliament met in November, and in December the ministry had resigned in consequence of their defeat on Disraeli's budget. For the next six years, during Lord Aberdeen's "ministry of all the talents" and Lord Palmerston's premiership, Lord Derby led the opposition, whose policy gradually became more generally Conservative and less distinctively Protectionist as the hopelessness of reversing the measures adopted in 1846 made itself apparent. In 1855 he was asked to form an administration after the resignation of Lord Aberdeen, but failing to obtain sufficient support he declined the task. After the defeat of Lord Palmerston on the Conspiracy Bill in Feb. 1858, he formed his second ministry. Though he still could not count upon a working majority, defeat was avoided for a whole session, owing chiefly to the dexterous management of the Commons by Disraeli. During the session of 1858 the government carried two important measures, one a bill to remove Jewish disabilities, and the other a bill to transfer the government of India from the East India Company to the crown. Next year the question of parliamentary reform had to be faced, and the government introduced a bill at the opening of the session, which was rejected by the House, and, on a dissolution, rejected also by the country. After a vote of no confidence (June 10) in the new parliament Derby at once resigned.

He now devoted much of the leisure the position afforded him to congenial classical studies. It was his reputation for scholarship as well as his social position that had led in 1852 to his appointment to the chancellorship of the university of Oxford, in succession to the duke of Wellington. His Translations of Poems *Ancient* and Modern (1862) was privately printed. Its reception by those to whom it was circulated encouraged him to proceed with his magnum opus, the translation of the whole of the Iliad, which appeared in 1864.

During the seven years that elapsed between Lord Derby's second and third administrations the terrible industrial crisis in Lancashire caused by the stoppage of the cotton supply in consequence of the American Civil War, absorbed much of his time and thought. Derby worked unceasingly for its relief. His personal subscription, munificent though it was, represented the least part of his service. His noble speech at the meeting in Manchester in Dec. 1862, where the movement was initiated, and his advice at the subsequent meetings of the committee, were of the very highest value in stimulating and directing public sympathy. His relations with Lancashire had always been cordial; after the cotton famine period the cordiality passed into a warmer and deeper feeling among the factory operatives.

On the rejection of Russell's Reform Bill in 1866, Derby formed his third cabinet. It was destined to be short-lived, but lasted long enough to settle on a permanent basis the question that had proved fatal to its predecessor. The passing of the Reform Bill was the main business of the session 1867. The chief debates were, of course, in the Commons, and Derby's failing powers prevented him from taking any large share in those which took place in the Lords. His description of the measure as a "leap in the dark" was eagerly caught up, because it exactly represented the common opinion at the time,—the most experienced statesmen, while they admitted the granting of household suffrage to be a political necessity, being utterly unable to foresee its effect on the constitution and government of the country.

Declining health compelled Derby to resign office in Feb. 1868. He yielded the entire leadership of the party as well as the premiership to Disraeli. His subsequent appearances in public were few and unimportant. His last speech in the House of Lords, denunciation of Gladstone's Irish Church Bill, was marked by much of his early fire and vehemence. A few months later, on Oct. 23, 1869, he died at Knowsley.

Lord Aberdeen was reported by The Times to have said that no one of the giants he had listened to in his youth, Pitt, Fox, Burke or Sheridan, "as a speaker, is to be compared with our own Lord Derby, when Lord Derby is at his best." (G. Saintsbury, Lord Derby, 1906.)

DERBY (dar'bi), a county and parliamentary borough and the county town of Derbyshire, England, 60 mi. S.E. of Manchester on the L.M.S.R. and L.N.E.R. Pop. (1938) 139,000. Area 12.7 sq.mi. Occupying a position almost in the centre of England, the town is situated on the Derwent, at the southern end of the Pennines. It is the centre of an important network of routes since early times and more especially since the Industrial revolution. A little to the N.E. is Littlechester which was the site of a Roman fort or village. Under the heptarchy Derby was known as Northworthig, receiving its present name from Deoraby as it was known to the Danes after the Treaty of Wedmore. It was reconquered by Aethelflaed in 917, and prospered during the 10th century, but much of the land was waste at the time of Domesday. The first charter was granted in 1206 giving it all the privileges which Nottingham had in the time of Henry I and Henry II. The charter provides that no one shall dye cloth within ten leagues of Derby except in the borough. A charter of Henry III in 1260 granted that no Jew should be allowed to live in the town. Edward III granted the petition of the burgesses for two bailiffs, In 1745 the young pretender marched as far south as Derby, where it was decided that he should return to Scotland instead of going on to London.

Among interesting buildings are St. Peter's church, a fine building of Perpendicular date but with earlier portions; St. Alkmund's and St. Andrew's, in the Decorated style; and All Saints' with a beautiful choir screen and good stained glass. The church tower was built 1509–27, and is one of the finest in the midland counties. Derby grammar school was placed in 1159 under the administration of the chapter of Darley abbey. It now occupies St. Helen's house. Derby possesses a municipal technical college, schools of science and art, a public library, museum and art gallery, an agricultural institute, and Liversage's almshouses, a foundation inaugurated by Robert Liversage in 1529. A town planning scheme was adopted in 1929, while under a central improvement plan a covered market, a bus station, police buildings and riverside gardens were constructed. Further improvements to the river were also carried out.

Derby is celebrated for its porcelain. This manufacture was introduced about 1750, and although partially abandoned, it has been revived. The manufacture of silk, hosiery, lace and cotton formerly employed large numbers, and there are still numerous silk mills and elastic webworks. Silk "throwing" or spinning was introduced into England from Piedmont in 1717 by John Lombe, who set up machinery in Derby. In the 19th century the principal centre of the Midland railway was established at Derby. It is still a leading centre under L.M.S. control. Other industries include the manufacture of aircraft, motor cars, especially the Rolls-Royce car, as well as of electrical apparatus, paint, shot, white and red lead and varnish; and there are sawmills and tanneries. The manufacture of hosiery profited greatly by the inventions of Jedediah Strutt about 1750. In Littlechester there are chemical and steam boiler works. Derby was a bishopric suffragan in the diocese of Southwell but in 1927 became a separate bishopric. The parliamentary borough returns two members.

DERBY, a city of New Haven county, Connecticut, U.S.A., 10 mi. W. of New Haven, on the Housatonic river at the mouth of the Naugatuck, just below Ansonia and opposite the borough

of Shelton. The population was 11,238 in 1920 (32% foreign-born white), and was 10,287 in 1940 by the federal census. Derby was settled in 1643 as an Indian trading post called Paugasset, and received its present name in 1675. It was chartered as a city in 1893. In the 18th century it had a thriving commerce with the West Indies. It was the birthplace of David Humphreys (1752–1818), Washington's aide and military secretary from 1780 to the end of the war, first minister of the United States to Portugal (1790–97) and minister to Spain (1797–1802), and one of the "Hartford Wits"; and of Commodore Isaac Hull (1773–1843), commander of the U.S. frigate "Constitution ("Old Ironsides") during the War of 1812.

DERBYSHIRE, a north midland county of England, bounded north and northeast by Yorkshire, east by Nottinghamshire, southeast and south by Leicestershire, south and southwest by Staffordshire, and west and northwest by Cheshire. The area of the geographical county is 1,006 sq.mi. with a population estimated in 1938 at 766,800.

The county may be divided into two sections — the northern upland region culminating in the High Peak, and the southern lowland area around Derby.

The north is made up of Carboniferous limestone, millstone grit and the coal measures, while the lowland south is mainly underlain by red Triassic rocks.

Geology. — The Carboniferous or "Mountain" limestone in the northwest of the county is the oldest formation; its thickness is over 2,000 ft. It is well exposed in the numerous narrow gorges cut by the Derwent and its tributaries and by the Dove on the Staffordshire border.

The limestone uplands are bleak and dry generally with smooth outlines cut by deep ravines. Many of these glens are richly wooded. Volcanic rocks, locally known as "Toadstone" are represented in the limestones by intrusive sills and flows of dolerite and by necks of agglomerate notably near Tideswell, Millersdale and Matlock.

The highest ground in the extreme north of the county is capped by shales and sometimes by the millstone grit. In this region are Bleaklow hill (2,060 ft.), Shelf Moss (2,046 ft.), Kinder Scout (2,088 ft.) and other summits of the Peak itself. A series of black shales with nodular limestones, the Pendleside series rests upon the mountain limestone on the east, south and northwest; much of the upper course of the Derwent has been cut through these soft beds. Main tor (1,700 ft.) is made of these shales. Then follows a thick mass of sandstones, grits and shales — the millstone grit series. On the west side these extend from Blacklow hill to Axe Edge; on the east, from Derwent Edge to near Derby. A patch of millstone grit and limestone occurs in the south of the county about Melbourne and Tickvale.

The coal measures rest upon the millstone grit; the largest area of these rocks lies on the east, where they are coterminous with the coalfields of Yorkshire and Nottingham. A small tract, part of the Leicestershire coalfield, lies in the south of the county, and in the northwest corner a portion of the Lancashire coalfield appears about New Mills and Whaley Bridge. The coal measure country is gently moulded. East of Bolsover the coal measures are covered unconformably by the Permian breccias and magnesian limestone. South of a line through Ashbourne, Quarndon and Stanford, the land is at a much lower level. Flanking the hills between the former towns are red beds of Bunter, sandstone and conglomerate; they also appear at Morley, east of the Derwent, and again round the small southern coalfield. Most of the south part of the county is covered superficially by glacial drift and alluvium of the Trent. Local boulders as well as northern erratics are found in the valley of the Derwent. The bones of Pleistocene mammals — the rhinoceros, mammoth bison, hyaena, etc., have been found at numerous places, often in caves and fissures in the limestones, *e.g.*, at Castleton, Wirksworth and Cresswell. At Doveholes the Pleiocene Mastodon has been reported.

The rivers of the county radiate from the northern hills. Those of the northwest belong to the Mersey and those of the northeast to the Don, but all the others to the middle Trent which forms part of the southern county boundary with Leicestershire. The tributary streams of the Trent, of which the Derwent, Dove and Erewash are the most important, flow from north-north est to south-southeast over the Carboniferous, but turn almost west-northwest to east-southeast on the newer rocks before they enter the middle Trent, flowing roughly east-northeastwards. The Dove flows as the boundary between Derbyshire and Staffordshire for nearly its entire course. The Derwent rising in the High Peak flows southward, almost bisecting the county. The Erewash is the boundary stream between Nottinghamshire and Derbyshire. The Goyt rises a little farther north than the junction of the three counties — Staffordshire, Cheshire and Derbyshire, and flows north-northeastward dividing Derbyshire from Cheshire and finally falls into the Mersey.

Climate. — The winters in the uplands are generally severe, and the rainfall heavy. At Buxton (1,000 ft.) the mean temperature in January is 34.9° F., and in July 57.5"; at Derby, in the southern lowland, the figures are respectively 37.5° and 61.2°; intermediate conditions are found at Belper where the figures are 36.3° and 59.9°.

The contrasts shown by the mean annual rainfall are similarly marked, ranging from 52.03 in. at Woodhead in the north of the county through 35.2 in. at Matlock and 24.35 in. at Derby in the south.

History. — Important traces of the cultures of the late Palaeolithic age in Cresswell crags have been discovered.

The early settlement of Derbyshire was confined almost entirely to the well-drained Carboniferous limestone lands of the Peak. The marked Derbyshire group of Beaker pots indicates an important settlement of the dawn of the age of metals around the Peak district. It is thought that the Beaker folk came from the continent via the east coast, and groups apparently from the East Riding of Yorkshire reached the Derbyshire Peak district; others penetrated from the East Anglian coasts inland over the English plain. There are numerous Megalithic remains in the same area, the stone circle being much in evidence. The largest circles are those of Arbor Low, near Hartington, which retains most of its stones, and the "Bull Ring," at Dove Holes, near Chapel-on-le-Frith. Finds of bronze age weapons and implements are not so numerous as in the neighbouring counties. Many defensible sites, especially in the north of the country, are capped by ancient camps. Main tor, near Castleton, and Carl's Wark, near Hathersage, are good examples. It is impossible to assign a date to these structures as they were probably in use over a great length of time. Structures of this type were important in Romano-British and post-Roman times. The Romans were the first to utilize the lowlands to any great extent. At this period Littlechester, a camp to the northeast of Derby, became a focus of ways, receiving Ryknield street in particular. Aquae (Buxton), Anavio (near Castleton) and Melandra (west of Glossop) were sites in the north of the county.

The post-Roman centuries revived interest in the north until the conquests of the West Angles in the 6th century brought them up the valleys of the Derwent and the Dove.

Later the district formed the northern division of Mercia, and in 848 the Mercian witenagemot assembled at Repton. In the 9th century the district suffered frequently from the ravages of the Danes, who in 874 wintered at Repton and destroyed its famous monastery. Derby under Guthrum was one of the five Danish burghs, but in 918 was recovered by Aethelflaed. In 924 Edward the Elder fortified Bakewell, and in 941–942 Edmund regained Derby from the Danes. Saxon barrows are numerous in Wirksworth hundred and the Bakewell district, among them being White-low near Winster and Bower's-low near Tissington. There are Saxon cemeteries at Stapenhill and Foremark Hall.

Derbyshire probably originated as a shire in the time of Aethelstan, but for long it maintained a close connection with Nottinghamshire, and Domesday gives a list of customs affecting the two counties alike. The two shire-courts sat together for the Domesday inquest, and the counties were under one sheriff until the time of Elizabeth. The villages of Appleby, Oakthorpe, Donisthorpe, Stretton-en-le-Field, Willesley, Chilcote and Measham were reckoned as part of Derbyshire in 1086, although separated from it by the Leicestershire parishes of Over and Nether

Seat. Early divisions of the county were known as wapentakes, five being mentioned in Domesday, while 13th century documents mention seven corresponding with the six present hundreds, except that Repton and Gresley were then reckoned as separate divisions In the 14th century the divisions were described as hundreds, and Wirksworth alone retained the designation wapentake until modern times. Ecclesiastically the county constituted an archdeaconry in the diocese of Lichfield, comprising the six deaneries of Derby, Ashbourne, High Peak, Castillar, Chesterfield and Repington In 1884 it was transferred to the newly formed diocese of Southwell, but in 1927 was created a separate diocese of Derby, which includes the whole county except three parishes in the diocese of Peterborough The assizes for Nottinghamshire and Derbyshire were held at Nottingham until the reign of Henry III, when they were held alternately at Nottingham and Derby until 1566, after which the Derbyshire assizes were held at Derby. The miners of Derbyshire formed an independent community under the jurisdiction of a steward and barmasters, who held two Barmote courts (*q.v.*) every year The forests of Peak and Duffield had their separate courts and officers.

At the time of Domesday Henry de Ferrers owned almost the whole of the modern hundred of Appletree. The Ferrers estates were forfeited by Robert. earl of Derby, in the reign of Henry III. Another Domesday landholder was William Peverel, the founder of Peak castle, whose possessions were known as the honour of Peverel In 1155 the estates were forfeited to the crown. During the reigns of John and Henry III discontent was rife in Derbyshire and attacks were made on the central power. Riots occurred in 1443. In the 17th century the county first supported the king, but by 1643 Sir John Gell of Hopton had secured almost the whole county for the parliament Derby, however, was always royalist and Romanist in sympathy, and in 1745 entertained the young pretender.

Agriculture and Industries. — Slightly over 67% of the total area of 639,120 ac. was devoted to agriculture in 1939, but of this only 16% was arable land. Among the higher altitudes of north Derbyshire, where the soil is poor and the climate harsh, grain is unable to flourish, while even in the more sheltered parts of this region the harvest is usually late. Such districts have heath pasture with sheep farming. Farther south are heavy crops of wheat and oats, while turnips and swedes and green crops are not uncommon. Some barley is cultivated about Repton and Gresley. Wheat (19,321 ac. in 1939) is the most important crop in the county. A large part of the Trent valley is under permanent pasture, being devoted to cattle feeding and dairy farming. The National Trust owned 2,565 ac. in the county in 1942.

Derbyshire has always been mainly a mining and manufacturing county, though the rich land in the south formerly produced large quantities of corn. The lead mines were worked by the Romans, and Domesday mentions lead mines at Wirksworth, Matlock, Bakemell, Ashford and Crich. Iron has also been produced in Derbyshire from an early date, and coal mines were worked at Norton and Xlfreton in the beginning of the 14th century. The woollen industry flourished in the county before the reign of John, when an exclusive privilege of dyeing cloth was conceded to the burgesses of Derby. Thomas Fuller in 1662 mentions lead, malt and ale as the chief products of the county, and the Buxton waters were already famous in his day. The 18th century saw the rise of numerous manufactures. In 1718 Sir Thomas and John Lombe set up an improved silk-throwing machine at Derby, and in 1758 Jedediah Strutt introduced a machine for making stockings. In 1771 Sir Richard Arkwright set up one of his first cotton mills in Cromford, and in 1787 there were 22 cotton mills in the county. The Derby porcelain or china manufactory was started about 1750. The industrial districts, based on the coalfield, are in the east and extreme southwest. Silk, cotton, iron, papermaking, woollens, lace, malting and brewing are important. Derby, Belper and Duffield are the silk centres, while Derby has also its china, lace, braids, cords, chemical and motor (Rolls-Royce) manufactures Belper, Glossop, Ilkeston and Cromford specialize in cotton-spinning and hosiery. The iron smelting focuses on Alfreton, Chesterfield, Derby, Dronfield and Eckington. Lead, gypsum, zinc, iron ore, manganese and barytes are raised to some extent. The county is famous for its limestone and marble quarries, whilr the fluorspar of the limestone caverns is made into ornaments. The warm mineral springs at Buxton, Matlock and Bakewell are well known.

The chief railway serving the county is the L.M.S., which ha.; one of its chief works at Derby, while a branch of the L.N.E. serves Derby and other places in the south. The Trent and Mersey canal crosses the southern part of the county, and there is a branch canal (the Derby) connecting Derby with this and with the Erewash canal, which runs north from the Trent up the Erewash valley. From it there is a little-used branch (the Cromford canal) to Matlock. There were 2,395 mi. of roads in the county in 1942.

Population and Administration. — The area of the administrative county, which contains six hundreds, is 992.9 sq.mi.; pop. (1938) 627,800. Wartime movements had little effect in Derby the population rising only 1% between Sept 1939 and Feb. 1941. Derby is a county borough; the municipal boroughs are Buxton, Chesterfield. Glossop and Ilkeston. The urban districts are Alfreton, Ashbourne, Bakewell, Belper, Bolsover, Clay Cross, Dronfield, Heanor, Long Eaton, Matlock, New Mills, Ripley, Staveley, Swadlincote District, Whaley Bridge and Wirksworth. The county is in the Midland circuit, and assizes are held at Derby. It has one court of quarter sessions and is divided into 15 petty sessional divisions. The boroughs of Derby, Chesterfield and Glossop have separate commissions of the peace, and that of Derby has also a separate court of quarter sessions. The total number of civil parishes is 310. The county returned two members to parliament from 1295 until 1832, after which it returned four members in two divisions until 1868 when six members were returned for three divisions. After 1918 the county returned eight members, one each for the following divisions: Belper, Chesterfield, Clay Cross, High Peak, Ilkeston, Northeastern, Southern and Western, while the county borough of Derby returned two members after 1275.

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DERBYSHIRE NECK: see GOITRE.

DEREHAM, (properly East Dereham), market town and urban district in Norfolk, England, 122 mi. N.N.E. from London. Pop (est. 1938) 5,730. Area, 8.9 sq.mi. The church of St. Nicholas is a cruciform Perpendicular structure with a beautiful central tower and some portions of earlier date. It contains a monument to William Cowper, who came to live here in 1796, and the Congregational chapel stands on the site of the house where the poet spent his last days. Dereham is an important agricultural centre, and has a large Friday market. There is an annual harvest fair in September. The manufactures are agricultural steam engines and threshing machines; there is also a coach works.

DERELICT, in law, property thrown away or abandoned by the owner in such a manner as to indicate that he intends to make no further claim to it. The word is used more particularly with respect to property abandoned at sea (see WRECK). Land gained gradually and slowly from the sea belongs to the owner of the adjoining land by *dereliction,* but in England in the case of sudden or considerable recession, the land belongs to the crown.

DERENBOURG, HARTWIG (1844–1908), French orientalist, son of the following, was born in Paris on June 17, 1844. He studied at Göttingen, Leipzig and at the École des Langues Orientales, Paris. In 1879 he was appointed professor of Arabic

at the École des Hautes Études in Paris. He collaborated with his father in the great edition of Seadiah (1893 etc) and the edition of Abu-'l-Walîd, and also prepared a number of important editions of other Arabic writers and a catalogue of the Arabic mss. in the Escorial (2 vols 1884–93).

DERENBOURG, JOSEPH (1811–1895), Franco-German orientalist, was born at Mainz on Aug. 21, 1811, and settled in Paris in 1839. He was a considerable force in the revival of Jewish education in France. He made great contributions to the knowledge of Seadiah (*q.v.*), and planned a complete edition of Seadiah's works in Arabic and French. Among his numerous works is an *Essai sur l'histoire et la géographie de la Palestine* (Paris, 1867). This was an original contribution to the history of the Jews and Judaism in the time of Christ, and has been much used by later writers on the subject (*e.g.*, Schurer). He became professor of Hebrew and rabbinical theology at the École des Hautes Études, Paris, in 1877. Derenbourg died on July 29, 1895, at Ems.

DERG, LOUGH, a lake of Ireland, on the boundary of the counties Galway, Clare and Tipperary. It is an expansion of the Shannon channel, 23 m. long and from 1 to 3 m. broad. The water appears to be dammed, as the Shannon flowing over the low lying central plain breaks through the narrow gorge between Slieve Bernagh and the Arra mountains. Ruined churches and fortresses are numerous on the eastern shore, and on Iniscaltra island are a round tower and the remains of five churches.

Another LOUGH DERG, near Pettigo in Donegal, is famous as the traditional scene of St. Patrick's purgatory. In the middle ages its pilgrimages had a European reputation, and they are still observed. The hospice, chapels, etc., are on Station island, and there is a ruined monastery on Saints' island.

DE RIDDER, a city of south-western Louisiana, U.S.A., on the watershed between the Sabine and the Calcasieu rivers; the capital of Beauregard parish. It is on Federal highway 171, and is served by the Santa Fe, the Kansas City Southern and the Southern Pacific railways. The population was 3,535 in 1920 (22% negro) and was 3,750 in 1940 by the Federal census. It was founded in 1900 as a pine-milling centre, and with the decline of that industry (about 1920) a study of the agricultural possibilities of the region was made, and the cultivation of satsuma oranges, grapefruit and lemons was introduced. By 1927 there were 400,000 citrus trees growing in the vicinity, of which 25,000 were already bearing full crops. De Ridder was organized as a city in 1912. It has a commission form of government.

D'ERLON, JEAN BAPTISTE DROUET, COUNT (1765–1844), marshal of France, was born at Reims on July 29, 1765. He entered the army as a private soldier in 1782, did good service in the campaigns of the revolutionary wars, and in 1799 attained the rank of general of brigade. He served in Switzerland under Masséna (1799), at Hohenlinden under Moreau (1800), at Jena (1806), and at Friedland (1807). After this last battle he was created count d'Erlon and received a pension. For the next six years d'Erlon was almost continuously engaged as commander of an army corps in the Peninsular War. At the pass of Maya in the Pyrenees he defeated (1814) Lord Hill's troops. After the first Restoration he was named commander of the 16th military division, but was arrested for conspiring with the Orléans party. He escaped, and joined Napoleon on his return from Elba. The emperor made him a peer of France, and gave him command of the I. army corps. In the Waterloo campaign d'Erlon's corps formed part of Ney's command on June 16, but, in consequence of an extraordinary series of misunderstandings, took part neither at Ligny nor at Quatre Bras *(see* WATERLOO CAMPAIGN).

He was in command of the right wing of the French army throughout the great battle of June 18 and fought in the closing operations around Paris. At the second Restoration D'Erlon fled into Germany, only returning to France after the amnesty of 1825. He was reinstated on the accession of Louis Philippe. As commander of the 12th military division (Nantes), he suppressed the legitimist agitation in his district and caused the arrest of the duchess of Berry (1832). He was governor of Algeria from 1834 to 1836. D'Erlon was made marshal of France shortly before his death in Paris on Jan 25, 1844.

DERMAPTERA, an order of insects (*q.v.*), which includes the earwigs (*q.v.*).

DERMATOLOGY: *see* SKIN DISEASES.

DERMOT MAC MURROUGH (d. 1171), Irish king of Leinster, succeeded his father in the principality of the Hui Cinsellaigk (1115) and eventually in the kingship of Leinster. About 1152 we find him engaged in a feud with O Ruairc, the lord of Breifne (Leitrim and Cavan). Dermot abducted the wife of O Ruairc more with the object of injuring his rival than from any love of the lady. The injured husband called to his aid Roderic, the high king (airdrigh) of Connaught; and in 1166 Dermot fled before this powerful coalition to invoke the aid of England. Obtaining from Henry II. a license to enlist allies among the Welsh marchers, Dermot secured the aid of the Clares and Geraldines. To Richard Strongbow, earl of Pembroke and head of the house of Clare, Dermot gave his daughter Eva in marriage; and on his death was succeeded by the earl in Leinster. The historical importance of Dermot lies in the fact that he was the means of introducing the English into Ireland. Through his aid the towns of Waterford, Wexford and Dublin had already become English colonies before the arrival of Henry II. in the island. To the credit of Derrnot Mac Murrough must be put the compilation of the *Book* of *Leinster,* a valuable collection of early Gaelic tradition.

See *The Song of Dermot and the Earl, an old French Poem* (by *M.* Regan?), edit. with trans. by G. H. Orpen (1892); Kate Norgate, *England under the Angevin Kings,* vol. ii.

DERNA, a town on the north coast of Cyrenaica, Africa (anc. *Darnis-Zarine*), 224 m. E. of Bengasi by road (railway as far as El Merg). Population (1938) 21,547. Situated below the eastern butt of Jebel Akhdar on a small but rich deltaic plain, watered by fine perennial springs, it has a growing population and trades in fruits grown in its extensive palm gardens, and in hides and wool brought down by the nomads from the interior. The bay is open from north-west round to south-east and often inaccessible in winter and spring. A portion of the people is of Moorish stock, of Andalusian origin, which emigrated in 1493; the descendants preserve a fine facial type. It was the easternmost city of the Pentapolis of Cyrenaica. There is a lighthouse west of the bay. The names Darnis and Zarine are philologically identical and probably refer to the same place. No traces are left of the ancient town except some rock tombs. Darnis continued to be of some importance in early Muslim times as a station on the Alexandria-Kairouan road, and has served on more than one occasion as a base for Egyptian attacks on Cyrenaica and Tripolitan'a. In 1805 the government of the United States, in dispute with the dey of Tripoli on account of piracies on American shipping, landed a force under William Eaton (*q.v.*) to co-operate in the attack on Derna then being made by Sidi Ahmet, an elder brother of the dey. After 1835 Derna passed under direct Ottoman control, and subsequently served as the point whence the sultan exerted a precarious but increasing control over eastern Cyrenaica and Marmarica. It passed to Italy in 1912. There is a caravan route to Tobruk (115 m.).

DERNBURG, HEINRICH (1829–1907), German legal scholar, was born on March 3, 1829, at Mainz, and died at Berlin on Nov. 23, 1907. He was made professor at Zurich (1854), at Halle (1862), at Berlin (1873) and from 1866 was in the Prussian Upper House. His chief publications are *Die Kompensation* (1854); *Das Pfandrecht* (2 vols., 1860); *Die Institutionen des Cajus* (1869); *Lehrbuch des preuss. Privatrechts* (3 vols., 1871–96); *Pandekton* (3 vols., 1884) and *Das burgerliche Recht des Deutschen Reichs u. Preussens* (5 vols., 1898).

DEROULEDE, PAUL (1846–1914), French author and politician, was born in Paris. His first published verses appeared in the *Revue nationale,* under the pseudonym of Jean Rebel, and in 1869 he produced at the Théâtre Français a one-act drama in verse entitled *Juan Strenner.* On the outbreak of the Franco-Prussian War he enlisted as a private, was wounded and taken prisoner at Sedan, and sent to Breslau, but effected his escape. He then served under Chanzy and Bourbaki, took part in the latter's disastrous retreat to Switzerland, and fought against the Commune in Paris. After attaining the rank of lieutenant, he

was forced by an accident to retire from the army. He published in 1872 a number of patriotic poems *(Chants du soldat)*, which enjoyed unbounded popularity. This was followed in 1875 by another collection, *Nouveaux Chants du soldat*. In 1877 he produced a drama in verse called *L'Hetman,* which derived a passing success from the patriotic fervour of its sentiments. For the exhibition of 1878 he wrote a hymn, *Vive la France,* which was set to music by Gounod. In 1880 his drama in verse, La *Moiibite,* which had been accepted by the Théâtre Français, was forbidden by the censor on religious grounds.

In 1882 M. Déroulède founded the *Ligue des patriotes,* with the object of furthering France's "revanche" against Germany. He was one of the first advocates of a Franco-Russian alliance, and as early as 1883 undertook a journey to Russia for the furtherance of that object. On the rise of General Boulanger, M. Déroulède attempted to use the *Ligue des patriotes,* hitherto *a* non-political organization, to assist his cause, but was deserted by a great part of the league and forced to resign his presidency. Nevertheless he used the section that remained faithful to him with such effect that the Government found it necessary in 1889 to decree its suppression. In the same year he was elected to the chamber as member for Angoulême. He was expelled from the chamber in 1890 for his disorderly interruptions during debate. He did not stand at the elections of 1893, but was re-elected in 1898. After the funeral of President Faure, on Feb. 23, 1899, he endeavoured to persuade Gen. Roget to lead his troops upon the Elysée. For this he was arrested, but on being tried for treason was acquitted (May 31). On Aug. 12 he was again arrested and accused, together with André Buffet, Jules Guérin and others, of conspiracy against the republic. After a long trial before the high court, he was sentenced, on Jan. 4, 1900, to ten years' banishment from France, and retired to San Sebastian. In Nov. 1905, however, the law of amnesty enabled him to return to France. He died near Nice on Jan. 30, 1914.

Besides the works already mentioned, he published *Le Sergent,* in the *Théâtre de campagne* (1880); *De l'éducation nationale* (1882); *Monsieur le Uhlan et les trois couleurs* (1884); *Le Premier grenadier de France; La Tour d'Auvergne* (1886); *Le Livre de la ligue des patriotes* (1887); *Refrains militaires* (1888); *Histoire d'amour* (1890); a pamphlet entitled *Désarmement?* (1891); *Chants du paysan* (1894); *Poésies Militaires* (1896) and *Messire du Guesclin, drame en vers* (1895); *La mort de Hoche. Cinq actes en prose* (1897); *La Plus belle fille du monde, conte dialogué en vers libres* (1898); *1870, Feuilles de route* (1905), a volume of reminiscences.

DERRICK, a type of crane; the name is derived from that of a famous early 17th-century Tybum hangman, and was originally applied as a synonym *(see* CRANES). The derrick of the petroleum industry is a skeleton framework or tower for hoisting or lowering from a fixed point.

DERRING-DO, valour, chivalrous conduct or "desperate courage." The word is a misconstruction of the verbal substantive *dorryng* or *durring,* daring, and the present infinitive of "do." Spenser first adapted *derring-do* as a substantive meaning "manhood and chevalrie," and this use was revived by Scott.

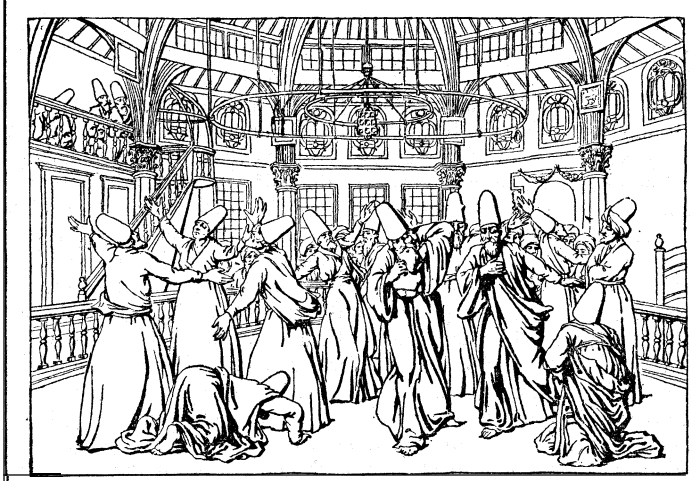
DERRY, a town of Rockingham county, New Hampshire, on Beaver Brook, 10 mi. S E. of Manchester; served by the Boston and Maine railroad. The population was 5.382 in 1920; 1940 it was 5,400. It is a summer resort; ships large quantities of milk to the Boston market; and manufactures shoes. wooden heels, tree labels, plant stakes, tags and witch hazel.

DE RUYTER, MICHAEL ADRIANZOON (1607–1676), Dutch naval officer, was born at Flushing on March 24. 1607. In 1636 he was entrusted by the merchants of Flushing with the command of a cruiser against the French pirates. In 1640 he entered the service of the United Provinces, and. being appointed rear-admiral of a fleet fitted out to assist Portugal against Spain, specially distinguished himself at Cape St. Vincent. Nov. 3, 1641. In the following year he left the service of the United Provinces to command a merchant vessel. In 1652 a squadron of seventy vessels was despatched against the English, under the command of Admiral Tromp. De Ruyter, who accompanied the admiral in this expedition. seconded him with great skill and bravery in the three battles which were fought with the English off Plymouth, the Kentish Knock, and Dungeness. He was afterwards stationed in the Mediterranean, where he captured several Turkish vessels. In 1659 he received a commission to join the king of Denmark in his war with the Swedes. As a reward for his services, the king of Denmark ennobled him and gave him a pension. In 1661 he grounded a vessel belonging to Tunis, released forty Christian slaves, made a treaty with the Tunisians, and reduced the Algerine corsairs to submission. He recaptured English settlements on the west coast of Africa but was repulsed at Barkad and failed to recover New Amsterdam. He returned to take command of a large fleet which had been organized against England, and in May of the following year, after a long contest off the North Foreland, he compelled the English to take refuge in the Thames and burnt the "King Charles" and other warships in the Medway. On June 7, 1672, he fought a drawn battle with the combined fleets of England and France, in Southwold bay, and convoyed saiely a fleet of merchantmen. In 1676 he assisted Spain against France in the Mediterranean, and, receiving a mortal wound in the battle on April 22, off Messina, died on the 29th at Syracuse. His body was carried to Amsterdam, where a magnificent monument to his memory was erected by command of the States-General. *(See* also DUTCH WARS.)

See Life of De Ruyter by Brandt (Amsterdam, 1687), and by Klopp (2nd ed., Hanover, 1858).

DERVISH, a Persian word, meaning "beggar"; generally in Islam a member of a religious fraternity, whether mendicant or not; but in Turkey and Persia more exactly a wandering, begging religious, called, in Arabic-speaking countries, a *faqir.* With important differences, the dervish fraternities may be compared to the regular religious orders of Roman Christendom, while the Ulama (*q.v.*) are, also with important differences, like the secular clergy. For the origin and history of the mystical life in Islam, which led to the growth of the order of dervishes *see* ṢŪFI'ISM; here an account is given of (1) the dervish fraternities, and (2) the Siifi hierarchy.

1. The Dervish Fraternities.— In the earlier times, the relation between devotees was that of master and pupil. Those inclined to the spiritual life gathered round the revered shaykh (*murshid,* "guide," *ustādh, pīr,* "teacher"), lived with him, shared his religious practices and were instructed by him. In time of war against the unbelievers, they might accompany him to the threatened frontier, and fight under his eye. Thus *murābit,* "one who pickets his horse on a hostile frontier," has become the *marabout* (*q.v.*) or dervish of Algeria; and *ribāt,* "a frontier fort," has come to mean a monastery. The relation, also, might be for a time only. The pupil might at any time return to the world, when his reli-



GROUP OF DANCING DERVISHES TAKING PART IN THE ZIKR CEREMONY
The zikr is the main devotional exercise of all orders of dervishes. Among the Mawlawis or "Dancing Dervishes," it consists of a monotonous chant accompanied with a slow whirling movement around the floor, with eyes closed and arms extended. The ceremony continues until the participants fall into a cataleptic state

gious education and training were complete. Continuous corporations began to be formed in the 12th century. Many existing orders trace their origin to saints of the 3rd, 2nd and even 1st Muslim centuries, *e.g.*, to either 'Ali or Abii Bakr, and in Egypt all are under the rule of a direct descendant of the latter, but such ascription is purely legendary.

Of these orders, 32 are commonly reckoned, but many have vanished or have been suppressed, and there are sub-orders innumerable. Each has a "rule" dating back to its founder, and a ritual which the members perform when they meet together in their convent (*khānqāh, zāwiya,* takiya). This may consist simply in the repetition of sacred phrases, or it may be an elaborate performance, such as the whirlings of the dancing dervishes, the Mawlawīs, an order founded by Jalāl ud-Din ar-Riimi, the most broad-minded and tolerant of all. There are also the performances of the Rifā'īs or "howling dervishes." In ecstasy they cut themselves with knives, eat live coals and glass, handle red-hot iron and devour serpents. They profess miraculous healing powers, and the head of the Sa'dis, a sub-order, used, in Cairo, to ride over the bodies of his dervishes without hurting them, the so-called Dōseh (dausa). Another division is made by their attitude to the law of Islam. Some neglect in general the ceremonial and ritual law, to such an extent that in Persia, India and Turkey dervish orders are classified as *bā-shar'*, "with law," and *bī-shar'*, "without law." The latter are really antinomians, and the best example of them is the Baktāshī order, widely spread and influential in Turkey and Albania and connected by legend with the origin of the Janissarics. The Sanūsī was the last order to appear, and is distinguished from the others by a severely puritanic and reforming attitude and strict orthodoxy, without any admixture of mystical slackness in faith or conduct. Each order is distinguished by a peculiar garb. Candidates for admission have to pass through a noviciate, more or less lengthy. First comes the *'ahd,* or initial covenant, in which the neophyte or *murīd,* "seeker," repents of his past sins and takes the shaykh of the order he enters as his guide (murskid) for the future. He then enters upon a course of instruction and discipline, called a "path" (*tarīqa*), on which he advances through diverse "stations" (*maqāmāt*) or "passes" ('aqabdt) of the spiritual life. The Mawlawīs have the most severe noviciate. Their aspirant has to labour as a lay servitor of the lowest rank for 1,001 days before he can be received. For one day's failure he must begin again from the beginning.

But besides these full members there is an enormous number of lay adherents, like the tertiaries of the Franciscans. Thus, nearly every religious man of the Turkish Muslim world is a lay member of one order or another, under the duty of saying certain prayers daily. Certain trades, too, affect certain orders. Most of the Egyptian Qādirīs, for example, are fishermen and, on festival days, carry as banners nets of various colours. On this side, the orders bear a striking resemblance to lodges of Freemasons and other friendly societies, and points of direct contact have even been alleged between the more pantheistic and antinomian orders, such as the Baktāshī, and European Freemasonry. They are the only ecclesiastical organization that Islam has ever known, but it is a multiform organization, unclassified internally or externally. They differ thus from the Roman monastic orders, in that they are independent and self-developing, each going its own way in faith and practice, limited only by the universal conscience (*ijmā,* "agreement": see ISLAMIC LAW) of Islam.

2. Saints and the **Sūfī** Hierarchy.— That an elaborate doctrine of wonder-working saints should have grown up in Islam may, at first sight, appear an extreme paradox. It, can, however, be conditioned and explained. First, Muhammad left undoubted loop-holes for a minor inspiration, legitimate and illegitimate. Secondly, the Siifis, under various foreigh influences, developed these to the fullest. Thirdly, just as the Christian church has absorbed much of the mythology of the supposed exterminated heathen religions into its cult of local saints, so Islam, to an even higher degree, has been overlaid and almost buried by the superstitions of the peoples to which it has gone. Their religious and legal customs have completely overcome the direct commands of the Qur'ān, the traditions from Muhammad and even the "Agreement" of the rest of the Muslim world (see ISLAMIC LAW). The worship of saints, therefore, has appeared everywhere in Islam, with an absolute belief in their miracles and in the value of their intercession, living or dead.

Further, there appeared very early in Islam a belief that there was always in existence some individual in direct intercourse with God and having the right and duty of teaching and ruling all mankind. This individual might be visible or invisible; his right to rule continued. This is the basis of the Ismā'īlī and Shi'i positions (see the article ISLAMIC INSTITUTIONS). The Siifis applied this idea of divine right to the doctrine of saints, and developed it into the Siifi hierarchy. This is a single, great, invisible organization, forming a saintly board of administration, by which the invisible government of the world is supposed to be carried on. Its head is called the *Quṭb* (Axis); he is presumably the greatest saint of the time, is chosen by God for the office and given greater miraculous powers and rights of intercession than any other saint enjoys. He wanders through the world, often invisible and always unknown, performing the duties of his office. Under him there is an elaborate organization of walis, of different ranks and powers, according to their sanctity and faith. The term wali is applied to a saint because of Kor. x. 63, "Ho! the walis of God; there is no fear upon them, nor do they grieve," where wali means "one who is near," friend or favourite.

In the fraternities, then, all are dervishes, cloistered or lay; those whose faith is so great that God has given them miraculous powers—and there are many—are walis; begging friars are fakirs. All forms of life—solitary, monastic, secular, celibate, married, wandering, stationary, ascetic, free—are open. Their theology is some form of Siifi'ism.

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DERWENT, the name of several English rivers (Celtic *Dwrgent,* clear water). (1) The Yorkshire Derwent drains North Yorkshire moors, rising in their eastern part. A southern headstream, however, rises in the Yorkshire wolds near Filey, about a mile from the North Sea, but it flows inland owing to a coast morainic deposit. The early course of the Derwent lies through the flat open vale of Pickering between the Yorkshire moors and the Yorkshire wolds, the upper part of which is known as the Carrs, when the river follows an artificial drainage cut. It receives many tributaries from the moors, then breaches the low hills below Malton, and reaches the central plain of Yorkshire. Its direction, hitherto westerly, now becomes southerly, roughly parallel to the Ouse, which it joins near Barmby-on-the-Marsh, after a course, of about 70 m. As a tributary of the Ouse it is included in the Humber basin. It is tidal up to Sutton-upon-Derwent, 15 m. from the junction with the Ouse, and is locked up to Malton, but the navigation is little used. A canal leads east from the tidal water to the market town of Pocklington.

(2) The Derbyshire Derwent rises in Bleaklow hill north of the Peak and traverses a narrow dale, which, with the tributaries, the Noe, watering Hope valley, and the Wye, is famous for its beauty (see DERBYSHIRE). The Derwent flows south past Chatsworth, Matlock and Belper and then, passing Derby, debouches upon a low plain, and turns south-eastward, to join the Trent, after flowing 60 in, near Sawley. It falls in all some 1,700 ft. (from Matlock 200 ft), and no part is navigable, save certain reaches at Matlock and elsewhere for pleasure boats.

(3) The Cumberland Derwent rises below Great End in the Lake District, draining Spinkling and Sty Head tarns, and flows through Borrowdale, receiving a tributary from Lang Strath. It then drains the lakes of Derwentwater and Bassenthwaite, after

which its course, hitherto northerly becomes westerly past Cockermouth to the Irish Sea at Workington. The length is about 34 m., and the fall about 2,000 ft. (from Derwentwater 244 ft.); the waters are beautifully clear, and the river is not navigable. At a former period Derwentwater and Bassenthwaite formed one lake, but they have been separated by lacustrine deltas at the mouths of the river Greta, which now joins the Derwent immediately below Derwentwater, and the Newlands Beck, which enters Bassenthwaite.

(4) A river Derwent rises in the Pennines near the borders of Northumberland and Durham, and forming a large part of the boundary between these counties, takes a north-easterly course of 30 m. to the Tyne, which it joins 3 m. above Newcastle.

DERWENT, the principal river of Tasmania, with a length of 130 miles. It rises in Lake St. Clair and flows south-west, entering Storm bay at Hobart by an estuary four miles wide. See TASMANIA.

DERWENTWATER, EARL OF, an English title borne by the family of Radclyffe or Radcliffe from 1688 to 1716, when the 3rd earl was attainted and beheaded, and claimed by his descendants, adherents of the exiled house of Stuart, from that date until the death of the last male heir in 1814. Sir Francis Radclyffe, 3rd baronet (1625–1697), was the lineal descendant of Sir Nicholas Radclyffe, who acquired the extensive Derwentwater estates in 1417 through his marriage with the heiress of John de Derwentwater, and of Sir Francis Radclyffe, who was made a baronet in 1619. In 1688 Sir Francis was created Viscount Radclyffe and earl of Derwentwater by James II., and dying in 1697 was succeeded as 2nd earl by his eldest son Edward (1655–1705), who had married Lady Mary Tudor (d. 1726), a natural daughter of Charles II. The 2nd earl died in 1705, and was succeeded by his eldest son James (1689–1716), who was born in London on June 28, 1689, and was brought up at the court of the Stuarts in France as companion to Prince James Edward, the old Pretender. In 1710 he came to reside on his English estates. Joining the Stuart rising of 1715, Derwentwater escaped arrest owing to the devotion of his tenantry, and in October, with about 70 followers, he joined Thomas Forster at Green-rig. When the rebels capitulated at Preston he was conveyed to London and impeached. Pleading guilty at his trial he was attainted, and was beheaded on Tower hill on Feb. 24, 1716, declaring on the scaffold his devotion to the Roman Catholic religion and to King James III.

On the death of the 3rd earl's son, John Radclyffe, in 1731 his uncle Charles (1693–1746), son of the 2nd earl, took the title of earl of Derwentwater. Charles Radclyffe had fought at Preston and was condemned to death for high treason; but, more fortunate than James, he escaped from prison and went to live in Rome. He was captured by an English ship in Nov. 1745 whilst proceeding to join Charles Edward, the young Pretender, in Scotland. He was beheaded on Dec. 8, 1746. His eldest son, James Bartholomew (1725–1786), who had shared his father's imprisonment, then claimed the title of earl of Derwentwater, and on his mother's death in 1755 became 3rd earl of Newburgh. His only son and successor, Anthony James (1757–1814), died without issue in 1814, when the title became extinct de facto as well as de jure. The present representative of the Radclyffe family is Lord Petre, and in 1874 the bodies of the first three earls of Derwentwater were reburied in the family vault of the Petres at Thorndon, Essex.

See R. Patten, *History of the Late Rebellion* (London, 1717); W. S. Gibson, *Dilston Hall, or Memoirs of James Radcliffe, earl of Derwentwater* (London, 1848–1850); G. E. C(okayne), *Complete Peerage* (Exeter, 1887–1898); and *Dictionary of National Biography*, vol. xlvii. (London, 1896).

DERWENTWATER, a lake of Cumberland, England, in the Lake District (*q.v.*). It is approximately oval in shape, about 3 m. long and from $\frac{1}{2}$ m. to $1\frac{1}{4}$ m. wide. The greatest depth is 70 feet. The lake is seen at one view, within an amphitheatre of mountains of varied outline, overlooked by others of greater height. Several elevations near the lake are famous view-points, *e.g.*, Castle Head. Walla Crag, Ladder Brow and Cat Bells. The shores are well wooded, and the lake is studded with several islands, of which Lord's Island, Derwent Isle and St. Herbert's are the principal. Lord's Island was the residence of the earls of Derwentwater. St. Herbert's Isle is so called because here lived St. Herbert, mentioned by Bede, in the 7th century. Derwent Isle (6 acres) contains a handsome residence surrounded by lawns, gardens and timber of large growth. The Falls of Lodore, at the upper end of the lake, consist of a series of cascades in the small Watendlath beck, which falls over crags from a height of nearly 200 feet. The "Floating Island" appears at intervals on the upper portion of the lake near the mouth of the beck, and is formed by the accumulation of decayed vegetable matter floating on the water. The river Derwent (*q.v.*) enters the lake from the south and leaves it on the north, draining it through Bassenthwaite lake, which is separated from Derwentwater by a lacustrine delta, to the Irish Sea. To the north-east of the lake lies the town of Keswick.

DERZHÁVIN, GAVRILA ROMÁNOVICH (1743–1816), Russian poet, was born at Kazán on July 14, 1743. He entered the army in 1762, was governor of Olónet (1784), Tambov (1785), and then secretary for petitions under Catherine II. to whom many of his odes are addressed. Under Alexander I. he was for a short time minister of justice, but in 1803 he retired to his estate at Zvanka, in the Novgorod Government, where he spent a serene and gay old age in the pursuit of letters. He died at Zvanka on July 21, 1816. Derzhbvin, says Prince Mirsky "for sheer imaginative power is one of the small number of Russia's greatest poets." His Ode to God (Eng. trans. Sir John Bowring, 1861), was one of his most famous poems and was translated into many European languages.

His works were edited by Grot (7 vols., 1864–73), who also wrote his biography (2 vols., 1880–83). His poems were translated into German by Kotzebue (1793). For translations of several of Derzhávin's poems into English *see* L. Wiener, *Anthology of Russian Literature* (1902) and Sir John Bowring, *Specimens of the Russian Poets* (1821).

DES ADRETS, FRANÇOIS DE BEAUMONT, BARON (*c.* 1512–1587), French Protestant leader, was born in 1512 or 1513 at the château of La Frette (Isère). In 1562, he joined the Huguenots, probably from motives of ambition and personal dislike of the house of Guise, and waged a successful campaign against the Catholics. In June of that year Des Adrets was master of the greater part of Dauphiné. The reprisals he exacted from the Catholics after their massacres of the Huguenots at Orange have left a dark stain upon his name. The garrisons that resisted him were brutally butchered, and at Montbrison, in Forez, he forced 18 prisoners to precipitate themselves from the top of the keep. Having alienated the Huguenots by his pride and violence, he entered into communication with the Catholics and declared himself openly in favour of conciliation. On Jan. 10, 1563, he was arrested on suspicion by some Huguenot officers and confined for a time in the citadel of Nimes. He died, a Catholic, on Feb. 2, 1587.

See J. Roman, *Documents inédits sur le baron des Adrets* (1878); and memoirs and histories of the time. *See* also Guy Allard, *Vie de François de Beaumont* (1675); l'abbé J. C. Martin, *Histoire politique et militaire de François de Beaumont* (1803); Eugene and Emile Haag, *La France protestante* (2nd ed., 1877 *seq.*).

DESAIX DE VEYGOUX, LOUIS CHARLES ANTOINE (1768–1800), French general, was born at Saint-Hilaire d'Ayat of noble parentage on Aug. 17, 1768, and was educated for the army. In 1789 he declared for the Revolution, and rose rapidly in the revolutionary army. By 1794 he had attained the rank of general of division. In the campaign of 1795 he commanded Jourdan's right wing, and in Moreau's invasion of Bavaria in 1796 he held an equally important command. In the retreat after the battles of Amberg and Wiirzburg (see FRENCH REVOLUTIONARY WARS) Desaix commanded Moreau's rearguard, and later the fortress of Kehl. He then obtained a mission to Italy, and met Bonaparte. Provisionally appointed commander of the "Army of England," Desaix was soon transferred by Ronaparte to the expeditionary force intended for Egypt. His division bore the brunt of the Mameluke attack at the battle of the Pyramids, and he defeated Murad Bey's army in Upper Egypt. Amongst the fellaheen he acquired the significant appellation of the "Just Sultan." Desaix was one of the small party selected to accompany Bonaparte on his return to France, but the campaign of 1800 was well on its

way to the climax when Desaix was able to report himself for duty in Italy. He was in command of a corps of two infantry divisions when (June 14) he heard the cannon of Marengo on his right. He marched at once towards the sound, meeting Bonaparte's staff officer, who had come to recall him, half way on the route. He arrived with Boudet's division at the moment when the Austrians were victorious all along the line. Exclaiming, "There is yet time to win another battle!" he led his three regiments straight against the enemy's centre. At the moment of victory Desaix was killed by a musket ball. Napoleon erected the monuments to his memory on the Place Dauphine and the Place des Victoires in Paris.

See F. Martha-Beker, Comte de Mons, *Le Général L. C. A. Desaix* (1852).

DESARGUES, GERARD (1593–1662), French mathematician, was born at Lyons. By profession he was an engineer and architect, and was an army officer in the engineering section at the siege of La Rochelle. Between 1626 and 1630 he gave a series of lectures on mathematics at Paris, and influenced Descartes and Pascal. He died at Lyons in 1662. Most of his mathematical work is on geometry, and the theory of involution and transversals is due to him. Desargues' most important writings are *Traitk de la section Perspective* (1636) and *Brouillon Project* (1639). The latter book deals with conics and embodies most of his researches.

DESAUGIERS, MARC ANTOINE MADELEINE (1772–1827), French dramatist and song-writer, son of Marc Antoine Désaugiers, musical composer, was born at Fréjus (Var). At the Revolution he emigrated to St. Domingo, and during the negro revolt he was made prisoner, barely escaping with his life. He took refuge in the United States, where he supported himself by teaching the piano. In 1797 he returned to his native country, and rapidly won fame as a writer of comedies, operas and vaudevilles, produced at the Théâtre des Variétés and the Vaudeville. He also wrote convivial and satirical songs, which, though different in character, can only worthily be compared with those of Béranger. He was at one time president of the *Caveau,* to which he introduced Béranger. In 1815 Désaugiers succeeded Pierre Yves Barré as manager of the Vaudeville. He died in Paris on Aug. 9, 1827.

An edition of Désaugiers' *Chansons et Poésies diverses* appeared in 1827 A new selection with a notice by Alfred de Bougy appeared in 1858. *See* also Sainte-Beuve's *Portraits contemporains,* vol. v.

DESAULT, PIERRE JOSEPH (1744–1795), French anatomist and surgeon, was born at Magny-Vernois (Haute Saône) on Feb. 6, 1744. He served as an apprentice in the military hospital of Belfort, and in 1782 he was appointed surgeon-major to the hospital *De la Charitk,* and in 1788 to the Hôtel Dieu. The clinical school of surgery which he instituted at the Hôtel Dieu attracted great numbers of students, not only from every part of France but also from other countries; and he frequently had an audienct of about 600. He died in Paris on June 1, 1795. Together with François Chopart (1743–95) he published a *Traitk des maladies chirurgicales* (1779), and Bichat published a digest of his surgical doctrines in *Oeuvres chirurgicales de Desault* (1798–99).

DESBOROUGH, JOHN (1608–1680), English soldier and politician, son of James Desborough of Eltisley, Cambs., married in 1636 Eltisley Jane, daughter of Robert Cromwell of Huntingdon, and sister of the future Protector. He fought on the parliamentary side in the Civil War, but avoided all participation in the trial of the king in Jan. 1649, being employed in the settlement of the west of England. He fought at Worcester as major-general and nearly captured Charles II. near Salisbury. During the Commonwealth he held many high offices and was a member of the parliaments of 1653, 1654 and 1656. In spite of his near relationship to the Protector's family, he violently opposed the assumption by Cromwell of the royal title, and after the Protector's death he was, with Fleetwood, the chief instigator and organizer of the hostility of the army towards Richard Cromwell's Administration, and forced him to dissolve his parliament in April 1659. He was chosen a member of the council of State by the restored Rump, but presenting with other officers a seditious petition from the army council, on Oct. 5, was dismissed. On the return of the Rump, Desborough was ordered to quit London. The reign of the new military Government was brief and inglorious, and after the Restoration he escaped to Holland where he engaged in republican intrigues. He was ordered home, in April 1666, on pain of incurring the charge of treason, and was imprisoned in the Tower till Feb. 1667. Desborough's rough person and manners are the constant theme of ridicule in the royalist ballads, and he is caricatured in Butler's *Hudibras* and in the *Parable of the Lion and Fox.*

DESCANT or **DISCANT,** a musical term much employed in earlier centuries, when it had various meanings. Thus it was at one time a term for any kind of polyphony and even for musical composition in general. In a more special sense it signified the addition of one part to another and-was thus the earliest term for counterpoint. In part music it meant the upper part or voice, especially the soprano or melody, while it also signified at a later period an instrumental piece consisting of what would be called nowadays a theme with variations. In modern usage, however, descant means primarily the early art of counterpoint, with its various rules and theories and successive forms, as practised from the 12th century onwards. What was known as the descant clef was the C, or treble, clef, with the sign placed on the lowest line of the staff. *(See* CLEF.)

DESCARTES, RENE (1596–1650), French philosopher and man of science. The name is sometimes given as Des Cartes, and sometimes in the Latinized form, Renatus Cartesius (whence the term *Cartesian).*

LIFE AND WRITINGS

Descartes was born at La Haye, in Touraine, on March 31, 1596. His grandfather, Pierre Descartes, was a doctor in Châtelleraut, in Poitou, who married the daughter of a medical colleague there, named Ferrand, who eventually became rector of the University of Poitiers. Pierre's son, Joachim, was councillor of the parliament of Rennes, and so a member of the lesser nobility. He married Jeanne Brochard, the daughter of a high law-officer of Poitiers. René was their third child. The house in which he was born at La Haye was his mother's property which she had inherited from her mother. She died in May 1597, when René was little more than a year old. About ten years later Joachim Descartes moved to Brittany, where he married a second time. Various members of the Descartes and Brochard families were men of learning, so that the scientific attainments of René Descartes were not really as exceptional as used to be supposed when it was thought that his ancestry was essentially military. The story of his military ancestry must be dismissed as a legend based on a confusion between his medical grandfather and an army officer of the same name.

Physically René Descartes was never robust. But already at an early age he displayed remarkable mental vigour, so that his father was wont to refer to him as his "little philosopher." In 1604, at the age of eight, he was sent to the Jesuit school at La Flhche, in Anjou. The school had only recently been founded and endowed by Henry IV. in the hope of ingratiating himself with the Jesuits, one of whom had tried to assassinate him in 1594. The rector of the school, during the latter part of Descartes' stay there, was Father Charlet, a kinsman of his, who naturally took a special interest in him. The teacher to whose special care he was entrusted was Father Dinet, who subsequently became confessor to Louis XIII. and Louis XIV. When Henry IV. was assassinated in 1610 Descartes was one of the pupils selected to receive the heart of the dead monarch for burial in the church of La Flhche.

The first five years of Descartes' school life were devoted to the then usual school subjects, especially to the classical languages. The last three years were devoted to the study of logic and ethics, mathematics and physics and metaphysics respectively. His health called for some special indulgence, and he was allowed to stay in bed as long as he liked. Then, as afterwards, a considerable part of his work appears to have been done in bed. But he had no difficulties with his studies. He mastered them with ease, distinguishing himself especially in mathematics. Many years afterwards he criticized rather severely the studies he had pursued at school.

But it is difficult to say to what extent, if any, those criticisms express his actual feelings while he was still at school. They were probably after-thoughts. In any case, they were not especially directed against his school, but rather (like Bacon's criticisms in the *Advancenzent of Learning)* against the general state of contemporary studies. Towards his school he always retained a feeling of warm attachment. Later, during his controversies with Bourdin and Voetius, he turned to his former school teacher, Father Dinet, for advice. And throughout his life Descartes showed a special regard for Jesuits. It seems to have been his greatest ambition in after years to get his own philosophy introduced at La Flèche and in other Jesuit colleges. But no details are available about his school life and friends. In later life he had among his intimate friends some former pupils of La Flbche, notably Marin Mersenne, who was about seven years his senior. But there is no evidence of their acquaintance prior to 1622.

Descartes left school in 1612, and appears to have studied from 1613–16 at the university of Poitiers, where he graduated in law in Nov. 1616. His older brother was already a lawyer, but he himself was not attracted by the legal profession, and seems to have been contemplating a military career. So he devoted himself to riding and fencing, and actually wrote an essay on the art of fencing. But next to nothing is known of his doings during 1613–17. In 1618 he left France apparently in search of military experience in Holland. He served as a gentleman volunteer in the army of the stadtholder, Prince Maurice of Nassau, at Breda. Of any real soldiering there is no evidence. His stay at Breda was only remarkable for his chance meeting with a brother mathematician, Isaac Beeckman, rector of the college at Dort. Mathematics was useful for military engineering, so there were a number of mathematicians in the stadtholder's entourage at Breda. In the absence of more urgent business some of them passed the time in propounding problems which they posted on the city walls with a challenge to others to solve them. One day Descartes was trying to get at the gist of such a challenge, which was written in Dutch. He turned to a bystander with the request to translate it for him into French or Latin. It happened to be Beeckman, who did as requested, and jestingly asked the French cadet to solve the problem. Descartes brought him the solution in a couple of days, and the chance acquaintances became friendly. Descartes gave Beeckman a manuscript *Essay on Algebra,* also a *Compendium of Music* (dated Breda, Dec. 31, 1618) which he dedicated to Beeckman. Some of the scant information about Descartes relating to this period consists of entries in the diary of Beeckman, which has fortunately been discovered in recent years.

In April 1619 Descartes left Holland. He had planned an extensive journey from Amsterdam to Copenhagen, and thence via Poland, Hungary and Bohemia to Bavaria. This very roundabout route to Bavaria seemed necessary because of the insecurity of the direct route from Holland to Bavaria owing to military conditions in the intervening area. But there is no evidence that Descartes carried out his plan. What is known is that he was in Frankfurt a.M. that summer, and there witnessed the festivities in connection with the coronation of the emperor Ferdinand. The following autumn and winter he seems to have passed in a village near Ulm on the Danube. Ostensibly he was taking part in the military campaigns which marked the opening of the Thirty Years' War. In reality he seems to have been occupied with problems of mathematics. Ulm was noted for its mathematicians, including Faulhaber (a reputed Rosicrucian) whom Descartes most probably met there. His stay near Ulm was chiefly remarkable for a certain illumination and certain dreams which he experienced there. He appears to have spent much of his time in solitary brooding over the problem of human knowledge. Moods of doubt and darkness assailed him, and he prayed for light. Of all his studies up to that point only one had really satisfied him, namely, mathematics. And he attributed the certainty of mathematics to the character of its method. On Nov. 10, 1619, the thought appears to have flashed upon him suddenly that the mathematical method, or, more precisely, the method of analytical geometry, might be extended to other studies. The thought dominated his mind like a divine revelation. Three dreams followed. In the first he appeared to be lame, and forced by a tempest to seek shelter in a church. In the second dream he heard the sound of thunder, and saw sparks of fire round about him. In the third he opened at random the poem of Ausonius, and his eyes fell on the words *Quid vitae sectabor iter?* (What way of life shall I follow?) The whole experience made such a deep impression on him that he vowed a pilgrimage to our Lady of Loretto. Whatever psychoanalytic interpretation one may put on the whole episode, there is no doubt of its profound effect on Descartes. He saw light. And it was probably at this period of his life that he arrived at his fundamental ideas relating to algebra, geometry and methodology. The years 1620–28 were no doubt devoted mainly to the elaboration and application of these ideas.

In 1620 Descartes visited Austria and Bohemia. He is reported to have served as a volunteer in the army of the duke of Bavaria against the protestant princes, and to have taken part in various battles, including that of the White Mountain, near Prague, which ended in the defeat of the Protestant princes and the downfall of Frederick V., father of the Princess Elizabeth of whom more will be said presently. But there is no reliable evidence for these dubious attempts to surround Descartes' head with a halo of military glory. Most probably he never smelled gunpowder. In April 1622 he was in France again, and stayed partly at Rennes and partly in Paris, until March 1623. He then went to Italy on certain family business. On May 16 (Ascension Day), 1624, he was in Venice and witnessed the symbolic ceremony of "the wedding of the sea" (the Adriatic). From Venice he went on his pilgrimage to our Lady of Loretto. Christmas 1624 saw him in Rome, where, in 1625, he witnessed the celebration of the Roman Catholic "Jubilee" (the Papal remission of the sins of the pilgrims). On his return he passed through Florence, but did not trouble to visit Galileo there. Indeed, in a subsequent letter, Descartes declared with emphasis that he had never learned anything from the writings of Galileo. The Loretto pilgrim could hardly have been expected to show sympathy for a semi-heretic like Galileo.

It appears that about this time Descartes was seriously thinking of settling in Italy, but the heat was too much for him. So he returned to France, passing the next three years partly in the country and partly in Paris. His contact with learned men in Paris stimulated his philosophic and scientific ambitions. Cardinal Bérulle, Mersenne and Mydorge were particularly encouraging to him. For a time he carried on research in optics with the help of Ferrier, a skilled maker of lenses. But the distractions of Paris were not conducive to fruitful work. Descartes consequently decided to move to some quiet place in Holland where he might devote his undivided attention to the problems of philosophy and science. He had seen enough of the bustle of the great world, and he longed for some quiet retreat where he might collect his thoughts and pursue his researches undisturbed by the claims of friends and acquaintances, or by other distractions. He had sold his estate and invested the proceeds to yield a comfortable income. His friends, Picot and Mersenne, undertook to look after his interests in France. So he felt free to settle where he liked.

In the autumn of 1628 Descartes went to Holland. He was in Dordrecht on Oct. 8. Nearly all the remaining years of his life were spent in Holland. He changed his place of residence many times for various reasons. But we know in what places he lived, and when, more or less accurately. It appears that in his choice of a locality he always considered the opportunities they afforded of practising catholicism. His first home in Holland was at Franeker (near Groningen), where he stayed from 1628–30, and it was here that he wrote his *Rules for the Direction of the Mind,* in 1628 or 1629, though it was not published till 1701. It may be recalled that his earliest known compositions, namely, the *Essay on Algebra* and the *Compendium of Music,* were written in Breda in 1618. In fact nearly all the works of Descartes were written in Holland. From 1630–32, and again from 1633–34, he lived in Amsterdam. Amsterdam was the London of that time in many ways. Another Frenchman who lived there in the 17th century described Amsterdam as "the most beautiful city of Europe." And Descartes evidently enjoyed his life there. In one of his letters to Balzac, dated Amsterdam, May 15, 1631, Descartes expressed

his deep satisfaction with his life there, and some of his reasons for it.

"In this great city where I now am," he wrote, "everybody but myself is in business and so engrossed with his profits that I could live here all my life without being noticed by anyone. I take my walk every day amid the Babel of a great thoroughfare with as much freedom and repose as you could find in your garden walks; and I observe the people whom I see just as I should the trees that you find in your forests or the animals that graze there; even the noise of their bustle does not disturb my reveries more than would the murmuring of a stream. When I consider their activities I derive the same pleasure which you have in watching the peasants till your fields, for I see that all their toil helps to adorn the place of my abode, and supplies all my wants. If there be pleasure in seeing the fruit grow in your orchard . . . think you there is not as much in seeing the vessels arrive which bring an abundance of all the produce of the Indies and all that is rare in Europe? What other place could you choose in all the world where all the comforts of life and all the curiosities that can be desired are so easy to find as here? What other country where you can enjoy such perfect liberty, where you can sleep with more security, where there are always armies afoot for our protection, where poisoning, treacheries, calumnies are less known, and where there has survived more of the innocence of our forefathers?"

In 1632 Descartes moved to Deventer. Here apparently he met a certain Hélène who, in 1635, bore him a child, which was christened Francine Descartes, and died at the age of five. It was during his stay in Deventer that Descartes heard of the Inquisition's condemnation of Galilei, in 1633, for supporting the Copernican hypothesis that the earth moves round the sun. Descartes had already written the greater part of a treatise, called The World, in which the Copernican hypothesis had been adopted. He at once abandoned the idea of completing and publishing the book, in the hope of discovering some more orthodox form of Copernicanism. This he eventually discovered in his vortex theory. Part of 1633 and 1634 was spent in Amsterdam. Descartes then moved to Utrecht in order to be near his first disciple, Reneri, who was professor at the university there.

From Utrecht Descartes went to Leyden, where he lived during 1636 and 1637, and again in 1640 and 1641. It was during his first stay here that he published, in 1636, the volume of essays containing the Discourse on Method, the *Dioptric,* Meteors and Geometry; and during his second stay here he published, in 1641, his Meditations on First Philosophy, together with Objections by Arnauld, Gassendi, Hobbes and others, and his Replies to them. From 1637–40 Descartes lived at Santpoort. After his second residence at Leyden he moved, in 1641, to Endgeest, near Leyden, where he remained till 1643. Here, in 1642, he was visited by Sorbikre, the French courtier, traveller and gossip, whose Voyage to England subsequently caused so much annoyance to the Royal Society of London. And we are indebted to Sorbikre for an interesting sketch of Descartes' life and surroundings at Endgeest. This is what he has written. "I was delighted with the civility of this *gentilhomme,* his retreat, and his household. He lived in a small château, beautifully situated, near a great and fine university (Leyden), three leagues from the court, and hardly two hours from the sea. He had a sufficient staff of servants, all well chosen and comely people; a nice garden with an orchard beyond it; and all around there were pastures from which stood out many steeples of various heights, until in the far horizon they appeared as mere points. He could go in a day by canal to Utrecht, Delft, Rotterdam, Dordrecht, Haarlem or Amsterdam. He could spend half his day at The Hague, and return in the evening, making this excursion by the most beautiful road in the world, through meadows and houses of pleasance, then through a great wood bordering this village, which is not inferior to the fairest towns of Europe, and boasted at that time the residence of three courts. That of the prince of Orange was quite military. . . . That of the States-General was composed of deputies from the united provinces and of burgomasters . . . the court of the queen of Bohemia, widow of King Frederick V., the elector-palatine, might be compared to that of the Graces, where all the fashionable world of The Hague went almost daily, to pay their homage to the talent, virtue and beauty of her four princesses, the eldest of whom (Elizabeth) had a fancy for the discourse of M. Descartes."

In the meantime Descartes was having his share of trouble too. His leading ideas were known to various scholars several years before they were published in book-form. Already in 1634 some of his doctrines were taught in the university of Utrecht by Reneri. It was in order to help Reneri in this work that Descartes had removed to Utrecht in 1635. The publication of the Discourse, etc., in 1636 soon involved Descartes in numerous controversies with mathematicians in Belgium, Holland and France, notably with Fermat. And for the rest of his life Descartes was frequently involved in controversies which sometimes embittered him, and which probably had something to do with his decision to go to Stockholm in 1649. Perhaps the most unpleasant of these controversies was that with G. Voetius, a Protestant divine and zealot, and rector of the university of Utrecht. When Reneri died in 1639, the funeral oration delivered by Emilius, lauded the dead scholar's friendship with Descartes, and incidentally Descartes himself. Voetius, a protagonist of ancient philosophy as allied with his theology, became alarmed and took an early opportunity to hint at the atheism of the new philosophy. In 1641 Regius, another Utrecht professor who for a time was an enthusiastic follower of Descartes, openly advocated certain Cartesian theses which so alarmed Voetius that he persuaded the magistrates of Utrecht, as well as the university, to pass judgment in favour of the old philosophy against the new. In 1642 Descartes brought out the second edition of his Meditations, with an introductory Lettre au P. Dinet, containing an attack on Voetius, who was so furious that he not only complained again to the magistrates, but also instigated the publication of a violent attack on Descartes in a pamphlet entitled Admiranda *Methodus* sive *Philosophia* Cartesian~ostensibly written by M. Schoock, who subsequently disowned it. Descartes replied in *Epistola* ad *Celeberrimum* Virum Gisbertum *Voetium* (May 1643). Thereupon the magistrates of Utrecht summoned Descartes to appear before them. Descartes did not appear, but sent them a letter. He was summoned a second time, and judgment was passed against him by default. Thanks to the intervention of influential friends at The Hague, the matter went no farther. The Utrecht magistrates simply decreed, in 1645, that nothing should be published either for or against the new philosophy. Descartes was also attacked by some of the professors at Leyden. And to crown it all he was soon involved also in a quarrel with Regius, whose aggressive advocacy of Cartesianism (as he understood or misunderstood it) had been the chief cause of the trouble with Voetius. The results of this quarrel were a Programma by Regius, and a reply by Descartes, Notae in Programma, in 1647.

However, if Descartes had some enemies in Holland among people like Gisbert Voetius, he also had many friends and admirers, and among these was the Princess Elizabeth to whom Sorbière referred in the passage cited above. As has already been mentioned above, Frederick V., the father of Elizabeth, had met with disaster at the battle of Prague (Nov. 1620). He lost the crowns of Bohemia and of the Palatinate, and was also deprived of his estates in Germany. He sought refuge in Holland, residing with his large family at The Hague, where he maintained a kind of court. His wife was Elizabeth Stuart, the sister of another unfortunate monarch, Charles I. Prince Rupert, who won and lost a great reputation as cavalry officer in the Civil War in England, was their third son. Another son, Charles Louis, was eventually reinstated in the palatinate, and showed his liberality of mind by inviting Spinoza, in 1673, to the chair of philosophy in the university of Heidelberg. Princess Elizabeth seems to have been the most bookish member of the family. She was about 19 when Descartes published his Discourse on Method (1637). She read it with great interest, as also subsequently his *Meditations* (1641), and made his personal acquaintance about 1640. Descartes dedicated to her his Principles of Philosophy, in 1644; and the dedicatory letter which he addressed to her shows what a deep impression she had made on him.

"The greatest advantage (Descartes wrote) I have derived

from my writings is the honour of becoming acquainted with your highness, and of being permitted at times to converse with you, and thus becoming a witness of your rare and estimable qualities; and I am sure that I shall render a service to posterity by holding them up as an example. It would be foolish of me to flatter, or to state what I am not convinced of, on the first page of a book in which I seek to expound the fundamental principles of knowledge. . . . I have met no one who has such a thorough and comprehensive understanding of my writings as you have. Even among the best and most cultivated minds, there are many who find them very obscure; and nearly always those who are familiar with mathematics cannot comprehend metaphysics, while those conversant with metaphysics cannot understand mathematics. The only mind, as far as my experience goes, to which both alike are easy, is yours; and so I am compelled to regard it as incomparable. And what increases my admiration is that it is not an aged man, who has given many years to study, in whom such wide and scientific knowledge is found, but a young princess whose charms resemble the Graces, as the poets describe them, rather than the Muses or the wise Minerva. I see in your highness all those excellences that are requisite to pure and sublime wisdom on the part, not only of the mind, but of the will and character; magnanimity and gentleness are united with a disposition which an unjust fortune with its persistent persecutions has not been able to embitter or discourage. It is this high-minded wisdom that I reverence in you; and I dedicate to it not only this work, because it treats of philosophy or the study of wisdom, but myself and my services." Apparently Descartes met the Princess Elizabeth fairly frequently during the years 1641 till 1643 when they lived near one another; but they do not seem to have met again after Elizabeth left The Hague in that year, though various letters passed between them almost to the time of his death, including one letter in which he condoled with her on the execution of her uncle, Charles I. Elizabeth lived for a time in Berlin, then in Heidelberg with her brother, and eventually she became abbess of the abbey of Herford (in Westphalia), where she died on the 30th anniversary of the death of Descartes (Feb. 11, 1680).

Descartes left Endgeest in 1643, and lived at Egmond-op-den-Hoef till 1644. His next, and last, place of residence in Holland was at Egmond-Binnen, near Alkmaar. Here he wrote his *Treatise on the Passions of the Soul* in 1649.

During the 21 years that Descartes lived in Holland (1628–49) he visited France on only three occasions, namely, in 1644, 1647 and 1648. The last of these visits was in connection with a royal pension, and in the hope of securing a congenial and important post in Paris. But he arrived in Paris at an unpropitious moment. It was on the eve of the civil war (the Fronde). So he hurried back to Holland empty handed.

In the meantime Chanut, the French resident at Stockholm, was trying to interest Christina, the queen of Sweden, in the philosophy of Descartes. Some correspondence followed, and in Feb. 1649, Descartes was invited to Stockholm. After his experience of royal patronage in Paris the year before, Descartes held back. A Swedish admiral was then sent to fetch him. But he hesitated still. Finally, however, he left Holland in Sept. 1649 for the Swedish court. Queen Christina received him in two audiences. He figured in various court functions, which did not appeal to him, and he regretted he had left Holland. Eventually it was arranged that Descartes should visit the queen three times a week at five in the morning in order to instruct her in his philosophy. But the severity of the northern winter and these unusually early hours were too much for Descartes. He became ill on Feb. 1, 1650, and died ten days afterwards.

THE PHILOSOPHY OF DESCARTES

Methodology. — Like Bacon, his older contemporary, and Spinoza, his younger contemporary, Descartes was deeply interested in the problem of method — the determination of the right method for obtaining real knowledge by the natural light of reason. Like numerous thinkers before him Descartes was thoroughly dissatisfied with the method of scholasticism then still in vogue. The scholastic method, on which Descartes had been nurtured at La Flèche, consisted mainly in attempting to solve problems by citing the views of more or less eminent writers or "authorities," instead of dealing with the problems themselves. It called for much book-learning, as well as much ingenuity in reconciling or harmonizing conflicting authorities, but it did not encourage independent research or thought. Now Descartes was not a bookworm by nature, and his early acquired habit of spending much time in bed was also more conducive to thinking than to much reading. Moreover, his genius was essentially mathematical; and in mathematics the question of "authority" did not arise even at his Jesuit school, where it counted in most other studies. Accordingly, we find Descartes engaged in questions of method already at an early stage in his career, and returning to them again and again subsequently. They are dealt with in his unfinished *Rules for the Direction of the Mind* (1628), in his fragmentary dialogue *The Search after Truth* (probably written either in 1628 or in 1641), in his *Discourse on the Method of Rightly Conducting the Reason* (published in 1637), in his *Meditations on First Philosophy* (published in 1641), and in *The Principles of Philosophy* (published in 1644).

In his autobiographical *Discourse*, Descartes relates how his dissatisfaction with book-learning came upon him. "I have been nourished on letters since my childhood, and since I was given to believe that by their means a clear and certain knowledge could be obtained of all that is useful in life, I had an extreme desire to acquire instruction. But so soon as I had achieved the entire course of study, at the close of which one is usually received into the ranks of the learned, I entirely changed my opinion. For I found myself embarrassed with so many doubts and errors that it seemed to me that the effort to instruct myself had no effect other than the increasing discovery of my own ignorance. And yet I was studying at one of the most celebrated schools in Europe. . . . I learned there all that others learned . . . and I did not feel that I was esteemed inferior to my fellow-students. . . . And this made me take the liberty of judging all others by myself and of coming to the conclusion that there was no learning in the world such as I was formerly led to believe it to be." And in his *Rules* he promptly demands that the investigation of any problem should not be dominated by what others have thought about, but by what we ourselves can see clearly or infer with certainty. "For" (he explains) "we shall not, for instance, become mathematicians, even if we know by heart all the proofs that others have elaborated, unless we have an intellectual talent that fits us to resolve difficulties of that kind. Neither, though we have mastered all the arguments of Plato and Aristotle, if we have not the capacity for forming a solid judgment on these matters, shall we become philosophers."

The one study which gave him real satisfaction was mathematics, "because of the certainty of its demonstrations and the evidence of its reasoning." He felt that there must be something about mathematics which made it a model for other studies. And he recalled with some satisfaction that "the earliest pioneers of philosophy in bygone ages refused to admit to the study of wisdom anyone who was not versed in mathematics, evidently believing that this was the easiest and most indispensable mental exercise and preparation for laying hold of other more important sciences." Now Descartes did not exaggerate the importance of mathematics after the manner of Pythagoras, as did even some of the most eminent astronomers of the 16th and 17th centuries. On the contrary, he speaks rather contemptuously of pure mathematics as such, remarking that "there is nothing more futile than to busy one's self with bare numbers and imaginary figures in such a way as to appear to rest content with such trifles." It was only the *method* of mathematics that appealed to him. And gradually the conviction grew on him that the method of mathematics could be extended to other sciences. Reference has already been made above to his experience on Nov. 10, 1619, for which he went on a pilgrimage to our Lady of Loretto. In course of time he formed the idea of "a species of mathematics," or a kind of "universal mathematics," that shall be applicable to all kinds of investigations. What he was thinking of was what may be called a Meth-

odology, or a study of scientific method, calling it a "species of mathematics" simply because "mathematics" literally means science. Methodical procedure in research was regarded by Descartes as of first-rate importance. Random search for knowledge and trust in some chance luck he condemned as at once fruitless and intellectually demoralizing.

Now the method of mathematics consists in beginning with the simplest notions and then proceeding cautiously to deduce inferences from them. Similarly in all scientific investigations one should begin with the simplest and surest notions, and advance logically to more complex truths by a progressive synthesis of the simpler factors; that is, by deduction. Descartes realized, of course, that knowledge is derived from experience as well as from deduction. But, in striking contrast with Bacon (whose *Novum Organum* he praised and commended to those who wished to follow the empirical path), he put more faith in deduction than in experience. Experience begins with very complex objects, and so our inferences from it are frequently fallacious, whereas deduction, according to Descartes, cannot be erroneous if carried out with moderate understanding. "This" (he says) "furnishes us with an evident explanation of the great superiority in certitude of arithmetic and geometry to other sciences. The former alone deal with an object so pure and uncomplicated, that they need make no assumptions at all which experience renders uncertain, but wholly consist in the rational deduction of consequences." The moral he draws is that "in our search for the direct road towards truth, we should busy ourselves with no object about which we cannot attain a certitude equal to that of the demonstrations of arithmetic and geometry."

The first problem of method turns on the starting-point, the simple notions or principles which furnish the material for the subsequent deduction. If the initial premises are false even the soundest deduction cannot lead to knowledge. How then do we come by our simplest notions or principles? "The first principles," says Descartes, "are given by intuition alone." And by *intuition* he means "the undoubting conception of an unclouded and attentive mind, which springs from the light of reason." Such intuitions are not uncommon. "Thus each individual can have intuition of the fact that he exists, and that he thinks; that a triangle is bounded by three lines only; a sphere by a single superficies, and so on. Facts of such a kind are far more numerous than many people think who disdain to direct their attention to such simple matters." Intuition and deduction, then, "are the most certain routes to knowledge." If any complex problem presents itself, the proper course is to analyse it into its simplest elements or notions, enumerate these carefully (this enumeration Descartes calls *induction),* make sure of each of them by intuition, and reason from them by deduction.

In the *Rules* Descartes made no attempt to get behind *intuition* as described, and exemplified above. The *Discourse on Method,* however, is much more sophisticated. It begins with a methodical doubt which is intended to serve as a severe test for whatever may claim to serve as the sure starting-point of knowledge. Everything must be questioned (de *omnibus dubitandurn)* so that we may discover something that is beyond doubt. At first everything seems to succumb to it—traditional beliefs, commonly accepted ideas, the very facts of direct observation may all be but illusions and dreams. Eventually, however, something is discovered that is beyond cavil; namely, doubt itself. He who doubts cannot doubt the reality of his doubting. But what is doubt? It is an act of thinking. And thinking implies a thinker. And so, says Descartes triumphantly, *Cogito, ergo sum*—"I think, therefore, I am." This, then, is an ultimate certainty. But why is it accepted as certain? Because it is so clearly and distinctly realized—it is an ultimate intuition that cannot be denied. This, however, implies that whatever is apprehended as clearly and distinctly is true. In this way Descartes found a philosophical basis for the acceptance of intuitions; and deduction from intuitions must at each step be as clearly and distinctly apprehended as the initial intuitions, though the connection between the final stage of a series of deductions and the initial intuitions may be a matter of memory rather than of immediate apprehension. Among the ultimate intuitions Descartes evidently included the principle of universal causation, otherwise he could never have passed from *Cogito, ergo sum* to the existence of God, and from the existence of God to the reality of things that are clearly and distinctly apprehended. But these questions pertain to his metaphysics.

Metaphysics — Descartes once compared himself to Archimedes. This Greek founder of mechanics had said that if he could only find a fixed point in space to serve as a fulcrum for a suitable lever, he could lift the whole earth. Similarly, Descartes, in his stage of methodical doubt, said that if he could only discover something indubitable he would rear on it a whole system of real science. And, as was explained above, Descartes found the required bedrock in the activity of doubt itself, in thought—*Cogito, ergo sum.* By "thought" he meant not only what is commonly meant by that term (the reflective solution of difficulties), but almost every kind of mental experience. "By the word thought I understand all that of which we are conscious as operating in us. And that is why not only understanding, willing, imagining, but also feeling are here the same thing as thought." But, even if we substitute the term "consciousness" for Descartes' "thought," what exactly is the extent of the knowledge furnished by the certainty that "I think"? It seems to be extremely limited, and to amount to no more than "*I* think" or "I am a thinking (or conscious) being," or "I experience certain mental processes or ideas." It does not warrant the reality of the apparently material objects of our perceptions; it does not prove the reality even of the body of the thinker. For in dreams such experiences occur although admittedly there are no such material objects corresponding to them. And, adds Descartes, "the same thing, perhaps, might occur if *I* had not a body at all." If so, thought might be a purely subjective matter, and throw no light at all on the question of the reality of an external world. There would be little comfort in the certainty that "I think, therefore I am" if the world of which *I* am conscious is but my dream-world, and "I" am but a solitary dreamer. It seems evident that Descartes' line of thought might end in so-called subjective idealism, or even in solipsism. It would be no great exaggeration to say that modern idealism and solipsism are the direct offspring of Descartes' thought. This, no doubt, may be regarded as a measure of his influence on modern philosophy; it may also be regarded as a measure of the mischief which he has wrought. Descartes did not consider sufficiently the claims of our waking consciousness to a direct apprehension of real external objects; his argument about dreams is not convincing, for, after all, it is easy enough to distinguish between dreaming and waking consciousness, and people are sometimes mistaken about what they think that they really think. He was probably betrayed partly by a bias common among mathematicians from the days of Pythagoras and Plato onwards, and partly by the early Christian tendency (under Platonic and Neo-Platonic influence) to belittle the material world. The former was probably the more important influence. Mathematicians as a class are so preoccupied with ideal or mental constructions that they are apt to exaggerate the powers of pure thought. Descartes clearly betrays this tendency already at the very beginning of his *Rules for the Direction of the Mind,* where he speaks of knowledge as though it were a kind of illumination which streams forth from the mind in the same way, without regard to differences in the objects studied. "The sciences," he says, "are identical with human wisdom, which always remains one and the same, however applied to different subjects, and suffers no more differentiation proceeding from them than the light of the sun experiences from the variety of the things which it illumines."

Descartes himself, however, was not a solipsist or even an idealist; his religion and his science saved him from that. He had, therefore, to bridge the gulf between the mere *cogito* and the external world. This he endeavoured to do by making his "I think, therefore I am" an argument for the existence of God, and then making God's being the ground for his belief in the existence of an external world. Descartes offers three proofs for the existence of God, one of them is *a priori,* based on the implication of the very notion of God, the others are *a posteriori* and argue from effect to cause. The *a priori,* or ontological proof, adapted more

or less from St. Anselm, and most in accordance with Descartes' mathematical method, runs as follows: "When the mind considers the diverse conceptions which it has, it discovers the idea of a Being who is omniscient, omnipotent and absolutely perfect, which is far the most important of all; and in this idea it recognizes not merely a possible and contingent existence, as in all the other ideas it has of things which it clearly perceives, but one which is absolutely necessary and eternal. For just as when it perceives that it is necessarily involved in the idea of a triangle that it should have three angles equal to two right angles, it is absolutely persuaded that a triangle really has three angles equal to two right angles, so from the fact it perceives that necessary and eternal existence is comprised in the idea of an absolutely perfect Being, it must clearly conclude that this absolutely perfect Being exists." Of the a posteriori proofs the more important one is the so-called anthropological one based, not on the mere implication of the concept God, but on the existence of the idea in an existing but imperfect mind or minds. Descartes formulates it as follows. "As we find in ourselves the idea of a God, or a supremely perfect Being, we can investigate the cause which produces this idea in us. But considering the immensity of the perfection it possesses, we are constrained to admit that it can only emanate from an all-perfect Being, that is, from God who really exists. For it is not only made manifest by the natural light that nothing cannot be the cause of anything whatever, and that the more perfect cannot proceed from the less perfect as its efficient and total cause, but also that it is impossible for us to have any idea of anything whatever, if there is not within us or outside us an original which actually possesses all the perfections. But as we do not in any way possess all these absolute perfections of which we have the idea, we must conclude that they reside in some other nature different from ours, that is, in God." The other a posteriori argument infers the existence of God from the thinker's own existence, and his continued existence. These imply a Creator who has not only created the thinker, but maintains him in existence. For existence at one moment is itself no reason for existence at a subsequent moment, so that the conservation of whatever exists is really a continued creation.

The combined effect of all these arguments, taken in conjunction with his doctrine of innate ideas, of which the idea of God is one, may have been to give Descartes the conviction that he had in some way a direct intuition of God revealing Himself to Descartes through his innate idea of Him. But Descartes does not make himself clear on this point.

Having proved the existence of God as the supremely perfect Being, Descartes argues in the next place that God would not deceive the thinking beings He has created. So our sense-perceptions cannot be mere illusions, and there must exist an external world of Beings which we apprehend in perception. In this way, whereas his predecessors were wont to prove the existence of God from the existence of the world, Descartes inferred the existence of the world from the existence of God. But now he seems to have proved too much. Undoubtedly there are such experiences as illusions and errors. How shall we distinguish the real from the illusory? Descartes meets the difficulty by reverting to one of the main points in his methodology — we can only be sure of what we apprehend clearly and distinctly. Error is the result of the neglect of this precaution. It arises when our will goes beyond our understanding, as it often does. For our will has no limits, whereas our understanding is severely limited. And judgment, according to Descartes, is a decision of the will.

Clear and distinct apprehension must also be our guide in determining what these external material things essentially are. The sense-qualities, the so-called secondary qualities of things, such as colour, smell, etc., are not clearly and distinctly thinkable. Extension in three dimensions, and motion are the only features of material bodies that are clear and distinct to thought, and so they alone are the real essential features of material things, the so-called secondary qualities being but the subjective experiences of the percipient. In this way Descartes helped to lay the foundations of a mechanical interpretation of physical Nature. On the other hand the essential feature of minds is thought or consciousness. Minds are essentially thinking substances, just as bodies are essentially extended substances. For Descartes, accordingly, Reality consists of God, the perfect Being and Creator, and His Creations, namely, thinking substances, or minds, and extended substances, or bodies. And, prompted by his religious training, Descartes endeavours to set bodies and minds in extreme opposition to one another—whatever mind is, body is not. One result of this is that because mind is active, body is not, and so he conceives of motion, not as a property of bodies, but as something put into them by God. Another result is that there can be no interconnection between body and soul. Lower animals are consequently conceived by Descartes as mere automata, cleverly constructed mechanisms without soul. And the undeniable conjunction and apparent interaction of mind and body in human beings is in the last resort explained by the constant intervention of God.

The philosophy of Descartes has undoubtedly exercised a potent influence on modern thought, and to that extent the usual designation of Descartes as the father of modern philosophy is justified. But the intrinsic merits of his philosophy have been grossly exaggerated; and the exaggeration is itself due to a misinterpretation of Descartes' mentality. Descartes was a dual personality. Two tendencies struggled within him. On the one hand, there was the mathematical genius with a passion for clear and distinct ideas, and for logical deduction. On the other hand, there was the loyal Catholic, genuinely attached to a certain traditional theology. So long as he pursued problems of a purely scientific character, especially problems pertaining to pure or applied mathematics, he was in his element and showed his master mind. But the moment he attacked problems of general philosophic orientation, he was the traditional theologian rather than the revolutionary philosopher. Historians of philosophy have tried to save the philosophic reputation of Descartes by treating his theology as mere camouflage. But that is a mistake. Mersenne had a keen scent for heresy, yet he defended Descartes' orthodoxy; and Mersenne was well informed about Descartes. It is not very unusual even in the 20th century, it was certainly not unusual in the 17th century, for the same person to be a detached scientist when dealing with one set of problems, and a conservative theologian when dealing with another set of problems. And Descartes was of that type. In the same breath with which he asserted that the mind should admit no other methods than intuition and deduction, he also asserted "but this does not prevent us from believing matters that have been divinely revealed as being more certain than our surest knowledge, since belief in these things . . . is an act, not of our intelligence, but of our will." His abandonment of the idea of the earth's motion and his substitution of the vortex theory was probably due to his genuine regard for the authority of the Catholic Church, not to fear. Saumaise, who visited Descartes at Leyden in 1637, reports that he was a Catholic "des plus zélés." His whole orientation was essentially that of popular Christian theology, with its supernatural God, who created souls and bodies. And when he went the length of regarding distinctions between good and evil, between truth and falsehood as depending on the arbitrary decisions of the Divine Will, he really abandoned altogether the realm of rational philosophy for that of a particularly narrow mediaeval theology. Descartes' methodical doubt has misled people into supposing that he was a revolutionary philosopher. But in the history of human thought real "believers" have posed as sceptics almost as often as real sceptics have posed as believers.

DESCARTES' CONTRIBUTIONS TO SCIENCE

From what has already been said above about Descartes' Methodology, one almost expects that his endeavour would be to reduce all science to a kind of applied mathematics. And that is what he really did attempt. "I do not accept or desire," he wrote, "any other principle in physics than in geometry or abstract mathematics, because all the phenomena of nature may be explained by their means." Another way of expressing the same thing is to say that Descartes tried to reduce every science of natural phenomena to a branch of mechanics. But it must be remembered that for Descartes mechanics was essentially kinetics, not dynamics — a

calculus of changes of position, not a calculus of "forces." The progress of the physical sciences during the 17th and 18th centuries was due in large measure to the adoption of a mechanical interpretation of physical phenomena. This method of interpretation was initiated by Galilei and extended by Descartes. Its merits can only be appreciated when one recalls the "substantial forms," "hypostatical principles," "real accidents," and other mystifying conceptions of the pseudo-science which preceded the Cartesian attempt to interpret all natural phenomena by means of clear and distinct mechanical concepts. It was left to a later age to discover the inadequacy of an exclusively mechanical interpretation of natural phenomena. But this must not be allowed to detract from the merits of Descartes in the history of science.

Physics **and** Cosmology. — Descartes, by refusing to attribute to matter any sense-qualities, which are not reducible to clear and distinct ideas, reduced matter to extension in three dimensions. Matter thus coincided for him with space. One consequence of this was that he denied the existence of a vacuum. For the same reason he also rejected the existence of "atoms" in the literal sense of the term, for any minute part of space or extension remains theoretically divisible. But how does this apparently continuous extension come to assume the form of those detached material bodies with which we are familiar? Descartes explains this by reference to motion, which he regards as a separate creation of God, who also conserves its quantity. It is motion that leads us to distinguish separate bodies or parcels of matter. Any part of extension that moves together or simultaneously is regarded as such a body. Since, however, matter is extension and there is no vacuum, the motion of one body must be followed immediately by the motion of certain other bodies, so that the circle of extension may remain complete, without gaps. This idea of a circular motion of matter eventually suggested to him his theory of vortices. "All natural motions" (Descartes explains in Le Monde) "are in some way circular. When a body leaves its place, it enters that of another, and this enters that of yet another, and so on to the final one which occupies at the same instant the place left by the first. There is thus no vacuum between bodies when they move, any more than when they are at rest. To this end it is not at all necessary that all the moving parts should be arranged in a true circle, or be of like size or shape, for inequalities in these respects may be compensated for by other inequalities. We do not commonly observe these circular motions in the air, because we are accustomed to regard the air as an empty place. But if we observe fishes swimming in a basin we see that, if they do not approach too near it, they do not stir the surface, although they pass under it at a great speed. It is clear, therefore, that the water which they push before them does not push indifferently all the water in the basin, but only that which can best serve to complete the circle of their motion and enter the place which they have vacated."

Another consequence of Descartes' identification of matter with extension or space was his insistence on the unity of physical nature, which must be a *universe* because space is one and continuous. Both in his early work The *World* and in his *Principles* of Philosophy, Descartes attempted to give an account of the genesis or formation of the physical world. The account was intended to be purely hypothetical or speculative, not a rival theory to Genesis — just a flight of fancy based on Cartesian principles. "Give me extension and motion," he said in his earlier book, "and I will construct the world." Assuming that God has created a uniform matter (or extension) and endowed it with a fixed quantity of motion, which follows certain laws (namely, the laws of motion formulated by Descartes), how might a world (like the existing world) have come into being "by natural and gradual means"? Descartes answers the question somewhat as follows.

In a world closely packed with matter so that there is no vacuum in it the only kind of motion possible is that described above as circular motion or vortex (whirlpool) motion. Consequently when motion was imparted (by God) to matter, such vortices were set in motion — innumerable more or less circular eddies of material parts of all sorts of shapes, sizes and velocities. The friction set up by this vortex motion of closely packed material bodies results in the mutual rubbing off of their corners. And so we get, to begin with, two main kinds of material particles — the original particles rendered smooth and globular by the friction which rubbed their corners off, and the finer particles composed of the rubbings or filings. These fine particles Descartes calls "first matter"; the larger, globular particles he calls "second matter." There is yet a "third matter," namely, the most massive and heavy of the original particles that suffer no fracture or rubbing off in the vortex motion, and such other original particles as, thanks to their peculiar shapes, combined into larger, stronger combinations that similarly resisted all damage. The first kind of matter, the finest sort, tends towards the centre of each vortex, where it forms self-luminous suns and fixed stars. The second kind of matter, consisting of globular particles, tends to move away from the centre of the vortices in straight lines towards the circumference. It constitutes the transparent heavens, and transmits the light of the radiating stars. The third and grossest kind of matter is that of which the earth, the other planets, and the comets are composed — these are all opaque bodies.

In the Principles Descartes explains the formation of the comets and planets in this way. Sometimes as the smaller particles in a vortex pass through the interstices between the revolving globular particles, they get caught and become twisted and channelled, and when they finally reach the stellar matter at the centre of the vortex they form crusts or "sun-spots" on it. This may cause a diminution in the expansive force of the star, which is then caught up by a neighbouring vortex. If the velocity of the crusted star is greater than that of the encroaching vortex, the star will soon pass out of that vortex into another, and continue to wander from vortex to vortex. It is then known as a comet. But if the crusted star has a velocity equal to that of some part of the encroaching vortex, it will stay there and continue to revolve in that vortex. In that case it is known as a planet. The planets of the solar system are the crusted stars and their several vortices that have been swept up by the vortex of the sun.

The vortex theory enabled Descartes to reconcile Copernican with Biblical doctrine. In The World Descartes had embraced the Copernican theory of the earth's motion round the sun. The condemnation of Galilei, in 1633, made him drop the idea in the Copernican form. But by supposing the earth to be carried in its vortex round the sun, Descartes believed that he left the earth at rest in its vortex, and so satisfied the dogma of a stationary earth, while he also satisfied the Copernican theory inasmuch as he represented the earth's vortex as circling round the sun.

Descartes' Principles contains a detailed account of practically all the natural phenomena that had been investigated up to his time. It contains, of course, many errors. Even his fundamental laws of motion are mostly inaccurate. But it was an amazing attempt to reduce all natural phenomena to one system composed of one ultimate kind of matter and governed by the same laws of motion. One of its incidental results was the explanation of weight without recourse to gravitation. Bodies tend to fall towards the earth, according to Descartes, because the particles of the second kind of matter which move round the earth push those bodies towards the earth, and so give them what we call their weight. The popular conception of gravitation makes more or less an occult power of it. Newton's intention was merely to describe certain tendencies to movement without any attempt to explain them at all. Again, Descartes' rejection of the existence of a vacuum not only undermined the idea of Nature's abhorrence of a vacuum (horror vacui) which was wont to serve as an explanation of the action of water-pumps, but prepared the way to the correct explanation, namely the pressure of the air on the surface of the water. In fact Descartes claimed that he had anticipated Torricelli (the inventor of the barometer) and that, during his visit to Paris in 1647, he had suggested to Pascal the idea of the barometric experiment which the latter carried out on the Puy-de-Dôme on Sept. 19, 1648. Another important consequence of Descartes' rejection of a vacuum was that he was thereby led to give up the old corpuscular or emission theory of light, and to conceive of the transmission of light as a transmission of pressure from the luminous body through the intervening particles of secondary

matter to the sensitive eye. This view prepared the way for the undulatory theory of light which was soon afterwards formulated by Christiaan Huygens, the son of Descartes' friend and correspondent, Constantijn Huygens.

Descartes was deeply interested in optics, devoting to it not only his *Dioptric* (1636), but also parts 3 and 4 of his *Principles* (1644). He compares the transmission of light to the eye with the way in which a blind man feels his way with a stick. The resistances or pressures of the different objects (such as stones, trees, water, etc.) are transmitted along the stick to his hand and thence to his brain, so that he can distinguish them. Similarly no corpuscles actually pass from the visible objects to the eye, only a pressure through the fine particles which constitute the transparent medium. Rays of light are the line along which the pressure is transmitted. When they pass through a transparent medium they are straight, otherwise they are deflected or even stopped just like a moving ball when it encounters some obstruction. If the obstruction is hard, the ball rebounds in another direction; if soft, its movement will be arrested. Similarly, when a ray of light impinges obliquely on certain kinds of surfaces, it is reflected, and its angle of reflection is equal to the angle of incidence. But if the medium allows the ray to pass through with diminished speed, then it is refracted. In the *Dioptric* the law of refraction was published for the first time. Snell had discovered it in 1621, but did not publish it; and Descartes has sometimes been suspected of plagiarism. Most likely, however, Descartes discovered it independently.

Physiology. — The *World,* as originally planned by Descartes, was to have contained an hypothetical account of the development of the universe from chaos to man. Referring to this book, in June 1633, he said: "I shall treat of man to a greater extent than I proposed; I intend to explain the principal functions of his body, and I have already given an account of some of them, such as digestion, the beating of the pulse, the distribution of nutritious matter, the action of the five senses, etc. I have dissected the heads of various animals, in order to ascertain in what memory, imagination, etc., consist." The book was not published as it was then planned; but the results of Descartes' studies in this field are contained in his *L'Homme* (published in 1662), the first text-book on physiology. In accordance with the whole spirit of *The World,* of which the treatise on *Man* was originally meant to be the concluding part, the human body and its functions were treated by Descartes mechanically, like "an earthly machine." In this view he was greatly encouraged by the views of Vesalius (1515–64), the father of modern anatomy and physiology, and by Harvey's demonstration of the mechanical nature of the circulation of the blood (his *Exercitatio* was published in 1628), though Descartes did not entirely agree with Harvey. Descartes explains that blood is formed in the liver from the chyle of the food. This blood flows drop by drop into the right cavity of the heart which is so hot that the blood expands and is exhaled into the lung, whence it passes into the left cavity of the heart, and is thence distributed over the whole body. He describes the valves in the arteries which secure that the blood shall flow only drop by drop. Now of the blood which flows through the direct arteries from the heart to the brain, "the most agitated and vivified parts" are called "animal spirits." They are like "a very subtle air." By dilating the brain they enable it to receive impressions of external objects, and so give rise to sensation, imagination and retentive memory; by flowing from the brain through the nerves into the muscles, they enable the nerves to function as organs of the external senses; and by distending, and so contracting, the muscles, they effect the movements of the limbs. For Descartes the "animal spirits" were just a subtle fluid, the nerves were just tubes through which they flowed in a mechanical way.

He illustrates his strictly mechanical conception of the bodily machine as follows. "You may have seen in the grottoes and fountains which are in our royal gardens that the simple force with which the water moves when issuing from its source is enough to set in motion various machines, and to make various instruments play or utter words, according to the different arrangements of the tubes which convey the water. And so one may well compare the nerves of the machine which I am describing with the tubes of the machines of these fountains, the muscles and tendons with the other engines and springs which move the machines, and the animal spirits, the source of which is the heart and of which the cavities of the brain are the reservoirs, with the water which puts them in motion. Moreover, breathing and similar acts, which are natural and usual to the machine, and which depend on the flow of the spirits, are like the movements of a [water] clock or of a mill which the ordinary flow of water keeps going continually. External objects, which by their presence act on the sense-organs of the machine and so determine it to move in different ways according to the disposition of the parts of the brain, may be compared to strangers who, entering one of the grottoes containing many fountains, themselves cause unwittingly the movements they witness. For on entering they tread on certain tiles or plates which are so arranged that if they approach a bathing Diana they cause her to hide in the rose bushes, and if they try to follow her they cause a Neptune to come towards them threatening them with his trident. Or if they pass in another direction they make a sea-monster spring forward and spout water in their faces, or things of a like kind according to the caprice of the engineers who constructed them.

"In order to understand how the brain can be excited by external objects which affect the organs of sense, so that all the members can be moved in a thousand different ways, imagine that the delicate threads which arise from the inside of the brain and form the marrow of the nerves, are so disposed in all those parts which serve as the organs of any sense that they can be easily set in motion by the objects of the senses, and that whenever they are so set in motion, even ever so little, they pull upon the parts of the brain whence they originate, and so open certain pores on the internal surface of the brain. Through these pores the animal spirits in the ventricles pass into the nerves and then into the muscles which carry out movements like those to which we are incited when our senses are affected in that way. If, *e.g.,* fire comes near the foot, the minute particles of the fire . . . set in motion the skin of the foot, and by thus pulling the delicate thread attached to the skin there, they open the pore against which the thread ends, just as by pulling at one end of a rope one rings a bell at the other end."

In this way Descartes tried to explain physiological phenomena mechanically, and to banish from biology such conceptions as those of "vegetative" and "sensitive" souls, much in the same way as he and Boyle, and others, tried to banish from physics and chemistry such notions as those of "substantial forms," and occult qualities, etc. To this extent he rendered a service to biology in spite of his excessive proneness to follow the high a *priori* road, and to be satisfied with any fancies that seemed "clear and distinct" to him. He may be credited to some extent with the anticipation of the conception of "reflex movements," though these are not interpreted now in his purely mechanical fashion. He may also be regarded as the forerunner of modern "behaviourism," at all events as applied to the lower animals, for he would certainly have condemned a "soul-less" human psychology, as will be seen presently. His view of the lower animals as mere automata rather alarmed some people. But Descartes' main object was to vindicate the superiority of man over animals, even over his own animal body, in virtue of his "rational soul" or mind.

Body and Mind. — In Descartes' philosophy, as already explained, the human mind is "a thinking substance" *toto coelo* different from any "extended substances," including human bodies. Yet a human being seems to be an intimate association of a mind and a body, each influencing the other. How can the "extended substance" or "earthly machine" of the human body come into such intimate relation with unextended "thinking substance"? Descartes' ultimate solution of these, as of all other problems, lies in God, who graciously does all that Descartes thinks ought to be done. But as a more immediate, scientific solution of the problem, Descartes suggests that the mind comes into contact with the body in the conarion "whence it radiates through the rest of the body by means of the animal spirits, nerves and even the blood." The pineal gland "in the middle of the substance of the

brain" is the primary reservoir of animal spirits, the central cavity of the brain being the secondary reservoir. Reverting to the above-mentioned comparison with the mechanical inventions in the royal gardens, Descartes likens the function of the rational soul or mind presiding at the conarion to that of "the fountaineer who has to take his place in the reservoir whence all the different tubes of the machines proceed whenever he wants to start them, to stop them, or to change them in any way." Descartes thought he surmounted the difficulty of explaining the mutual influence of mind and body by supposing, on the one hand, that the conarion requires but a minimum of influence to incline it one way or another, and, on the other hand, that the "animal spirits" are such a subtle kind of air that they are on the verge of ceasing to be material. But according to his own philosophy the material remains material however fine it may be, and so remains entirely alien from the mental or spiritual.

Psychology.—The mind being, according to Descartes, a thinking substance entirely different from, and independent of, extended or material things, it "can work independently of the brain." This, at all events, is true of the most characteristic activities of the rational soul, "for clearly there can be no use of the brain for pure intelligence," says Descartes. Ideas in which pure intelligence expresses itself are innate, not derived from without, but from the rational soul itself. For Descartes, as for Plato, experience can only be the occasion for the recall of such ideas to consciousness. These ideas are not always explicit in our consciousness, rather they are latent in the "thinking substance," but they are not originated by experience, though experience may occasion their explicit recall. Among such innate ideas Descartes includes our "clear and distinct" ideas of God, of the self as a thinking thing, the axioms of mathematics and other so-called "common notions" like those of space, time and motion. Above all, perhaps, he finds the mind expressing itself most fully in acts of will, under which heading he includes all judgments and beliefs, as well as voluntary decisions. But then the mind is conjoined with a body, and they do somehow influence each other through the mediation of the conarion and the animal spirits, as already explained. One result of this is that in addition to the mind's own innate ideas, we have also "adventitious ideas" which come to us through the influence of external bodies, and also "factitious ideas" of merely imaginary objects which the mind puts together out of simpler "adventitious" and "innate" ideas. Descartes is not very clear or consistent in dealing with these problems. The idea of God, *e.g.*, is treated at once as "innate," and also as produced in us by God Himself, and therefore, in a sense, "adventitious." And his treatment of images is rather bewildering. Sometimes he treats images, in contrast with ideas, as something physical, and says: "no corporeal image is received in the mind; pure thinking is carried out without corporeal images; imagination, however, which can only arise in the case of corporeal things, needs an image, which is a truly corporeal thing; to this the mind applies itself, though the image is not received into the mind." At other times, however, he includes images, and even sensations and perceptions, under "thought," and distinguishes them from innate ideas, or pure thoughts, and volitions in so far as "imagination and sensation" need the brain as well as the mind; that is to say, in so far as they express not the pure *activity* of mind, but rather its *passivity*, the effect upon it of physical things, including the body with which it is mated. Hence he calls all such experiences "passions," under which heading he includes not only the feelings and emotions, but also sensation, retention, perception, and all adventitious ideas. The feelings are passions caused by the agitation of the animal spirits, but are not referred to any objects outside the body, whereas sensations are "passions" that are referred to external stimuli. Descartes' account of the emotions anticipates to some extent the James-Lange theory, inasmuch as it gives primary to the physical or physiological processes. Our perception of certain animals, *e.g.*, causes fear and flight immediately without the mediation of reason or volition, which only come into play afterwards. Since, however, the brain is the organ of the passions and also the seat of the rational soul, the passions can be brought under the control of the reason and the will. In fact, Descartes is quite Socratic in his insistence on the competence of right reason to conduce to right feeling and action.

The power which Descartes attributes to reason and will may seem to be little in harmony with his naturalistic, mechanical account of such large tracts of human experience. But, as already remarked, his great aim was really to vindicate the supremacy of the human mind or spirit. There was a marked tendency in his day, and long before him, to efface the sharp distinction between man and the lower animals by crediting the lower animals with human powers, including intelligence, which they were sometimes said to use more humanly than man. This tendency was mainly supported by the results of comparative anatomy, which showed essential similarity between the structures of human and animal bodies, including the central nervous system. Descartes tried to save the situation by regarding even the human body as a machine, and treating mechanically all such human experiences as might conceivably also be credited to lower animals, but claiming unique privileges for the rational soul, which he regarded as the *differentia* of man, and as absolutely independent of all that is material.

Mathematics.—Descartes has been described as the first modern mathematician. He was certainly one of the pioneers of modern mathematics. His only treatise on mathematics is the *Geometry* (1637) in which he laid the foundations of analytical or algebraic geometry. Descartes was not the first to apply algebra to geometry, or to conceive a line as generated by a moving point, or to solve geometrical problems by regarding them as solved and analysing the result ("analytic geometry" in the older sense). These things were already known to ancient and mediaeval mathematicians. But he applied these methods much more systematically and fruitfully.

He knew that a point in a plane can be fully determined if we know its distances from two given straight lines in the same plane (allowing for the sign-conventions relating to their different sides, and taking not perpendicular distances but distances parallel to given lines). If the distances be represented by x and y respectively, we can get an equation of the form $f(x,y)=o$. And although such an equation is indeterminate in the sense thst it can be satisfied by an infinite number of sets of values of x and y, yet these values determine the co-ordinates of a series of points which form a curve such that the equation in question is true of every point on it. He realized, moreover, that the properties of a curve can be ascertained by choosing as a definition any specific geometrical property, and expressing it as an equation by means of the co-ordinates of any point on the curve. Such an equation contains by implication all the properties of that curve. And any such property can be deduced from the equation by purely algebraic processes, and without direct reference to the geometry of the curve.

Descartes was the first to attempt a systematic classification of curves. First, he distinguished between "geometric" and "mechanical" curves, according as they could or could not be precisely expressed in equations. (These terms were subsequently displaced by Newton's terms "algebraic" and "transcendental.") Confining himself to "geometric" curves, Descartes classifies these into a series of classes of increasing complexity as follows. Class I. consists of curves (the circle, the parabola, the hyperbola and the ellipse) whose equations contain no term of higher degree than the multiple of two unknown quantities or the square of one. Class II. includes any curve whose equation contains one or more terms of the third or fourth degree in one or both of the two unknown quantities. Class III. contains curves whose equations include a term of the fifth or sixth degree in either or both of the unknown quantities, and so on. The curves are paired in each class in the way indicated because there are methods of reducing a curve of the fourth to one of the third degree, a curve of the sixth to one of the fifth degree, and so on. The straight line he regarded as an exceptional case of a curve of the second degree (Class I.).

In algebra Descartes' systematic application of it to geometrical measurement involved important consequences. It involved the geometric interpretation of negative quantities. It also led to the idea of continuity, which in its turn led to the theory of function

and to the theory of limits. Descartes, moreover, made important contributions to the theory of equations, to which the third and last book of his *Geometry* is devoted, and to which he appears to have been led by his (successful) efforts to solve the problems of doubling the cube and of trisecting an angle. It is also worth noting that we are indebted to Descartes for the convention of using the first letters of the alphabet to represent known quantities, and the last letters for unknown quantities. He also introduced our system of indices (although he frequently used xx instead of x^2). On the other hand, he used the sign ∞ instead of $=$ which Recorde had already introduced with its present meaning.

Descartes' general rule for solving equations is this. Write the equation in the zero form, and try to factorize the L.H.S. so as to reduce the equation to two or more equations of lower degree. If this is impossible, higher methods must be used. If the equation is of the third or fourth degree, the solution depends on the intersection of a circle with a conic. To solve equations of still higher degree, Descartes proposes the use of intersections of circles with the successive classes of geometric curves—conics being used to generate curves of Class II. and these again to generate curves of Class III., and so on. He thought that equations of any order could be solved in this way; but he was mistaken.

What is still known as *Descartes' Rule of Signs* is to the effect that an equation can have no more "true" (*i.e.*, positive) roots than its coefficients have changes of sign from + to −, and no more "false" (*i.e.*, negative) roots than the number of times two plus or two minus signs occur in succession.

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(A. Wo.)

DESCHAMPS, ÉMILE (1791–1871), French poet and man of letters, was born at Bourges. In 1818 he collaborated with Henri de Latouche in two verse comedies, *Selmours de Florian* and *Le Tour de faveur.* He and his brother were among the most enthusiastic disciples of the *cénacle* gathered round Victor Hugo, and in July 1823 Emile founded with his master the *Muse française,* which during the year of its existence was the special organ of the romantic party. His *Études françaises et étrangères* (1828) were preceded by a preface which may be regarded as one of the manifestos of the romanticists. The versions of Shakespeare's *Romeo and Juliet* (1839) and *Macbeth* (1844), important as they were in the history of the romantic movement, were never staged. He was the author of several libretti, among which may be mentioned the *Roméo et Juliette* of Berlioz. His works include two volumes of stories, *Contes physiologiques* (1854) and *Réalités fantastiques* (1854). He died at Versailles on April 23, 1871. His *Oeuvres complètes* were published in 1872–74 (6 vols).

His brother, Antoine François Marie, known as ANTONY DESCHAMPS, was born in Paris on March 12, 1800, and died at Passy on Oct. 29, 1869. Like his brother, he was an ardent romanticist, but his production was limited by a nervous disorder, which has left its mark on his melancholy work. He translated the *Divina Commedia* in 1829, and his poems, *Dernières Paroles* and *Résignation,* were republished with his brother's in 1841.

DESCHAMPS, EUSTACHE, called **MOREL** (1346?–1406?), French poet, was born at Vertus, Champagne. He studied at Reims, where he is said to have received some lessons in the art of versification from Guillaume de Machault, who is stated to have been his uncle. From Reims he proceeded *c.* 1360 to the University of Orleans to study law and the seven liberal arts. He entered the king's service as royal messenger *c.* 1367, and was sent on missions to Bohemia, Hungary and Moravia. In 1372 he was made *huissier d'armes* to Charles *V.* He received many other important offices, was *bailli* of Valois, and afterwards of Senlis, squire to the Dauphin, and governor of Fismes. In 1380 his patron, Charles V., died, and in the same year the English burnt his house at Vertus. In his childhood he had been an eye-witness of the English invasion of 1358; he had been present at the siege of Reims and seen the march on Chartres; he had witnessed the signing of the treaty of Bretigny; he was now himself a victim of the English fury. His violent hatred of the English found vent in numerous appeals to carry the war into England, and in the famous prophecy that England would be destroyed so thoroughly that no one should be able to point to her ruins. His own misfortunes and the miseries of France embittered his temper. He complained continually of poverty, railed against women and lamented the woes of his country. His last years were spent on his *Miroir de ntariage,* a satire of 13,000 lines against women, which contains some real comedy. The mother-in-law of French farce has her prototype in the *Miroir.*

The historical and patriotic poems of Deschamps are of much greater value. He does not, like Froissart, cast a glamour over the miserable wars of the time but gives a faithful picture of the anarchy of France, and inveighs ceaselessly against the heavy taxes, the vices of the clergy and especially against those who enrich themselves at the expense of the people. The terrible ballad with the refrain *Sà, de l'argent; sà, de l'argent* is typical of his work. Deschamps excelled in the use of the ballade and the chant royal. In ballade form he expressed his regret for the death of Du Guesclin, who seems to have been the only man except his patron, Charles V., for whom he ever felt any admiration. One of his ballades (No. 28j) was sent with a copy of his works to Chaucer, whom he addresses with the words:

> Tu es d'amours mondains dieux en Albie
> Et de la Rose en la terre Angélique.

Deschamps was the author of an *Art poétique,* with the title of *L'Art de dictier et de fere chancons, balades, virelais et rondeaulx.* He lays immense stress on the harmony of verse, because, as was the fashion of his day, he practically took it for granted that all poetry was to be sung.

The work of Deschamps marks an important stage in the history of French poetry. With him and his contemporaries the long, formless narrations of the *trouvères* give place to complicated and exacting kinds of verse. He was perhaps by nature a moralist and satirist rather than a poet, and the force and truth of his historical pictures gives him a unique place in 14th-century poetry. Raynaud fixes the date of his death in 1406, or at latest, 1407. Two years earlier he had been relieved of his charge as *bailli* of Senlis, his plain-spoken satires making him many enemies at court.

His *Oeuvres complètes* were edited (10 vols., 1878–1901) for the *Société des anciens textes français* by Queux dr Saint-Hilaire and Gaston Raynaud. The supplemrntary vol. ii. (1903) consists of an Introduction by *G.* Raynaud. *Set.* also E. Hoeppner. *Eustache Deschamps* (Strasbourg, 1904).

DESCHANEL, PAUL EUGENE LOUIS (1856–1922), French statesman, son of Émile Deschanel (1819–1904), professor at the Collilge de France and senator, was born at Brussels, where his father was living in exile (1851–59), owing to his opposition to Napoleon III. Paul Deschanel studied law, and began his career as secretary to Deshayes de Marcère (1876), and to Jules Simon (1876–77). In Oct. 1885 he was elected deputy for Eure and Loire. He was one of the most notable orators of the Progressist Republican group. In Jan. 1896 he was elected vice-president of the chamber. In June 1898 he was elected president of the chamber, and was re-elected in 1901, but rejected in 1902. In 1904 and 1905 he supported the law on the separation of Church and State. After presiding over the commission of foreign and colonial affairs (1905–09) and acting as reporter of the foreign office estimates committee, Deschanel filled many responsible positions. In Jan. 1920, he was elected president of the Republic, as being a "safer" candidate than Clemenceau, though the latter's popularity spoke strongly in his favour. In the autumn of the same year, however, failing health obliged him to resign office. He died in Paris on April 28, 1922, from the effects of a fall from a railway carriage. Deschanel was elected a member of the French Academy in 1899, his most notable works being *Orateurs et hommes d' état* (1888), *Figures de femmes* (1889), *La Décentralization* (1895), *La Question sociale* (1898).

DESCLOIZITE, a rare mineral species consisting of basic lead and zinc vanadate, crystallizing in the orthorhombic system and isomorphous with olivenite. It occurs as small prismatic or pyramidal crystals, usually forming drusy crusts and stalactitic aggregates; also as fibrous encrusting masses with a mammillary surface. The colour is deep cherry-red to brown or black, and the crystals are transparent or translucent with a greasy lustre; the streak is orange-yellow to brown; specific gravity 5.9 to 6.2; hardness $3\frac{1}{2}$. A variety known as cuprodescloizite is dull green in colour; it contains a considerable amount of copper replacing zinc and some arsenic replacing vanadium. Descloizite occurs in veins of lead ores in association with pyromorphite, vanadinite, wulfenite, etc. Localities are the Sierra de Cordoba in Argentina, Lake Valley in Sierra county, New Mexico, Arizona, Phoenixville in Pennsylvania, Kappel (Eisen-Kappel) near Klagenfurt in Carinthia, and Broken Hill, Rhodesia.

DESCLOT, BERNAT (*fl.* 2nd half of 13th century), Catalan historian, is known through his chronicle of the life of Peter III. of Aragon. It was printed in Barcelona 1616, at Paris in 1840 in *Chroniques étrangères relatives aux expéditions françaises pendant le XIIIe siècle,* and edited by J. Coroleu at Barcelona in 1885.

DESCRIPTION, in the strict sense, means an account of the perceptible qualities or characteristics of objects or events. In this sense it is commonly contrasted with explanation (*q.v.*), which usually seeks to account for what is perceptible by means of factors and processes which are not open to observation. Extreme empiricists maintain that science should confine itself to bare description and keep clear of any attempt at explanation. It is very easy, however, to smuggle what is really explanation into a so-called description. In the popular use of the term it is clear that a complete description of any object or event would include its explanation.

See A. Wolf, *Essentials of Scientific Method* **(1928).**

DESCRIPTIVE GEOMETRY is concerned with the methods of making accurate drawings to represent completely any object and to solve, with instrumental precision, problems relating to the position and shape of the object. It forms the theoretical basis of all architectural and mechanical drafting, and its practical applications are found in the drawing of machinery, buildings, bridges, vessels, in the representation of shades and shadows, in the construction of maps, and in the graphical solution of spherical triangles. It is the means by which the designer conveys his ideas to the builder or mechanic, and has been called the universal language of the engineer.

By the methods of descriptive geometry the solution of any problem concerning three-dimensional objects involves the following steps: (1) representation of the lines, surfaces, or solids in space by corresponding plane figures; (2) solution of the problem by means of the plane figures; (3) interpretation of this solution as a relation between the objects in space. In order to carry out these steps it is necessary to have a definite scheme by which it is possible to pass without ambiguity from the object in space to its representation by drawings in a plane, and also without ambiguity from the drawings to the object in space again. The scheme now universally used for this purpose was devised about the end of the 18th century by G. Monge (1746–1818).

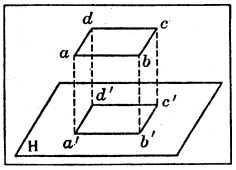


FIG. 1

The *orthographic projection* of a point *a* upon a plane is the point where a line from *a* perpendicular to the plane meets the plane. The orthographic projection of a point *a* in a room upon the floor is the point on the floor directly under the given point *a*. The projection upon a plane of any object in space is the figure on the plane made by projecting each point of the given object. For example (fig. 1) the plane of the square *abcd* is parallel to the plane H and the projection of *abcd* upon H is an equal square *a'b'c'd'*. If (fig. 2) the edge *ab* is parallel to H but the plane *abcd* is not parallel to H, the projection of the square *abcd* on H is the rectangle *a'b'c'd'* in which $a'b'=ab$ but *b'c'* is less than *bc*. If (fig. 3) the edge *ab* is parallel to H and the plane of *abcd* is perpendicular to H, the projection of the square *abcd* upon H is the straight line $a'b'=ab$. In fig. 4 the plane *abcd* is perpendicular to H and the diagonal *ac* is parallel to H. In this case the projection of the square is the line $a'c'=ac$.

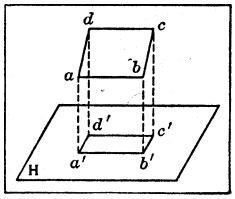


FIG. 2

The line *aa'* which projects a point *a* upon a plane is called a projecting *ray,* or *projector.* In orthographic projection the projecting rays are perpendicular to the plane of projection; consequently all projecting rays are parallel. An oblique projection is obtained when all projecting rays are parallel but are not perpendicular to the plane of projection. Oblique projection is used in the construction of shades and shadows. When the projecting rays are parallel the size of the projection does not depend upon the distance of the object from the plane of projection.

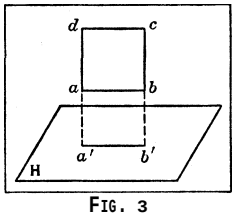


FIG. 3

A *scenographic projection,* or *perspective (see* PERSPECTIVE) is obtained when all of the projecting rays converge to a single point, the *point of sight* (fig. 5). This method produces a picture or representation of an object, or group of objects, as it appears to the eye. The size of the scenographic projection of an object depends upon the distances from it to the point of sight and to the plane of projection.

Unless otherwise specified, projection usually means orthographic projection.

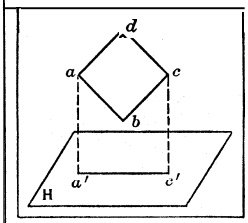


FIG. 4

Monge's method of representation of an object consists in making orthographic projections of the object on two (or more) planes and establishing a definite relation between the different projections. The two principal planes are the *vertical* (denoted by V) and the *horizontal* (denoted by H). The line of intersection of these planes is called the *ground line* (denoted by GL). Except for special cases H and V are sufficient for the solution of the problems of descriptive geometry. When a third plane, the *profile plane* (denoted by P), is desirable it is taken perpendicular to GL and is therefore perpendicular to both H and V.

The projection of an object on the vertical plane is called the *V-projection* or *elevation;* the projection on the horizontal plane is the *H-projection* or *plan.* In commercial terminology the elevation is called also the *front view,* or *rear view,* or *sectional elevation,* as the case may be. The plan is called also the *top view, bot-*

tom view, or sectional *plan.* Similarly, we have the profile or *end* view.

Notation. — A systematic notation is necessary for work in descriptive geometry but, unfortunately, no one system has been adopted by a majority of writers on the subject. In this article a point in space is denoted by a small letter, as a, b, the V-projection of a point a is denoted by a^v and the H-projection by a^h. A straight line is denoted by two points on it, the two end points if the line is of limited length, as ab. (The ground line is denoted by capital letters, GL.) A plane is denoted by a single capital letter, or may be designated by three points in it or by two lines in it.

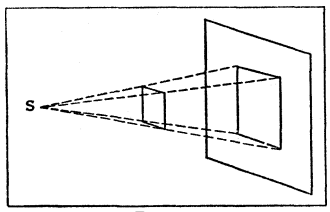


FIG. 5

Representation of a Point. — The position of a point a in space is determined if we know its V-projection and its H-projection. In fig. 6 imagine that H represents the floor of a room and V a wall. The V-projection of the point a is a^v; this determines the distance xa^v or height of the point above the floor. The H-projection, a^h, determines the length xa^h, or distance of the point from the wall. The position of the point from right to left is not given absolutely by this method, but its position with respect to other points of the object is determined.

The two principal planes of projection are supposed to be unlimited in extent and divide space into four compartments called quadrants or angles. In order to distinguish among these quadrants imagine an observer looking at the planes as they appear in fig. 6. He is above H and in front of V. This is the first quadrant. The second is above H and behind V. The third is below H and behind V. The fourth is below H and in front of V. An end view is shown in fig. 7.

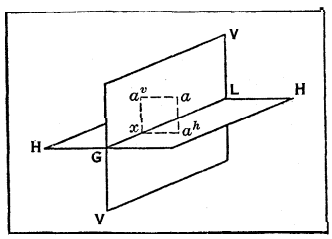


FIG. 6

The methcd of Monge for representing the position of a point in space by a plane drawing consists in turning the V-plane about GL as an axis until it coincides with the H-plane. The direction of rotation (fig. 7) is such that the upper part of V is made to coincide with the part of H which is behind GL.

It is one of the fundamental relations of orthographic projection that, in space, the two projections of any point together with the point itself must always be in a plane which is perpendicular to GL. After revolving V, the two projections of any point will lie in a straight line which is perpendicular to GL. The relation between a point in space and its plane representation is shown for each quadrant by figs 8–11.

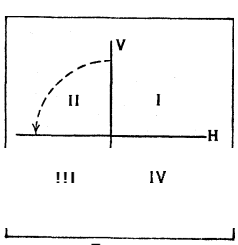


FIG. 7

In architectural drawing the objects are usually supposed to be located in the first quadrant, so that the elevation appears above the plan. In engineering drawings the objects are usually in the third quadrant. In perspective drawing the objects are usually in the second quadrant. The fourth quadrant is little used in practice

Representation of a Line. — The orthographic projection of a straight line upon a plane is a straight line, and a straight line in space is represented on the drawing plane by its V-projection and its H-projection. The truth of the three following statements can be made apparent by holding a pencil in various positions with respect to the floor and a wall. In each statement the letters H and V may be interchanged.

1. If a line of definite length is parallel to V alone, its V-projection is parallel and equal to the line, and its H-projection is parallel to GL.

2. If a line is perpendicular to V, its V-projection is a point, and its H-projection is perpendicular to GL.

3. If a line is parallel to H and V, both of its projections will be parallel to GL.

The projection of a line ab in space will be the lines joining the projections of a and b, that is (fig. 12), the V-projection of ab is a^vb^v and the H-projection is a^hb^h.

In general, any two lines assumed as projections in the plane drawing will determine a line in space. There are, however, exceptions when one or both of the projections are perpendicular to the ground line.

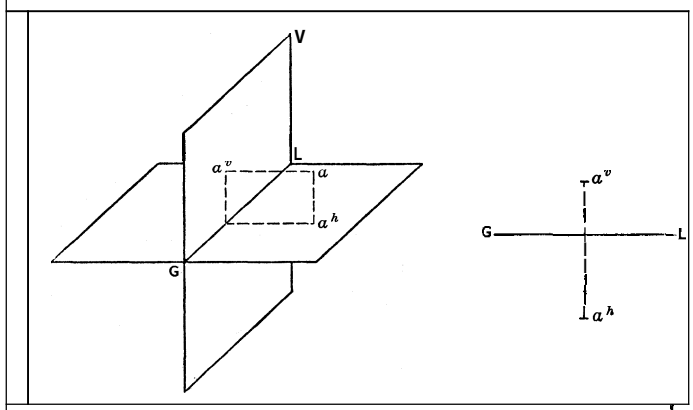


FIG. 8

A line of indefinite length, which is parallel to neither principal plane, will pierce H in a point called its *horizontal trace* and will pierce V in its *vertical trace.* These special points are sometimes used to represent the line in the drawing.

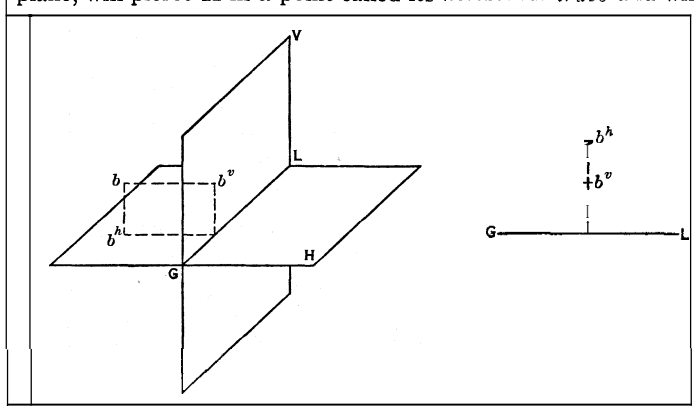


FIG. 9

Representation of a Plane.—A plane of unlimited extent cannot be represented by its projections because, in general, the projections of all of its puints would coinpletely cover both of the principal planes. Hence a plane is represented by its traces, that is, the lines in which it cuts the principal planes. The truth of the three following statements can be made apparent by holding a piece of csrdhoard in various positions with respect to the floor

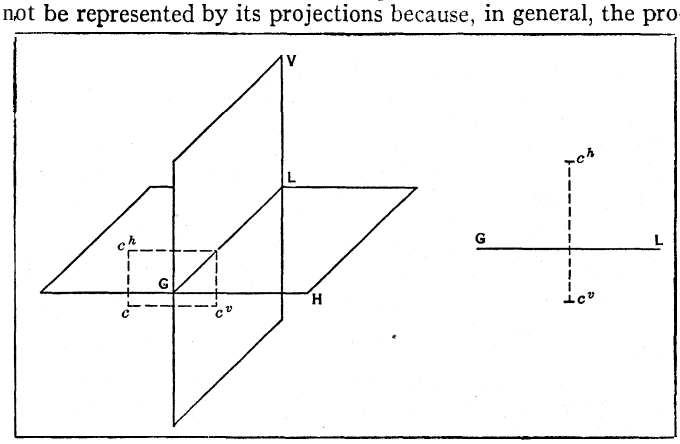


FIG. 10

and a wall. In each statement the letters H and V may be interchanged.

1. If a plane is parallel to V, it has no V-trace and its H-trace is parallel to GL.

2. If a plane is perpendicular to V, but oblique to H, its H-trace is perpendicular to GL.

3. If a plane is parallel to neither principal plane, its traces will

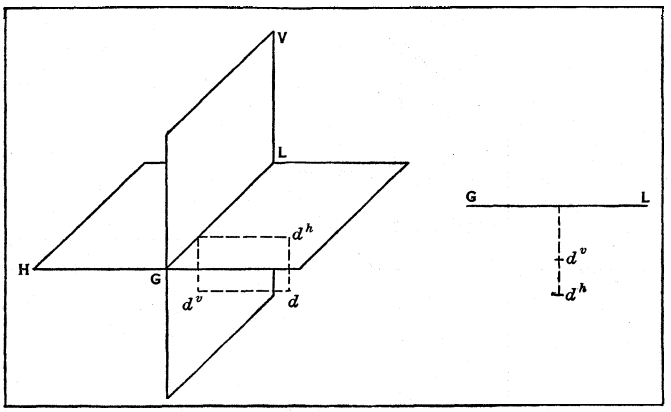


FIG. 11

either (a) both be parallel to GL, or (b) intersect GL in the same point.

A profile plane is perpendicular to both H and V. If a plane contains GL, it is represented by its trace on a profile plane.

In the plane drawing (fig. 13) any two i n s which meet GL at the same point may be taken as the traces of a plane, and they completely determine the position of the plane in space.

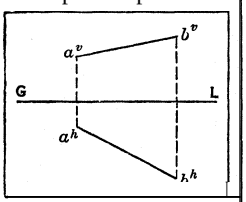


FIG. 12

The solution of a problem by the methods of descriptive geometry may be illustrated by the following simple example:

Problem. — TO find the true length of a line joining two given points in space.

Solution. — The end points a,b of the line are given, and hence their projections are known.

Theory. — Fig. **14** represents the line *ab* in space and shows the projection a^hb^h on the H-plane. Imagine the plane figure abb^ha^h to be revolved about the line a^hb^h as an axis into the H-plane. Point *a* will fall at *d* and b will fall at *b'*. Moreover $a'a^h$ is perpendicular to a^hb^h and is equal to *aha;* $b'b^h$ is perpendicular to a^hb^h and is equal to b^hb.

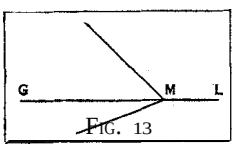


FIG. 13

Construction. — Fig, **15** is the plane drawing representing the given points a, *b* by their projections. From a^h lay off a^ha' perpendicular to a^hb^h and equal to xa^v. From b^h lay off b^hb' perpendicular to a^hb^h and equal to yb^v. Then $a'b'$ is the true length of *ab*.

The scope of the operations involving points, lines, and planes in descriptive geometry is indicated by the following partial list of standard problems:

1. To find the plane which contains two given intersecting or parallel lines.

2. To find the plane which contains a given line and is parallel to a second given line.

3. To find the plane which contains a given point and is parallel to each of two given lines.

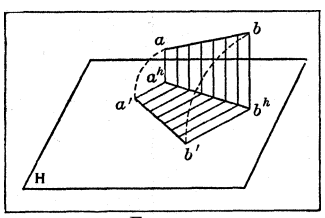


FIG. 14

4. To find the plane which contains a given point and is parallel to a given plane.

5. To find the plane which contains a given point and is perpendicular to a given line.

6. To find the plane which contains a given line and is perpendicular to a given plane.

7. To find the line of intersection of two planes.

8. To find the point in which a straight line intersects a plane.

9. To find the shortest distance from a point to a plane.

10. To find the perpendicular distance between two parallel planes.

11. To find the projections of a line making given angles with H and V.

12. To find the angles which an oblique plane makes with H and V.

13. To find the angle between two intersecting lines.

14. To find the angle between two planes.

15. To find the angle between a line and a plane.

16. To find the shortest distance from a point to a line.

17. To find the shortest distance between two lines not in the same plane.

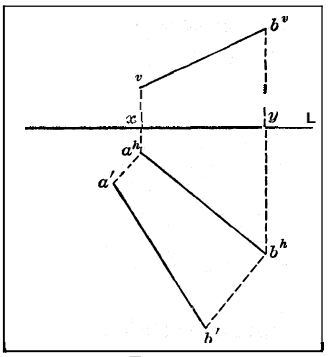


FIG. 15

18. At a given point in a plane, to draw a line which shall be perpendicular to the plane and of given length.

Surfaces. — The methods of descriptive geometry are applicable to the study of curved surfaces in space and of the curves of intersection of such surfaces. The process consists in examining various sections and projections of the figures involved. Of particular interest are those surfaces which can be formed by bending a plane surface without stretching, crumpling, or tearing. Such a surface is called a developable surface. Examples are a cylindrical surface (stove pipe) and a conical surface (funnel). A spherical surface is not developable. An important problem in descriptive geometry is to find the development of a given surface. This means to find the shape of the plane figure which would be obtained by rolling out a given developable surface. The result is illustrated by figs. **16,** 17, 18. Fig. 16 represents a truncated right circular cylinder, which means that the lower base is a circle, the elements of the curved surface are perpendicular to the lower base, and the upper base is not parallel to the lower base. Fig. 17 is the development of the curved surface.

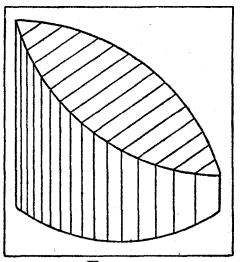


FIG. 16

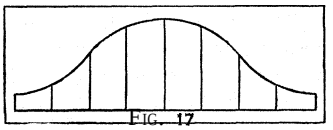


FIG. 17

Fig. **18** represents the development of the spout of a teapot. The problem involves the intersection of two conical surfaces. The development furnishes a pattern for cutting the metal from which the spout is made.

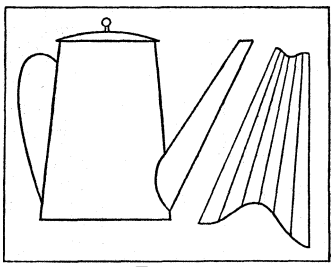


FIG. 18

Shades and shadows are studied by the methods of descriptive geometry. The technical meaning of the terms is shown by fig. 19. The rays of light are supposed to come from a source at a great distance, like the sun, and are regarded as parallel. In conventional drawings the rays are supposed to pass over the left shoulder of the observer at such an angle that their H and V projections make angles of 45° with GL. The illuminated *part* of an object is that part upon which rays of light fall. *Shade* is that part of an object not exposed to the rays of light. ***Line of*** shade is the line between the illuminated and shaded parts of an object. The part of unlighted space behind an object in light

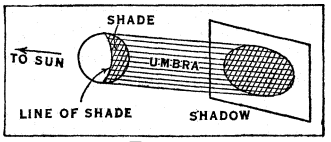


FIG. 19

is called the *umbra* or *indefinite shadow*. *Shadow* is the part of a surface in light from which rays of light are excluded by an opaque object. Problems of shades and shadows involve finding the shaded parts of given objects in given positions and the shadows cast by given objects upon other objects.

Descriptive geometry is a regular study in the curriculum of engineering students, and books on the subject are to be found in the list of every prominent publisher of educational texts for technical schools. (W. R. L.)

DESCRIPTIVE POETRY, the name given to a class of literature which may be defined as belonging to the 16th, 17th and 18th centuries in Europe. From the earliest times, all poetry which was not subjectively lyrical was apt to indulge in ornament which might be named descriptive. But the critics of the 17th century formed a distinction between the representations of the ancients and those of the moderns. We find Boileau emphasizing the statement that, while Virgil *paints*, Tasso *describes*. This may be a useful indication in defining not what should be, but what in practice has been, called "descriptive poetry." It is poetry in which the landscape, or architecture, or still life, or whatever may be the object of the poet's attention, is not used as an accessory, but is itself the centre of interest. It is, in this sense, not correct to call poetry in which description is only the occasional ornament of a poem, and not its central subject. descriptive poetry. The landscape or still life must fill the canvas, or, if human interest is introduced, that must be treated as an accessory. Thomson's *Seasons*, in which landscape takes the central place, and Drayton's *Polyolbion*, where everything is sacrificed to a topographical progress through Britain, are strictly descriptive.

It will be obvious from this definition that the danger ahead of all purely descriptive poetry is that it will lack intensity, that it will be frigid, if not dead. Boileau was naturally the first to see this and in verses of brilliant humour he mocked the writer who, too full of his subject, and describing for description's sake, will never quit his theme until he has exhausted it:

> Fuyez de ces auteurs l'abondance stérile
> Et ne vous chargez point d'un détail inutile.

But Boileau's humorous sallies do not quite meet the question whether such purely descriptive poetry as he criticizes is legitimate at all.

In England had appeared the famous translation (1592–1611), by Joshua Sylvester, of the *Divine Weeks and Works* of Du Bartas, containing such lines as those which the juvenile Dryden admired so much:

> But when winter's keener breath began
> To crystallize the Baltic ocean,
> To glaze the lakes, and bridle up the floods,
> And perriwig with wool the bald-pate woods.

There was also the curious physiological epic of Phineas Fletcher, *The Purple Island* (1633). But on the whole it was not until French influences had made themselves felt on English poetry, that description, as Boileau conceived it, was cultivated as a distinct art. The *Cooper's Hill* (1642) of Sir John Denham may be contrasted with the less ambitious *Penshurst* of Ben Jonson, and the one represents the new no less completely than the other does the old generation. If, however, we examine *Cooper's Hill* carefully, we perceive that its aim is after all rather philosophical than topographical. The Thames is described indeed, but not very minutely, and the poet is mainly absorbed in moral reflections. Marvell's long poem on the beauties of Nunappleton comes nearer to the type. But it is hardly until we reach the 18th century that we arrive, in English literature, at what is properly known as descriptive poetry. This was the age in which poets, often of no mean capacity, began to take such definite themes as a small country estate (Pomfret's *Choice*, 1700), the cultivation of the grape (Gay's *Wine*, 1708), a landscape (Pope's *Windsor Forest*, 1713), a military manoeuvre (Addison's *Campaign*, 1704), the industry of an apple orchard (Philip's *Cyder*, 1708) or a piece of topography (Tickell's *Kensington Gardens*, 1722), as the sole subject of a lengthy poem, generally written in heroic or blank verse.

This species of writing had been cultivated to a considerable degree through the preceding century, in Italy and (as the remarks of Boileau testify) in France, but it was in England that it reached its highest importance. The classic of descriptive poetry, in fact, the specimen which must be considered as the most important and the most successful, is *The Seasons* (1726–30) of James Thomson (*q.v.*). In Thomson, for the first time, a poet of considerable eminence appeared, to whom external nature was all sufficient, and who succeeded in conducting a long poem to its close by a single appeal to landscape, and to the emotions which it directly evokes. Coleridge, somewhat severely, described *The Seasons* as the work of a good rather than of a great poet, and it is an indisputable fact that, at its very best, descriptive poetry fails to awaken the highest powers of the imagination. A great part of Thomson's poem is nothing more or less than a skilfully varied catalogue of natural phenomena. Yet Thomson succeeds, as few other poets of his class have succeeded, in producing nobly-massed effects and comprehensive beauties such as were utterly unknown to his predecessors. He was widely imitated in England, especially by Armstrong, by Akenside, by Shenstone (in *The Schoolmistress*, 1742), by the anonymous author of *Albania*, 1737, and by Goldsmith (in *The Deserted Village*, 1770). No better example of the more pedestrian class of descriptive poetry could be found than the last-mentioned poem, with its minute and Dutch-like painting:

> How often have I paused on every charm:
> The sheltered cot, the cultivated farm;
> The never-failing brook, the busy mill,
> The decent church that topped the neighbouring hill:
> The hawthorn-bush, with seats beneath the shade.
> For talking age and whispering lovers made.

On the Continent of Europe the example of Thomson was almost immediately fruitful. Four several translations of *The Seasons* into French contended for the suffrages of the public, and J. F. de Saint-Lambert (1716–1803) imitated Thomson in *Les Saisons* (1769), a poem which enjoyed popularity for half a century, and of which Voltaire said that it was the only one of its generation which would reach posterity. Nevertheless, as Madame du Deffand told Walpole, Saint-Lambert is *froid, fade et faux*, and the same may be said of J. A. Roucher (1745–94), who wrote *Les Mois* in 1779, a descriptive poem, famous in its day. The Abbé Jacques Delille (1738–1813), perhaps the most ambitious descriptive poet who has ever lived, was treated as a Virgil by his contemporaries; he published *Les Géorgiques* in 1769, *Les Jardins* in 1782, and *L'Homme des champs* in 1803, but he went furthest in his brilliant, though artificial, *Trois règnes de la nature* (1809), which French critics have called the masterpiece of this whole school of descriptive poetry. Delille, however, like Thomson before him, was unable to avoid monotony and want of coherency. Picture follows picture, and no progress is made. The satire of Marie Joseph Chénier, in his famous and witty *Discours sur les poèmes descriptifs*, brought the vogue of this species of poetry to an end.

In England, again, Wordsworth, who treated the genius of Thomson with unmerited severity, revived descriptive poetry in a form which owed more than Wordsworth realized to the model of *The Seasons*. In *The Excursion* and *The Prelude*, as well as in many of his minor pieces, Wordsworth's philosophical and moral intentions cannot prevent us from perceiving the large part which pure description takes; and the same may be said of much of the early blank verse of S. T. Coleridge. Since their day, however, purely descriptive poetry has gone more and more completely out of fashion, and its place has been taken by the richer and directer effects of such prose as that of Xuskin in English, or of Fromentin and Pierre Loti in French.

DESERT, a term used for those lands which produce insufficient vegetation to support a human population. Deserts are classified according to the causes which give rise to them. In "cold deserts" the absence of vegetation is consequent on the prevailing low temperature, while in "hot deserts" the causes are high temperatures and deficient rainfall. Cold deserts accordingly occur in high latitudes or high altitudes. Hot deserts are primarily found along the hot, dry tropical belts of high atmospheric pressure, and on their equatorial sides, but the zonal arrangement is considerably modified in some regions by the influence of ele-

vated land. The northern hemisphere provides examples of this type in the African Sahara, the Asiatic deserts of Arabia and Iran, and in the Great Basin of North America. The southern hemisphere has the Kalahari in Africa, the deserts of Western Australia, and the Atacama in South America. Where a line of elevated land runs east and west in this zone as in Asia, the desert belt tends to occur eastwards in higher latitudes but where the line runs north and south, as in Africa, America and Australia, the desert zone weakens on the windward side of the elevation and the arid conditions are accentuated on the lee side. Desert conditions occasionally arise from somewhat obscure local causes, but the Indian desert (*q.v.*) seems to be situated in a region inaccessible to either of the two main branches of the wet south-west monsoon.

Although permanent rivers rising in wetter regions may traverse deserts (*e.g.,* the Nile) the fundamental-physical condition of an arid area is that it contributes nothing directly to oceanic waters. The rainfall chiefly occurs during violent cloudbursts (*q.v.*) and the soluble matter in the soil is carried down by intermittent streams to salt lakes around which deposits of economic value are found on evaporation. Surface erosion is caused by rapid and extreme changes of temperature, while wind action often forms dunes resembling waves. Dry valleys with precipitous sides, and cirque-like heads are probably caused by occasional cloud-bursts. Natural springs in some deserts give rise to oases which make trans-desert routes possible. When a desert-river has low banks (*e.g.,* the Nile) irrigation is made possible.

See *Das Gesetz der Wüstenbildung by* Walther, Berlin, 1900, for a general account of deserts.

DESERTION, the act of forsaking or abandoning; more particularly, the wilful abandonment of an employment, office or duty, in breach of a legal or moral obligation. For naval or military desertion, see MILITARY LAW; for desertion from the merchant service, see SEAMEN; for desertion of husband, see DIVORCE; for the desertion of children, see CHILDREN—PROTECTIVE LAWS and INFANT.

DESERT WILLOW (*Chilopsis* linearis), a small North American tree of the Bignonia family (Bignoniaceae), native to stream banks and the vicinity of springs in deserts from western Texas to southern California and southward to northern Mexico. It grows usually from 8 ft. to 25 ft. high, with stems from 2 in. to 10 in. in diameter, slender, ascending branches, and narrow, willow-like leaves. During summer it bears a succession of showy, funnel-shaped, pink flowers, about $1\frac{1}{2}$ in. long and $1\frac{1}{4}$ in. across, in profuse terminal clusters, followed in autumn by narrow seed-pods about 8 in. long. It is a characteristic plant of southwestern deserts, in appearance suggestive of a slender willow with catalpa-like flowers.

DESFORGES, PIERRE JEAN BAPTISTE CHOUDARD (1746–1806), French dramatist and man of letters, natural son of Dr. Antoine Petit, was born in Paris on Sept. 15, 1746, and educated at the Collkge Mazarin and the Collkge de Beauvais. After appearing on the stage of the ComCdie Italienne in Paris he joined a troupe of wandering actors, whom he served in the capacity of playwright. He married an actress, and the two spent three years in St. Petersburg, where they were well received. In 1782 he produced at the ComCdie Italienne an adaptation of Fielding's novel with the title Tom Jones *à* Londres. His first great success was achieved with *L'Épreuve* villageoise (1785) to the music of Grétry. La Femme *jalouse,* a five-act comedy in verse (1785), Joconde (1790) for the music of Louis Jaden, Les *Époux* divorce's (1799), a comedy, and other pieces followed. He has left a record of his own early indiscretions in Le *Poète,* ou *mémoires d'un* homme de lettres *écrits* par *lui-même* (4 vols., 1798). He died in Paris on Aug. 13, 1806.

DESGARCINS, MAGDELEINE MARIE (LOUISE) (1769–1797), French actress, was born at Mont Dauphin (Hautes Alpes). In her short career she became one of the greatest of French tragédiennes, the associate of Talma, with whom she nearly always played. She made her *début* at the ComCdie Française on May 24, 1788, in *Bajazet,* and was at once made *sociétaire.* She left the ComCdie Française in 1791 for the house in the Rue Richelieu, soon to become the Théâtre de la République, and there her triumphs were no less—in *King* Lear, Othello, La Harpe's *Mélanie* et Virginie, etc. She died insane, in Paris, on Oct. 27, 1797.

DESHAYES, GERARD PAUL (1795–1875), French geologist and conchologist, born at Nancy on May 13, 1795, was professor of natural history in the Muséum d'Histoire Naturelle. Deshayes examined the fossil Mollusca of the Paris Basin and of other Tertiary areas. His studies on the relations of the fossil to the recent species led him as early as 1829 to conclusions somewhat similar to those arrived at by Lyell, whom Deshayes assisted in the classification of the Tertiary system into Eocene, Miocene and Pliocene. His chief work, *Mollusques* de *l'Algérie,* the result of collections made in Algeria, where he was sent by the French Government in 1839, was issued (incomplete) in 1848. He died at Boran, Oise, on June g, 1875.

DESHOULIÈRES, ANTOINETTE DU LIGIER DE LA GARDE (1638–1694), French poetess, was born in Paris on Jan. 1, 1638. At the age of 13 she married Guillaume de Boisguerin, seigneur Deshoulikres, who followed the prince of Condé to the wars. Madame Deshoulikres returned for a time to the house of her parents, where she wrote poetry and studied the philosophy of Gassendi. She rejoined her husband at Rocroi, near Brussels, and was imprisoned in the chbteau of Wilworden because of her insistence that her husband's arrears of pay should be met. After a few months she was freed by her husband, who attacked the chbteau at the head of a small band of soldiers. They were amnestied, and returned to France, where Madame Deshoulikres soon became a conspicuous personage at the court of Louis XIV. and in literary society, some of her more zealous flatterers even going so far as to style her the tenth muse and the French Calliope. Voltaire pronounced her the best of French poetesses, and she was elected a member of the Academy of the Ricovrati of Padua and of the Academy of Arles. In 1688 she was pensioned by the king. She died in Paris on Feb. 17, 1694. Complete editions of her works were published at Paris in 1695, 1747 and 1882 (edit. Lescure). These include a few poems by her daughter, Antoine Thérèse Deshoulikres (1656–1718), who inherited her talent.

See Sainte-Beuve, *Portraits de femmes* (1892).

DESICCATION, the operation of drying or removing water from a substance. It is of particular importance in practical chemistry. If a substance admits of being heated to say 100°, the drying may be effected by means of a steam bath, which is simply an oven heated by steam; an air-bath may be used for higher temperatures. Otherwise a desiccator must be employed; this is essentially a closed vessel in which a hygroscopic substance is placed together with the substance to be dried. The process may be accelerated by exhausting the desiccator; this so-called vacuum desiccation is especially suitable for the concentration of aqueous solutions of readily decomposable substances. Hygroscopic substances in common use are phosphoric anhydride, concentrated sulphuric acid, potassium and sodium hydroxides, soda lime, anhydrous sodium sulphate and calcium chloride.

Two common types of desiccator are in use. In one the absorbent is placed at the bottom, and the substance to be dried above; in the other, this arrangement is inverted. Liquids are dried either by means of the desiccator, or, as is more usual, by shaking with a substance which removes the water. Fused calcium chloride is the commonest absorbent; but it must not be used with alcohols and certain other liquids with which it forms compounds. Quicklime, barium oxide and dehydrated copper sulphate are especially applicable to alcohol and ether; the last traces of water may be removed by adding metallic sodium snd distilling. Gases are dried by leading them through towers or tubes containing an appropriate drying material. The experiments of H. B. Baker on the influence of moisture on chemical combination have shown the difficulty of removing the last traces of water—see DRYNESS, CHEMICAL.

In chemical technology, apparatus on the principle of the

laboratory air-bath is mainly used. Crystals and precipitates, deprived of as much water as possible by centrifugal machines or filter-presses, are transported by means of a belt, screw or other form of conveyor, on to trays staged in brick chambers heated directly by flue gases or steam pipes; the latter are easily controlled, and if the steam be superheated a temperature of 300° and over may be maintained. In some cases the material traverses the chamber from the coolest to the hottest part on a conveyor or in wagons. Rotating cylinders are also used; the material to be dried is placed inside, and the cylinder heated by a steam jacket or otherwise.

DESIDERIO DA SETTIGNANO (1428–1464), Italian sculptor, was born at Settignano, near Florence, and was for a short time a pupil of Donatello, whom, according to Vasari, he assisted in the work on the pedestal of David, and he seems to have worked also with Mino da Fiesole, with the delicate and refined style of whose works those of Desiderio seem to have a closer affinity than with the perhaps more masculine tone of Donatello. It does not appear that Desiderio ever worked elsewhere than at Florence; for there are to be found there his few surviving decorative and monumental works, though a number of his delicately carved marble busts of women and children are to be found in the museums and private collections of Germany and France. The most prominent of his works are the tomb of the secretary of state, Marsuppini, in Santa Croce, and the great marble tabernacle of the Annunciation in San Lorenzo, both of which belong to his later period, and the cherubs' heads which form the exterior frieze of the Pazzi chapel. Vasari mentions a marble bust, by Desiderio, of Marietta degli Strozzi, which has been identified as a marble portrait bust acquired by the Berlin museum in 1842. The Berlin museum also owns a coloured plaster bust of an Urbino lady, by Desiderio. Other important busts by the master are in the Bargello, Florence, the Louvre in Paris and in private collections.

See Wilhelm Bode, *Die italienische Plastik* (Berlin, 1893).

DESIDERIUS, the last king of the Lombards, is chiefly known through his connection with Charlemagne. He was duke of Tuscany and became king of the Lombards in 756. Seeking to extend the Lombard power, he came into collision with the papacy, and about 772 Adrian I., implored the aid of Charlemagne against him. Other causes of quarrel already existed between the Frankish and the Lombard kings. In 770 Charlemagne had married a daughter of Desiderius; but he soon sent her back to her father. Moreover, Gerberga, Charlemagne's sister-in-law, had sought the protection of the Lombard king after her husband's death in 771; Desiderius had recognized her sons as the lawful Frankish kings, and had attacked Adrian for refusing to crown them. Such was the position when Charlemagne took the Lombard capital, Ticinum, the modern Pavia, in June 774, and appropriated the kingdom of Lombardy. Desiderius was carried to France, where he died, and his son, Adalgis, spent his life in futile attempts to recover his father's kingdom.

See S. Abel, *Untergang des Langobardenreichs* (Gottingen, 1859); and *Jahrbücher des fränkischen Reiches unter Karl dem Grossen* (Leipzig, 1865); Paulus Diaconus, *Historia Langobardorum,* ed. by L. Bethmann and G. Waitz (Hanover, 1878); L. M. Hartmann, *Geschichte Italiens im Mittelalter* (Gotha, 1903).

DESIGN is the arrangement of lines or forms which make up the plan of a work of art with especial regard to the proportions, structure, movement and beauty of line of the whole. A design may be naturalistic or wholly the abstract conception of the artist. Its structure is related to the structure of the frame and the rendering of the subject, but not to the structure or anatomy of the subject itself. A design may be successful which is incorrect in every detail of anatomy. Design in one sense is synonymous with composition, and has to do with all the arts, though more pronounced in the applied arts than in the fine arts.

The Japanese artist Korin arrived at much of his design through the selection of certain parts of purely natural arrangements which were simplified and selected as typical, but which were rendered in a naturalistic manner. Much of modern design is not so made up, but consists of gross distortion for the overstressing of structure or movement, with a complete loss of other characteristics. This type of design is so close to caricature that it often detracts rather than adds to the beauty of a work of art.

Design is concerned not only with typical movement but also with typical rhythms. Through the medium of parallel master strokes or accenting of repeating movements, rhythms are set

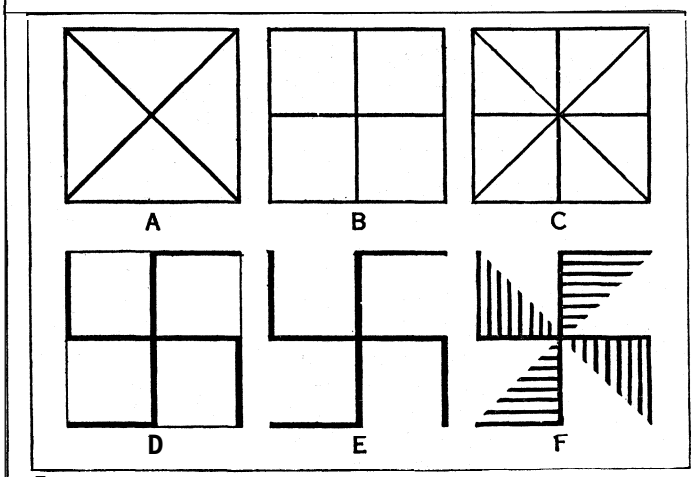


FIG. 1.— PROGRESSIVE STEPS IN THE FORMING OF A SWASTIKA WITHIN A SQUARE

up which should, like the rhythms of great poetry, accent the meaning and express a crystallization of the personality of the artist, and at the same time of his subject as seen through his eyes. Just as in "The Raven" by Poe, we have the summing up of all of Poe's mood in his work and at the same time have the summing up of the expression of all human despair in the bird's recurring "Never more," so in the design of a master of the graphic arts will be found accents and rhythms which build the mood he wishes to establish. Design is to the graphic arts what verse form and rhyme are to poetry: the ladder up which it climbs to the heights. Design can exist without colour, but just as there can be design in line and mass so there can also be design in colour, based upon the distribution of harmoniously blending or contrasting tones; when design is present in both line and colour the two must work together to further the effect of the conception. Every element of art can be designed separately and in relation to the other elements. Thus there can be structural design, movement design, outline design. (See DRAWING.)

Teaching.— In the teaching of design it is often helpful to have the student cut out various pieces of paper representing

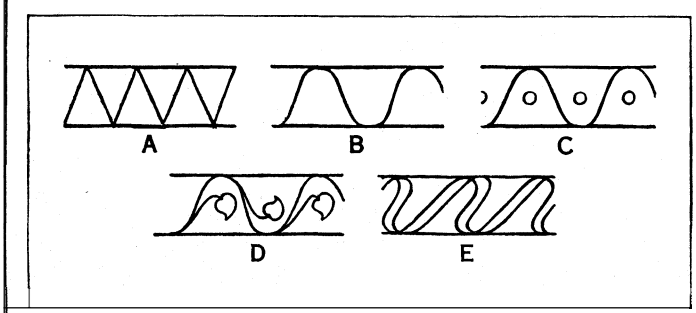


FIG. ,?.— DEVELOPMENT OF WAVE. OR VINE. DESIGN WITHIN PARALLEL LINES FROM SIMPLE GEOMETRICAL FORM

the main areas to be used and move them about within the size area, cut out of the centre of another piece of paper, upon which he is to work. When these have been arranged to his satisfaction, lines should be thrown in which tie the whole together; and finally, with these established areas and lines to guide him, work can be begun. The Chinese artist does this mentally as he sits contemplating the silk upon which he is to paint, for he has trained his mind to remember the arrangement once he has de-

cided upon it. The student can teach himself to do this, but it is well to begin with the more objective method.

It is interesting to note that in given areas only a certain number of effective designs are possible, and that man has hit upon them in every part of the world without intercommunication. Scientists have tried to prove a common origin for the race because of the almost universal use of the swastika, but many

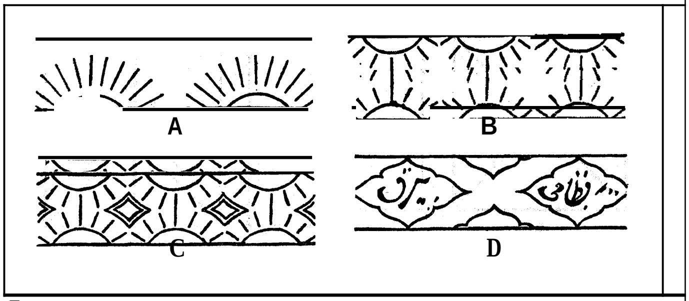


FIG. 3.—PROBABLE EVOLUTION OF TYPICAL PERSIAN OGEE DESIGN FROM OLD ZOROASTRIAN MOTIF

children who have never seen this sign arrive at it spontaneously, when left to decorate squares. The steps are simple (see fig. 1): (1) The corners, which catch the eye quickest for a starting point, are joined; (2) the sides; (3) both are combined and before long, in the age-old attempt to represent movement, the spurs are discovered and all sorts of variations follow. The "wave" or "vine" or "running" border is developed in like manner, because it is the most obvious way to decorate a narrow space between parallel lines. We usually find (A) the geometrical treatment (fig. 2); (B) the curve with open areas which are soon (C) filled with spots assuming the shape of leaves on a vine as time goes on (D), and an excuse for their being is demanded. Finally, as in (E), the movement is increased and it becomes on many Tzu Chow vases of China a leaping rather than a running border, representative of waves from which the fiery dragon ascends.

Development. — The typical Persian ogee design has an interesting origin which is demonstrable on existing vases. In fig. 3 (A) is shown the old Zoroastrian motif of the rising sun which only loosely filled the border; other suns were introduced at a still earlier period. In a further attempt to build the border together a design was inserted between them, which sometimes held written characters and finally, as the religion is developed, the suns disappear and ogee patterns are fitted together, becoming a typical national motif.

Design is, therefore, old and has been thought of for many thousand years, and the student does well to acquaint himself with early examples found in various parts of the world. It is almost as difficult to create a new design as it is to discover a new geometric principle; but another element enters design, and, once having learned it as one would learn geometry, there is available, instead of a cold, mathematical deduction, a vehicle for the expression of one's personal sense of beauty. (W. E. Cx.)

ORIGINALITY

Modern use has tended to associate design with the word "original" in the sense of new or abnormal. But the end of design is utility, fitness and delight. If a discovery, it should be a discovery of what seems inevitable, an inspiration arising out of the conditions, and parallel to invention in the sciences. The faculty of design has best flourished when an almost spontaneous development was taking place in the arts, and while certain classes of arts, more or less noble, were generally demanded and the demand copiously satisfied, as in the production of Chinese porcelain, Greek vases, Byzantine mosaics, Gothic cathedrals and Renaissance paintings. Thus where a "school of design" arises there is much general likeness in the products but also a general progress. The common experience — "tradition" — is a part of each artist's stock in trade; and all are carried along in a stream of continuous exploration. Some of the arts, writing, for instance, have been little touched by conscious originality in design, all has been progress, or, at least, change, in response to conditions. Under such a system, in a time of progress, the proper limitations react as intensity; when limitations are removed the designer has less and less upon which to react, and unconditioned liberty gives him nothing at all to lean on. Design is response to needs, conditions and aspirations. The Greeks so well understood this that they appear to have consciously restrained themselves to the development of selected types, not only in architecture and literature. but in domestic arts, like pottery. Design with them was less the new than the true.

For the production of a school of design it is necessary that there should be a considerable body of artists working together, and a large demand from a sympathetic public. A process of continuous development is thus brought into being which sustains the individual effort. It is necessary for the designer to know familiarly the processes, the materials and the skilful use of the tools involved in their production; [illegible] only one who practises a craft can design for it. It is necessary to enter into the traditions of the art, that is, to know past achievements. It is necessary, further, to be in relation with nature, the great reservoir of ideas, for it is from it that fresh thought will flow into all forms of art. These conditions being granted, the best and most useful meaning we can give to the word design is exploration, experiment, consideration of possibilities. Putting too high a value on originality other than this is to restrict natural growth from vital roots, in which true originality consists. To take design in architecture as an example, we have rested too much on definite precedent (a different thing from living tradition) and, on the other hand, hoped too much from newness. Exploration of the possibilities in arches, vaults, domes and the like, as a chemist or a mathematician explores, is little accepted as a method in architecture at this time, although in antiquity it was by such means that the great master-works were produced: the Pantheon, Santa Sophia, Durham and Amiens cathedrals. The same is true of all forms of design. Of course the genius and inspiration of the individual artist is not here ignored, but assumed. What we are concerned with is a mode of thought which shall make it most fruitful. See ARTS AND CRAFTS; RENDERING, ARCHITECTURAL. (W. R. LE.)

DESK, any kind of flat or sloping table for writing or reading. Its earliest shape was probably that with which we are familiar in pictures of the monastic *scriptorium*—rather high and narrow with a sloping slab. The primitive desk had little accommodation for writing materials, and no storage room for papers; drawers, cupboards and pigeonholes were the evolution of periods when writing grew common, and when letters and other documents requiring preservation became numerous. It was long the custom to secure papers in chests or cabinets, whereas the modern desk serves the double purpose of a writing-table and a storehouse for documents. The first development from the early stall-like desk consisted of the addition of a drawer; then the table came to be supported upon legs or columns. Eventually the legs were replaced by a series of superimposed drawers forming pedestals—hence the familiar pedestal writing-table.

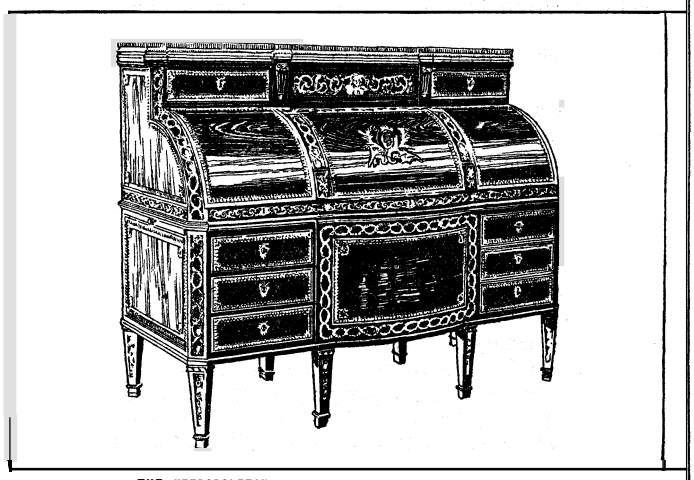
For a long period there were two distinct contemporary forms of desk — the table and the bureau or escritoire. The latter shape attained a popularity so great that it was found even in houses in which there was little occasion for writing. The English-speaking people of the 18th century were amazingly fond of pieces of furniture which served a double or triple purpose. The bureau —the word is the French generic appellation for a desk—derives its name from the material with which it was originally covered (Fr. bure, woollen cloth). It consists of an upright carcass sloping inward at the top, and provided with long drawers below. The upper part is fitted with small drawers and pigeon-holes, and often with secret places, and the writing space is formed by a hinged slab supported on runners; when not in use this slab closes up the sloping top. During the 18th century innumerable thousands of these bureaux were made on both sides of the Atlantic — indeed, if we except tables and chairs, no piece of old furniture is more common. In the first part of that period they were usually of oak, but when mahogany was introduced into Europe it speedily ousted the heavier-looking wood. Its deep rich colour and the

high polish of which it was capable added appreciably to its ornamental appearance. While the pigeon-holes and small drawers were used for papers, the long drawers were often employed for purposes other than literary. In time the bureau-secretaire became a bureau-bookcase, the glazed shelves, which were often a separate erection, resting upon the top of the bureau. The cabinet-makers of the second half of the 18th century, the period of the greatest *floraison* of this combination, competed with each other in devising elegant frets for the glass fronts. Solid and satisfying to the eye, if somewhat severe in form, the mahogany bureau was usually an exceedingly presentable piece of furniture. Occasionally it had a *bombé* front which mitigated its severity; this was especially the case in the Dutch varieties, which were in a measure free adaptations of the French Louis Quinze *commode*. These Dutch bureaux, and the English ones made in imitation of them, were usually elaborately inlaid with floral designs in coloured woods; but whereas the Batavian marquetry was often rough and crude, the English work was usually of considerable excellence. Side by side with this form of writing apparatus was one variety or another of the writing-table proper. In so far as it is possible to generalize upon such a detail it would appear that the bureau was the desk of the yeoman and what we now call the lower middle class, and that the slighter and more table-like forms were preferred by those higher in the social scale.

A SCRIBE OF THE XVTH CENTURY WORKING AT HIS DESK

Just about the time when the flat table with its drawers in a single row was finally assuming its familiar modern shape, an invention was introduced which was destined eventually to supersede all other forms of desk. This was the cylinder-top writing-table. Nothing is known of the originator of this device, but it is certain that if not French himself he worked in France. The historians of French furniture agree in fixing its introduction about the year 1750, and we know that a desk worked on this principle was in the possession of the French crown in the year 1760. Even in its early days the cylinder took more than one form. It sometimes consisted of a solid piece of curved wood, and sometimes of a tambour frame—that is to say, of a series of narrow jointed strips of wood mounted on canvas; the revolving shutters of a shop-front are an adaptation of the idea. For a long period, however, the cylinder was most often solid, and remained so until the latter part of the 19th century, when the "American roll-top desk" began to be made in large numbers. This is indeed the old French form with a tambour cylinder, and it is now the desk that is most frequently met with all over the world for commercial purposes. Its popularity is due to its large accommodation, and to the facility with which the closing of the cylinder conceals all papers, and automatically locks every drawer. To France we owe the construction of many of the finest and most historic desks that have survived—the characteristic marquetry writing-tables of the Boulle period, and the gilded splendours of that of Louis XV. have never been surpassed in the history of furniture. Indeed, the "Bureau du roi" which was made for Louis XV. is the most famous and magnificent piece of furniture that, so far as we know, was ever constructed. This desk, which is now one of the treasures of the Louvre, was the work of several artist-artificers, chief among whom were Oeben and Riesener—Oeben, it may be added here as a matter of artistic interest, became the grandfather of Eugene Delacroix. The bureau is signed *Riesener* fa. 1769 *à l'Arsenal de Paris*, but it has been established that, however great may have been the share of its construction which fell to him, the conception was that of Oeben. The work was ordered in 1760; it would thus appear that nine years were consumed in perfecting it, which is not surprising when we learn from the detailed account of its construction that the work began with making a perfect miniature model followed by one of full size. The "bureau du roi" is a large cylinder desk elaborately inlaid in marquetry of woods, and decorated with a wonderful and ornate series of mounts consisting of mouldings, plaques, vases and statuettes of gilt bronze cast and chased. These bronzes are the work of Duplessis, Winant and Hervieux. The desk, which shows plainly the transition between the Louis XV. and Louis XVI. styles, is as remarkable for the boldness of its conception as for the magnificent finish of its details. Its lines are large, flowing and harmonious, and although it is no longer exactly as it left the hands of its makers (Oeben died before it was finished) the alterations that have been made have hardly interfered with the general effect. For the head of the king for whom it was made, that of Minerva in a helmet was substituted under his successor. The ciphers of Louis XV. have been removed and replaced by Sèvres plaques, and even the key which bore the king's initial crowned with laurels and palm leaves, with his portrait on the one side, and the *fleur de lys* on the other, has been interfered with by an austere republicanism. Yet no tampering with details can spoil the monumental nobility of this great conception.

(J. P.–B.)



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

AN XVIIITH CENTURY CYLINDER DESK IN LOUIS XVITH STYLE

DESMARETS or **DESMARETZ, JEAN,** SIEUR DE SAINT-SORLIN (1595–1676), French dramatist and miscellaneous writer, was born in Paris in 1595. The success of his romance *Ariane* in 1631 led to his admission to the circle that met at the house of Valentin Conrart and later developed into the Académie Française. Desmarets was its first chancellor. He began to write for the theatre at the request of his patron Richelieu. In this kind he produced a comedy long regarded as a masterpiece, *Les Visionnaires* (1637); a prose-tragedy, *Érigone* (1638); and *Scipion* (1639), a tragedy in verse. His success brought many official preferments. His long epic *Clovis* (1657) is noteworthy because Desmarets rejected the traditional pagan background and maintained that Christian imagery should supplant it. With this standpoint he contributed several works in defence of the moderns in the quarrel between the Ancients and the Moderns. In his later years Desmarets wrote religious poems. He was a violent opponent of the Jansenists, against whom he wrote a *Réponse à l'insolente apologie de Port-Royal* . . . (1666). He died in Paris on Oct. 28, 1676.

See also H. Rigault, *Histoire de la querelle des anciens et des modernes* (1856), pp. 80–103 and R. Kerviler, *Desmarets* (1879).

DESMARETS, NICOLAS, SIEUR DE MAILLEBOIS (1648–1721), French statesman, was born in Paris, Sept. 10, 1648. He was a nephew of J. B. Colbert, rose rapidly in the financial administration, and was disgraced after Colbert's death. In 1686 he was recalled, and during the next ten years presented to the controllers-general a series of remarkable memoirs exposing the desperate economic situation of France. He held office under Chamillart from 1699 onwards, and in 1708 succeeded him as controller-general. The situation was exceedingly grave. The ordinary revenues of the year 1708 amounted to 81,977,007 livres, of which 57,833,233 livres had already been anticipated, and the expenses to meet were 200,251,447 livres. In 1709 a famine reduced still more the tax

returns. Emission of paper money, and an improved collection of taxes tided over the years of 1709 and 1710. Then Dcsmarets decided upon an income tax. His "tenth" was based on Vauban's plan; but the privileged classes managed to avoid it. After the death of Louis XIV. Desinarets was dismissed by the regent and withdrew to his estates. He was certainly, after Colbert, the greatest finance minister of Louis XIV.'s reign. *See* Forbonnais, *Recherches et considérations sur les finances de la France* (2 vols. Basel, 1758); Montyon, *Particularités et observations sur les ministres des finances de la France* (1812); De Boislisle, *Correspondance de contrôleurs-généraux des finances* (3 vols. 1873–97); and the same author's "Desmarets et l'affaire des pièces de quatre sols" in the appendix to the seventh volume of his edition of the *Mémoires de Saint-Simon.*

DES MOINES (dĕ-moin′), the capital and largest city of Iowa, U.S.A., in the south-central part of the State, on the Des Moines river, at the mouth of the Raccoon; a port of entry and the county seat of Polk county. It is on Federal highways 6, 65 and 69, has municipal and commercial airports, and is served by the Burlington, the Chicago and North Western, the Chicago Great Western, the Chicago, Milwaukee, St. Paul and Pacific, the Fort Dodge, Des Moines and Southern, the Minneapolis and St. Louis, the Rock Island and the Wabash railways, and by interurban motor bus and trolley lines and additional railways for freight only.

The population in 1930 was 142,559 and in 1940 was 159,819 of which 89.4% were native white and 6.5% foreign-born white.

The city lies on both banks of the river, at an altitude of 861 ft., and has an area of 55.91 sq.mi. The state capitol (completed in 1882 at a cost of $3,000,000) stands on an eminence in a park of 80 acres. Near by is the State Historical, Memorial and Art building and the State library. Des Moines was one of the first among American cities to plan on a relatively generous scale for beauty in its development. A comprehensive city plan was adopted in 1924 and considerable progress has been made in carrying it out. Along the river front, through the heart of the city, extends the civic centre, in which have been erected (by 1941) a city hall ($500,000), a municipal courthouse ($600,000) a federal building, a post office and a coliseum with a seating capacity of 8,500 and other accommodations for large conventions. When completed the centre will contain other public buildings. The city's system of parks and playgrounds covers 1,400 ac., and the grounds of the state fair, which has an attendance of over 400,000 each year, have an area of 600 ac., and represent an investment of $1,500,000.

Drake university, founded in 1881 by the Disciples of Christ, is located here, and co-operates with the city in maintaining a municipal observatory. The assessed valuation of property in 1940 was $131.315,146.

Adjoining the city on the south is Ft. Des Moines, an important army post, where almost a full regiment of cavalry is stationed, besides various other troops. At Camp Dodge, 11 mi. north, now used by the national guard, thousands of soldiers were trained during the World War of 1914–18.

Since 1907 the city has been under a commission form of government, known as the "Des Moines Plan," which has been adopted by many other municipalities. Des Moines has the highest percentage of home ownership among the large American cities (50.8% in 1940).

The percentage of illiteracy is one of the lowest. The death rate is low.

In the heart of the corn belt, and surrounded by a coal field which has produced as much as 3,000,000 tons in a year, Des Moines is an important commercial centre. The jobbing business of its 396 wholesale houses amounts to more than $143,015,000 annually.

Its retail trading territory has a population of 821,393 Incoming and outgoing freight totals 2,500,000 tons in a year; and 200 package-freight cars leave the city daily. Manufactures also are important, with an output in 1939 valued at $79,125,123 Chief among them are meat products, flour, clothing, foundry products, brick and tile, printing and cosmetics. The printing and publishing of newspapers and periodicals is one of the leading industries. The city is the principal centre for the publication of farm journals.

Forty-four insurance companies, with aggregate assets of $546,337,907, have their home officesthere.

In 1843 a military post called Ft. Des Moines was established on the site of the city to protect the rights of the Sacs and Foxes, and in the same year the district was opened to settlement by the whites. The town was incorporated in 1851. In 1857 it was chartered as a city and was made the State capital, superseding Iowa City. The population in 1860 was 3,965, which grew to 12,035 in 1870, 22,408 in 1880, and 50,093 in 1890. Between 1890 and 1920, without any annexations of territory, the population increased 152%. The fort was re-established in 1900 The name of city and fort was taken from that of the river, which is supposed to be a corruption of the original Indian name, *Moingona,* by the French, who at first, using the abbreviation *moin,* called it *la rivière des moins,* and later, through its association with the Trappist monks, changed it to *la rivière des moines.*

DESMOND, EARLS OF: *see* FITZGERALD; DESMOND, GERALD FITZGERALD, 15TH EARL OF.

DESMOND, GERALD FITZGERALD, 15TH EARL OF (d. 1583), Irish leader, was son of James, 14th earl, by his second wife More O'Carroll. Young Gerald was to have been educated in England as the companion of the young king, Edward VI. Unfortunately for the subsequent peace of Munster these projects were not carried out. Claims on the Desmond estates were made by the Butlers, the hereditary enemies of the Geraldines, but temporary peace was made by Gerald's marriage with the daughter and heiress of the 11th earl of Desmond, who had previously married, first, the 9th earl of Ormonde and secondly, Sir Francis Bryan.

Gerald succeeded to the earldom in 1558; he was knighted by the lord deputy Sussex, and did homage at Waterford. He allied himself with his namesake Gerald Fitzgerald, 11th earl of Kildare (1525–1585), and with Shane O'Neill, and trouble was renewed between Ormonde and the Fitzgeralds. Desmond, summoned to appear in London to account for the misdeeds of his clan, delayed his appearance until May 1562. He was detained in London for two years, and after his return the death of his wife freed him from such restraint as had existed. Open war followed, and Desmond was defeated and taken prisoner. Desmond and his brother Sir John of Desmond were sent over to England, where they surrendered their lands to the queen after a short experience of the Tower.

Dcsmond was allowed to return to Ireland in 1573. He was detained for six months in Dublin, but in November slipped through the hands of the Government, and in a short time had reduced the province to a state of anarchy. On July 18, 1574, the Geraldine chiefs signed the "combination" promising to support the earl unconditionally; shortly afterwards Ormonde and the lord deputy, Sir William Fitzwilliam, marched on Munster, and put Desmond's garrison at Derrinlaur Castle to the sword. Desmond submitted at Cork on Sept. 2, handing over his estates to trustees. Sir Henry Sidney visited Munster in 1575, and affairs seemed to promise an early restoration of order. But Fitzmaurice had fled to Brittany in company with other leading Geraldines. He intrigued at the French and Spanish courts for a foreign invasion of Ireland, and at Rome met the adventurer Stucley, with whom he projected an expedition which was to make a nephew of Gregory XIII. king of Ireland. In 1579 he landed in Smerwick bay, where he was joined later by some Spanish soldiers at the Fort del Ore. His ships were captured on July 29, and he himself was slain in a skirmish while on his way to Tipperary. Desmond had perhaps been restrained before by jealousy of Fitzmaurice; his indecisions ceased when on Nov. 1 Sir William Pelham proclaimed him a traitor. The sack of Youghal and Kinsale by the Geraldines was speedily followed by the successes of Ormonde and Pelham acting in concert with Admiral Winter. In June 1581 Desmond had to take to the woods; on Nov. 11 he was seized and murdered by a small party of soldiers. His brother Sir John of Desmond had been caught and killed in Dec. 1581, and John Fitz-

gerald, seneschal of Imokilly, had surrendered on June 14, 1583.

By his second marriage with Eleanor Butler, the 15th earl left two sons, the elder of whom, James, 16th earl (1570–1601), spent most of his life in prison. After an unsuccessful attempt in 1600–01 to recover his inheritance he returned to England, where he died, the title becoming extinct.

See G. E. C(okayne), ***Complete Peerage;*** R. Bagwell, ***Ireland under the Tudors*** (1885–90); ***Annals of Ireland by the Four Masters*** (ed. J. O'Donovan, 1851); ***The Sidney Papers,*** ed. A. Collins (1746) and the article FITZGERALD.

DESMOND (Des-Mumha), an ancient kingdom of Ireland, covering southern Munster. About A.D. 200 Oilill, king of Munster, divided his territory between his two sons, giving Desmond to Eoghan and Thomond or N. Munster to Cormac Cas. In the 10th century Brian Boru, representing the latter, united all Munster, but in the 12th century the MacCarthys, descendants of Eoghan, became kings of Desmond. The Norman conquests reduced Desmond in size to the present county Cork and south Kerry, and the MacCarthys were driven into the south-west of Munster where they ruled till the 16th century as "kings of Desmond" or "MacCarthy More." The title "earl of Clancare" or "Clancarthy" was bestowed on MacCarthy More by Elizabeth, but this ancient family forfeited it as a result of the Jacobite war of 1690–91. In 1329 Maurice, head of the Munster Fitzgeralds, was created earl of Desmond, but this powerful family was extinguished in the "Desmond War" of 1579–83 when Gerald, the last true earl, was killed and his territories confiscated. Desmond was organized as a county for a time but ultimately its western part was added to county Kerry. In 1619 the earldom of Desmond was conferred on Richard Preston, Lord Dingwall, and after him on George Fielding, second son of the earl of Denbigh, through whom it has descended to the earls of Denbigh.

DESMOULINS, LUCIE SIMPLICE CAMILLE BENOIST (1760–1794), French journalist and politician, was born at Guise, in Picardy, on March 2, 1760. He was educated at the college of Louis-le-Grand. In this school, in which Robespierre was also a bursar and a distinguished student, Camille Desmoulins laid the solid foundation of his learning. He was admitted an advocate of the parlement of Paris in 1785. His professional success was not great; his manner was violent, his appearance unattractive, and his speech impaired by a painful stammer.

In March 1789 Desmoulins began his political career. Having been nominated deputy from the *bailliage* of Guise, he appeared at Laon as one of the commissioners for the election of deputies to the States-General summoned by royal edict of Jan. 24. Camille heralded its meeting by his *Ode to the States-General.* The sudden dismissal of Necker by Louis XVI. brought Desmoulins to fame. On July 12, 1789, Camille, leaping upon a table outside one of the cafés in the garden of the Palais Royal, announced to the crowd the dismissal of their favourite. He inflamed the passions of the people by his burning words and his call "To arms!" "This dismissal," he said, "is the tocsin of the St. Bartholomew of the patriots." This scene was the beginning of the actual events of the Revolution. Following Desmoulins the crowd surged through Paris, procuring arms by force; and on the 13th it was partly organized as the Parisian militia which was afterwards to be the National Guard. On the 14th the Bastille was taken.

His *La France libre* (1789) brought him the friendship of Mirabeau, and the studied abuse of numerous royalist pamphleteers. After the publication of his *Discours de* la *lanterne aux Parisiens,* Desmoulins was dubbed "Procureur-général de la lanterne."

Desmoulins was powerfully swayed by the influence of more vigorous minds; and for some time before the death of Mirabeau, in April 1791, he had begun to be led by Danton, with whom he remained associated during the rest of his life. In July 1791 Camille appeared before the municipality of Paris as head of a deputation of petitioners for the deposition of the king. In that month, however, such a request was dangerous; there was excitement in the city over the presentation of the petition, and the private attacks to which Desmoulins had often been subject were now followed by a warrant for the arrest of himself and Danton. Danton left Paris for a while; Desmoulins, however, remained there, appearing occasionally at the Jacobin club. Upon the failure of this attempt of his opponents, Desmoulins published a pamphlet, *Jean Pierre Brissot démasqué,* followed in 1793 by a *Fragment de l'histoire secrète de la Révolution,* in which the party of the Gironde, and specially Brissot, were most mercilessly attacked. Desmoulins took an active part on Aug. 10 and became secretary to Danton, when the latter became minister of justice. On Sept. 8 he was elected one of the deputies for Paris to the National Convention, where he was of the party of the "mountain," and voted for the abolition of royalty and the death of the king. The *Histoire des Brissotins* was inspired by Robespierre. The success of the *brochure,* so terrible as to send the leader? of the Gironde to the guillotine, alarmed Danton and the author. In 1789 he had issued a weekly journal, *Les Revolutions de France et de Brabant.* In Dec. 1793, appeared the first number of the *Vieux Cordelier,* which was at first directed against the Hébertists and approved of by Robespierre, but which soon formulated Danton's idea of a committee of clemency. Then Robespierre turned against Desmoulins and took advantage of the popular indignation roused against the Hébertists to send them to death. The time had come, however, when Saint Just and he were to turn their attention not only to *les enragés,* but to *les indulgents — the* powerful faction of the Dantonists. On Jan. 7, 1794, Robespierre in addressing the Jacobin club counselled not the expulsion of Desmoulins, but the burning of certain numbers of the *Vieux Cordelier.* By the end of March Danton, Desmoulins and the best of the moderates were arrested. On the 31st the warrant of arrest was signed and executed, and on the 3rd, 4th and 5th of April the trial took place before the Revolutionary Tribunal. Camille on being asked his age, replied, "I am thirty-three, the age of the *sans-culotte* Jesus, a critical age for every patriot." He was, in fact. thirty-four. The accused were prevented from defending themselves; a decree of the convention denied them the right of speech. Sentence of death was passed in absence of the accused, and their execution was appointed for the same day. Despite the indifference to death he had pretended to in his writings, Desmoulins showed little courage at his death, in sharp contrast to the brave and dignified death of his wife a week later.

On Dec. 29, 1790, Camille had married Lucile Duplessis, and their only child, Horace Camille, was born on July 6, 1792. The boy was afterwards pensioned by the French government, and died in Haiti in 1825.

See J. Claretie, ***Oeuvres de Camille Desmoulins avec une étude biographique . . .*** etc. (1874), and ***Camille Desmoulins, Lucile Desmoulins, étude sur les Dantonistes*** (1875; Eng. trans., 1876); F. A. Aulard, ***Les Orateurs de la Ltgislative et de la Convention*** (1905, 2nd ed.); ***G.*** Lenôtre, "La Maison de Camille Desmoulins" ***(Le Temps,*** March ***25, 1899)***; K. Hilt, ***Camille Desmoulins, seine politische Gesinnung und Parteistellung*** (1915); ***V.*** M. Methby, ***Camille Desmoulins*** (1914).

DESNOYERS, AUGUSTE GASPARD LOUIS BOUCHER, BARON (1779–1857), French engraver, was born in Paris on Dec. 19, 1779. He started his artistic education at the age of 12 under Lethière. After visiting Italy he entered the studio of Alexandre Tardieu in 1799, and became one of the most eminent line engravers of his time. His fame was established in 1805 by an engraving after the "Belle Jardinière" of Raphael; whereupon Napoleon I. commissioned him to reproduce his full-length portrait in coronation robes by Gérard. He died in Paris on Feb. 2, 1857.

DE SOTO: *see* SOTO, FERDINANDO DE.

DE SOTO, a city of Jefferson county, Missouri, U.S.A., 42 mi. S.S.W. of St. Louis, on Joachim creek. It is served by the Missouri Pacific railroad. Pop. (1930) 5,069; in 1940 it was 5,121. It is in a fertile agricultural region, and lead, zinc, tin, barytes and silica are mined in the vicinity. The city has railroad shops, a plate-glass factory and large shoe and clothing factories. De Soto was laid out in 1855 and incorporated in 1869. It is the seat of Mt. St. Clement's college.

DESPARD, EDWARD MARCUS (1751–1803), Irish conspirator, was born in Queen's Co., Ireland, in 1751. In 1766 he entered the British navy, was promoted lieutenant in 1772, and stationed at Jamaica. He was promoted captain after the San

Juan expedition (1779), then made governor of the Mosquito shore and the Bay of Honduras, and in 1782 commander of a successful expedition against the Spanish possessions on the Black river. In 1784 he took over the administration of Yucatan. Upon frivolous charges he was suspended by Lord Grenville, and recalled to England. From 1790 to 1792 these charges were held over him, and when dismissed no compensation was forthcoming. His complaints caused his arrest in 1798, and with a short interval he remained in gaol until 1800. Despard was arrested on a charge of plotting to assassinate George III., tried before a special commission, found guilty of high treason, and, with six of his fellow-conspirators, sentenced in 1803 to be hanged, drawn and quartered. These were the last men to be so sentenced in England. Despard was executed on Feb. 21, 1803.

His eldest brother, JOHN DESPARD (1745–1829), had a long and distinguished career in the British army; gazetted an ensign in 1760, he became general in 1814. In the American War of Independence he was twice made prisoner.

See Sir Charles Oman, *The Unfortunate Colonel Despard and other studies* (1922).

DESPATCH or **DISPATCH,** to send off immediately, or by express; particularly in the case of the sending of official messages, or of the immediate sending of troops to their destination, or the like. The word is used as a substantive of written official reports of events, battles and the like, sent by ambassadors, generals, etc., by means of a special messenger, or of express correspondence generally. From the primary meaning of the prompt sending of a message, the word is used of the quick disposal of business, or of the disposal of a person by violence. The French word *dépêche* came into England as *depeach,* which was in use from the 15th century until "despatch" was introduced. An early use of "dispatch" occurs in a letter to Henry VIII. from Bishop Tunstall, commissioner to Spain in 1516–17.

DESBENSER, HUGH LE (d. 1265), chief justiciar of England, first played an important part in 1258, being prominent on the baronial side in the Mad Parliament of Oxford. In 1260 the barons chose him to succeed Hugh Bigod as justiciar, and in 1263 the king was further compelled to put the Tower of London in his hands. On the outbreak of civil war he joined the party of Simon de Montfort, earl of Leicester, and led the Londoners when they sacked the manor-house of Isleworth, belonging to Richard, earl of Cornwall, king of the Romans. Having fought at Lewes (1264) he was made governor of six castles after the battle, and was then appointed one of the four arbitrators to mediate between Simon de Montfort and Gilbert de Clare, earl of Gloucester. He was summoned to Simon de hlontfort's parliament in 1264, and acted as justiciar throughout the earl's dictatorship. Despenser was killed at Evesham in Aug. 1365.

See C. Bémont, *Simon de Montfort* (Paris, *1884)*; T. F. Tout in *Owens College Historical Essays,* pp. *76* ff. (Manchester, 1902).

DESPENSER, HUGH LE (1262–1326), English courtier, was a son of the justiciar, fought for Edward I. in Wales, France and Scotland, and in 1295 was summoned to parliament as a baron. Ten years later he was sent by the king to Pope Clement V. to secure Edward's release from the oaths he had taken to observe the charters in 1297. Almost alone Hugh spoke out for Edward II.'s favourite, Piers Gaveston, in 1308; but after Gaveston's death in 1312 he himself was the king's chief adviser until Edward's defeat at Bannockburn in 1314. Then, hated by the barons, and especially by Earl Thomas of Lancaster, as a deserter from their party, he was driven from the council, but was quickly restored to favour and loaded with lands and honours, being made earl of Winchester in 1322. Before this time Hugh's son, the younger Hugh le Despenser, had become associated with his father, and was enjoying a still larger share of royal favour. About 1306 this baron had married Eleanor (d. 1337), one of the sisters and heiresses of Gilbert de Clare, earl of Gloucester, who was slain at Bannockburn; and after a division of the immense Clare lands had been made in 1317 violent quarrels broke out between the Despensers and the husbands of the other heiresses, Roger of Amory and Hugh of Audley. Interwoven with this dispute was another between the younger Despenser and the Mowbrays, who were supported by Humphrey Bohun, earl of Hereford, about some lands in Glamorganshire. Fighting having begun in Wales and on the Welsh borders, the English barons showed themselves decidedly hostile to the Despensers, and in 1321 Edward II. was obliged to consent to their banishment. The elder Hugh left England for a time, but father and son were soon again at court. They fought against the rebellious barons at Boroughbridge, and after Lancaster's death in 1322 they practically ruled the country. But their next enemy, Queen Isabella, was more formidable, or more fortunate, than Lancaster. Returning from France in 1326 the queen directed her arms against her husband's favourites. The elder Despenser was seized at Bristol, where he was hanged on Oct. 27, 1326, and the younger was taken with the king at Llantrissant and hanged at Hereford on Nov. 24. The attainder against the Despensers was reversed in 1398. The intense hatred with which the barons regarded the Despensers was due to the enormous wealth which had passed into their'hands, and to the arrogance and rapacity of the younger Hugh. The younger Despenser left two sons, Hugh (1308–49), and Edward, who was killed at Vannes in 1342.

The latter's son EDWARD LE DESPENSER (d. 1375) fought at the battle of Poitiers; he was a patron of Froissart, who called him *le grand sire Despensier.* His son, THOMAS LE DESPENSER (1373–1400), the husband of Constance (d. 1416), daughter of Edmund of Langley, duke of York, supported Richard II. against Thomas of Woodstock, duke of Gloucester, and the other lords appellant in 1397, when he himself was created earl of Gloucester, but he deserted the king in 1399. Then, degraded from his earldom for participating in Gloucester's death, Despenser joined the conspiracy against Henry IV., but he was seized and executed by a mob at Bristol in January 1400.

The elder Edward le Despenser left another son, HENRY (*c.* 1341–1406), who became bishop of Norwich in 1370. In early life Henry had been a soldier, and when the peasants revolted in 1381 he took readily to the field, defeated the insurgents at North Walsham, and suppressed the rising in Norfolk with some severity. Pope Urban VI. in 1382 employed him to lead a crusade in Flanders against the supporters of the anti-pope Clement VII. After capturing several towns he was checked at Ypres, and defeated by the French. On his return the bishop was impeached and deprived of his lands; Richard II., however, stood by him. Almost alone among his peers Henry remained true to Richard in 1399; he was then imprisoned, but was quickly released. He died on Aug. 23, 1406. Despenser was an active enemy of the Lollards, whose leader, John Wycliffe, had fiercely denounced his crusade in Flanders.

The barony of Despenser, called out of abeyance in 1604, was held by the Fanes, earls of Westmorland, from 1626 to 1762; by the notorious Sir Francis Dashwood from 1763 to 1781; and by the Stapletons from 1788 to 1891. In 1891 it was inherited, through his mother, by the 7th Viscount Falmouth.

DES PÉRIERS, BONAVENTURE (*c.* 1500–1544), French author, was born of a noble family at Arnay-le-duc in Burgundy at the end of the 15th century. In 1533 or 1534 Des Périers visited Lyons, then the most enlightened town of France, and a refuge for many liberal scholars. He gave some assistance to Robert Olivetan and Lefèvre d'Étaples in the preparation of the vernacular version of the Old Testament, and to Étienne Dolet in the *Commentarii linguae latinae.* In 1536 he put himself under the protection of Marguerite d'Angoulême, queen of Navarre, who made him her *valet-de-chambre.* He acted as the queen's secretary, and transcribed the *Heptaméron* for her. It is probable that his duties extended beyond those of a mere copyist, and some writers have gone so far as to say that the *Heptame'ron* was his work. The free discussions permitted at Marguerite's court encouraged a licence of thought as displeasing to the Calvinists as to the Catholics. This free enquiry became scepticism in Bonaventure's *Cymbalum Mundi* . . . (1537), and the queen of Navarre disavowed the author, though she continued to help him privately until 1541. The book consisted of four dialogues in imitation of Lucian. Its allegorical form did not conceal its real meaning, and the Sorbonne secured the suppression of the edi-

tion (c. 1538) before it was offered for sale. The book was reprinted in Paris in the same year. It made many bitter enemies for the author. Henri Estienne called it dktestable, and Étienne Pasquier said it deserved to be thrown into the fire with its author if he were still living. Des Périers prudently left Paris, and settled at Lyons, where in 1544 he put an end to his existence by falling on his sword. In 1544 his collected works were printed at Lyons. The volume, Recueil des oeuvres de feu Bonaventure des Pkriers, included his poems, which are of small merit, the *Traité des quatre vertus cardinales après Sénèque*, and a translation of the Lysis of Plato. In 1558 appeared at Lyons the collection of stories and fables entitled the *Nouvelles récréations et joyeux devis*, the work on which his fame rests. Some of the tales are attributed to the editors, Nicholas Denisot and Jacques Pelletier, but their share is certainly limited to the later ones. The stories are models of simple, direct narration in the vigorous and picturesque French of the 16th century.

His Oeuvres françaises were published by Louis Lacour (Paris, 2 vols., 1856). See also the preface to the *Cymbalum Mundi* . . . (ed. F. Franck, 1874); A. Chenevière, *Bonaventure Desptriers, sa vie, ses poésies* (1885); and P. Toldo, *Contributo allo studio della novella francese del XV. e XVI. secolo* (Rome, 1895).

DESPORTES, PHILIPPE (1546–1606), French poet, was born at Chartres in 1546. As secretary to the bishop of Le Puy he visited Italy, where he gained a knowledge of Italian poetry. He then attached himself to the duke of Anjou, and followed him to Warsaw on his election as king of Poland. Nine months in Poland satisfied the civilized Desportes, but in 1574 his patron became king of France as Henry III. and gave the poet the abbey of Tiron and four other valuable benefices. A good example of the light and dainty verse in which Desportes excelled is furnished by the well-known *villanelle* with the refrain "Qui premier s'en repentira," which was on the lips of Henry, duke of Guise, just before his tragic death. Desportes imitated Petrarch, Ariosto, Sannazaro, and still more closely the minor Italian poets, and in 1604 a number of his plagiarisms were exposed in the *Reconcontres des Muses de France et d'Italie*. As a sonneteer he showed much grace and sweetness, and English poets borrowed freely from him. In his old age Desportes prepared a translation of the Psalms remembered chiefly for the brutal mot of Malherbe: *Votre potage vaut mieux que vos psaumes*. Desportes died on Oct. 5, 1606, leaving the reputation of the courtier poet.

BIBLIOGRAPHY.—Desportes had published in 1573 an edition of his works including *Diane, Les Amours d'Hippolyte, Élégies, Bergeries, Oeuvres chrétiennes*, etc. A splendid edition printed by Étienne appeared in 1579. An edition of his Oeuvres, by Alfred Michiels, was published in 1858.

DESPOT, in Greek usage the master of a household, hence the ruler of slaves (Gr. δεσπότης, lord or master). It was also used by the Greeks of their gods, but was principally applied to the absolute monarchs of the Eastern empires, and it is in this sense that the word, like its equivalent "tyrant," is in current usage for an absolute sovereign whose rule is not restricted by any constitution. In the Roman empire of the East "despot" was used as a title of honour or address of the emperor, and later of his sons, brothers and sons-in-law. Later still it was adopted by the vassal princes of the empire. This gave rise to the name "despotats" applied to the tributary states which survived the break-up of the empire in Epirus, Cyprus, Trebezond, etc. Under Ottoman rule the title was preserved by the despots of Serbia, etc.

DES PRÉS, JOSQUIN (c. 1445–1521), also called DEPRÉS or DESPREZ, and by a latinized form of his name, JODOCUS PRATENSIS or A. PRATO, French musical composer, was born, probably in Condé in the Hennegau, about 1445. He was a pupil of Ockenheim, and himself one of the most learned musicians of his time. In spite of his great fame, the accounts of his life are vague and the dates contradictory. In his early youth Josquin seems to have been a member of the choir of the collegiate church at St. Quentin; when his voice changed he took lessons in counterpoint from Okeghem; afterwards he again lived at his birthplace for some years and probably spent some time at various Italian courts until he joined the papal chapel in Rome in 1486. In Rome Des Prés lived till 1494, and it was there that many of his works were written He was considered by his contemporaries to be the greatest master of his age. Luther, who was a good judge, is credited with the saying that "other musicians do with notes what they can, Josquin what he likes." The composer's journey to Rome marks in a manner the transference of music's headquarters from the North to Italy, which for the next two centuries remained the centre of the musical world. To Des Prés and his pupils Arcadelt, Mouton and others, much that is characteristic in modern music owes its rise, particularly in their influence upon Italian developments under Palestrina. After leaving Rome Josquin accepted an invitation of King Louis XII. of France to become the chief singer of the royal chapel. Re was also, for a time at least, in the service of the emperor Maximilian I., and at the time of his death, on Aug. 27, 1521, was a canon of the cathedral of Condé.

The most complete list of his compositions—consisting of masses, motets, psalms and other pieces of sacred music—will be found in Fétis. The largest collection of his ms. works, containing no fewer than 20 masses, is in the possession of the papal chapel in Rome. During the 17th and 18th centuries Josquin's value was ignored, nor does his work appear in the collections of Martini and Paolucci. Burney was the first to recover him from oblivion, and Forkel continued the task of rehabilitation. Ambros furnishes the most exhaustive account of his achievements. An admirable account of Josquin's art will be found in the article "Josquin," by the Rev. J. R. Milne in Grove's *Dictionary of Music and Musicians*, 3rd ed. vol. ii. An edition of the complete works of Josquin has been undertaken by the *Vereeniging voor Noord-Nederlandsche Muziekgeschiedenis* under the editorship of A. Smijers. Seventeen of Josquin's masses were published during his lifetime by Perrucci (1502–16), and two others in 1539 by Johannes Ott at h'uremberg. Many of his motets were printed in various collections, notably in Commer's *Collectio operum musicorum Batavorum* (12 vols., 1840), and another selection of his works was edited by Eitner.

DESPRES, SUZANNE (1875–), French actress, was born at Verdun, and trained at the Paris Conservatoire. She then became associated with, and subsequently married, Aurelien Lugné-Poë (b. 1870), the actor-manager, who had founded a new school of modern drama, *L'Oeuvre*, and she had a brilliant success in several plays produced by him. In succeeding years she played at the Gymnase and at the Porte Saint-Martin, and in 1902 made her début at the Comédie Française, appearing in *Phèdre* and other important parts.

DESSAIX, JOSEPH MARIE, COUNT (1764–1834), French general, was born at Thonon, Haute Savoie, on Sept. 24, 1764. He studied medicine, took his degree at Turin and then went to Paris, where in 1789 he joined the National Guard. In 1791 he tried without success to raise an *kmeute* in Savoy. In 1792 he organized the "legion of the Allabroges," and served at the siege of Toulon, in the army of the Eastern Pyrenees, and in the army of Italy. Dessaix was elected a member of the council of Five Hundred, and opposed the *coup d'état* of the 18th Brumaire (Nov. 9, 1799). Promoted general of brigade in 1803, he fought at Wagram (1809), was made general of division and in 1810 a count. He took part in the expedition to Russia, and was for some time commandant of Berlin. He joined Napoleon in the Hundred Days, and in 1816 was imprisoned for five months. He died on Oct. 26, 1834.

See *Le Général Dessaix, sa vie politique et militaire*, by his nephew Joseph Dessaix (Paris, 1879).

DESSAU, the capital city of the Land of Anhalt, Germany, on the left bank of the Mulde, 2 mi. from its confluence with the Elbe, 67 mi. S.W. from Berlin and at the junction of lines to Cöthen and Zerbst.

Pop. (1939), 120,744.

Dessau, probably founded by Albert the Bear, had attained civic rights as early as 1213. It grew into importance at the close of the 17th century, after the religious emancipation of the Jews in 1686, and of the Lutherans in 1697.

Apart from the old quarter on the Mulde, the town is well built with spacious squares such as the Grosse Markt and the

public buildings of a capital. The Schlosskirche is adorned with paintings by Lucas Cranach, in one of which ("The Last Supper") are portraits of several reformers. The ex-ducal palace, standing in extensive grounds, contains a collection of historical curiosities and a gallery of pictures, which includes works by Cimabue, Lippi, Rubens, Titian and Van Dyck; the Amalienstift also has a picture gallery. Dessau manufactures sugar, chocolate, chemicals, small iron goods and machinery, various household objects and some textiles. There is also a considerable trade in corn and garden produce. Because of its airfield, its importance as a railway centre, and as the seat of the great Junkers plane factory, Dessau was frequently bombed by the British in World War II.

DESSOIR, LUDWIG (1810–1874), German actor, whose name was originally Leopold Dessauer, was born on Dec. 15, 1810, at Posen, the son of a Jewish tradesman. He made his first appearance on the stage there in 1824 in a small part. After some experience at the theatre in Posen and on tour, he was engaged at Leipzig from 1834–36. In 1836 he was at the Breslau municipal theatre, and during 1837–39 at Budapest. From there he went to Karlsruhe and in 1847 to Berlin where his success in *Othello* and *Hamlet* won him a permanent engagement at the Hof theatre. In 1853 he appeared in London. He retired in 1872 and died on Dec. 30, 1874, in Berlin. Dessoir was twice married; by his first wife he had one son, the actor Ferdinand Dessoir (1836–92). In spite of certain physical disabilities Ludwig Dessoir's genius raised him to the first rank of actors, especially as an interpreter of Shakespeare's characters. G. H. Lewes placed Dessoir's Othello above that of Kean, and the *Athenaeum* preferred him in this part to Brooks or Macready.

DE STEFANI, ALBERTO (1879–), Italian economist and statesman, was born at Verona on Oct. 6, 1879. Educated at the university of Padua he became professor of political economy at the Superior Commercial Institute of Venice. In 1921 he was returned to the Chamber as a Fascist and was Mussolini's first Minister of Finance. Later he was also entrusted with the Treasury department and welded the two into a single ministry. He abolished useless expenditure and simplified the fiscal system, reducing innumerable taxes to three main sources of revenue, with the result that, in three years a deficit of 6,500,000,000 lire was converted into a surplus of 209,000,000. His measures for restraining speculation in the currency and stock markets during the financial slump in the spring of 1925 were less successful; he lost the confidence of the banking community, and in July was superseded by Count Volpi.

DESTOUCHES, PHILIPPE (1680–1754), French dramatist, whose real name was Néricault, was born at Tours. He was attached successively to the French embassies in Switzerland and in London, and married a Lancashire lady, Dorothea Johnston. On his return to France (1723) he was elected to the Academy. He spent his later years at his chbteau of Fortoiseau, near Melun, dying on July 4, 1754. His early comedies were: *Le Curieux Impertinent* (1710), *L'Ingrat* (1712), *L'Irrésolu* (1713) and *Le Médisant* (1715). The best of these is *L'Irrésolu,* in which Dorante, after hesitating throughout the play between Julie and Célimène, marries Julie, but concludes the play with the reflection:—

"J'aurais mieux fait, je crois, d'épouser Célimène."

After 11 years of diplomatic service Destouches returned to the stage with the *Philosophe marié* (1727), followed in 1732 by his masterpiece *Le Glorieux,* a picture of the struggle then beginning between the old nobility and the wealthy *parvenus* who found their opportunity in the poverty of France. Among his later comedies may be mentioned: *Le Tambour nocturne* (1736), *La Force du naturel* (1750) and *Le Dissipateur* (1736).

His works were issued in collected form in 1755, 1757, 1811 and, in a limited edition (6 vols.), 1822.

DESTROYER, an unarmoured warship of approximately 1,000 to 1,400 tons, very fast, with a powerful torpedo armament and a few medium calibre guns (usually 4″ or 5″ dual purpose guns). A larger type, used as senior officer's ship of a division of destroyers, is known as a flotilla leader. These latter are of 1,500 to 2,000 tons and carry a rather more powerful gun armament.

The destroyer as a type was evolved about 1892 as the answer to the torpedo boat, which was then regarded as being as serious a menace to the large surface warship as is the submarine, in certain quarters, to-day. Partly as the result of the evolution of the destroyer, but largely because the ineffectiveness of the original small torpedo boat was gradually realized, the latter as a type has ceased to exist in all the more important navies, while the destroyer has not only replaced it as a means of executing torpedo attacks, but has proved of great value for innumerable other naval services. Destroyers are essential auxiliaries to the battle fleet. In a fleet action their functions are to attack the enemy's battle fleet under cover of the fire of their own battleships, or by taking advantage of low visibility or smoke screens; to counter the attacks of the enemy flotilla, by going out to meet them before they can manoeuvre into position to launch their torpedoes; and to form an anti-submarine and anti-aircraft screen to protect the battle fleet against these forms of attack, when necessary. As the principal safeguard of the battle fleet against submarine attack the destroyer proved efficient in the War of 1914–18, so much so that no single battleship or battle cruiser of the British Grand Fleet was torpedoed by a submarine throughout the war, although the fleet was repeatedly in waters where the German "U Boats" were in wait.

Destroyers may find special scope for their powers of offence during dark hours, particularly if they can locate their quarry and surprise it unprepared. On the other hand, the experience of the war showed that a battleship, well prepared and with a good fire control system for her secondary armament, is by no means the simple prey to the destroyer that it was sometimes anticipated she would be. For example: the German battle fleet, in its desperate break through the British destroyer flotillas the night after the battle of Jutland (*q.v.*), displayed remarkable powers of self-protection; although repeatedly engaged by torpedo craft, only one of their battleships was sunk. This ship succumbed to a well-executed attack by a British destroyer flotilla just before dawn. A battleship lying unprotected in an open roadstead is likely to fall an easy prey to a destroyer attack. (*See* DARDANELLES.)

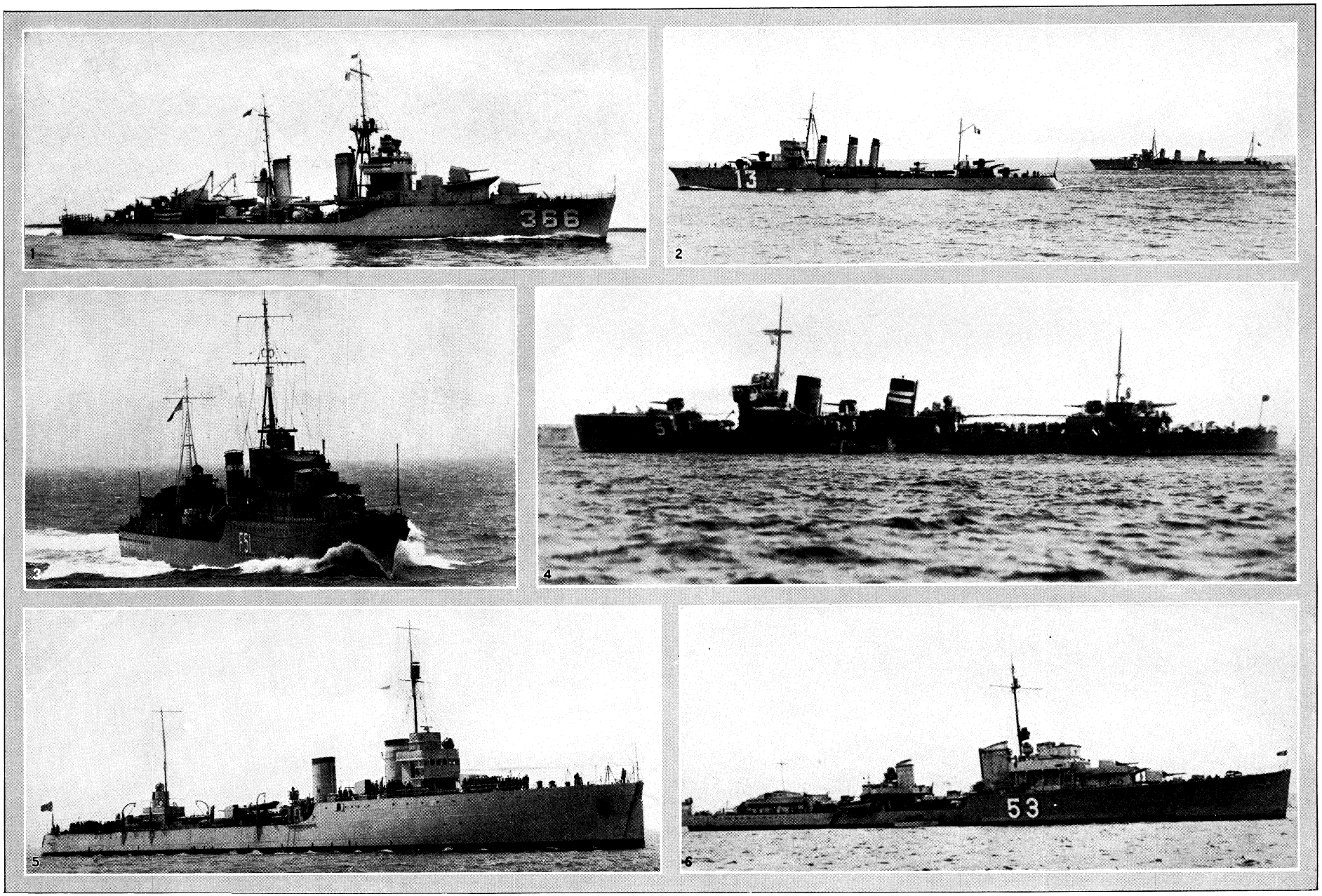
In World War I, destroyers had to be built for many services besides battle fleet work. A large force was maintained at Harwich, where they co-operated with the light cruisers in making sweeps into the Heligoland Bight. Another force was employed in the Dover Command in safeguarding the approaches to the Channel, in supporting mine-sweeping and bombarding operations and in escorting transports, convoys and shipping generally. Some of the very oldest class of destroyers, known as the "30 knotters," were particularly hard worked in the early days of the War.

The question of whether, on the very limited displacement, a gun or a torpedo armament shall predominate has always been rather a moot one, but, with the increase in size of modern destroyers, a fairly satisfactory compromise has been arrived at; the torpedo armament is adequate for offensive purposes and the gun armament is sufficient to counter that of potential opponents of a similar type. Special destroyers are fitted for mine laying, their speed enabling them to dash in, under cover of fog or darkness, run their line of mines, and escape before they can be detected or brought to action. The extent to which the destroyer can provide protection to the larger surface ship against torpedo attack by aircraft is a problem which modern navies have yet to work out. (E. A.; X.)

TECHNICAL

Previous to 1877 the torpedo vessels of the various navies had been small craft fitted with spar or towing torpedoes; in that year the British Government introduced the "Lightning," the first torpedo-boat—a vessel of 34 tons and 19 knots, with one bow tube and equipped with the Whitehead torpedo. This step was soon followed by other navies. The torpedo boat steadily increased in speed and armament, till in 1908 the last torpedo boats built for the British Navy displaced 280 tons, carried two 12-pounder guns, three 18-in. tubes, and developed 26 knots.

The next step was to build boats capable of overtaking and destroying the torpedo boats before they could launch their attack. It was evident that the type of vessel to perform this duty must be very similar to the torpedo boat itself, but of larger size and



BY COURTESY OF (1) THE U.S. NAVY DEPARTMENT; PHOTOGRAPHS. (2, 5) STEPHEN CRIBB, (3) BRITISH COMBINE. (4) FROM "JANE'S FIGHTING SHIPS;" (6) FROM EUROPEAN

MODERN TYPES OF THE DESTROYER AND FLOTILLA LEADER

1. U.S.S. "Drayton": 5–5″ 38-calibre, 4 M.G. guns; 8 quadruple 21″ tubes; 42,800 h.p., 36.5 knots
2. Left, French destroyer "Orage," sunk off Dunkirk in 1940: right, French flotilla leader "Tigre"
3. H.M.S. "Ashanti": 8–4.7″ guns, 4–21″ torpedo tubes; 1,870 tons dis.; engines 44,000 h.p., 36.5 knots
4. Japanese destroyer "Harukaze": 1,270 tons dis.; engines 38.500 h.p., 34 knots
5. Italian flotilla leader "Leone": armament, 8 guns. 6 torpedo tubes: sunk in April 1941
6. German destroyer "Hans Ludemann," of 1,811-ton Roeder class, sunk in April 1940. Class has 5-5" guns; speed, 36 knots

greater speed and power. So the torpedo boat destroyer (to give the type its full name) appeared, and soon rendered the old torpedo boat ineffective and obsolete.

The first destroyers were the "Havoc," "Hornet," "Daring" and "Decoy," started in 1892. Their displacement was 275 tons, speed 27 knots (4,200 i.h.p.), and they were armed with one 12-pounder and three torpedo tubes. The success of these boats warranted the wholesale building of destroyers, and from that time until the outbreak of World War I in 1914, some 240 vessels of this type were built. The size and speed increased from year to year, and, by 1900, the speed had risen to 30 knots and the displacement ranged from 350 to 450 tons. A typical vessel of the period was the "Albatross" of 430 tons, 31 knots (7,500 i.h.p.), armed with one 12-pdr., five 6-pdr., and two 18-in. tubes.

With reciprocating machinery it was impracticable to obtain greater speed than 31 knots, but the advent of the steam turbine provided means of obtaining greater engine power, the first warships to be fitted with turbine machinery being the destroyers "Cobra" and "Viper," laid down in 1899. The power obtained was 12,000 s.h.p., giving a speed of 34 knots on a displacement of 370 tons.

In order to obtain high speeds on small displacements, destroyers up to this period were structurally very light and the machinery weights were reduced to the minimum possible. Several vessels after extended voyages showed signs of weakness and demands were made for greater strength and reliability. These were met in the "River" class of 1902–04. The displacement became 550–600 tons, they were armed with four 12-pdr. guns and two 18-in. torpedo tubes; and they were made more seaworthy by the addition of a forecastle.

In 1904, the Committee on Designs recommended the use of oil as the sole fuel for destroyers. This in conjunction with turbine machinery permitted the high speed desirable and enabled the engines and boilers to be handled with comparative ease, while there was a marked decrease in fuel consumption and consequent increase in radius of action. The first destroyers to have oil-fired boilers and turbines were the '(Tribal" class of "ocean-going" destroyers, of which 12 were built during the years 1905–08. The displacement of this class was 900 tons and speeds of 33 knots were obtained with 15,000 s.h.p. It was in the later vessels of this class that the 4-in. gun was first introduced into destroyer armament. The "Basilisk" class, which followed in 1908–09, saw the introduction of the 21-in. torpedo tube, all previous destroyers having mounted only 18-in. tubes. Destroyers subsequently continued to develop in the direction of increased speed and displacement and heavier armament both of guns and torpedoes, and at the outbreak of war the "M" class, of the 1913–14 program, were beginning to be delivered from the builders. These vessels had a displacement of 1,025 tons and were armed with three 4-in. guns, two 2-pdr. guns and four 21-in. torpedo tubes. The propelling machinery developed 25,000 s.h.p., which gave a speed of 34 knots.

The utility of destroyers was very fully demonstrated in World War I, and during the period of hostilities some 280 were built. The first destroyers under the war program, ordered in September 1914, were similar to the "M" class. Greater efficiency in the propelling machinery was realized in the "R" class which followed, as they had geared turbines in place of the direct drive hitherto fitted. This enabled the revolutions to be reduced and more efficient propellers to be fitted. The displacement of this class was 1,065 tons, the dimensions and armament remaining the same as in the "M" class. The horse-power was, however, increased to 27,000, giving a speed of 36 knots.

Developments during the war, and especially the heavier guns of the enemy submarines, made a more powerful gun armament indispensable for destroyers, and in the "V" and "W" classes which followed late in 1916, an advance in fighting power was made. They were fitted with four 4-in. guns of a heavier type, and the system of superimposing these guns in pairs forward and aft was adopted. This arrangement gives these vessels a high gun command and concentration of fire, so making them superior to the previous classes. They carry a 3-in. anti-aircraft gun amidships, and the torpedo armament is increased to two sets of 21-in. triple tubes. These improvements increased the displacement to 1,300 tons, and consequently the 27,000 s.h.p. propelling machinery entailed a reduction of speed to 34 knots.

Later vessels of the "W" class under construction at the cessation of the war, had the 4.7-in. gun in place of the 4-inch. These vessels, of which 14 were completed, also carry two 2-pdr. pom-poms, and six 21-in. tubes in two triple mountings, and in many respects approach more closely to a small light cruiser than to the destroyer of the pre-1914 period.

The progress of the war in 1914–18 called for many and varied duties, quite different from those for which the destroyer was primarily designed; not the least important of these was the active part taken in combating the enemy's submarine campaign, for which most British destroyers were fitted with special apparatus. A cast or forged steel ram, in association with double shell plating at the bows, proved successful in several instances in action with enemy submarines. Explosive "depth charges" fitted at the stern proved effective in dealing with submarines when they submerged before the destroyer could incapacitate them with gunfire or by ramming. Certain destroyers were fitted out as minelayers, and many were provided with mine and submarine sweep gear.

The building of British destroyers ceased altogether soon after the Armistice, and no vessels of the class were built till "Amazon" and "Ambuscade" were completed in 1927. These were followed by the eight vessels of the "Acasta" class built in 1930. All these vessels very closely followed the "W" class design.

During 1914–18 France built very few destroyers, but in 1917 obtained 12 vessels of the Japanese "Kaba" class. In 1922, 12 vessels of the "Bourrasque" class were laid down, followed in 1924 by 14 vessels of "L'Alcyon" class.

These last vessels were of 1,970 tons displacement, 34 knots (35,000 s.h.p.), armed with four 5.1-in. guns and one 3-in. anti-aircraft, with six 21.7-in. torpedo tubes.

Italy built destroyers steadily from 1916, averaging about three vessels per year, starting with "Sirtori" class of 800 tons and 30 knots speed.

Among the last to be laid down were the 16 ships of the "Nembo" class, the latest of which were of 1,350 tons displacement, 38 knots speed (44,000 s.h.p.), armed with four 4.7-in. guns and six 21-in. torpedo tubes.

American destroyers up to 1916 were of the "Porter" and "Manley" classes of 1.125 tons displacement, 32 knots speed (22,000 s.h.p.), armed with four 4-in. guns, one 3-in. anti-aircraft and twelve 21-in. torpedo tubes.

When the United States entered World War I in 1917, destroyers of 1.215 tons were constructed, carrying the same armament but with speeds up to 34 knots. Later types up to 1940 had a displacement of 1,570 tons, five 5-in. 38 calibre guns and twelve 21-in. torpedo tubes.

Japan's latest type of destroyer in 1914 was the "Kaba" class of 12 ships. 665 tons displacement. 30 knots speed (9,500 s.h.p.), armed with one 4.7-in. and four 18-in. torpedo tubes.

Ships of similar type to the British "R" and "W" classes were laid down, and the building of destroyers was thereafter continuous. the latest class being the "Kamikaze" class of 21 ships.

These are of 1,445 tons displacement. 34 knots speed (38,500 s.h.p.), armed with four 4.7-in. guns and six 21-in. torpedo tubes.

The most recent class of destroyers in each nation during the early part of World War II was approximately of the same type as the British "W" class, the principal difference being that, in France and Italy, greater length and power were adopted.

Flotilla-Leaders. — British destroyers on service are grouped in flotillas and there is insufficient room in a destroyer to provide the accommodation necessary for the officer commanding the flotilla with his staff and offices. A larger vessel uith the same general characteristics as the destroyer therefore became necessary; and such vessels were built, one for each flotilla, to act as its leader.

The forerunner of this class was the "Swift" of 1,800 tons displacement, built under the recommendations of the Committee on

Designs in 1904. The first leaders, built definitely to lead flotillas of destroyers, were the four vessels of the "Kempenfeldt" class—1,600 tons displacement, 34 knots speed, armed with four 4-in. guns and four torpedo tubes. These vessels were acting as leaders to flotillas of "K" and "L" class destroyers in 1914. During 1914–18, 25 leaders were constructed for service with flotillas of the "M," "R," "S" and "W" classes, the last being the "Campbell" class of 1,800 tons—36 knots (40,000 s.h.p.), armed with five 4.7-in. guns and six 21-in. torpedo tubes.

After 1918, the only flotilla leader laid down for the British navy was the "Codrington" of 1,520 tons displacement, speed 35 knots (39,000 s.h.p.), armed with five 4.7-in. guns and eight 21-in. torpedo tubes, built for service with "Acasta" class destroyers.

America by 1940 had started 20 ships of 1,630 tons with speeds up to 36.5 knots, and Japan had laid down 15 ships of the "Fubuki" class of 1,700 tons displacement, speed 34 knots (50,000 s.h.p.), armed with six 4.7-in. guns and nine 21-in. torpedo tubes.

After 1922 France laid down 6 flotilla leaders of the "Tigre" class, 2,360 tons displacement, speed 35.5 knots (50,000 s.h.p.), armed with five 5.1-in. and two 3-in. anti-aircraft guns, and six vessels of the "Guépard" class of 2,646 tons displacement, speed 38.5 knots (70,000 s.h.p.), armed with five 5.5-in. guns and six 21·7-in. torpedo tubes.

During the same years, Italy laid down three flotilla leaders of the "Leone" class, 1,960 tons displacement, speed 35 knots (42,000 s.h.p.), armed with eight 4.7-in. and two 3-in. anti-aircraft guns and six 18-in. torpedo tubes, and 12 ships of the "Navigatore" class, 1,980 tons displacement, speed 38 knots (50,000 s.h p.), armed with six 4.7-in. guns and six 21-in. torpedo tubes.

The tendency of flotilla leaders was to increase in size and speed, particularly in France and Italy, until they much more resembled light cruisers than leaders for torpedo boat destroyers.

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DESTRUCTORS. This term is applied, particularly in England, by municipal engineers, to a battery of high-temperature furnaces constructed for disposing, by burning, of household and town refuse. Messrs. Manlove, Alliott and Co., of Nottingham first registered the word destructor as their special trade name for such a furnace. (For developments in the United States, *see* REFUSE DISPOSAL.) The first destructor built by this firm under Fryer's patent was erected in Manchester in 1874. Disposal of refuse is not, however, the only consideration. Utilization of refuse as fuel for steam production is also important. Many towns systematically utilize the calorific value of refuse.

A proper degree of caution, however, should be exercised when contemplating the use of refuse as a low grade fuel. When its value for this purpose was first recognized it was believed that the refuse of a given population was of itself sufficient to develop the necessary steam-power for supplying that population with their electric lighting requirements. The supposed economic importance of a combined destructor and electric undertaking of this character possibly had much to do, in some districts, with the development both of the adoption of the principle of dealing with refuse by fire and of lighting by electricity. Engineering experience, however, very often has shown this to be impractical. But, under favourable circumstances, determining the merits in each case, useful service to other power-using undertakings, such as sewage pumping, clinker crushing plants, etc., may be obtained.

Composition of Refuse.—The composition of house-refuse, which obviously affects its calorific value, varies widely in different districts. The following is an analysis of refuse as dealt with in destructors, based on the average of 12 towns in Great Britain. The percentages of the various constituents are as follows:—fine dust 45.45, ½in. to ¾in. and large cinders 36·16, bricks, pots, shale, etc., 6·5, tins 1·3, rags ·54, glass ·83, bones ·09, vegetable refuse 4·05, scrap iron ·42, paper 2.26, fish offal, greens, small paper bags, carpet, oil cloth, boots, etc., 2.4 per cent.

In London, the quantity of house-refuse amounts approximately to from 4cwt. to 5cwt. per head per annum, or to from 200 to 250 tons per 1,000 of the population per annum. Statistics, however, vary widely in different districts. At Ipswich 7·5cwt. per 1,000 of the population per working day are collected, whereas, at Merthyr Tydfil 40·1cwt. per 1,000 people per day are produced. Recent data show the normal quantity collected to lie between 15 and 20cwt. per 1,000 people per day. When estimating the required capacity of a destructor plant, the quantity of refuse produced by the particular town in question must first be independently investigated, and all calculations based accordingly.

A cubic yard of ordinary house-refuse weighs from 12 to 15cwt. but varies according to its condition whether wet or dry, etc. Shop refuse often consists largely of paper, packings, straw and cardboard. Its weight may be as little as 7cwt. per cubic yard.

Methods of **Disposal.**—Various methods of disposal of refuse are adopted by different towns according to local facilities and conditions. Owing to the high costs involved after World War I in the working of refuse destructors, a system of controlled tipping upon suitable land has been largely resorted to, notably at Bradford, where some 45 tips within the city boundaries are in use. The refuse is spread in layers of about 8ft. in depth and regularly covered with soil. By this means waste land, old quarries, etc., are reclaimed for future use as parks and open spaces. Pulverization of refuse has been adopted in some towns. The refuse is crushed to a small gauge, and where possible disposed of as manure, but the difficulty of securing a reliable market is usually considerable. When obtained such markets are not to be relied upon with any certainty of continuity. Another means of disposal is by the separation or salvage system. In this case the dust, cinders, paper, rags, glass, metals, tins, etc., are all separately sorted out and sold where markets can be found. The vegetable and other putrescible constituents are burned. The handling and redistribution of refuse material in this way amongst the population cannot be regarded with favour in the interests of public health. Disposal at sea and sinking in deep water are also practised, but is often rather costly and sometimes unsatisfactory.

The Destructor System.—The destructor system in which the refuse is burned to an innocuous clinker in specially constructed high-temperature furnaces is that which is most generally resorted to when other methods have proved unsatisfactory, especially in districts which have become well built up and thickly populated. Conditions regarding this method of disposal have, however, changed materially during recent years, particularly in reference to the present high capital costs and greatly increased working expenses. There has also been an appreciable deterioration in the calorific value of present-day refuse in many districts. These conditions have increased the difficulty of usefully combining a destructor with some form of power-using undertaking, with the object of earning credits as a set-off against the heavy working expenses of a destructor installation. The greatly extended use of electric and gas fires, improved types of oil and slow-combustion heating stoves, the high price of coal and the more economical habits of householders, have all contributed to the production of house refuse with a smaller proportion of cinders and scraps of coal, thereby resulting in a low calorific value, and also a poorer quality of clinker from the destructor furnace. At Farnborough it is found that the calorific value of refuse is now about 50% less than in pre-war days, and there has been similar experience at Southampton, Hull and elsewhere.

Many of the earlier destructor and electricity station combinations have not proved satisfactory for various reasons, and have been abandoned. One difficulty often experienced has been that of maintaining a steady and reliable steam pressure with so variable and uncertain a fuel.

A number of destructor-electric combinations are, however, working satisfactorily in districts where the local conditions are favourable, as at Rhondda, Wolverhampton and Pontypridd. At Rhondda and Pontypridd the refuse is of a high calorific value, and contains a relatively large percentage of small coal and unburnt cinders. During an official test, the Rhondda destructor (Heenan and Froude) evaporated 4·15 lb. of water per 1 lb. of refuse burned from and at 212°. This destructor was erected

in 1915, and the South Wales Power Co. purchased the electric current produced at this installation. The electrical energy generated is equal to 264 units per ton of refuse burnt.

The electrical output at the Rhondda destructor plant has not been equalled by any combined destructor and electric station. Other power-using services to which the surplus heat from a destructor is applied include the pumping of low level sewage, as carried out at Salisbury, Lincoln, Cambridge, Watford, Eastbourne, Luton, Felixstowe, Aldershot and Twickenham.

During recent years, the question of high running costs at destructor installations has been under careful review by many British public authorities, and many destructors have either been discontinued or rendered of limited service.

Conditions for Destructor System.—As regards the general question of the advisability or otherwise of erecting a destructor, each town should decide for itself, according to the local conditions and requirements. It is a question upon which it is unwise to generalize, but when considering the matter, some leading points to be kept in view are: (a) Is the district so closely built up and congested as to render all other less costly means of disposal impracticable, thus rendering the expense of a destructor necessary as a last resort? (b) Has the refuse sufficient calorific value to justify its use for steam-raising purposes, and are there any necessary local services, such as sewage pumping, upon which the heat from the destructor can be profitably utilized, and thus save the cost of coal as a set-off against the heavy working expenses? (c) Are any local markets available for the sale of surplus clinker, tins, etc.? (d) Can a suitable central site for a destructor be found in a populated area without involving additional expense in haulage to some outlying site, or causing nuisance from smells, dust, and the concentrated cartage of refuse, to the neighbouring inhabitants? *(e)* Can the existing system of disposal be carried on without risk of real danger (as distinguished from sentiment) to the public health? If not, the installation of a destructor must then be seriously considered.

Although the conditions arising out of the World War placed a check in Great Britain, in the United States and on the Continent upon the laying down of new destructor installations, and the maintenance of existing plants, the past few years have shown a renewal of activity in this direction.

Notwithstanding high capital costs and working expenses, necessity arising out of local conditions has led to the erection of new plants at Birmingham, Hornsey, Devonport, Rochdale, Wimbledon, Portsmouth, Brighton, Llandudno, East Ham, Hastings, Leicester, Leeds, Hereford, Accrington, Coventry, Edinburgh, Perth, Stoke, New York, Gibraltar and elsewhere.

Modern Equipment.—A modern installation usually includes, in addition to the leading feature of the destructor cells or furnaces, a mechanical power-driven plant used in connection with the preliminary screening of the refuse and comprising screens, elevators, etc., for the removal of dust up to about $\frac{1}{8}$in. gauge, an overhead runway for conveyance of hot clinkers from the furnace mouths, and storage accommodation for raw refuse for use when the collectors are not at work.

For the removal of tins and iron from the raw refuse electromagnetic separators are frequently installed where these materials have a marketable value. The tins are reduced in bulk to convenient blocks by means of a hydraulic baling-press. Clinker from the furnaces is reduced to saleable form by suitable clinker-crushing and screening plants. Other accessory machinery includes a strongly built mortar mill and a hydraulic press for the manufacture of slab-paving in order to utilize the surplus clinker, a power-driven fan with air-ducts for the supply of forced draught to the cells. Machinery for the manufacture of asphalt from clinker for the surfacing of roadways is in some cases also installed, as, *e.g.*, at Brighton and Abertillery. The motive-power for actuating all this accessory plant at the destructor station, including an electric lighting equipment, is usually economically obtainable from the surplus heat from the cells when applied to the generation of steam in a suitable boiler.

Forced Draught.—The forced draught to destructor cells may be given by an air fan or by steam blast. The air fan will require to work at about 6in. total water-gauge pressure, and to give from 2in. to ;in. of pressure in the ashpit itself. The actual pressure will vary according to the thickness of the fires being burnt at any given time. The power required to drive the air fan suitable for six furnaces of the Sterling type (New Destructor Co., Ltd.) will not exceed 25 brake horse-power.

In the case of steam blast with 2in. to $2\frac{1}{2}$in. water-gauge pressure in the ashpit, the quantity of steam used per hour would be approximately 1,000 lb. in four Heenan cells, or 250 lb. of steam per hour per grate of 30sq.ft. area. The temperature required to be developed in the combustion chamber is approximately 2,000°. The advantages of forced draught are that a much higher temperature is attained, little more air than the quantity theoretically necessary is needed, and the minimum amount of cold air is admitted to the furnaces. The air supply to modern furnaces is usually delivered hot—the inlet-air being first passed through an air-heater the temperature of which is maintained by the waste heat in the main flue.

Types of Cells.—The evolution of a good type of destructor cell or furnace, has occupied many years of experience, and has been the subject of much experiment and many failures. The principal towns in England which took the lead in the adoption of the destructor were Manchester, Birmingham, Leeds, Warrington, Blackburn, Bradford, Bury, Hull, Nottingham, Ealing and London. Ordinary furnaces, built mostly by dust contractors, began to come into use in London and in the north of England in the second half of the 19th century, but they were not scientifically adapted to the purpose, and necessitated the admixture of coal with the refuse to ensure its proper cremation.

The Manchester Corporation erected a furnace of this kind about the year 1873–74, and Messrs. Mead and Co. made an unsatisfactory attempt in 1870 to burn house-refuse in closed furnaces at Paddington. Shortly after Alfred Fryer erected his destructor at Manchester, several other towns also adopted this furnace. Other types were from time to time brought before the public, among which may be mentioned those of Pearce and Lupton, Pickard, Healey, Whiley, Thwaite, Young, Wilkinson, Burton, Hardie, Jacobs and Ogden. In addition to these the Beehive and the Nelson destructors became well known. The former was introduced by Stafford and Pearson of Burnley, and one was built in 1884 in the parish yard at Richmond, Surrey, but the results being unsatisfactory, it was closed during the following year. The Nelson furnace, patented in 1885 by Messrs. Richmond and Birtwistle, was erected at Nelson-in-Marsden, Lancashire, but, being costly in working, was abandoned.

Types of Destructors.—The principal types of destructors now in use are those of Fryer, Warner, Manlove-Alliott, Meldrum, Beamen and Deas, Heenan and Froude, and the Horsfall and Sterling destructor. The Fryer destructor was patented by Alfred Fryer in 1876. The cells are usually arranged in pairs back to back, and enclosed in a rectangular block of brickwork having a flat top on which the house-refuse is tipped from the carts. The furnace burns from four to six tons of refuse per cell per 24 hours. The outlets for the products of combustion are placed at the back near the refuse feed openings. This arrangement is imperfect in design as it permits offensive vapours from unburnt refuse to escape into the main flue with the products of combustion. Nuisances from smell arising from this cause led, in some instances, to the introduction of a secondary furnace, known as a cremator, which was patented by C. Jones of Ealing in 1885. This furnace was placed in the main flue leading to the chimney shaft for the purpose of cremating the organic matters in the vapours from the unburnt refuse, but it added considerably to the cost of running the destructor and was abandoned. The Fryer destructor, with a cremator, was largely used during the early history of destructors, but it has given place to more modern and improved designs of high temperature furnaces.

The Horsfall destructor is a high-temperature furnace of later design than the foregoing. Important improvements are to be found in the arrangement of the flues and flue outlets for the products of combustion, and in the provision of a forced draught duct through which air is supplied under pressure into a closed

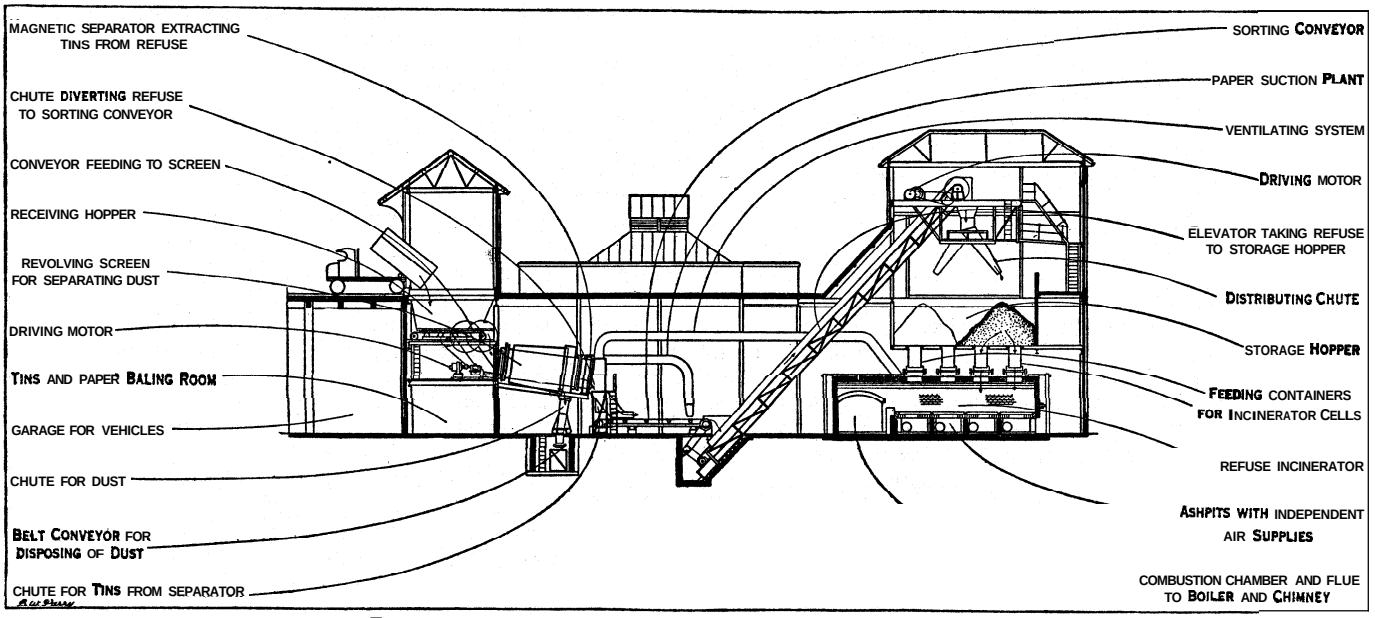


FIG 1.—CROSS SECTION THROUGH "HEENAN" DESTRUCTOR SYSTEM
Showing dust screening plant and entire course of the refuse from arrival in the refuse-collecting vehicle to its destruction in the furnaces

ashpit. The flue opening for the removal of gaseous products of combustion is placed at the front of the furnace over the dead plate whilst the feeding-hole for the raw refuse is situated at the back of and above the furnace. By these means the gases from the raw refuse must pass, on their way to the main flue, over the hottest part of the furnace and through the flue opening in the red-hot reverberatory arch. By means of the forced draught, a temperature of from 1,500° to 2,000°, as tested by a thermo-electric pyrometer, is attained in the main flue. Cast-iron boxes are provided at the sides of the furnaces, and through these the forced draught is conveyed on its way to the fire grate. The boxes are also designed to prevent the adhesion of clinker to the side walls of the cells and so to preserve the brickwork.

The standard arrangement for a modern Manlove-Alliott top-feed destructor is designed on the "continuous hearth" principle whereby the furnace gases pass from cell to cell on their way to the combustion chamber, thus ensuring a uniform temperature and minimising the cooling down effect when fresh refuse is charged into the furnaces. A joint destructor and sewage pumping scheme has been installed by the Borough of Guildford and the Rural District Council of Hambledon, in which sewage is raised by pneumatic ejectors worked by steam from the refuse. There are four cells of the top-feed type arranged with two water-tube boilers on the Wood and Brodie "Unit" system. Each boiler is sandwiched between a pair of cells, and the high-temperature gases pass immediately into contact with the boiler heating surface. There are eight ejector stations, in each of which two ejectors work as a pair, arranged so that both ejectors cannot be filling or discharging at the same time. The ejectors are of the Alliott and Philps's automatic improved type.

Warner's destructor (the "Perfectus") was similar to Fryer's in general arrangement, but was provided with special charging hoppers, dampers in flues, dust-catching arrangements, rocking grate bars, and other improvements. The refuse was tipped into feeding-hoppers, consisting of rectangular cast-iron boxes over which plates were placed to prevent the escape of smoke and fumes. When refuse was fed into the furnace a flap-door controlled by a lever was thrown over, the contents of the hopper dropped on to the sloping fire-brick hearth beneath, and the door at once closed again to prevent the admission of cold air into the furnace as far as possible. The cells were each 7ft. wide by 11ft. deep. The rear portion consisted of a fire-brick drying hearth, and the front of rocking grate bars upon which the combustion took place. The amount of refuse consumed varied from five to eight tons per cell per 24 hours.

The Meldrum "Simplex" destructor produced good steam raising results and was first installed at Rochdale, Hereford, Darwen, Nelson, Plumstead and Woolwich. Cells have also been erected at Burton, Hunstanton, Blackburn, Burnley, Cleckheaton, Lancaster, Sheerness and Weymouth. This destructor differs from those previously described in general arrangement. The fire-grates are placed side by side without separation except by dead plates, but, in order to localize the forced draught, the ashpit is divided into parts corresponding with the different grate areas. Each ashpit is closed airtight by a cast-iron plate, and is provided with an airtight door for removing the fine ash. Two Meldrum steam-jet blowers are provided for each furnace, supplying any required pressure of blast up to 6in. water column. The pressure usually used is about $1\frac{1}{2}$ to 2 inches. The furnaces are designed for hand-feeding from the front, but hopper-feeding can be applied if preferred. The products of combustion are led from the back of each fire grate into a common flue leading to the boilers and to the chimney shaft, or are conveyed sideways over the various grates and a common fire-bridge to the boilers or chimney. The heat in the gases, after passing the boilers, is still further used to heat the air supplied to the furnaces — the gases being passed through an air-heater or continuous regenerator consisting of a number of cast-iron pipes from which the air is delivered through the Meldrum blowers at a temperature of about 300°. At Rochdale, the Meldrum furnaces consumed from 53 lb. to 66 lb. of refuse per square foot of grate area per hour, as compared with 22·4 lb. per square foot in a low-temperature destructor burning six tons per cell per 24 hours with a grate-area of 25 square feet. The evaporative efficiency varied from 1·39 lb. to 1·87 lb. of water (actual) per 1 lb. of refuse burned, and the average steam pressure was about 114 lb. per square inch.

The Beaman and Deas destructor was installed at Warrington, Dewsbury, Leyton, Canterbury, Llandudno, Colne, Streatham, Rotherhithe, Wimbledon, Bolton and elsewhere. At Leyton, which, at the date when this destructor was installed, had a population of over 100,000, an eight-cell plant dealt with house refuse and filter press cakes of sewage sludge from the sewage disposal works adjoining. Each cell burnt about 16 tons of the mixture in 24 hours and developed about 35 i.h.p. continuously, at an average steam pressure in the boilers of 105 lb. The essential features of this destructor include a level fire-grate with ordinary type bars spaced only $\frac{3}{32}$ in. apart, a high-temperatured combustion chamber of about 2,000° at the back of the cells, a closed ashpit with forced draught, provision for the admission of a secondary air supply at the fire-bridge, and a fire-brick hearth sloping at an angle of about 52°. The forced draught is supplied from fans at a pressure of from $1\frac{1}{2}$ to 2in. of water gauge, and is

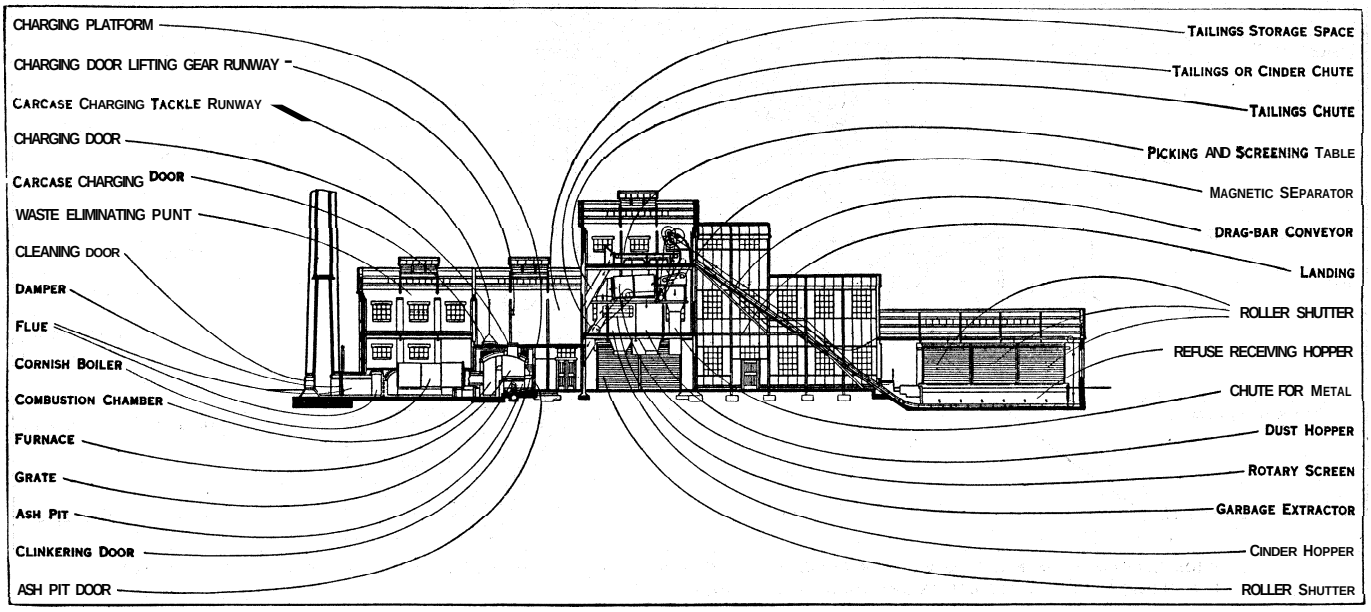


FIG. 2.— LONGITUDINAL SECTION OF REFUSE DISPOSAL PLANT OF THE NEW DESTRUCTOR COMPANY, WITH REFUSE-SCREENING PLANT
The refuse is delivered to "refuse receiving hopper," then raised by "dragbar conveyor" to the "picking and screening table." After sorting and screening, the "tailings" from the refuse are passed on to the "charging platform" over the destructor cells, where the material is burnt to an innocuous clinker

controlled by means of baffle valves worked by handles on either side of the furnace. The heat from the cells is used in conjunction with a water-tube boiler such as the Babcock and Wilcox, and the gases on their way from the combustion chamber to the main flue pass three times between the boiler tubes. The grate area of each cell is 25sq.ft. and the consumption varies from 16 to 20 tons of refuse per cell per 24 hours.

The Heenan destructor has been in use for over 25 years and a large number of installations have been erected in many of the largest cities throughout the world, including Birmingham, Glasgow, London, Leeds, Brussels, Paris, Rotterdam, Leningrad, New York, San Francisco, Montreal, Melbourne, Singapore, Edinburgh, Coventry, and many other places. The essential features of the Heenan System (fig. 1) include a continuous furnace chamber with divided ashpits, air heater or regenerator, combustion and gas mixing chamber, steam generator, forced draught supply with efficient air regulation and a ventilation system.

The cells may be designed for hand-feed under the direct control of the eye and hand of the stoker, either on the front-feed or back-feed system, or, where preferred, a system of mechanical charging and clinkering is installed. Mechanical clinkering has involved a change in grate design, and what is known as the trough-gate has been largely employed in the Heenan system. The advantages claimed are: perfect combustion and the maintenance of a regular temperature and boiler pressure during the process of feeding and clinkering; freedom from dust and a minimum of labour in the clinkering operations; the production of a hard clinker practically free from carbon, and a general cleanliness and expedition in the clinkering operations.

By means of the air-heater or regenerator system (placed in the path of the gases after these have passed through the boiler) employed with these furnaces, the thermal efficiency of the furnace is improved, excess of air in the cells is avoided, and more steady and better steaming results are obtained. Those destructors fitted with top-feed are either charged by container feed, skip feed, or feed by conveyor. The mechanical control of the doors permitting the fall of the refuse into the furnace chamber may be by hand operation from the clinkering floor, hydraulic operation with ram cylinders on platforms at the level of the top charging doors, or electric motors may be used for the opening and closing of the doors controlled from the clinkering floor.

Furnace doors are air-cooled. When clinkering, provision is made by means of an asbestos preparation to seal the doors to prevent the escape of fumes into the building. During the three years the Coventry Heenan plant was under observation, over 2 lb. of steam at 160 lb. pressure was produced for every 1 lb. of refuse burnt, and in colliery districts as much as 4 lb. of steam per 1 lb. of refuse have been developed from the refuse.

In the London metropolitan area an important installation of the Heenan system was installed at Ilford in 1916, embodying mechanical charging and clinkering accessories. The plant consists of two three-grate (trough-type) units, each unit comprising three mechanically charged and clinkered grates, one Babcock and Wilcox water-tube boiler of 200 lb. per square inch working pressure, one Foster superheater, three electrically operated top-charging doors with frames, shafting, drums, pulleys and wire ropes complete, one Heenan fan and engine for forced draught, and two electric ,cranes for lifting the refuse skips. The steam produced is used to drive generators in an adjoining station. The average rate of evaporation per hour, from and at 212° per square foot heating surface of boiler, under test, was 3.9 lb. The average rate of evaporation per 1 lb. of refuse burnt (from and at 212°) was 1·82 lb., and the steam pressure 155·8 lb. per square inch. The temperature of the combustion chamber was—maximum 2,462°, minimum 1,886°.

At a modern installation at Birmingham (Brookvale road depot) a specially designed suction plant was installed to collect waste paper from the end of the conveying belts, and to deliver it free of dust, to baling presses. To facilitate clinker handling, a monorail or overhead railway, with skips equipped with raising and lowering gear, provides convenient means of transporting the clinker to the cooling area or to the clinker plant.

The Heenan system had been largely used on the Continent, where some of the largest and best equipped installations are to be found. The plant erected at Rotterdam (Holland) in 1912 is a good example.

The refuse disposal plants of the New Destructor Co. include designs on the improved Horsfall and Sterling types. A typical plant is illustrated in fig. 2 showing the handling and path of the refuse from the time it is delivered to the destructor works until its reception into the furnaces. The cells are of modern continuous grate high-temperature type, and equipped for good steam-raising results. The Horsfall Poplar plant yields 700 h.p. from the combustion of the refuse, the power being used for generating electric current. The evaporation per 1 lb. of refuse burnt (from and at 212°) is about 1·5 lb. of water. The Mersey Dock and Harbour Board, Liverpool, use a Horsfall plant yielding 360h.p., for lighting, clinker treatment, etc., the capacity of five cells being 130 tons of refuse per 24-hour day. Sterling plants are used at Sydney (N.S.W.), Zurich, Colombo, Pittsburgh

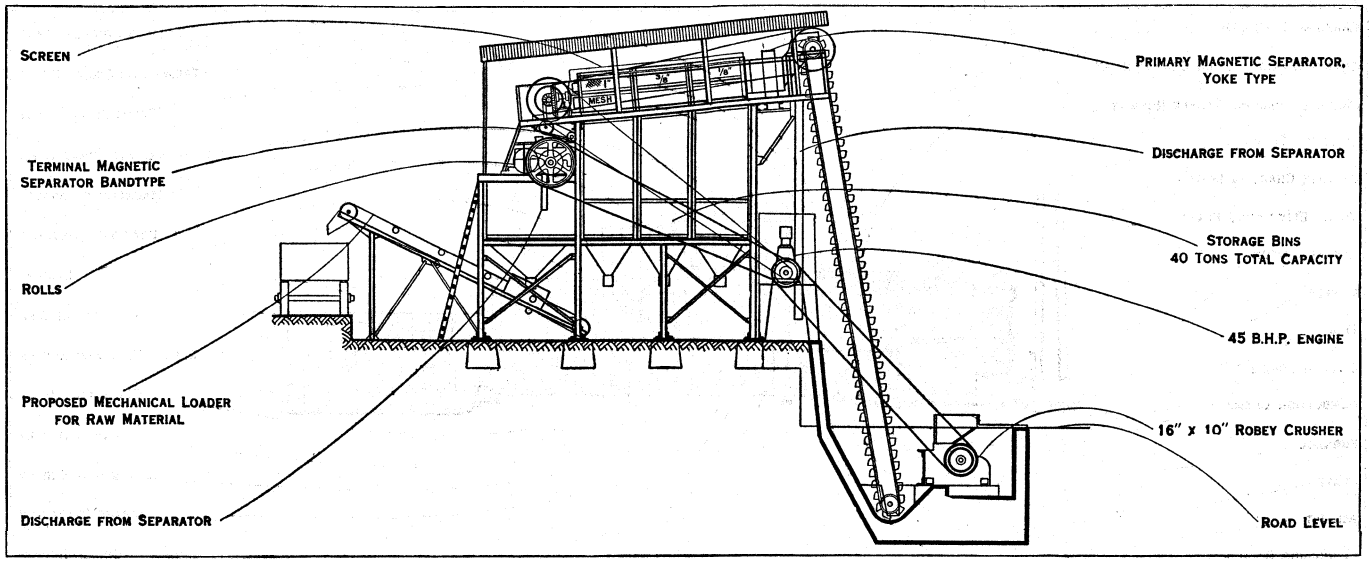


FIG. 3.—SIDE ELEVATION OF MILLAR'S CLINKER CRUSHING. SCREENING AND GRADING PLANT, FOR THE ECONOMICAL PREPARATION OF DESTRUCTOR CLINKER. BEFORE ITS USE IN THE MANUFACTURE OF ASPHALT

(U.S.A.), Berkeley (U.S.A.), and Toronto (Canada). The Colombo plant is a six-cell Horsfall back-feed type with continuous grate; each cell has a grate area of 30sq.ft. and is capable of burning ten tons per 24 hours. Forced draught is supplied by two positive blowers of the Roots pattern, exhausted through a galvanized-iron overhead main with its intake in the hoppers. The foul gases from the refuse are thus drawn over with the cold air and forced through the regenerative air heater and through underground ducts to the front of the furnace blocks. A 6in. cast-iron pipe is built into these ducts and connected to the side boxes for delivering the heated air to the underside of the grate bars.

Clinker asphalt machinery for the manufacture of road surfacing material is also provided, when required, in connection with Horsfall and Sterling furnaces. At an installation at Abertillery the cost per square yard of finished road including 2½in. base or binder course with a 1in. surfacing carpet costs about 7s. 3d. per square yard. Clinker-asphalt plants are also in use at Woolwich and Hendon, and a complete plant is being erected at Walthamstow.

Beast-cremating Chamber.—This installation includes two beast-cremating chambers to enable cattle, horses, dogs, etc., to be disposed of in the event of cattle murrain breaking out in the city. At the top of the chambers are large cast-iron doors lined with fire-bricks. The doors are fitted with a water seal to prevent hot gases blowing out. Carcasses are hoisted by pulley blocks mounted on a trolley fixed to steel joists so placed as to enable the beast to be lifted from the clinkering floor, traversed over the top of the furnaces to the centre of the cremating chamber, and dropped in by cutting a rope to avoid handling.

Destructor Records and Tests.—To judge correctly of the true performance of a destructor installation it is necessary to take careful observations and tests over long periods. Reliable records of every-day working throughout the whole year are necessary to gain a true knowledge of the performance of the plant. For such tests the destructor station should be provided with a road platform weigh-bridge, water meter, a pyrometer and, if possible, a carbon-dioxide recorder. The principal data to be noted include: the weight and description of refuse burned, the quantity of water evaporated in destructor-fired boilers, the average steam pressure, the weight of clinker and dust produced, the temperature in the combustion chamber and settings, and the percentage of carbon-dioxide in the flue gases. In order to determine the all-round efficiency of an installation, the leading facts to be ascertained from these data are: the weight of refuse burnt per square foot of grate area, the water evaporation per 1 lb. of refuse consumed from and at 212°, the average temperature of the combustion chamber, the average carbon-dioxide gas analysis, the percentage of steam required to operate the destructor and its accessory plant, and the percentage and quality of clinker compared with the weight of refuse consumed.

Temperatures in the combustion chamber may be obtained by the use of the Fêry radiation pyrometer, after the boiler by a mercury pressure pyrometer, and other temperatures by the mercury expansion thermometer. Other instruments used in connection with destructor tests are the Meyland-D'Arsonval galvanometer, and the Chatellier resistance pyrometer and galvanometer, as made by the Cambridge Scientific Instrument Co., Ltd. The continuous record of the chemical composition of the gases in the combustion chamber may be taken by means of the Simmance and Abady CO_2 recorder.

The higher the percentage of carbon-dioxide passing away in the gases the more efficient the furnace, provided there is no formation of carbon-monoxide the presence of which would indicate incomplete combustion. The theoretical maximum of carbon-dioxide for refuse burning is about 20%, and, by maintaining an even clean fire, by admitting secondary air over the fire, and by regulating the dampers or the air-pressure in the ashpit, an amount approximating to this percentage may be attained in a well designed furnace if properly worked. If the proportion of free oxygen (*i.e.*, excess of air) is large, more air is passed through the furnace than is required for complete combustion, and the heating of this excess is clearly a waste of heat.

Capital Costs and Working Expenses.—The capital cost of a destructor installation will depend very largely upon the local conditions, situation and nature of the site. In addition to the customary destructor buildings, cells, charging and clinkering machinery, brick settings, chimney shaft, inclined approach roadway, water supply, drainage, light, etc., a modern installation also usually comprises screening machinery for the removal of dust up to about ¼in. to ⅜in. gauge, power-driven elevators, sorting conveyor, electro-magnetic separators, clinker crusher and grading machinery, mortar mills, tin baling press, mess room and spray room, foreman's cottage, office, workshop, weigh-bridge, necessary road and yard formation, electric lighting and other accessories. The writer has had recent occasion closely to investigate the capital cost of such an installation for erection in Kent, capable of dealing with about 72 tons of refuse per 24 hours, and the inclusive cost, based on quotations received, was estimated at £19,700 including a 150h.p. Lancashire boiler, a 40b.h.p. horizontal engine, and a five-kilowatt electric lighting set, all comprised within destructor buildings built with steel stanchions, 14in. piers and gin. plain brick panels.

As regards the working expenses of dealing with the refuse by destructor, the average cost per ton of refuse, based on data from 20 towns in the south of England, was found to be 7s 4¾d. exclusive of loan charges. On a large portion of this class of

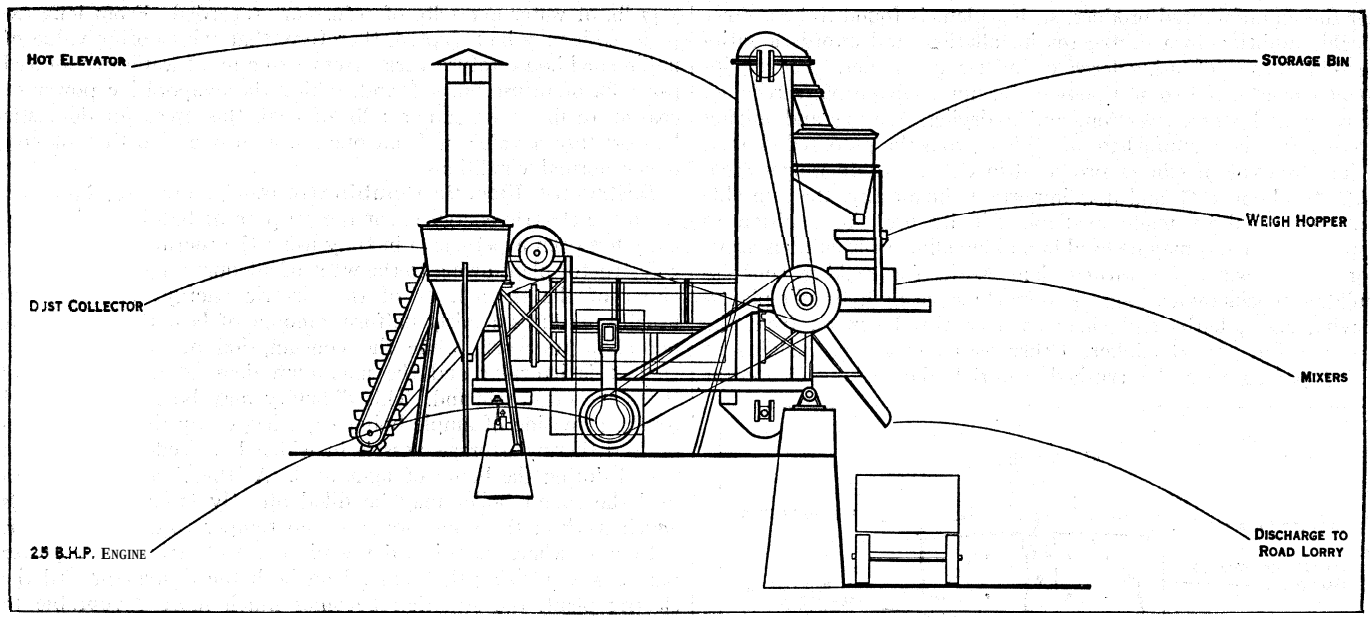


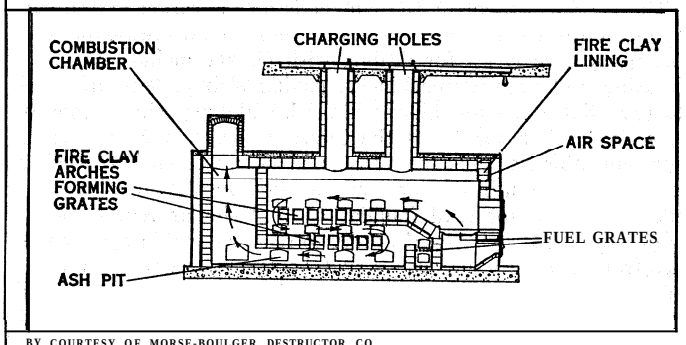
FIG. 4.— SIDE ELEVATION OF MILLAR'S CLINKER ASPHALT PLANT, FOR THE CONVERSION OF DESTRUCTOR CLINKER INTO ASPHALT FOR ROADWAYS

plant the depreciation and wear and tear are considerable. The loan period would therefore be relatively short, say from ten to 15 years only. Loan charges may amount to about 4s. per ton, under present conditions of high costs of building and machinery, on a complete scheme as outlined above. In view of the high temperature at which the cells work they would probably require relining within a period of ten years.

As regards labour required, stokers, with hand-fed plants, may deal with from five to six tons of refuse per man per eight-hour shift. For burning 50 tons of refuse per day of 16 hours four men per eight-hour shift would be required for stoking and firing. Extra labour would be needed for outside work such as clinker crushing, mortar making and other such work.

General Arrangement of Station. — In the general arrangement of a destructor station the cells are placed either side by side, with a common main flue in the rear, or back to back with the main flue arranged in the centre and leading to a tall chimney-shaft. The heated gases on leaving the cells pass through the combustion chamber into the main flue, and thence go forward to the boilers, where their heat is absorbed and utilized. Forced draught, or in many cases, hot blast, is supplied from fans through a conduit commanding the whole of the cells. An inclined roadway, of as easy gradient as circumstances will admit, is provided for the conveyance of the refuse to the tipping platform, from which it is fed, either by hand or mechanically, through feed-holes into the furnaces. In the installation of a destructor, the choice of suitable plant and the general design of the works must be largely dependent upon local requirements, and should be entrusted to an engineer experienced in these matters. The following primary considerations, however, may be enumerated as materially affecting the design of such works: (a) The plant must be simple, easily worked without stoppages, and without mechanical complications upon which stokers may lay the blame for bad results; (b) it must be strong, must withstand variations of temperature, must not be liable to get out of order, and should admit of being readily repaired; (c) it must be such as can be easily understood by stokers or firemen of average intelligence, so that the continuous working of the plant may not be disorganized by change of workmen; (d) a sufficiently high temperature must be attained in the cells to reduce the refuse to an entirely innocuous clinker, and all fumes or gases should pass either through an adjoining red-hot cell or through a chamber whose temperature is maintained by the ordinary working of the destructor itself at a degree sufficient to exclude the possibility of the escape of any unconsumed gases, vapours or particles. The temperature may vary between 1,800° and 2,000°.

Modern practice favours the continuous hearth principle whereby the furnace gases pass from one cell to another on their way to a common combustion chamber; *(e)* the plant must be so worked that while some of the cells are being recharged, others are at a glowing red heat, in order that a high temperature may be uniformly maintained; (f) the design of the furnaces must admit of clinkering and recharging being easily and quickly performed, the furnace doors being open for a minimum of time so as to obviate the inrush of cold air to lower the temperature in the main flues, etc.; (g) the chimney draught must be assisted with forced draught from fans or steam jet to a pressure of 1½in. to zin. under grates by water-gauge; (*h*) where a destructor is required to work without risk of nuisance to the neighbouring inhabitants, its efficiency as a refuse destructor plant must be primarily kept in view in designing the works, steam-raising being regarded as a secondary consideration; (i) where steam-power and a high fuel efficiency are desired a large percentage of carbon-dioxide should be sought in the furnaces with as little excess of air as possible,



BY COURTESY OF MORSE-BOULGER DESTRUCTOR CO.

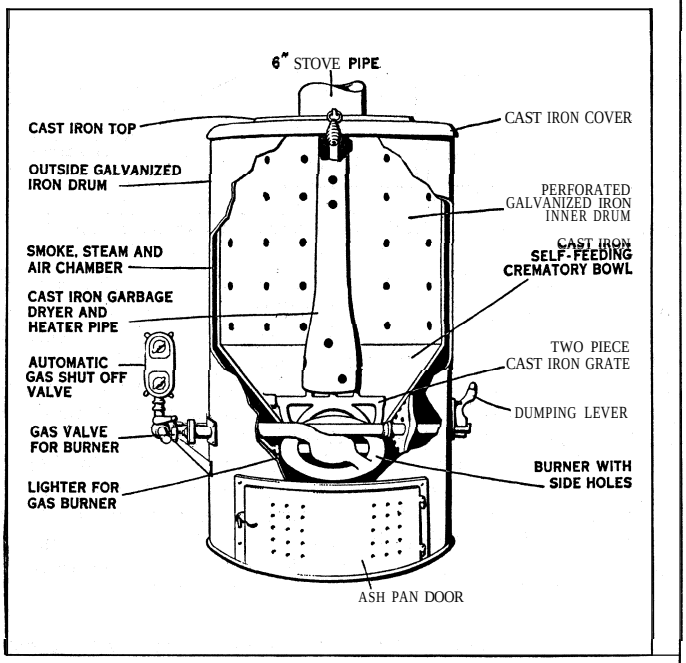
FIG. 5.— DIAGRAM OF THE INSIDE OF A DESTRUCTOR. DESIGNED TO DISPOSE OF REFUSE BY BURNING AND, AT THE SAME TIME, UTILIZE THE REFUSE AS FUEL TO DEVELOP STEAM POWER AND OTHER USEFUL SERVICES

and the flue gases should be utilized in heating the air-supply to the grates, and the feed-water to the boilers; (j) ample boiler capacity and hot-water storage feed-tanks should be included in the design where steam-power is required.

Clinker Asphalt Plants. — The cells at the Brighton destructor works have been reconstructed by Messrs. Heenan and Froude, Ltd., of Worcester, and a modern clinker asphalt plant installed. By means of this the destructor clinker is crushed, graded and mixed for use as an asphalt carpet or surfacing for roadways. This plant is illustrated in figs. 3 and 4. Where there is a suitable outlet

for the manufactured product, such a plant is found to be a serviceable addition to a destructor installation, and affords a satisfactory means of using large quantities of clinker. The equipment consists of two sections—a crushing, separating, screening, grading and storage section, and a drying, heating and mixing section for the manufacture of asphalt from the prepared clinker.

The amount of clinker produced in Great Britain ranges from 20% to about 35% and it is important, financially, that suitable outlets should be made available for its use. In addition to asphalt making, it may be used in making clinker bituminous grout for carriageways, for tarmacadam work, for making concrete building blocks by hand-operated machines or by hydraulic plants. Paving slabs, kerbs and channels may also be made from the crushed and graded clinker. Other uses include the bedding of street paving with the crushed material, the making of mortar



BY COURTESY OF HOME INCINERATOR CO.

FIG. 6—DIAGRAM OF THE INCINERATOR, A TYPE OF DESTRUCTOR

for building, and the bottoming of roads and footways.

The carbon content of the clinker is an indication of the efficiency of the combustion in the cell, and should always be low. The usual accessories for dealing with clinker include crushing, elevating and grading machinery, paving slab presses and machinery, clinker concrete block and brick making machines, mortar mills and asphalt plant. At the Coventry destructor the clinker represents about 25% of the refuse, and some 5,000 tons of clinker per annum are utilized for slab making, mortar making, tarmacadam work, for road foundations and similar requirements.

Use of Surplus Heat.—In order to render the refuse and gases therefrom perfectly innocuous and harmless, the modern high-temperature destructor must be worked at a temperature of not less than from 1,800° to 2,000°. The great heat thus developed has naturally suggested its utilization for steam production, and, where suitable outlets exist for its use, a reasonable additional expenditure on plant and labour is justified. The actual calorific value of refuse varies widely in different places and also during different seasons of the year, but as a general average, with a suitably designed and well managed plant, an evaporation of 1 lb. of water per 1 lb. of refuse burned is a result readily attainable, and one which affords a basis of calculation which engineers may adopt in practice. The evaporative results obtained depend also upon the industry and skill of the stokers as well as on the quality of the refuse. Many destructor steam-raising plants give considerably higher results than those named above, and evaporations approaching 2 lb. of water per 1 lb. of refuse are met with under favourable conditions. In the coal-mining districts of Rhondda and Pontypridd evaporations from and at 212° of 4·1j lb. and 3.47 lb. of water per 1 lb. of refuse are recorded. From long experience it may be accepted, therefore, that the calorific value of unscreened house-refuse varies from 1 to 2 lb. of water evaporated per 1 lb. of refuse burned, and, taking the evaporative power of coal at 10 lb. of water per 1 lb. of coal, this gives for domestic house-refuse a value of from one-tenth to one-fifth that of coal under normal conditions.

Destructor Electric Combinations.—In practice, however, when the electric energy is for the purpose of lighting only, difficulty has been experienced in fully using the thermal energy from a destructor plant owing to the want of adequate means of storage either of the thermal or of the electric energy. A destructor usually produces a fairly uniform amount of heat throughout the period of its work, while the consumption of electric lighting current is irregular and the maximum demand may be several times the mean demand. This difficulty may be greatly reduced by the provision of ample boiler capacity, or by the introduction of feed thermal storage vessels in which hot feed-water may be stored during the hours of light load. At the time of maximum load the steam boiler may be filled directly from these vessels which work at the same pressure and temperature as the boiler.

In cases where there is a day load, as for electric motive power purposes, equalizing the demand on both the destructor and the electric plant, the situation becomes much more favourable to the full utilization of the available surplus heat.

As regards sewage pumping, destructor installations of the New Destructor Co. are supplying power for this purpose at Gosport, Hampton, Leamington, Teddington, Worthing and other places, and a similar service is rendered by plants of Messrs. Manlove, Alliott and Co. at Guildford, Stroud and Cambridge, whilst the Heenan destructor affords power for sewage pumping at Portsmouth, Nuneaton, Hanwell, Lincoln and elsewhere. *(See* REFUSE DISPOSAL for American practice.)

BIBLIOGRAPHY.—W. H. Maxwell, *Removal and Disposal of Town Refuse,* with an exhaustive treatment of Refuse Destructor Plants; a special supplement embodies later results; H. F. Goodrich, *Refuse Disposal and Power. See* also the *Proceedings of the Incorporated Association of Municipal and County Engineers,* vols. xiii. p. 216, xxii. p. 211, xxiv. p. 214 and xxv. p. 138; the *Proceedings of the Institution of Civil Engineers,* vols. cxxii. p. 443, cxxiv. p. 469, cxxxi. p. 413, cxxxviii. p. 508, cxxix. p. 434, cxxx. pp. 213 and 347, cxxiii. pp. 369 and 498, cxxviii. p. 293, cxxxv. p. 300, and cxxxix.

(W. H. M.)

DESTUTT DE TRACY, ANTOINE LOUIS, COUNT: *see* TRACY, ANTOINE LOUIS DESTUTT, COMTE DE.

DE TABLEY, JOHN BYRNE LEICESTER WARREN, 3rd BARON (1835–1895), English poet, eldest son of George Fleming Leicester (afterwards Warren), 2nd Baron De Tabley, was born on April 26, 1835, and died at Ryde on Nov. 22, 1895. He was educated at Eton and Christ Church, Oxford, where he took his degree in 1856 with second classes in classics and in law and modern history. In the autumn of 1858 he went to Turkey as unpaid attaché to Lord Stratford de Redcliffe, and two years later was called to the bar. In 1871 he removed to London, where he became a close friend of Tennyson for several years. From 1877 till his succession to the title in 1887 he lived in complete seclusion, but in 1892 he returned to London, and enjoyed a sort of renaissance of reputation and friendship.

De Tabley was at one time an authority on numismatics; he wrote two novels; published *A Guide to the Study of Book Plates* (1880); and the fruit of his careful researches in botany was printed posthumously in his elaborate *Flora of Cheshire* (1899).

From time to time he published volumes of verse under various pseudonyms. On the publication of *Philoctetes* in 1866 De Tabley met with wide recognition. *Philoctetes* bore the initials "M.A.," which were interpreted as meaning Matthew Arnold. He at once disclosed his identity. In 1867 he published *Orestes,* in 1870 *Rehearsals* and in 1873 *Searching the Net.* These last two bore his own name, John Leicester Warren. *The Soldier of Fortune* (1876), a drama on which he had bestowed much careful labour, proved a complete failure. The success of his *Poems, Dramatic and Lyrical* (1893), encouraged him to publish a second series in 1895, the year of his death. His posthumous poems were collected in 1902. The characteristics of De Tabley's poetry are

pre-eminently magnificence of style, derived from close study of Milton, sonority, dignity, weight and colour. He was always a student of the classic poets, and drew much of his inspiration directly from them.

See a sketch *by* Sir Edmund Gosse in his *Critical Kit-Kats* (1896).

DETAILLE, JEAN BAPTISTE EDOUARD (1848–1912), French painter of military subjects, was born in Paris on Oct. 5, 1848, and died there on Dec. 23, 1912. After working as a pupil of Meissonier's, he first exhibited, in the Salon of 1867, a picture representing "A Corner of Meissonier's Studio." He gained his reputation by depicting the scenes of a soldier's life with every detail truthfully rendered. He exhibited "A Halt" (1868); "Soldiers at rest, during the Manoeuvres at the Camp of Saint Maur" (1869); "Engagement between Cossacks and the Imperial Guard, 1814" (1870). The war of 1870–71 furnished him with a series of subjects which gained him repeated successes. Perhaps the most famous is the "Salut aux blessés" (1877). In 1884 he exhibited at the Salon the "Evening at Rezonville," a panoramic study, and "The Dream" (1888), now in the Luxembourg. He became a member of the Institute in 1898.

See Frédéric Masson, *Édouard Detaille and his* work (Paris and London, 1891); Marius Vachon, *Detazlle* (Paris, 1898).

DETAINER: *see* DETINUE.

DETECTIVE STORIES: *see* MYSTERY STORIES.

DETECTOR, that part of a wireless circuit whose function is to *pick up* or *detect* the electric oscillations which are set up in the antenna (*q.v.*) by the electromagnetic vibrations. (*See* WIRELESS TELEGRAPHY AND TELEPHONY.) As used in a radio receiving apparatus it is connected to a circuit carrying current of radio frequency, and translates the radio-frequency power into a form suitable for the operation of an indicator. This translation may be effected either by the conversion of the radio-frequency power into some other form or by the control of local power. The indicator may be a telephone receiver, loudspeaker, relaying device, tape recorder, etc. The most common type of detector is a vacuum tube operated on a non-linear portion of its characteristic curve, thereby converting a modulated radio-frequency current into a modulated direct current.

DETERMINANT, a special kind of algebraic expression involving a square number of quantities or elements, and usually denoted by arranging these elements in a square array with an upright line on each side:

$$a \quad a \quad ; \quad \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc;$$

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = aei + bfg + cdh - afh - bdi - ceg; \text{ etc.}$$

A determinant with n^2 elements is said to be of the nth order, those just written being of the first, second and third orders respectively. It consists of the aggregate of all possible products of n of these elements taken one from each horizontal row and vertical column of the square array, with the sign + or − attached according to the rule of signs given below. The particular product whose factors are the elements in the *principal diagonal,* extending from the upper left-hand to lower right-hand corner of the array, always has the sign + attached.

The number of terms in a determinant increases rapidly with its order. Thus a determinant of the fourth order has 24 terms, a determinant of the fifth order has 120 terms, and so on.

If any k rows and k columns of the determinantal array be selected, the elements common to these rows and columns form an array of k^2 elements and define a *minor determinant,* or simply a *minor,* of order k. The minor formed from the n–k rows and $n-k$ columns not selected is called the *complementary minor.* Relations between a determinant and its minors play an important role in the theory of determinants.

The discovery of determinants is usually ascribed to G. W. Leibniz, who stated their law of formation in a letter written to De L'Hospital in 1693; however, a Japanese mathematician Seki Kōwa, had come close to the same discovery at least as early as 1683. The work of Leibniz seems to have exerted no influence. It was left to G. Cramer to rediscover determinants, and to publish first a statement of their law of formation in 1750. The convenient notation used above was introduced by A. Cayley in 1841. For these and other historical facts the reader may be referred to T. Muir's *The Tlzeory of Determinants in the Historical Order of Development,* vols. i.–iv. (London, 1906–20), and to D. E. Smith's and Y. Mikami's *A History of Japanese Mathematics* (Chicago, 1914).

Determinants necessarily arose as soon as two or more equations of the first degree in the unknown quantities were considered from an algebraic point of view. For example any two equations of the first degree may be written

$$ax + by = e,$$
$$cx + dy = f,$$

in which the letters a, b, . f stand for known quantities, while x and y are the two unknown quantities to be determined. If we multiply both sides of the first of these equations by d, and multiply both sides of the second equation by b, we obtain

$$adx + bdy = ed,$$
$$bcx + bdy = bf,$$

whence, by subtraction, there results

$$(ad - bc)x = (ed - bf) \text{ or } \begin{vmatrix} a & b \\ c & d \end{vmatrix} x = \begin{vmatrix} e & b \\ f & d \end{vmatrix}.$$

Hence x can be expressed as the quotient of two determinants of the second order, at least provided $(ad - bc)$ is not zero.

Similarly if there be given any number n of equations of the first degree in an equal number of unknown quantities, x, y, z, . . , these quantities can be expressed as quotients of determinants of the nth order. Such expressions for the quantities x, y, z , are obtained below.

Determinants are especially useful as an instrument of classification. Thus in dealing with equations of the first degree many possibilities exist, of which one, for instance, is that in which there are no values whatsoever of the unknown quantities satisfying the equations. The theory of determinants gives a comprehensive means of distinguishing between the various cases which may arise in this and many other algebraic questions.

The subject of determinants forms an extensive and fundamentally important part of higher algebra, and has application in nearly every mathematical field. The reader interested in the classical applications of determinants in higher algebra may be referred to M. Bôcher's *Introduction* to *Higher Algebra* (New York, 1907).

The daring notion of a determinant of infinite order was first developed by the American mathematician and astronomer, G. W. Hill (1877), in connection with his theory of lunar motion. This extension has proved to be one of importance. On the other hand determinants of n dimensions, based upon cubical arrays of elements ($n=3$) or, more generally on arrays of n dimensions, do not seem to be especially useful.

The Rule **of** Signs.—Suppose now that we select any particular product of n elements, one from each row and column of the square array, and count the number of pairs of letters in this product in which one letter of the pair appears to the right of and above the other. If there is an even number of such pairs, the sign + is to be prefixed to the product; if there is an odd number, the sign − is to be prefixed to the product. Since there are no pairs of this kind in the product formed from the Principal diagonal (and o is an even integer), the sign + is to be attached always to this especial product, as stated previously.

In illustration of this rule of signs we may consider the product $b\,h\,k\,m$ in the determinant of the fourth order

$$\Delta = \begin{vmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m & n & o & p \end{vmatrix}.$$

The four pairs of letters bm, hk, hm, km, are to be counted: b appears to the right of and above m; h, to the right of and above k; etc. Hence the rule attaches a sign + to this one of the 24 products which appear in **A.**

The Fundamental Property of Determinants.—Imagine two adjacent rows or columns of a determinant to be interchanged. The only pair of elements of any product whose status changes as far as the rule of signs is concerned, is precisely the pair found in the two rows or columns which are interchanged. If this pair was counted before the interchange it will not be counted afterwards, and if not counted before, it will be counted afterwards. Hence such an interchange changes the number of pairs to be counted from odd to even, or from even to odd, and thus alters the sign of every product in the determinant.

Now to interchange any two rows or columns of a determinant requires an odd number of interchanges of adjacent pairs of rows or of columns. For example, in order to interchange the first and last rows in the above determinant A, the first row may be moved to the last position by three such interchanges of adjacent rows, and the row that stood last at the outset goes to the first position by two more such interchanges, so that five interchanges of adjacent rows suffice. In general, if two rows or columns are separated by k intervening rows or columns, evidently the odd number ak–I of interchanges of adjacent rows or columns will suffice. But each interchange of adjacent rows or columns alters the sign of every term in the determinant.

Thus the determinant has the fundamental property that the interchange of any two rows or columns reverses its sign.

In consequence, if two rows or two columns are made up of the same elements in the same order, the determinant must reduce to zero. For by the interchange of these two rows or columns the determinant is unaltered and yet is changed to its negative, and o is the only number equal to its negative.

The Solution of Equations of the First Degree.—Let us now return to the determinant of the fourth order written above, which can be regarded as associated with the four equations of the first degree, in x, y, z, w, written below:

$$ax+by+cz+dw=q,$$
$$ex+fy+gz+hw=r,$$
$$i\,x\,f\,j\,y\,f\,kz+lw=s,$$
$$mx+ny+oz+pw=t,$$

in which $a, b, \ldots, t$ are regarded as known quantities, and x, y, z, w, are unknown quantities to be determined. We propose to show that if Δ stands for the determinant written above, and $\Delta_1, \Delta_2, \Delta_3, \Delta_4$ stand for the four similar determinants obtained by replacing the first, second, third and fourth columns of A respectively by the column formed from the known quantities q, r, s, t, then the solution is given by the formulas:

$$x=\Delta_1/\Delta,\ y=\Delta_2/\Delta,\ z=\Delta_3/\Delta,\ w=\Delta_4/\Delta.$$

Let us denote the aggregate of all the products in Δ which contain a factor a by aA; similarly we may define bB, cC, ..., pP. Since every product in Δ contains one and only one element in the first column, we must have:

$$a\mathrm{A}+e\mathrm{E}+i\mathrm{I}+m\mathrm{M}=\Delta.$$

This gives a decompositidn of A in four parts; there are evidently seven other like decompositions of A obtained by considering the elements of any other column or of any row.

Now if we replace a, e, i, m, in the above equation by the elements of any other column of A, say by b, f, j, n respectively, the sum vanishes, *i.e.*,

$$b\mathrm{A}+f\mathrm{E}+j\mathrm{I}+n\mathrm{M}=0.$$

In fact this sum is evidently itself a determinant, obtained from Δ by replacing a, e, i, m, by b, f, j, n, respectively, and so its first two columns are the same. Consequently this sum will vanish.

Now multiply through the first of the four given equations by A, the second by E, the third by I, the fourth by M, and add all four equations. The co-efficient of x in the resulting equation is A. The co-efficient of y is the sum written above which vanishes. The co-efficients of z and w are similar sums which vanish also. On the right-hand side there is a sum which is evidently the determinant A_q. Thus we find $\Delta x=\Delta_1$, from which follows the expression for x as stated.

To obtain the expression for y it suffices to multiply the equations by B, F, J, N, respectively and add. A similar method expresses z and w in this manner.

Evidently this reasoning would establish the following general rule:

Let there be given any set of equations of the first degree with terms arranged according to the n unknown quantities in the left-hand members of the equations, while the terms on the right are known. If the determinant Δ formed from the square array of co-efficiepts on the left-hand side is not o, and if $\mathrm{A}_q, \mathrm{A}_r, \ldots, \mathrm{A}_t$ denote the n determinants obtained by replacing the first, second, ..., nth columns of A respectively by the sets of n constants on right-hand sides of the equations, then the unknown quantities are given by the quotients of determinants $\Delta_1/\Delta, \Delta_2/\Delta, \ldots, \Delta_n/\Delta$.

This general rule applies in case Δ is not zero, and actually furnishes the only possible set of values of the unknown quantities. No further consideration of the exceptional case when Δ is zero can be included here. (*G. D. Bi.*)

DETERMINISM, in ethics, the name given to the theory that all moral choice, so called, is the determined or necessary result of previously existing mental, physical or environmental causes (Lat. *determinare,* to prescribe or limit). It is opposed to the various doctrines of free-will, known as voluntarism, libertarianism, indeterminism, and is commonly regarded as more or less akin to necessitarianism and fatalism. There are various degrees of determinism. It may be held that every action is causally connected not only externally with the agent's environment, but also internally with his motives and impulses. In other words, if we could know exactly all these conditions, we should be able to forecast with mathematical certainty the course which the agent would pursue. On this theory the agent cannot be held responsible for his action in any sense. It is the extreme antithesis of indeterminism or indifferentism, the doctrine that a man is absolutely free to choose between alternative courses (the *liberum arbitrium indifferentiae*). Since, however, the evidence of ordinary consciousness almost always goes to prove that the individual, especially in relation to future acts, regards himself as being free within certain limitations to make his own choice of alternatives, many determinists go so far as to admit that there may be in any action which is neither reflex nor determined by external causes solely an element of freedom. This view is corroborated by the phenomenon of remorse, in which the agent feels that he ought to, and could, have chosen a different course of action. These two kinds of determinism are sometimes distinguished as "hard" and "soft" determinism. The controversy between determinism and libertarianism hinges largely on the significance of the word "motive"; indeed in no other philosophical controversy has so much difficulty been caused by purely verbal disputation and ambiguity of expression. How far, and in what sense, can action which is determined by motives be said to be free? The scientific doctrine of evolution has gone far towards obliterating the distinction between external and internal compulsion, *e g.*, motives, character and the like. In so far as man can be shown to be the product of, and a link in, a long chain of causal development, so far does it become impossible to regard him as entirely self-determined. Even in his motives and his impulses, in his mental attitude towards outward surroundings, in his appetites and aversions, inherited tendency and environment have been found to play a very large part; indeed many thinkers hold that the whole of a man's development, mental as well as physical, is determined by external conditions.

In the Bible the philosophical-religious problem is nowhere discussed, but the Bible usually assumes the freedom of the human will. It has been argued by theologians that the doctrine of divine foreknowledge, coupled with that of the divine origin of all things, necessarily implies that all human action was foreordained from the beginning of the world. Such an inference is, however, clearly at variance with the whole doctrine of sin, repentance and the atonement, as also with that of eternal reward and punishment, which postulates a real measure of human responsibility, impossible without free-will.

For the history of the free-will controversy, *see* the articles, FREE-WILL; PREDESTINATION (for the theological problems); ETHICS, KISTORY OF.

DETINUE, in law, an action whereby one who has an absolute or a special property in goods seeks to recover from another who is in actual possession and refuses to redeliver them. (See CONTRACT; TORT.)

DETMOLD, the capital city of the Land of Lippe, Germany, is on the east slope of the Teutoburger Wald, 25 mi. S. of Minden, on the Herford-Altenbeken line of the Prussian State railways. Pop. (1939) 23,314. The Renaissance château of the princes of Lippe-Detmold (1550) is an imposing building nearly in the centre of the town; whilst at the entrance to the large park on the south is the New Palace (1708–1718), enlarged in 1850. Detmold possesses a natural history museum, theatre, etc. Furniture, gloves, agricultural implements, etc., are made. About 3 mi. to the south-west of the town is the Grotenburg, with Ernst von Bandel's colossal statue of Hermann or Arminius, leader of the Cherusci. Detmold (Thiatmelli) was in 783 the scene of a conflict between the Saxons and the troops of Charlemagne.

DETONATORS. Devices employing certain explosives (*q.v.*) used to initiate the explosion of others, less sensitive but more easily regulated, or otherwise preferable for particular purposes. (See also MERCURY, FULMINATE OF; LEAD AZIDE; AZOIMIDE.)

DETROIT, Michigan, U.S.A., fronting *12* mi. an the Detroit river, and 4 mi. on the River Rouge, is the oldest city of any size in the U.S.A. west of the original seaboard colonies. Founded in 1701 by Antoine de la Mothe Cadillac with 100 settlers and soldiers, it was 17 years old when de Bienville began operations in New Orleans, and 63 years old before St. Louis was founded. The city antedates Buffalo by about a century, and it was 137 years old when Chicago received its first charter.

The first settlers as well as the first soldiers were French, and the government was French until 1760 when, as one of the results of the French and Indian War, it was occupied by the British under Col Robert Rogers. A few English settlers took up farms near by, but the place remained chiefly a military and trading post through the whole of the first century. During the Revolutionary War, Detroit was a centre of British influence, and a point from which Indian forays into the Ohio country were directed. Under the treaty that closed the war, Detroit passed nominally to the united colonies, but on various pretexts the British held possession until Jan. 11, 1796, when, under the Jay Treaty, the American flag was raised over the fort. During the War of 1812, the place was surrendered to the British under Gen. Brock, but the next year, after the battle of Lake Erie, it was returned to United States control. In the year 1805 Michigan was organized as a separate territory, with Detroit as its capital and also as the county seat of Wayne county, which included what are now Michigan, Wisconsin and part of Minnesota. The territory was afterwards narrowed down, and Detroit continued to be the capital of the territory until 1837, It was the capital of the state until 1847 when the seat of government changed to Lansing.

In 1805 every house in the town except one was destroyed by fire. This gave opportunity for an entire replanning of the place. The old division into narrow streets and small lots was entirely abandoned. To each citizen, whose old site was obliterated, a much larger lot was awarded free. The arrangement of streets left a number of open spaces which were dedicated as parks. The whole effect was one of openness and roominess unusual in the planning of towns at that early day. The older portions of the city retain the old characteristic of wide streets with occasional triangular parks. From this centre radiate the main thoroughfares which follow the lines of the old territorial roads. Michigan avenue is the starting point of the old "Chicago road"; Grand River avenue runs across the state to the "rapids of the Grand river," now the city of Grand Rapids; Woodward avenue leads north to "The Saginaws," and Gratiot to the foot of Lake Huron. Outside the city limits these roads were generally four rods wide, but modern improvement has transformed them mostly into wide paved roads. Woodward avenue is 120 ft. wide within the city limits and 204 ft. wide from the city limits to Pontiac, making it one of the finest main roads in the country. When the automobile began to create a need for improved highways, the county of Wayne, of whose wealth and population Detroit constitutes the largest part, established an efficient road commission. Through its work the county has been covered with an extensive network of paved roads. For a number of the main thoroughfares 204 ft. has been established as a standard width. The road system has been supplemented by ample provision for parks. The largest of these, River Rouge park, is 1,204 acres; but Belle Isle park is the gem of the system. It is an island of 985 ac. in the Detroit river, connected with the mainland by a bridge. Palmer park, 287 ac., Chandler, 230 ac. and Eliza Howell, 158 ac. are also highly developed. The total park system in 1940 comprised 3,651 ac. A boulevard 12 mi, long and 150 ft. wide encircles the central section of the city.

The city's remarkably rapid growth is shown by the increase in population, which in 1890 was 205,876; in 1900, 285,704; 1910, 465,766; 1920, 993,678; in 1930, 1,568,662; and in 1940 by federal census 1,623,452.

Administration. — When Michigan territory was first organized, both it and the town of Detroit came under the rule of the governor and judges. This administrative body had the very unusual combination of legislative, executive and judicial powers, and continued in force about 20 years. In 1818 the question of establishing a republican form of government with elective officers was submitted to the people, but the conservative French element voted it down. In 1824 a city charter was given to Detroit, and this was extensively amended or revised in 1827. 1837, 1857 and 1883. The settlement was officially styled the "Town of Detroit" till 1815. It was then called the "City of Detroit" till 1837, when it was enacted that the corporate name should be "The Mayor, Recorder and Aldermen of Detroit." In 1857 it again became the "City of Detroit." The old charters provided for elective officers, with aldermen elected by wards. The board of education and board of estimates were elected in the same way.

In 1918 an entirely new charter was adopted making radical changes in this form of government. In place of a board of aldermen of two members from each ward, there is a common council of nine members, elected at large and all elected at the same time. The term is two years. Members of the council must be at least 25 years old, and resident in Detroit at least three years, and may not hold any other civil office. The member having the highest number of votes at the election becomes president of the council and acting mayor in the absence of the elected mayor. The council is required to meet as a committee of the whole every day except Saturdays, Sundays and legal holidays for the purpose of receiving communications, complaints, petitions and reports, holding public hearings and discussing pending matters, and must meet in regular session at least once in each week in the evening. It has full legislative powers on all subjects that are within the scope of the city charter. At the same time that members of the common coupcil are chosen, the voters also elect a mayor, city clerk and city treasurer, nominations for all of these officers being made at a primary. The mayor under the new charter has exceedingly wide powers. He may veto acts of the common council. He has the appointment, without reference to the council, of a large number of administrative officials and commissions, and may remove most officials without trial or cause being given. The mayor also appoints the members of the board of assessors and board of health; city planning, public lighting, water, street railway, fire, public welfare, police and other commissions. An attempt to change the number of councillors to 15 chosen by wards and to reduce the mayor's power was defeated in November 1936 for the fourth time since the adoption of the 1918 charter.

The mayor and common council together have the final determination of tax levies and the issue of bonds, subject to certain limitations. The amounts to be raised by taxation in any one year, aside from the school expenses, cannot exceed 2% of the assessed valuation, and Detroit bonds are not marketable in New York if issued in excess of 9% of the assessed valuation. The charter also requires that all new issues of bonds shall be submitted to vote of the electorate. The heads of city departments are required to transmit to the controller, on or before Jan. 15, an itemized statement of amounts needed for the next fiscal year. The controller

compiles these in a budget book which he transmits to the mayor, who has until March 1 for its consideration. He may increase any items, but the total may not exceed the 2% limit, and the amounts required for interest and sinking fund of outstanding bonds may not be impaired. The mayor transmits the amended budget to the common council, which has about a month for its consideration. It is then returned to the mayor for his second revision which is final except that the council can, by seven affirmative votes, override the mayor's action on any particular item.

The city's fiscal year is from July 1 to June 30. On account of the expansion of its territory and business, its financial record has been on a constantly rising scale. The assessed valuation of the city for the fiscal year 1917–18 was $1,174,517,900; for 1940–41 it was $2,413,180,400. The tax rate was $13.80 in the former year and $28.08 for the latter; tax budget in the same period increased from $16,218,778 to $67,759,692. In 1911 the public debt, less amount in the sinking fund, was $8,088,098. Ten years later it was $68,208,347; in 1940 it had increased to $332,125,348. In the first period Detroit had the smallest *per* capita debt of any of the large cities in the country. In 1940, however, it had the third largest. In the fiscal year 1940–41 the total amount raised for municipal purposes mas $137,353,529, of which $67,759,692 was raised by tax levy while the remainder came from assessments, subventions, rent, department earnings and public-service earnings.

Manufacturing. — The modern growth of Detroit has been dependent largely upon manufacturing. According to the census reports for 1880 the city was nineteenth in the value of its manufactured products, that value being a little over $30,000,000. At the present time, the factories in Detroit take a little over three days to turn out products of that value. In 1899 the city was tenth with products valued at $88,640,000. Ten years later it was ninth with value of $252,992,000. In 1919 Detroit had risen to fourth place, with products (inclusive of those of Hamtramck and Highland Park) valued at $1,803,728,000. In 1925 the products of the city, together with its integrated suburbs, had increased to a total of $2,252,826,112, giving this industrial centre third place in manufactures among cities of the U.S.; the district was still third in 1937 when its products were worth $3,409,350,809.

To a remarkable extent the manufactures of Detroit have been associated with the instruments for transportation. The Pullman car works were first established there and continued in operation till 1893. The first freight car works were established in 1853. In the year 1904 these works employed 7,200 men with a production value of $23,000,000.

Detroit's situation led to the construction of small watercraft. The building of large vessels for lake traffic commenced in 1852 and has continued till the present day. In 1863 the building of marine engines was commenced; large shipyards on the river front and at Ashtabula, Ohio, were established. During the World War of 1914–18 many steamers were built in Detroit yards for overseas service.

About the time that freight car building began to decline, a new vehicle for transportation came into existence. Ransom E. Olds at Lansing and Henry Ford at Detroit were for years at work solving the problem of a vehicle to be "propelled by power generated within itself." Both succeeded, but Olds was first in the market. In 1899 he commenced the manufacture of the "Oldsmobile" in Detroit. The Cadillac Motor Car company was incorporated in 1901 and the Ford and Packard in 1903. This first appeared as a separate industry in the census reports in 1904 when it had 2,034 employees together with an output for the year valued at $6,240,000. From this beginning the increase was rapid. Detroit was well situated to become the centre of this new industry. Detroit and three of the neighbouring cities of Michigan had been centres of carriage making, and hence had the necessary raw materials available with workmen skilled in the making of springs, wheels and bodies and in upholstering. Detroit was making a larger number of gas engines than any other city in the entire country. With this reservoir of labour skilled in trades similar to those needed in the manufacture of automobiles, this industry became more and more concentrated in the Detroit area. In 1940 more than 90% of all American cars were produced by manufacturers whose main plants are in Michigan within 85 mi. of Detroit. In 1937, more than 5,000,000 cars, valued with replacement parts and accessories at $4,377,828,641, were produced, giving employment to 560,928 persons.

At the same time that the automobile was under production in such immense numbers, Detroit began taking a leading place in the making of the aeroplane. The first all-metal aeroplanes in the country were made here, and the construction of this kind of craft was conducted on an extensive scale. A canvass of the business made in the year 1929 by the board of commerce disclosed 57 companies in Detroit engaged in manufacturing or jobbing aircraft or their motors or supplies. Of these eight companies were assembling the completed planes, and 43 were making aircraft engines or parts. In 1941 there were about 75 companies making aircraft engines or parts in the Detroit area, and demands of the defence program were rapidly enlarging this activity, as the automobile manufacturers made available their enormous plants for the production of this vital defence item.

Apart from its prominence in the manufacture of aids to transportation lines the Detroit district has been notable for other achievements. The first iron furnace west of Pittsburgh mas built by Dr. Geo. B. Russel in Hamtramck in 1848. The first iron vessel built in the country was launched at the Wyandotte yards of the Detroit Dry Dock company and the first Bessemer steel forged in this country was produced at Capt. Ward's mill at Wyandotte. The city is one of the nation's leading steel centres. with products exceeded, in this area, only by the automobile industry. Other leading products in 1939 were nonferrous metal alloys, wirework, drugs, malt liquors, paints, stoves, electrical machinery and foundry and machine shop products.

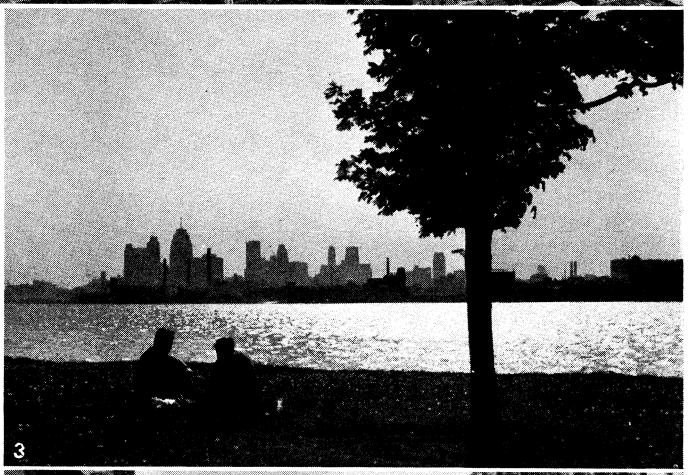
Education and Culture. — By an act of the legislature approved by popular vote in 1916, the board of education in Detroit was changed from a large body elected by wards to a group of seven members elected at large. They are chosen two or three at a time on a general ticket. Nominations are made at a primary. Elections are held in the spring at the same time that supreme court judges are chosen. The names of candidates for members of the board are placed upon a separate ticket, upon which no party designations are allowed. The board has entire charge of the public schools, though the mayor has the veto power over particular acts, and the appropriations asked are subject to revision by the mayor and common council. At the end of 1940 there were in operation in the city 200 elementary schools, 19 intermediate schools and 25 high schools. There were also 43 schools housed in temporary buildings. Advance also has been made into the realm of higher education with the following six units of Wayne University: college of engineering, college of liberal arts, college of medicine and surgery, college of law, college of pharmacy and teachers college. In the grades as far as the high school, tuition is free to residents of Detroit. The number of teachers in the grade schools up to and including the high schools for the fall term of 1940 was 7,593; the number of pupils enrolled the same term, 255,647.

The appropriations for the public schools in Detroit for the fiscal year 1940–41 were as follows: from taxes $16,185,920; primary school money from state, $10,000,000; federal and other state aid, $552,800; county funds $304,000; all other sources $2,908,500; a total of $29,951,220. Of the total public debt of the city, $65,781,682 was incurred for school buildings.

Every year a census of "children of school age" (5 to 20 years) in the city is taken, and upon this is based a dividend from the primary school interest fund. The census showed 392,033 such persons in Detroit in the summer of 1940.

Besides public institutions there are in the city 132 parochial schools, chiefly Catholic and Lutheran, two law schools, the University of Detroit (Catholic) and a considerable number of private schools, literary, art and music. On opposite sides of Woodward avenue, each in the midst of grounds two blocks in extent, are the public library and the art institute. The library was established in 1865 with a collection of 5,000 volumes, occupying an annex to the old capitol building. It was for several years under the direction of a committee of the common council, but in 1880

DETROIT



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VIEWS OF DETROIT

1. Air view showing the Detroit river, and Belle Isle in the distance: Canada is at the right
2. Cadillac square and Woodward avenue, Detroit's principal street
3. Sky line of the city as seen across the Detroit river from Belle Isle park
4. The Detroit Boat club on Belle Isle. The island, located near the centre of the city, also has a zoo, a golf course, swimming beach and playgrounds
5. Grand Circus park, a main thoroughfare of downtown Detroit

the control of the library was given to a board of six members elected by the board of education. The building at present occupied by the library is of white marble and is arranged in eight different departments, including the noted Burton historical collection. The library had 18 branches and 891,532 volumes in 1935.

The Detroit Institute of Arts goes back in its foundation to a noted loan exhibition in 1883. After the close of the exhibition a society was formed consisting of 40 incorporators each of whom contributed $1,000 for establishing a permanent art institution. The subscription was subsequently increased to $100,000, and the first art museum building was erected. It remained the property of the corporation until 1919 when it was taken over by the city. The new building which was opened to the public in Nov. 1927 is of Vermont marble, of Italian Renaissance style, and cost about $4,000,000. It is divided into three main departments, for European, American and Asiatic art.

Miscellaneous. — Detroit's land transportation needs are adequately supplied by the following railroads: Michigan Central, Pere Marquette, Wabash, Detroit, Toledo and Ironton, Grand Trunk and Canadian Pacific. The two first named have each a number of lines, and together form a network of tracks covering the whole of Michigan's lower peninsula. The two last named have direct connection with the whole Canadian railroad system. The railroads are supplemented by motorbus and motor truck lines extending in all directions from the city. Detroit's situation on the strait connecting the upper and lower lakes, gives the city peculiar advantages for water transportation.

The Detroit river ranks as the busiest inland waterway of the world. During the 1939 season, 91,643,043 tons of freight were transported through it to terminal and way ports of the Great Lakes. The chief commodities in order of their importance were iron ore, coal, petroleum, limestone and grain. Detroit has become an important factor in the air express business. In 1940 planes carried 1,091,901 lb. as contrasted with 489.348 lb. in 1938. This area in 1941 was served by three major air transport companies with nation-wide coverage. (H. CAM.)

DETTINGEN, village of Germany (Bavaria), 10 m. N.W. of Aschaffenburg, scene of the battle of Dettingen (1743) *(see* AUSTRIAN SUCCESSION, *WAR* OF THE).

DEUCALION, in Greek legend, son of Prometheus, king of Phthia in Thessaly, husband of Pyrrha, and father of Hellen, the mythical ancestor of the Hellenic race. When Zeus had resolved to destroy all mankind by a flood, Deucalion constructed a boat in which he landed on Mount Parnassus with his wife. Having offered sacrifice and enquired how to renew the human race, they were ordered to cast behind them the "bones of the great mother," that is, the stones from the hill-side. Those thrown by Deucalion became men, those thrown by Pyrrha, women.

DEUCE, a term applied to the "two" of any suit of cards, or of dice. It is also a term in tennis when both sides have each scored three points in a game, or five games in a set; to win the game or set two points or games must then be won consecutively, and the players return to a position of equality as often as they cannot score two such points or games consecutively. The earliest instances in English of the use of the slang expression "the deuce," in exclamations, date from the middle of the 17th century.

DEUS, JOÃO DE (1830–1896), the greatest Portuguese poet of his generation, was born at Messines in Algarve on March 8, 1830. Matriculating in the faculty of law at the University of Coimbra, he settled in the city, dedicating himself wholly to the composition of verses. In 1862 he left Coimbra for Beja, where he was appointed editor of *O Bejense,* and four years later he edited the *Folha do Sul.* As the pungent satirical verses entitled *Eleições* prove, he was not an ardent politician, and, though he was returned as Liberal deputy for the constituency of Silves in 1868. he acted independently and promptly resigned his mandate. In 1868 his friend José Antonio Garcia Blanco collected from local journals the series of poems, *Flores do campo,* which is supplemented by the *Ramo de pores* (1871). This is João de Deus's masterpiece. The *Folhas soltas* (1876) is a collection of verse in the manner of *Flores do campo,* brilliantly effective and exquisitely refined. Within the next few years the writer turned his attention to educational problems. This was a misfortune for Portuguese literature; his educational mission absorbed João de Deus completely, and is responsible for many publications of no literary value. A copy of verses in Antonio Vieira's *Grinalda de Maria* (1877), the *Loas á* Vwgem (1878) and the *Proverbios de Salomão* are evidence of a complete return to orthodoxy during the poet's last years. He died at Lisbon on Jan. 11, 1896, and was buried in the National Pantheon at Belem.

Next to Camoens and perhaps Garrett, no Portuguese poet has been more widely read, more profoundly admired than João de Deus; yet no poet in any country has been more indifferent to public opinion and more deliberately careless of personal fame. And yet, though he never appealed to the patriotic spirit, though he wrote nothing at all comparable in force or majesty to the restrained splendour of *Os Lusiadas,* the popular instinct which links his name with that of his great predecessor is just.

DEUSDEDIT or **ADEODATUS,** Pope and Saint (?–618), became pope on Oct. 19, 615, and died on Nov. 8, 618. The few decretals ascribed to him are unauthenticated and nothing is really known aboat him. He is said to have been the first pope to use leaden seals for pontifical documents.

DEUSSEN, PAUL (1845–1919), German philosopher and Sanskrit scholar, was born at Oberdreis on Jan. 7, 1845. He taught at Berlin (1881–89), and then became professor of philosophy in Kiel, where he died on July 7, 1919. As a philosopher, Deussen regarded the spatial world and objects as forms of the all-important empirical consciousness. The reality for him lay in a non-spatial, non-temporal and non-causal sphere to which we attain by moral activity rather than by intellect.

DEUTERIUM, or **HEAVY HYDROGEN,** is the isotope (*q.v.*) of hydrogen of atomic weight 2. A third isotope of hydrogen, tritium, is known having atomic weight 3. However, deuterium is the isotope which has been separated in appreciable quantities and which is of greatest interest at the present time.

Deuterium was discovered by Urey with the help of F. G Brickwedde and G. M. Murphy. Theory employing the third law of thermodynamics and the Debye theory of the solid state. predicted a difference in the vapor pressures of hydrogen and hydrogen deuteride and the possibility of concentrating the isotope by the distillation of liquid hydrogen at the triple point of hydrogen (13·92K). The deuterium was detected in the concentrates through its atomic spectrum. It was found that the concentration of deuterium had been increased from about one part in five or six thousand to approximately one part in 1,100.

The great scientific value of deuterium is due largely to the successful separation of this variety of hydrogen from natural hydrogen. Though the first effective concentration was made by the distillation of liquid hydrogen, large scale production of deuterium has been accomplished by the electrolytic method discovered by Dr. E. W. Washburn. This method makes use of the fact that in the electrolysis of water the rate of discharge of H_2 is more rapid than that for D_2, resulting in a concentration of D_2 in the electrolyte. By continuing the process until the residual water is sufficiently small, namely, about 1/100,000 of the original volume very nearly pure deuterium oxide or heavy water remains. In this way nearly pure heavy water was produced first by Lewis, and has since been produced in many laboratories of the world and now is an article of commerce.

Deuterium has also been produced by Hertz, using a method of diffusion of hydrogen gas through porous tubes, but this method cannot produce deuterium in as large quantities as the electrolytic method. The distillation of liquid hydrogen has been used by Brickwedde to produce hydrogen deuteride, which has not been prepared in any other way. Due to the difference in the vapor pressures of hydrogen oxide and deuterium oxide, that is, light and heavy water, it should be possible to separate the isotopes of hydrogen by fractional distillation of water if a sufficiently efficient fraction column can be devised. Lewis doubled the concentration of deuterium in water by such a distillation method, using a column of 40 theoretical plates. Although this method is

not as yet an accomplished fact, it appears probable that it will in the future replace the electrolytic methods.

The chemical properties of two isotopes are in general very similar, and this is true in the case of the hydrogen isotopes. Thus deuterium gas is very similar to hydrogen gas and deuterium oxide is in general very similar in its properties to hydrogen oxide. It is also true that other compounds in which deuterium replaces hydrogen are similar in their chemical and physical properties to the corresponding compounds of hydrogen. The differences in physical and chemical properties of hydrogen and deuterium and the corresponding compounds of hydrogen and deuterium, are much greater than in the case of any other two isotopes which have been investigated thus far. Thus the ratio of the vapor pressures of hydrogen oxide and deuterium oxide at the boiling point of water is approximately 1·05, while in the case of the two waters H_2O^{16} and H_2O^{18}, the ratio of the vapor pressures is 1·003 approximately. These comparatively great differences in the chemical properties of the hydrogen and deuterium compounds make possible the separation of these isotopes, whereas the separation of other isotopes has been accomplished only in a few cases or to very slight extents.

The difference in physical properties of hydrogen and deuterium may be illustrated by the melting points and boiling points of hydrogen, hydrogen deuteride, and deuterium, as shown in Table I.

Table I.

	H_2	HD	D_2
Gram molecular volume of solids	26 15 cc		23 17 cc
Heat of fusion.	28 0 cal.	37 0 cal.	52 3 cal.
Heat of vaporization at triple points	217 7 cal.	265 cal.	303 1 cal.
Triple point	13.92°K	16.60°K	18.71°K
Boiling Point.	20 38°K	22.13°K	23 59°K

The chemical properties of hydrogen and deuterium are qualitatively the same, though quantitatively there are marked differences. We may classify such differences with respect to the equilibrium and the kinetic properties of chemical reactions.

The velocities of chemical reactions in which deuterium replaces hydrogen differ more markedly than do the equilibrium properties. Hydrogen reacts with chlorine 13·4 times more rapidly at 0°C than deuterium, and similar differences are observed in the case of other chemical reactions.

The nucleus of the deuterium atom, known as the deuteron, can be used in transmutation reactions in much the same way as the proton or hydrogen nucleus; the nuclei of hydrogen atoms can be used in producing beams of high speed particles by allowing protons or deuterons to fall through large electric fields and then allowing them to impinge upon solid surfaces. In this way many of the chemical elements can be transmuted. Deuterons falling upon deuterium atoms produce hydrogen atoms and tritium atoms. Deuterium atoms falling upon lithium may produce helium atoms or helium atoms and neutrons. These transmutation reactions are of very great interest in connection with the study of the nuclei of atoms.

The biological effects of deuterium oxide are of considerable interest. It has been established that both plants and animals do not continue to live and thrive in water containing deuterium oxide of high concentrations. So far no case of acclimatization to the deuterium oxide has been observed.

Perhaps more interesting than the gross effects of life and death of living organisms in deuterium oxide can be secured by using deuterium as an indicator in the study of metabolic processes within living things. It often is of interest to trace a variety of atom or compound through living organisms. Deuterium makes possible such studies for if given to an animal in its food the particular compounds of the food can again be identified in the excretory products, in the blood, in the fat deposits of the body, or other tissues, and hence the course of the foods through the animal body can be traced. Studies of this kind will probably prove to be among the most interesting applications of deuterium.

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(H. C. U.)

DEUTERONOMY, the fifth book of the Law in the Old Testament. The name is a Greek mistranslation of the term Mishneh *hat-Torah,* "copy of the Law," found in Deut. xvii. 18 and Josh. viii. 32. It is ostensibly an account of the Law as given by Moses just before his death in the plains of Moab, the theory of the book being, apparently, that the Law given 38 years earlier at Horeb was confined to the "Ten Words" (see DECALOGUE), and that the present precepts are offered as a rule for life in the country which Israel will soon enter.

Contents and Structure. — The book falls into the following well marked divisions: (i.) i. 1–iv. 43. Introductory discourse by Moses, mainly a historical retrospect. (ii.) iv. 44–xi. 32. A second Introduction, consisting of a repetition of the Decalogue and an exhortation to observe the Law. (iii.) xii.–xxviii. A code containing both religious and civil laws, and including in ch. xxvii. instructions for the solemn ratification of the Law after the conquest of Canaan. (iv.) xxix.–xxxi. Concluding exhortation, with Moses's farewell to Israel. (v.) xxxii. and xxxiii. Two poems ascribed to Moses, the latter being a collection of tribal songs similar in form to Gen. xlix. (vi.) xxxiv. The death of Moses.

The original extent of the book is not fully determined. It may well have begun with iv. 44, or even with xii. 1 (though this is less probable). Chaps. xxvii., xxix.–xxxiv. may have been later appendices, and it is extremely unlikely that the two poems formed a part of the original book. There are signs of a double tradition, *e.g.,* xii. 2–7 and 8-14 cover the same ground ostensibly. The curious variation between the use of the second plural and the second singular in addressing Israel has led some scholars to believe that we have here the interweaving of two different documents, though it must be admitted that the two forms interchange so frequently and irregularly that analysis on this basis is most precarious. The tone and style of the book are very clearly marked. The whole has a humanitarian outlook, which is manifested both in modifications of existing laws and in the promulgation of new regulations. It thus contains repeated exhortations to love Yahweh, and to recognize His love to Israel. The ritual and ceremonial elements ate comparatively slight.

Date. — (a) *Comparative.* There are three other codes with which Deuteronomy may be compared, and the relation of the book to the work of some of the prophets, especially Hosea and Ezekiel, is of importance. In its present form it seems to be later than the Book of the Covenant (Exod. xx.–xxiii.) and Hosea, and earlier than the Priestly Code and, probably, Ezekiel. It may also be a little earlier than the Law of Holiness, though the affinities between these two documents suggest some connection. The order JE, D, Ezekiel, P, is, however, generally accepted.

(b) Absolute. Part of the importance of Deuteronomy for the history of Hebrew literature and thought lies in the fact that it seems possible to assign an actual date to its promulgation. Its main ritual provision, the concentration of sacrifice, finds practical expression in the religious measures of Josiah, 621 B.C. (II. Ki. xxii.; xxiii.) and Deuteronomy, or a nucleus of the book, has therefore been identified with the Book of the Law found by Hilkiah in the temple. If that view be correct, then Deuteronomy is a "programme" based on the teaching of the 8th century prophets, and compiled during the 7th century,

Whilst this is the "regnant hypothesis," it has not passed unchallenged. It involves two difficulties. One is that the provisions —or some of them — intended to meet the new order are unworkable in practice. Even in II. Ki. xxiii. 9 it is stated that the priests of the local sanctuaries, brought to Jerusalem as prescribed in Deut. xviii. 6–8, were not permitted to share in the offices performed by the Jerusalem priesthood in the temple. The other difficulty is that while the reform of Josiah tended to exalt Jerusalem, the Book of the Covenant (on which the Deuteronomic code is clearly based) and the historical traditions followed in Deuteronomy are of northern provenance, belonging to E rather than to J. Attempts have been made to solve these problems by throwing the date of the book either forward or backward.

Here it can only be remarked that these solutions raise other difficulties which would also have to be solved.

Whatever the exact date of the book may have been, its influence on Hebrew literature and thought is undeniable. In its spirit and from its point of view the Book of Kings was written, and some of the material now found in our prophetic books (especially Jeremiah) bears the same stamp, alike in matter and in style. It sprang out of and represents one of the most important schools of thought in the history of Israel.

BIBLIOGRAPHY.—In addition to commentaries and works on biblical criticism (on which *see* BIBLE: *Old Testament) see* especially *R. H.* Kennett, *Deuteronomy and the Decalogue;* and *A. C.* Welch, *The Code of Deuteronomy. See* also *HEBREW* RELIGION. **(T. H. R.)**

DEUTSCH, IMMANUEL OSCAR MENAHEM (1829–1873), German orientalist, was born of Jewish extraction at Neisse on Oct. 28, 1829. His studies at the University of Berlin made him an excellent Hebrew and classical scholar, and in 1855 he became assistant in the British Museum library. He worked intensely on the Talmud and contributed more than 190 papers to Chambers's Encyclopaedia. His famous article on the Talmud in the *Quarterly* Review for Oct. 1867 was translated into many European languages. He died at Alexandria on May 12, 1873. His Literary Remains were edited by Lady Strangford in 1874.

DEUTSCHE BANK, German Bank, Berlin, was founded in 1870 for the special purpose of furthering and facilitating commercial relations between Germany and other countries and markets. It developed into one of the largest German banks. Its capital and reserves amounted in 1939 to 175,000,000 Reichmarks.

The Deutsche Bank was the first of the big German banks to found branch offices in the German seaports, to assist on a large scale the German export trade. It has maintained large offices in Bremen since 1871, and in Hamburg since the beginning of 1872, and by conceiving the idea of opening Depositenkassen (city offices) introduced the cheque system in connection with the receipt of interest-carrying cash deposits. In October 1929 a merger was arranged with the Disconto-Gesellschaft of Berlin, an important German Bank founded in 1851, which at that time had about 130 branches all over Germany and capital and reserves at about 186,000,000 Reichsmarks. The joint institution under the name of Deutsche Bank und Disconto-Gesellschaft developed a net of branches, densest in the industrial West. In 1939 the bank took over the branches of the Bohmische Union-Bank and of the Deutsche Agrar-und Industriebank situated in the Sudeten area. The Deutsche Bank has branches in 293 places. In addition, city offices have been opened in the larger towns. Foreign branches are maintained at Danzig, Katowice and Istanbul.

By virtue of its share holdings the Deutsche Bank is permanently interested in inter *alia* the Handelmaatschappij H. Albert de Bary & Co. N.V. in Amsterdam, the Kreditbank at Sofia and the Österreichische Creditanstalt-Wiener Bankverein, Vienna. It also holds a very large part of the share capital of the Deutsche O'oerseeische Bank (Banco Aleman Transatlantico) founded by the Deutsche Bank in 1886, which has its seat in Berlin and maintains 18 branches in Argentina, Brazil, Chile, Peru, and Uruguay and branches in Barcelona, Madrid and Seville.

In 1937 the bank resumed its old name, Deutsche Bank.

(E. WAG : X.)

DEUTSCHKRONE, town in the east of the Land of Prussia, Germany, between the two lakes of Arens and Radau, 15 mi. north-west of Schneidemiihl, a railway junction 60 mi. north of Posen. Pop. (1939) 15,044. It is the seat of the public offices for the district, and manufactures machinery, woollens and tiles.

DEUTZ (anc. Divitio), formerly an independent town of Germany, in the Prussian Rhine Province, on the right bank of the Rhine, opposite to Cologne, and incorporated with it since 1888. It contains the church of St. Heribert (a 17th century), cavalry barracks, artillery magazines, and gas, porcelain, machine and carriage factories. It has a handsome railway station on the banks of the Rhine. To the east is the manufacturing suburb of Kalk. The old castle in Deutz was in 1002 made a Benedictine monastery by Heribert, archbishop of Cologne. Permission to fortify the town was in 1230 granted to the citizens by the archbishop of Cologne. The fortifications were finally razed in 1888.

DEUX-SÈVRES, an inland department of western France, formed in 1790 mainly of the three districts of Poitou, Thouarsais, Gbtine and Niortais, added to a small portion of Saintonge and a still smaller portion of Aunis. Area. 2,338 sq.mi. Pop. (1936) 308,841. It is bounded N. by Maine-et-Loire, E. by Vienne, S.E. by Charente, S. by Charente-Inférieure and W. by Vendée. The Sèvre of Niort traverses the southern portion, and the Sbvre of Nantes (an affluent of the Loire) drains the north-west. There are three regions—the Gbtine, in the north and centre, the Plaine in the south and the Marais-distinguished by their geological and physical character. The Gâtine, formed of primitive rocks (granite and schists), is the continuation of the "Bocage" of Vendée and Maine-&-Loire. Its surface is irregular and covered with hedges and clumps of wood or forests. Application of lime has improved the soil, which is naturally poor. The Plaine, resting on oolite limestone, is treeless but fertile. The Marais, a low-lying alluvial district in the extreme south-west, is extremely productive when properly drained. The highest points, several above 700 ft., are found in a line of hills which begins in the centre of the department, to the south of Parthenay, and stretches north-west into the neighbouring department of Vendée. It divides the region drained by the Sbvre-Nantaise and the Thouet (both affluents of the Loire) in the north from the basins of the Sèvre-Niortaise and the Charente in the south, The climate is mild, the annual temperature at Niort being 52°, the rainfall nearly 25 in. Winters are colder in the Gâtine, summers warmer in the Plaine.

Three-quarters of the entire area of Deux-Sèvres, which is primarily an agricultural department, consists of arable land. Wheat and oats are the main cereals. Potatoes and mangold-wurzels are the chief root-crops. Niort is a centre for the growing of vegetables (onions, asparagus, artichokes, etc.) and of angelica. Much beetroot is raised to supply the distilleries of Melle. Colza, hemp, rape and flax are also grown. Vineyards are numerous in the neighbourhood of Bressuire in the north, and of Niort and Melle in the south. The department is well known for the Parthenay breed of cattle and the Poitou breed of horses; and good mules are reared in the south. The system of co-operative dairying is practised in some localities.

The apple-trees of the Gâtine and the walnut-trees of the Plaine bring a good return.

Some coal is mined, and the department produces building-stone and lime.

There is manufacture of textiles (serges, druggets, linen, handkerchiefs, flannels, and knitted goods). Tanning and leather-dressing are carried on at Niort and other places, and gloves are made at Niort.

Wool and cotton spinning, hat and shoe making, distilling, flour-milling and oil-refining are also main industries. The department exports cattle and sheep to Paris and Poitiers; also cereals, oils, wines, vegetables and its industrial products.

The Sèvre-Niortaise and its tributary the Mignon furnish 19 mi. of navigable waterway. The department is served by the Ouest-État railway. It contains a large proportion of Protestants, especially in the south-east. The two arrondissements are Niort and Parthenay; the cantons number 31, and the communes 357.

Deux-Sèvres is part of the region of the IX. Army Corps (Tours) and of the diocese and the *académie* (educational circumscription) of Poitiers, where also is its court of appeal.

Niort (the capital), Bressuire, Melle, Parthenay, St. Maixent, Thouars and Oiron are the principal places in the department. Several other towns contain features of interest. Among these are Airvault, where there is a church of the 12th and 14th centuries which once belonged to the abbey of St. Pierre, and an ancient bridge built by the monks; Celles-sur-Belle, where there is an old church rebuilt by Louis XI., and again in the 17th century; and St. Jouin-de-Marnes, with a fine Romanesque abbey church with Gothic restoration.

DEVA, a Roman legionary fortress in Britain on the Dee at the site of the modern Chester (q *v.*).

DEVA, DEWA, in the Zoroastrian mythology the Devs

were demons or evil spirits, but in the Indian Vedas. deva means a god, from Sanskr. *div,* "sky." In later Hindu, Buddhist and Jain literature the term denoted a god, demigod or spirit.

See A. A. Macdonell, *Vedic Mythology;* E. W. Hopkins, *Epic* Mythology,

DEVADATTA, the son of Suklodana, who was younger brother to the father of the Buddha (*Mahāvastu,* iii:76). Both he and his brother Ananda, who were considerably younger than the Buddha, joined the brotherhood in the twentieth year of the Buddha's ministry. Devadatta, fifteen years afterwards, having gained over the crown prince of Magadha, Ajātasattu, to his side, made a formal proposition, at the meeting of the order, that the Buddha should retire, and hand over the leadership to him, Devadatta (Vinaya Texts, iii:238; Jdtaka, i:142). This proposal was rejected, and Devadatta is said in the tradition to have successfully instigated the prince to the execution of his aged father and to have made three abortive attempts to bring about the death of the Buddha (Vinaya Texts, iii:241–250; Jhtaka, vi:131). Shortly afterwards, relying upon the feeling of the people in favour of asceticism, he brought forward four propositions for ascetic rules to be imposed on the order. These being refused, he appealed to the people, started an order of his own, and gained over 500 of the Buddha's community to join in the secession. We hear nothing further about the success or otherwise of the new order, but it may possibly be referred to under the name of the Gotamakas, in the Anguttara (see Dialogues of the Buddha, i:222), for Devadatta's family name was Gotama. But his community was certainly still in existence in the 4th century A.D., for it is especially mentioned by Fa Hien, the Chinese pilgrim (Legge's translation, p. 62). And it possibly lasted till the 7th century, for Hsiian Tsang mentions that in a monastery in Bengal the monks then followed a certain regulation of Devadatta's (T. Watters, On Yuan Chwang, ii:191). There is no mention in the canon as to how or when Devadatta died; but the commentary on the *Jātaka,* written in the 5th century A.D., has preserved a tradition that he was swallowed up by the earth near Sāvatthi, when on his way to ask pardon of the Buddha (Jdtaka, iv:158). The spot where this occurred was shown to both the pilgrims just mentioned (Fa Hien, *loc. cit.* p. 60; and T. Watters, On Yuan Chwang, i:390).

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DE VALERA, EAMON (1882–), Irish politician, was born in New York city Oct. 14, 1882, of a Spanish father and an Irish mother. On the death of his father he was committed at the age of two to the care of his grandmother in County Limerick. He was educated at the local National school, the Christian Brothers' school at Charleville, Blackrock College, and graduated from the Royal university. In 1910 he married Jane Flannagan by whom he had six children. Although a teacher of mathematics he was an enthusiastic member of the Gaelic League. In 1913 he joined the newly-formed Irish Volunteers. He commanded a group of 50 in the Easter week rebellion (1916) and was the only leader to survive it. The British may have spared him because of his American birth. Instead, he was sentenced to life imprisonment at Dartmoor.

Upon his release in the general amnesty of June 1917 he worked for the Republican cause, and after the secession of the Sinn Fein members from parliament to form an Irish parliament, he was made president of the Sinn Fein government. In May 1918 he was re-arrested on the charge of planning another rising and imprisoned in Lincoln Gaol, England. In jail he pursued his mathematical interests. He escaped in Feb. 1919. From Ireland he went to the United States, where, as president of the Irish Republic, he collected more than $5,000,000 for the revolutionary movement on the security of Republican bonds.

In 1921 he appointed plenipotentiaries to negotiate a settlement with the British government. The treaty was not acceptable to him, for he demanded formal independence from Britain. The treaty was accepted by the Dail and upheld in elections. The Republican forces resisted the Free State government and De Valera was led to support their resistance.

In Aug. 1923 he was imprisoned by the Free State government. Upon his release in July 1924 he resumed active leadership of Sinn Fein as a Republican party with a policy of abstention from the Dail. Two years later Sinn Fein was split by the decision of a group led by De Valera to take the oath of allegiance to the king but only as "an empty political formula." This group became Fianna Fail and entered the Dail in 1927. The party was committed to removal of the oath, retention of the land annuities, an end of partition, preservation of the Gaelic language, and a policy of extensive social services and economic nationalism. After the 1932 election De Valera became president of the executive council of the Free State. He abolished the oath of allegiance, withheld payment of the land annuities and used the tariff retaliation of Britain as an excuse for hastening his self-sufficiency program. In 1933 and again in 1938–39 he was president of the League of Nations Assembly and called for a more effective league. Subsequently he opposed a proposal that the league use military sanctions. He was especially firm in supporting the nonintervention policy concerning the Spanish Civil war.

His relations with Neville Chamberlain were friendly. They modified the tariff war between Eire and Britain. By an agreement with Chamberlain (1938), De Valera received the naval bases of Cobh, Lough Swilly and Bearhaven. De Valera in turn supported the policy of appeasement. After the outbreak of World War II he attempted to follow a policy of strict neutrality. This policy was so widely supported in Eire that De Valera indicated that Eire would not participate in the war even if Northern Ireland were to be incorporated in Eire.

De Valera's economic policies were modified in his ten years of power. The economic war with Britain only emphasized Eire's dependence on the British market. In 1938 and 1939 De Valera expressed his awareness that this dependence might lead Ireland into a war in which Britain would be involved. This awareness and the trade agreements with Britain indicated a departure from the aim of self-sufficiency.

At home and abroad De Valera had serious trouble with the Irish Republican army. He was committed to the cause of Irish national independence and fought against the treaty (1921). He constantly criticized the Cosgrave government for the repressive measures it took against the I.R.A. He was unwilling to act severely or to condemn its terrorism unreservedly; his patience was several times strained. Finally in June 1939 the I.R.A. was declared an illegal organization.

In Feb. 1939 he attended the coronation of Pope Pius XII.

There are biographies of De Valera by Dwane, S. O'Faolain, Denis Gwynn and Desmond Ryan. (F. E. MN.)

DEVELOPMENT COMMISSION. The development commission was founded by act of parliament (1909) "to promote the economic development of the United Kingdom" by recommending advances for aiding and developing agriculture and rural industries, the reclamation and drainage of land, the development and improvement of fisheries, and the construction and improvement of harbours. Since 1921 Ireland has ceased to benefit under the act. There are eight commissioners appointed by royal warrant, each for a term of eight years, of whom one is salaried. The grants or loans recommended are made by the treasury from the development fund, into which the total amount paid by the exchequer down to March 31, 1939, was £10,518,000, most of which had been used by the end of that year. The commissioners' recommendations require treasury approval. Before deciding upon an application, the commissioners must receive a report from the government department concerned. They also appoint expert advisers and advisory committees to assist them. Advances may be made to government departments, public authorities, educational or other institutions, but not to individuals or to associations or companies trading for profit.

The agricultural research council, acting under the direction of a committee of the privy council, was established by royal charter in 1931. One of its functions is to act as advisers to the development commission in regard to all expenditure upon agricultural research.

A chain of institutions in Great Britain deals with research on such subjects as soils, plant physiology, plant breeding and diseases, fruit culture and preservation, the breeding, nutrition and diseases of animals, dairying, entomology, agricultural economics and machinery. There were 41 such institutes or stations in 1939 mostly based on universities, receiving maintenance grants from the development fund. District advisory officers have been provided to deal with local problems. Research scholarships are offered, and grants are made for researches into special problems, such as foot-and-mouth disease. On the agricultural education side, grants have been made for colleges and college farms, and for farm institutes, where less elaborate instruction is given suitable for farmers and small holders. Provision for agricultural scholarships has also been made.

In 1921, a rural industries bureau was set up in order to provide an intelligence and a technical advisory service for the development of rural industries work. The bureau is financed from the development fund and grants are also made from the fund to rural community councils in England and Wales for rural industries work carried out on a policy framed by the bureau. Loans are made for the erection and improvement of village halls. In a limited number of cases grants have been made on a diminishing scale for the establishment of new rural community councils. Grants of considerable amount have also been made to the national bodies in Great Britain responsible for the establishment of women's institutes in aid of their general work, for handicrafts instruction and for organizing the production and use of home-grown food. Advances have been made to the Land Settlement association, for experiments in the settlement of unemployed industrial workers on whole-time and part-time holdings.

Fisheries have been aided by grants for research made to the fishery departments and to various marine research institutes, the object being to gain that knowledge of fish and their environment which is necessary for the best exploitation of the resources of seas and rivers. Large loans have been made for installing motors in fishing boats, and co-operative societies organized to assist fishermen in marketing their catch. Fishery harbours have in many cases been improved and deepened, particularly in connection with the herring fishery in north-east Scotland.

The commissioners are empowered to make compulsory orders for the acquisition of land for purposes of development, and also for road improvements. An annual report is published.

DEVENS, CHARLES (1820–1891), American lawyer and jurist, was born in Charlestown, Mass., April 4, 1820. He graduated at Harvard college in 1838, and at the Harvard law school in 1840, and was admitted to the bar. Throughout the Civil War he served in the Federal Army, becoming colonel of volunteers in July 1861 and brigadier-general of volunteers in April 1862. After the war he was a judge of the Massachusetts superior court from 1867 to 1873, and was an associate justice of the supreme court of the State from 1873 to 1877, and again from 1881 to 1891. From 1877 to 1881 he was attorney-general of the United States in the Cabinet of President Hayes. He died at Boston, Mass., Jan. 7, 1891.

See his ***Orations and Addresses,*** with a memoir by John Codman Ropes (Boston, 1891).

DEVENTER, SIR JACOB LOUIS VAN (1874–1922), South African soldier, was born in the Orange Free State. He fought in the South African War of 1899–1902, becoming second-in-command to Gen. Smuts during the latter's invasion of Cape Colony. A colonel on the permanent staff of the South African defence force, Van Deventer served in the campaign in German South West Africa, 1914–15. His gifts as a general were shown later in the operations in East Africa, where in 1917 he was appointed commander-in-chief. He was then a major-general, and was given the temporary rank of lieutenant-general on becoming commander-in-chief. Shortly afterwards, he was created K.C.B. As commander-in-chief he brought the campaign to a successful end. He died on Aug. 27, 1922. (See EAST AFRICA, OPERATIONS IN.)

DEVENTER, a town in the province of Overysel, Holland, on the right bank of the Ysel, at the union of the Schipbeek, and a junction station 10 mi. N. of Zutphen. Pop. (1939) 40,311. In the 14th century Deventer was the centre of the famous religious educational movement associated with the name of Gerhard Groot (*q.v.*), who was a native of the town (see BROTHERS OF COMMON LIFE). The Groote Kerk (St. Lebuinus), dates from 1334, and occupies the site of an older structure of which the 11th-century crypt remains. The Roman Catholic Broederkerk, or Brothers' church, contains among its relics three ancient gospels attributed to St. Lebuinus (Lebwin), the apostle of the Frisians and Westphalians (d. c. 773). The Bergkerk, dedicated in 1206, has two late Romanesque towers. The town hall was built in 1693. In the fine square called the Brink is the old weigh-house, now a school (gymnasium), built in 1528, with a large external staircase (1644). The town library, also called the library of the Athenaeum, includes many mss. and incunabula, and a 13th-century copy of Reynard the ***Fox.*** The archives of the town are of considerable value. Besides a considerable agricultural trade, Deventer has important carpet and textile factories (the Smyrna carpets being especially famous).

In the church of Bathmen, a village 5 mi. E. of Deventer, some 14th-century frescoes were discovered. German troops occupied Deventer in 1940.

DE **VERE, AUBREY THOMAS** (1814–1902), Irish poet and critic, was born at Curragh Chase, Co. Limerick, being the third son of Sir Aubrey de Vere Hunt (1788–1846), also a poet, whose verses and a drama, Mary Tudor, were published by his son in 1875 and 1884. Aubrey de Vere was educated at Trinity college, Dublin, and in his 28th year published The Waldenses, which was the first of many volumes of verse and prose to his credit. In many of his poems, notably in the volume of sonnets called St. Peter's Chains (1888), he made rich additions to devotional verse. After Matthew Arnold's fine lecture on "Celtic Literature," nothing perhaps did more to help the Celtic revival than Aubrey de Vere's insight into the Irish character and his reproductions of the early Irish epic poetry.

A volume of ***Selections*** from his poems was edited in 1894 (New York and London) by G. E. Woodberry.

DEVIATION, in magnetism (*q.v.*), the horizontal angle through which a magnetic needle is deflected away from the magnetic meridian by the iron in a ship (see COMPASS).

DEVICE, a scheme or simple mechanical contrivance; also a design, particularly an heraldic design or emblem, often combined with a motto or legend. (See HERALDRY.)

DEVIDASI: see CASTE.

DEVIL is the generic name for a spirit of evil, especially the supreme spirit of evil, the foe of God and man, but also for minor evil spirits or "demons." It is given as a name to many destructive and repulsive animals, to apparatus for tearing cloth, etc., to highly seasoned dishes, to boy assistants in printing-houses (probably because of their inky appearance), and to juniors and hacks who prepare work (or "devil") for barristers, authors, etc. Here, however, we are concerned with the word only as used in mythology and religion.

The primitive philosophy of animism involves the ascription of all phenomena to personal agencies; the agents of good become gods, those of evil, demons. When the divine is most completely conceived as unity, the demonic is also so conceived, and over against God stands Satan, or the devil.

Though it is in connection with Hebrew and Christian monotheism that belief in the devil has been most fully developed there are approaches to the doctrine in other religions, *e.g.,* "the lady Nina" and the dragon Tiamat in Babylonian, the serpent Apap in Egyptian, the Titans and Prometheus in Greek, Hel and Loki among the Teutons and Ahi and Siva among Hindus. The opposition of good and evil is most fully carried out in Zoroastrianism. Opposed to Ormuzd, the author of all good, is Ahriman, the source of all evil; and the opposition runs through the whole universe (D'Alviella's Hibbert Lectures, pp. 158–164).

The conception of Satan belongs to the post-exilic period of Hebrew development, and probably shows traces of the influence of Persian on Jewish thought; it also has its roots in much older beliefs (cf. 1 Sam. xvi. 14; Judges ix. 23; 1 Ki. xxii. 22; Gen. vi. 1–4), and evil, whether as misfortune or as sin, is generally assigned to divine causality (1 Sam. xviii. 10; 2 Sam. xxiv. 1; 1 Ki. xxii. 20; Isa. vi. 10, lxiii. 17). After the Exile there is a tendency to protect the divine transcendence by the introduction of mediating angelic agency, and to separate all evil from God by ascribing its origin to Satan, the enemy of God and man. In the prophecy of Zechariah (iii. 1–2) he stands as the adversary of Joshua, the high priest; in the book of Job he presents himself before the Lord among the sons of God (ii. 1), yet is represented both as accuser and tempter; and while, according to 2 Sam. xxiv. 1, God himself tests David in regard to the numbering of the people, according to 1 Chron. xxi. 1, it is Satan who tempts him.

The development of the conception continued in later Judaism, which was probably more strongly influenced by Persian dualism, as in Tobit iii. 8, vi. 14; Ecclesiasticus xxi. 27; Wisdom ii. 24; Psalms of Solomon xvii. 49; and the book of Enoch. In the Jewish *Targums* Sammael "the highest angel that stands before God's throne, caused the serpent to seduce the woman"; he coalesces with Satan, and has inferior Satans as his servants. The birth of Cain is ascribed to a union of Satan with Eve. As accuser affecting man's standing before God he is greatly feared.

This doctrine, stripped of much of its grossness, is reproduced in the New Testament. Satan is the διάβολος, from διαβάλλειν, to slander (Matt. xiii. 39; John xiii. 2; Eph. iv. 27; Heb. ii. 14; Rev. ii. 10), slanderer or accuser, the πειράξων (Matt. iv. 3; 1 Thess. iii. 5), the tempter, the πονηρός (Matt. v. 37; John xvii. 15; Eph. vi. 16), the evil one, and the ἐχθρός (Matt. xiii. 39), the enemy. He is apparently identified with Beelzebub (or Beelzebul) in Matt. xii. 26, 27. Jesus appears to recognize the existence of demons belonging to a kingdom of evil under the leadership of Satan "the prince of demons" (Matt. xii. 24, 26, 27), whose works in demonic possessions it is his function to destroy (Mark

i. 34, iii. 11, vi. 7; Luke x. 17–20), but he himself conquers Satan in resisting his temptations (Matt. iv. 1–11). Simon is warned against him, and Judas yields to him as tempter (Luke xxii. 31; John xiii. 27). Jesus's cures are represented as a triumph over Satan (Luke x. 18). This Jewish doctrine is found in Paul's letters also. Satan rules over a world of evil. Paul's own "stake in the flesh" is Satan's messenger (2 Cor. xii. 7). According to Hebrews Satan's power over death Jesus destroys by dying (ii. 14). Revelation describes the war in heaven between God with his angels and Satan or the dragon, the "old serpent," the deceiver of the whole world (xii. 9), with his hosts of darkness. After the overthrow of the Beast and the kings of the earth, Satan is imprisoned in the bottomless pit a thousand years (xx. 2). Again loosed to deceive the nations, he is finally cast into the lake of fire and brimstone (xx. 10; cf. Enoch liv. 5, 6; 2 Peter ii. 4). In John's Gospel and Epistles Satan is opposed to Christ. Sinner and murderer from the beginning (1 John iii. 8) and liar by nature (John viii. 44), he enslaves men to sin (viii. 34), causes death (verse 44), rules the present world (xiv. 30), but has no power over Christ or those who are His (xiv. 30, xvi. 11; 1 John v. 18). He will be destroyed by Christ with all his works (John xvi. 33; 1 John iii. 8).

In the common faith of the Gentile Churches after the Apostolic age the influence of polytheism survived in the belief in the dominion of demons, from which Christ is the Redeemer. While Christ's First Advent delivered believers from Satan's bondage, his overthrow would be completed only by the Second Advent. The belief in Satan appears in fantastic forms in Gnosticism. The Fathers traced false doctrine as well as evil practice to him. In Irenaeus emerges the strange doctrine that the death of Christ was a ransom paid to the devil. God was represented by Origen as duping the devil, and His right to do so was justified. While this view was maintained by several Christian thinkers, others felt scruples about ascribing a "pious fraud" to God, and it at last fell into the background. The possibility of the redemption of Satan, advanced by Origen, however, was in the 5th century branded as a heresy. Persian dualism was brought into contact with Christian thought in the doctrine of Mani; and it is permissible to believe that the gloomy views of Augustine regarding man's condition are due in some measure to this influence. Mani taught that Satan attacked the earth, and defeated man sent against him by the God of light, but was overthrown by the God of light, who then delivered the primeval man. "During the middle ages," says Tulloch, "the belief in the devil was absorbing —saints conceived themselves and others to be in constant conflict with him." This superstition, perhaps at its strongest in the 13th to the 15th century, passed into Protestantism. Luther was always conscious of the presence and opposition of Satan. He held that this world will pass away with its pleasures, as there can be no real improvement in it, for the devil continues in it to ply his daring and seductive devices. This belief in the devil was specially strong in Scotland among both clergy and laity in the 17th century.

In more recent times a great variety of opinions has been expressed on this subject. The reality of demonic possession has been denied, and Satan variously represented as a personification of the principle of evil. But some Christian theologians, such as Daub, Dorner, Martensen, have tried to form a speculative defence of the common belief. A. Ritschl gives no place in his constructive doctrine to the belief in the devil; but recognizes that the mutual action of individual sinners on one another constitutes a kingdom of sin, opposed to the Kingdom of God (A. E. Garvie, *The Ritschlian Theology*, p. 304). In the boor entitled *Evil* and *Evolution* there is "an attempt to turn the light of modern science on to the ancient mystery of evil." The author contends that the existence of evil is best explained by assuming that God is confronted with Satan, who in the process of evolution interferes with the divine designs, an interference which the instability of such an evolving process makes not incredible. Satan is, however, held to be a creature who has by abuse of his freedom been estranged from, and opposed to his Creator, and who at last will be conquered by moral means. W. M. Alexander in his book on demonic possession maintains that "the confession of Jesus as the Messiah or Son of God is the classical criterion of genuine demonic possession" (p. 150) and argues that as "the Incarnation indicated the establishment of the kingdom of heaven upon earth," there took place "a counter movement among the powers of darkness," of which "genuine demonic possession was one of the manifestations" (p. 249).

Interesting as these speculations are, it may be confidently affirmed that belief in Satan is not now generally regarded as an essential article of the Christian faith, nor is it found to be an indispensable element of Christian experience. On the one hand science has so explained many of the processes of outer nature and of the inner life of man as to leave no room for Satanic agency. On the other hand the modern view of the inspiration of the Scriptures does not necessitate the acceptance of the doctrine of the Scriptures on this subject as finally and absolutely authoritative. The preaching of Jesus even in this matter may be accounted for as either an accommodation to the views of those with whom He was dealing, or more probably as a proof of the limitation of knowledge which was a necessary condition of the Incarnation, for it cannot be contended that as revealer of God and redeemer of men it was imperative that He should either correct or confirm men's beliefs in this respect. The possibility of the existence of evil spirits, organized under one leader Satan to tempt man and oppose God, cannot be denied; the sufficiency of the evidence for such evil agency may, however, be doubted; the necessity of any such belief for Christian thought and life cannot, therefore, be affirmed. *(See* also DEMONOLOGY; POSSESSION.)

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DE VILLIERS, JOHN HENRY, BARON (1842–1914), first Chief Justice of the Union of South Africa, was born at Paarl, Cape Colony, in June 1842. He was educated at the South African college, Cape Town, and Utrecht and Berlin universities. In 1865 he was called to the bar by the Inner Temple and began practice in Cape Colony. Entering Cape politics in 1866, he was elected a member of the House of Assembly, became attorney-general of the Colony in 1872 and two years later was appointed Chief Justice of the Cape. In this capacity he succeeded, by his decisions, in adapting the Roman-Dutch law of the colony to modern requirements. He was appointed President of the National Convention in 1908 and in 1910 was raised to the peerage on becoming Chief Justice of the Union of South Africa. He died Sept. 2, 1914.

DEVIL'S ADVOCATE: *see* ADVOCATUS DIABOLI.

DEVIL'S ISLAND, a small island in the Atlantic Ocean off the coast of French Guiana, South America, used by the French as a penal settlement because of the difficulty of escape. It was here that Capt. Alfred Dreyfus (*q.v.*) was confined.

DEVILS LAKE, a city of North Dakota, U.S.A., on Devils Lake, 85m. W. by N. of Grand Forks; the county-seat of Ramsey county. It is on Federal highway 2, and is served by the Farmers Grain and Shipping Company, the Great Northern and the Soo Line railways. Population in 1940 federal census was 6,204. The city has creameries, flour mills and railroad shops. It is the seat of the state school for the deaf. The state university has a biological station on the lake, and just south of the lake is Sully's Hill national park, an important wild animal preserve, with historic associations. Devils Lake was settled in 1880 and incorporated in 1887.

DEVILS POSTPILE, a national monument (reservation) in the southeast corner of Madera county, California, U.S.A., and only a few miles southeast of Yosemite national park. The reservation (800 ac. in area) was created on July 6, 1911, to preserve an unusual mass of basaltic columns, 10 to 30 in. in diameter, and rising, like an immense pile of posts, as high as 60 ft. It is said to rank with the Giant's Causeway in Ireland.

DEVILS TOWER, first of the U.S. national monuments, on the Belle Fourche river about 25 mi. northwest of Sundance in Crook county, Wyoming, U.S.A. The area (1,152.91 ac.) was

established Sept. 24, 1906, to preserve a remarkable natural rock tower, of volcanic origin, 600 ft. from base to summit and 1,300 ft. above the Belle Fourche river.

DE VINNE, THEODORE LOW (1828–1914), the most eminent American printer during the later 19th century and the first decade of the 20th. He was known as an authority on the history of typography and was the author of many scholarly books on this subject. Born at Stamford, Conn., on Dec. 25, 1828, he took the first steps toward learning his trade in 1843 in a printing office at Fishkill, N.Y., but entered on his regular apprenticeship soon after in the office of the Gazette at Newburgh, N.Y. In 1847 he went to New York city and after working in several offices, in 1849 entered the employ of Francis Hart, one of the leading printers in that city, a relation destined to prove both happy and permanent. From work as a job compositor, he graduated in 1850 into the position of foreman. Nine years later, when De Vinne was offered a partnership elsewhere, Hart decided to hold him by making him a member of the firm. At this period the business of Francis Hart and Co. was tending more and more to book printing, a field to which De Vinne devoted most of his efforts from that time onward. About 1864 De Vinne began to write on printing, his earliest contributions dealing with the economic aspects of the business, but his attention soon turned to the aspects of typographic style and the history of the craft.

In 1873 the firm began to print St. Nicholas and soon after took on the Century Magazine, in printing the illustrations for which some new standards were established. The Century Dictionary was another job of importance produced under De Vinne's direction.

Francis Hart died in 1877 and in 1883 the name of the firm was changed to Theodore L. De Vinne and Company, the plant coming to be known as the De Vinne press, which earned a reputation as the outstanding printing office of the country. De Vinne was one of the founders of the Grolier Club and one of its most active members, printing most of the early books issued by that organization, and writing or editing a number of them. He died on Feb. 16, 1914.

As a printer De Vinne was a craftsman of high standards and stood head and shoulders above his contemporaries, but he could not be regarded as a great creative artist. His simplest books were his best. De Vinne's most important contributions to typographic literature were: The Practice of Typography (1900–04), a series of four manuals; The Invention of Printing (1876); Christopher *Plantin* and the *Plantin-Moretus Museum* at *Antwerp* (1888); and Notable Printers of *Italy* during the Fifteenth Century (1910). (D. C. McM.)

DEVISE or **DEVICE,** the conveyance of real property by will. See LEGACY.

DEVIZES, a market town and municipal borough in the eastern parliamentary division of Wiltshire, England, 86 mi. S.W. of London by the G.W. Ry. Pop. (1938) 7.000. Area 2.2 sq.mi. Its castle was built on a tongue of land flanked by two deep ravines, behind which the town grew up on a stretch of exposed tableland. Its main streets, in which a few ancient timbered houses are left, radiate from the market place, where stands a market cross with a remarkable inscription referring to a certain dishonest market transaction in 1753. The Rennet and Avon canal, now practically disused, is raised to two levels of ten towers through a chain of locks. St. John's church (12th century), one of the most interesting in Wiltshire, is cruciform, with a massive central tower and fine Norman chancel, and contains several ancient monuments, besides some beautiful carved stonework and oak ceilings. St. Mary's, a smaller church, is partly Norman, but was rebuilt in the 15th and restored in the 19th century. Roundway Down. on the edge of which the town stands, stretches eastward, and is the site of an ancient British earthwork, besides having yielded other remains. The county general and mental hospitals are situated in Devizes, which also has a museum, and is the depot of the Wiltshire regiment. It is an important corn, cattle and pig market, and has bacon and cheese factories. tileworks, engineering works and manufactures of snuff and tobacco. Assize courts are held at Devizes, which has its own commission of the peace and court of quarter sessions.

The construction at Devizes in the reign of Henry I. of a castle of exceptional magnificence by Roger, bishop of Salisbury, at once constituted the town an important political centre, and the name itself is possibly a corruption of the mediaeval Latin referring to the "castle at the boundaries" (ad *divisas*). After the disgrace of Roger in 1139 the castle was seized by King Stephen. In the 14th century it formed part of the dowry of the queens of England. Devizes' first charter, from Matilda, confirmed by successive later sovereigns, merely grants exemption from certain tolls and the enjoyment of undisturbed peace. Edward III. added a clause conferring on the town the liberties of Marlborough, and Richard II. instituted a coroner. A gild merchant was granted by Edward I., Edward II. and Edward III., and in 1614 was divided into the three companies of drapers, mercers and leather-sellers. The present governing charters were issued by James I. and Charles I., the latter being little more than a confirmation of the former, which instituted the common council. Devizes returned two members to parliament from 1295 until deprived of one member in 1867; its representation was merged in that of the county in 1885.

See *Vict.* County *Hist.*, Wiltshire; History *of* Devizes (Devizes, 1859).

DEVOLUTION, WAR OF (1667–68), the name applied to the war which arose out of Louis XIV.'s claims to certain Spanish territories in right of his wife Maria Theresa, upon whom the ownership was alleged to have "devolved." (See, for the military operations, DUTCH WARS.) The war was ended by the Treaty of Aix-la-Chapelle in 1668.

DEVON, EARLS OF. From the family of De Redvers (De Ripuariis; Riviers), who had been earls of Devon from about 1100, this title passed to Hugh de Courtenay (c. 1275–1340), but was subsequently forfeited by Thomas Courtenay (1432–1462), a Lancastrian who was beheaded after the battle of Towton. It was revived in 1485 in favour of Edward Courtenay (d. 1509), whose son Sir William (d. 1511) married Catherine, daughter of Edward IV. Too great proximity to the throne led to his attainder, but his son Henry (c. 1498–1539) was restored in 1517 as earl of Devon, and in 1525 was created marquess of Exeter; his second wife was a daughter of William Blount, 4th Lord Mountjoy. The title again suffered forfeiture on Henry's execution, but in 1553 it was recreated for his son Edward (1526–1556). At the latter's death it became dormant in the Courtenay family, till in 1831 a claim by a collateral branch was allowed by the House of Lords, and the earldom of Devon was restored to the peerage, still being held by the head of the Courtenays. The earlier earls of Devon were referred to occasionally as earls of Devonshire, but the former variant has prevailed, and the latter is now solely used for the earldom and dukedom held by the Cavendishes (see DEVONSHIRE, EARLS AND DUKES OF, and also the article COURTENAY).

DEVON, a south-western county of England, bounded north-west and north by the Bristol channel, north-east by Somerset and Dorset, south-east and south by the English channel, and west by Cornwall. The area, 2,612 sq.mi., is exceeded only by those of Yorkshire and Lincolnshire among the English counties. East to west structural lines dating from Armorican times are dominant features. The high ground to the north of Barnstaple may be considered as an extension of the Quantock hills—Brendon hills—Exmoor forest line, and terminates in Morte point and Baggy point, which face Lundy. Here are exposed a series of slates, grits and limestones considered so characteristic of the county that it was called the Devonian system (*q.v.*). It represents here the northern rim of a trough in the hollow of which lie the Culm measures of central Devon. The same series appears in the southern rim of the trough in the latitude of Tavistock, but this line is much affected by the granitic mass of Dartmoor, intruded into the Culm and Devonian strata in post-Carboniferous times and subsequently exposed by denudation. The hard core stands out in High Willhays (2,039 ft.), Yes Tor (2,028 ft.) and other peaks. Evidences of Devonian volcanic activity are abundant in the masses of diabase, dolerite, etc., at Bradford and Trusham, south of Exeter, around Plymouth and at Ashprington. Perhaps the most interesting is the Carboniferous volcano of

Brent Tor, near Tavistock. An Eocene deposit, the product of the denudation of the Dartmoor hills, lies in a small basin at Bovey Tracey; it yields beds of lignite and valuable clays.

The eastern side of the county is built of younger rocks, unconformable above the old ones and dipping gently eastwards. The lower and most westerly situated member of the younger rocks is a series of breccias, conglomerates, sandstones and marls which are exposed on the coast by Dawlish and Teignmouth, and extend inland, producing a red soil, past Exeter and Tiverton. A long narrow strip of the same formation reaches out westward on the top of the Culm as far as Jacobstow. Farther east, the Bunter pebble beds are represented by the well-known pebble deposit of Budleigh Salterton, whence they are traceable inwards towards Rockbeare. These are succeeded by Keuper marls and sandstones, well exposed at Sidmouth, where the Upper Greensand plateau is clearly seen to overlie them. Greensand covers all the high ground northward from Sidmouth as far as the Blackdown hills. At Beer Head and Axmouth the chalk is seen, and at the latter place is a landslip caused by the springs which issue from the Greensand below the chalk. The lower chalk at Beer has been mined for building stone, and was formerly in considerable demand. At the extreme east of the county, Rhaetic and Lias beds make their appearance, the former with a "bone" bed bearing the remains of saurians and fish.

Local Tertiary movements may account for relics of peneplains, one of which has been located at a height of about 1,000 ft. on the south-eastern edge of Dartmoor, and for the north-west and north-north-west systems of faults, which can be traced in several valleys on the eastern edge of Dartmoor. The raised beaches of Hope's Nose, the Thatcher Stone and other parts of the coast, together with traces of submerged forests, and most of all the long, steep-sided, drowned valleys forming the numerous inlets of the south Devon coast are evidences of recent coastal movements.

The Tamar, which constitutes the boundary between Devon and Cornwall, flows into the English channel. Its estuary has been utilized for the harbours of Plymouth and Devonport. The other principal rivers rise on Dartmoor. These include the Teign, Dart, Plym and Tavy, falling into the English channel, and the Taw flowing north towards Bideford bay. The river Torridge, also discharging northward, receives part of its waters from Dartmoor through the Okement, but itself rises in the angle of high land near Hartland point on the north coast. The lesser Dartmoor streams are the Avon, the Erme and the Yealm, all running south. The Exe rises on Exmoor in Somerset, but the main part of its course is through Devon, and it is joined on its way to the English channel by the lesser streams of the Culm, the Creedy and the Clyst. The Otter, rising on the Blackdown hills, also runs south, and the Axe, for part of its course, divides the counties of Devon and Dorset. The finds made at Oreston, near Plymouth, at Kent's Cavern, near Torquay, at Windmill Hill Cavern, Brixham, and at Cattedown, Plymouth, suggest that these limestone areas with southerly aspects were much favoured by Palaeolithic man. Later settlement seems to have been chiefly on the higher land of the interior. Tumuli, stone circles and alignments are numerous on Dartmoor, and are fairly well distributed over the high land of the county. Hill forts and camps occupy strategic positions and their distribution suggests that Dartmoor had already lost much of its former significance when they were built. Many are found around the coasts guarding routes into the interior.

Roman relics have been found from time to time at Exeter (Isca Damnoniorum), the only large Roman station in the county.

HISTORY

The Saxon conquest of Devon must have begun some time before the 8th century, for in 700 there existed at Exeter a famous Saxon school. By this time, however, the Saxons had become Christians, and established their supremacy, not by destructive inroads, but by a gradual process of colonization, settling among the native Welsh and allowing them to hold lands under equal laws. The final incorporation of the district which is now Devon with the kingdom of Wessex must have taken place about 766. At the beginning of the 9th century Wessex was divided into definite *pagi,* probably corresponding to the later shires, and the Saxon Chronicle mentions the district by name in 823, when a battle was fought between the Welsh in Cornwall and the people of Devon at Camelford. During the Danish invasions of the 9th century aldermen of Devon are frequently mentioned. In 851 the invaders were defeated by the fyrd and aldermen of Devon, and in 878 they were again defeated with great slaughter. In 1003, in the reign of Ethelred the Unready, the Danes sacked Exeter.

Devon, in the 7th century, formed part of the vast bishopric of Dorchester-on-Thames. In 705 it was attached to the newly-created diocese of Sherborne, and in 910 Archbishop Plegmund constituted Devon a separate diocese, and placed the see at Crediton. About 1030 the dioceses of Devon and Cornwall were united, and in 1049 the see was fixed at Exeter.

William the Conqueror immediately recognized the importance of securing the loyalty of the West by the capture of Exeter. The city withstood an 18-days' siege, and William was only admitted at length upon honourable terms. The many vast fiefs held by Norman barons in Devon were known as honours, chief among them being Plympton, Okehampton, Barnstaple, Harberton and Totnes. The honour of Plympton was bestowed in the 12th century on the Redvers family, together with the earldom of Devon; in the 13th century it passed to the Courtenay family (*q.v.*), who had already become possessed of the honour of Okehampton, and who in 1335 obtained the earldom. The dukedom of Exeter was bestowed, in the 14th century, on the Holand family, which became extinct in the reign of Edward IV. The ancestors of Sir Walter Raleigh, who was born at Budleigh, had long held considerable estates in the county. In 1204 the inhabitants paid 5,000 marks to have the county disafforested, with the exception of Dartmoor and Exmoor.

Devon ,had an independent sheriff, the appointment being at first hereditary, but afterwards held for one year only. In 1320 complaint was made that all the hundreds of Devon were in the hands of the great lords, who did not appoint a sufficiency of bailiffs for their proper government. The miners of Devon had independent courts, known as stannary courts, for the regulation of mining affairs, the four stannary towns being Tavistock, Ashburton, Chagford, and Plympton. The ancient miners' parliament was held in the open air on Crockern Tor. For mining purposes West Devon is in the Duchy of Cornwall and under the jurisdiction of the Stannary court.

In 1140 the castles of Exeter and Plympton were held against Stephen by Baldwin de Redvers. In the 14th and 15th centuries the French made frequent attacks on the coast. During the Wars of the Roses frequent skirmishes took place between the earl of Devon and Lord Bonville, the respective champions of the Lancastrian and Yorkist parties. In 1470 Warwick and Clarence were pursued as far as Exeter by Edward IV after the battle of "Lose-Coat Field." Warwick subsequently escaped to the Continent from Dartmouth. Richard III came to Exeter to punish personally those who had inflamed the West against him. Hundreds were outlawed, including the bishop and the dean. Perkin Warbeck besieged Exeter in 1497, and Henry VII came down to thank the citizens for their resistance and to judge the prisoners. Great disturbances in the county followed the inaugural service of Edward VI's prayer book on Whit Sunday, 1549. A priest at Sampford Courtenay was persuaded to read the old Mass on the following day. Swiftly the insubordination spread into a serious revolt, in which the men of Cornwall joined, and Exeter suffereda distressing siege before it was relieved by Lord Russell. On the outbreak of the Civil War the county as a whole favoured the parliament, but the prevailing desire was for peace, and in 1643 a treaty for the cessation of hostilities in Devon and Cornwall was agreed upon. Skirmishes, however, continued until 1646. After the Monmouth rebellion, Judge Jefferies held a "bloody assize" at Exeter. In 1688 the prince of Orange landed at Torbay and stayed for several days at Forde and at Exeter.

The tin mines of Devon have been worked from time immemorial, and in the 14th century mines of tin, copper, lead, gold and silver are mentioned. At the time of the Domesday Survey the salt industry was important, and there were 99 mills in the

county and 13 fisheries. From an early period the chief manufacture was that of woollen cloth, and a statute 4 Ed. IV permitted the manufacture of cloths of a distinct make in certain parts of Devon. About 1505 Anthony Bonvis, an Italian, introduced an improved method of spinning into the county, and cider-making is mentioned in the 16th century. In 1680 the lace industry was already flourishing at Colyton and Ottery St. Mary, and flax, hemp and malt were largely produced in the 17th and 18th centuries.

Devon returned two members to parliament in 1290, and in 1295 Barnstaple, Exeter, Plympton, Tavistock, Torrington and Totnes were also represented. In 1831 the county, with its boroughs, returned 26 members, but under the Reform Act of 1832 they were reduced to 18. Subsequent bills brought further reductions. The redistribution bill of 1918 left the county with a total of 11 members.

The churches are for the most part of the Perpendicular period, dating from the middle of the 14th to the end of the 15th century. Exeter cathedral is an exception, the whole (except the Norman towers) being very beautiful Decorated work. The special features of Devonshire churches are the richly-carved pulpits and chancel screens of wood. The largest and the most beautiful screen is that at Hartland (*c.* 1450). Granite crosses are frequent, the finest being that of Coplestone, near Crediton. A number of ancient rude stone crosses stand among the prehistoric pagan remains on the wastes of Dartmoor. Monastic remains are scanty; the principal are those at Tor, Buckfast, Tavistock and Buckland abbeys. Buckfast abbey was reconstructed (*see* BUCKFASTLEIGH). Among domestic buildings may be mentioned the 14th century parsonage at Little Hempston, the houses of Wear Gifford, Bradley and Dartington of the 15th century; Bradfield and Holcombe Rogus (Elizabethan) and Forde (Jacobean). The ruined castles of Okehampton (Edward I), Exeter, with its vast British earthworks, Berry Pomeroy (Henry III, with ruins of a large Tudor mansion). Totnes (Henry III) and Compton (early 11th century), are all interesting.

Climate and **Agriculture.**—The climate is more humid than that of the eastern or southeastern parts of England. The mean annual temperature somewhat exceeds that of the midlands, but the average summer heat is rather less than that of the southern counties to the east. The air of the Dartmoor highlands is sharp and bracing. Mists are frequent, and snow often lies long. On the south coast frost is little known, and hydrangeas, myrtles, geraniums and heliotrope live through the winter without protection. The climate of the watering places on this coast is very equable, the mean temperature in January being 43.9° at Plymouth. The north coast, exposed to the storms of the Atlantic, is more bracing; although there also, in the more sheltered nooks (as at Combe Martin), myrtles of great size and age flower freely.

The cultivated area falls a little below the average of the English counties. In 1939 there were, however, about 364,381 ac. of rough grazing and 708,272 ac. of permanent grass. The arable land was estimated at 415,438 ac. Oats, wheat, barley and root-crops are chiefly grown. The acreage under oats—83,600 ac.—was about four times that under barley. Wheat occupied 22,901 ac. The Devon breed of cattle is well adapted both for fattening and for dairy purposes; while sheep are kept in great numbers on the hill pastures (973,209 in 1939). Devon is specially famous for clotted cream and junket. The bulk of the acreage under green crops is occupied by turnips and swedes and mangolds at 22,335 ac. and 14,984 ac. respectively. Orchards occupy a large acreage, 21,400 ac. in 1939, and consist chiefly of apple trees, mainly for the manufacture of cider. The National Trust owned about 2,250 ac. in the county in 1942 and had a 500-year lease of 10,000 acres in Exmoor at a nominal rent.

Fisheries.—Large quantities of the pilchard and herrings caught in Cornish waters are landed at Plymouth. Much of the fishing is carried on within the three-mile limit; and it may be asserted that trawling is the main feature of the Devonshire industry, whereas seining and driving characterize that of Cornwall. pilchard, cod, sprats, brill, plaice, soles, turbot, shrimps, lobsters, oysters and mussels are met with, besides herring and mackerel, which are fairly plentiful. After Plymouth the principal fishing station is at Brixham, but there are many lesser stations.

Other Industries.—The principal industrial works are the various government establishments at Plymouth and Devonport. Among other industries may be noted the lace-works at Tiverton; the manufacture of pillow-lace for which Honiton and its neighbourhood has long been famous; and the potteries and terra-cotta works of Bovey Tracey and Watcombe. Woollen goods and serges are made at Buckfastleigh, while Plymouth produces chemical manure, soap, starch, blue and black lead.

Minerals.—Silver-lead was formerly worked at Combe Martin. near the north coast, and elsewhere. Tin has been worked on Dartmoor (in stream works) from an unknown period. Copper was not much worked before the end of the 18th century. Tin occurs in the granite of Dartmoor, and along its borders, and especially, with zinc and iron, around Tavistock, which has the Devon Great Consols mine within 4 mi., which from 1843–71 were the richest of copper mines. But Devonshire mining is affected by the same causes as that of Cornwall. The quantity of ore has greatly diminished. and the cost of raising it from the deep mines prevents competition with foreign markets. In many mines tin underlies the general depth of the copper, and is worked when the latter has been exhausted. Great quantities of refined arsenic have been produced at the Devon Great Consols mine, by elimination from the iron pyrites contained in the various lodes. Manganese occurs in the neighbourhood of Exeter, in the valley of the Teign and in north Devon; but the most profitable mines are in the Tavistock district. There are two mines for tungsten ores, at Gunnislake, near Tavistock, and Marytavy.

The other mineral productions of the county consist of marbles, building stones, slates and potters' clay. The granite of Dartmoor is much quarried near Princetown, near Moreton Hampstead on the northeast of Dartmoor, and elsewhere. Hard traps, which occur in many places, are also much used for building. as are the limestones of Buckfastleigh and of Plymouth. The Roborough stone, used from an early period in Devonshire churches, is found near Tavistock, and is a hard porphyrytic elvan, taking a fine polish. Excellent roofing slates occur in the Devonian series round the southern part of Dartmoor. The chief quarries are near Ashhurton and Plymouth (Cann quarry). Potters, clay is worked at King's Teignton, whence it is largely exported; at Bovey Tracey; and at Watcombe. The Watcombe clay is of the finest quality. China clay or kaolin is found on the southern side of Dartmoor, at Lee Moor, and near Lustleigh. There is a large deposit of umber close to Ashburton.

Communications.—The main line of the G.W. railway, entering the county in the east from Taunton, runs to Exeter, skirts the coast as far as Teignmouth, and continues a short distance inland by Newton Abbot to Plymouth, after which it crosses the estuary of the Tamar by a great bridge to Saltash in Cornwall Branches serve Torquay and other seaside resorts of the south coast; and among other branches are those from Taunton to Barnstaple, and from Plymouth northward to Tavistock and Launceston. The main line of the Southern railway between Exeter and Plymouth skirts the north and west of Dartmoor by Okehampton and Tavistock. A branch from Yeoford serves Barnstaple, Ilfracombe, Bideford and Torrington. The branch line to Princetown from the Plymouth-Tavistock line of the G.W. company in part follows the line of a very early railway—that constructed to connect Plymouth with the Dartmoor prison in 1819–21, which was worked with horse cars. The only waterways of any importance are the Tamar, which is navigable up to Gunnislake (3 mi. S.W. of Tavistock), and the Exeter ship canal, noteworthy as one of the oldest in England, for it was originally cut in the reign of Elizabeth.

The area of the administrative county is 2,582 sq mi. Pop. (est. 1938) 741,660. Wartime movements caused by evacuation from dangerous areas raised the population of Devon by 10% between Sept. 1939 and Feb. 1941. There were in 1943 ten municipal boroughs, two county boroughs, and 21 urban districts.

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DEVONIAN SYSTEM, THE. The Devonian rocks receive their name from the locality where the stratigraphical and historical position of those of marine origin—between the Silurian below and the Carboniferous above—was first recognized. In some areas they consist of sediments laid down in fresh water or on land, and as these are usually arenaceous and red in colour, they are known as the Old Red Sandstone.

In Devonian times Africa was already an ancient continent, but it lay far south of its present position and extended into the Antarctic. A second continent stretched across northern Europe to the north-east of North America. Between them lay the ocean the geologists call Tethys. In the Western Hemisphere narrow seas existed in the east and west of what is now North America, and low land, submerged later, lay between. In the Old Red Sandstone are the first well preserved remains of vertebrates, comprising many strange types. (The letters D, L, M and U indicate the division of the period in which they occur—Downtonian [passage beds], Lower, Middle and Upper Devonian.)

Palaeospondylus M, was tadpole-shaped, perhaps allied to the lamprey.

The PLACODERMI were fish-like, but without jaws, or true paired limbs. Some (ANASPIDA), like *Birkenia* D, were protected only by tubercles. In others, such as *Cyathaspis* D, L, *Pteraspis* L, *Auchenaspis* D, *Cephalaspis*, D, L, M, U and *Psammosteus* D, U, the tubercles were fused into dorsal and ventral shields. The ANTIARCHI form a separate group with paired paddles, including *Pterichthys* M, U, *Asterolepis* U, and *Bothriolepis* U. The Arthrodira had jaws and articulated head and trunk shields. *Phlyctaenaspis* L, *Coccosteus M*, U, *Dinichthys M*, *U* and *Homosteus* M, U are examples. None of the above survived the Devonian.

With them are undoubted fish. The *Acanthodi* are elasmobranchs. Both paired and unpaired fins have a spine in front. *Mesacanthus* L, M, has additional paired fins between the pectorals and ventrals. Other genera are *Ischnacanthus* M, U; and *Parexus* L; the *Dipnoi* have a swimming-bladder lung. They are represented in the Old Red by *Dipterus* M, and *Phaneropleuron* U. The *Teleostomi* are represented by the *Crossopterygii* and the *Ganoidei*. The former have a radiate structure of the paired fins comparable to the limbs of higher vertebrates. One family, the *Holoptychiidae*, with *Glyptolepis* M, and *Holoptychius* U, has teeth with a folded structure like those of the labyrinthodonts. Another, the *Osteolepidae*, includes *Thursius M*, and *Osteolepis* M. The Ganoidei are represented by *Cheirolepis* M, U.

An amphibian footprint in the Upper Old Red of Pennsylvania shows that the higher vertebrates had made their appearance before the close of the period.

INVERTEBRATES

Among the invertebrates, the "eurypterids" allied to the king crabs and arachnids: include the genera *Eurypterus* D, L, *Pterygotus* D, L. The bivalve crustacean *Estheria* M, U is of interest as the genus is now confined to saline springs in deserts. Isopods and other crustaceans also occur. Myriapods are met with at different horizons, but true insects are unknown. A fresh-water lamellibranch *Archanodon* (*Amnigenia*) M, U is found in South Wales, Europe, North America and, it is said, Bolivia.

The plants are generalized types distantly allied to the ferns. Those best known are grouped as *Psilophytales*. In the Rhynie chert, silicified peat of Middle Old Red age, the minute structure of the plants *Rhynia, Hornia* and *Asteroxylon* has been preserved. In the Upper Old Red *Archaeopteris hibernica*, with fern-like foliage, is widely distributed.

The vegetation, like the animal life, was probably confined to streams, lakes and marshes, while the high ground was left unprotected by vegetation.

The **Marine** Fauna — The marine life of the Devonian is closely linked with that of the formations below and above it. The most important change is the disappearance of the graptolites. Their loss is partly made good by the goniatites and clymenias which, like their relatives, the ammonites, make excellent zone-fossils, as the species are widely extended in space but have a brief duration. The corals have also been employed for zoning. Most of the Silurian types continue, but with modifications. Among special Devonian forms may be mentioned *Pleurodictyum problematicum* L; the slipper-shaped *Calceola sandalina* M; *Phillipsastrea* U.

Brachiopods are numerous and the species of *Spirifer* are of especial value for zoning. Gastropods and lamellibranchs indicate littoral conditions, except those with thin shells, and certain thick-shelled lamellibranchs associated with coral reefs. Conical forms such as *Tentaculites* and *Styliolina* play an important part. Trilobites are less numerous than in the Silurian. They are often provided with spines.

It is only under special conditions that marine and continental sediments are associated. As the latter are more constant in character, they will be taken first. They include conglomerates laid down by torrents escaping from mountain ranges, and sandstones and shales spread out by streams traversing the plains. Some lake deposits are fluviatile in origin, others are formed of fine sand and dust, transported by the wind till they are arrested by sheets of water or by damp soil. Sometimes the sand is rounded by attrition. Arkose—disintegrated but undecomposed granite materials—is itself evidence of desert conditions. Where organic life was plentiful, the deposits may be bituminous, or coal may occur.

Sometimes there is evidence of alternation of wet and dry seasons. In the latter, the shallow lakes or moist areas dried up and the calcium carbonate that had been in solution separated out in the form of concretions or "cornstones." Gypsum and salt also occur in places.

On the Welsh border the transition to continental conditions is marked by the Ludlow Bone Bed, a widely extended layer some six inches in thickness consisting of fragments of fish and eurypterids. Then follows the Downton Sandstone and Temeside Shales, the Downtonian of Elles and Slater. This term has been extended by Wickham King to 700 ft. more of marls and sandstones in which *Lingula* and a few other marine forms are occasionally present. He calls it alternatively the "Anaspida Marls," and makes the Bone Bed the base not only of the Downtonian, but of the Old Red Sandstone. The Downtonian thus defined is characterized by *Cephalaspis lyelli, Cyathaspis*, and *Anaspida*. *Pteraspis* is absent. It is covered conformably by the "Dittonian" or "Pteraspis Cornstones," distinguished by *Cephalaspis murchisoni* and *Pteraspis*. This is followed, also conformably, by the unfossiliferous "Brownstonee," sandstones formerly referred to the Upper Old Red. This, however, overlaps not only them but the Dittonian and Downtonian and rests in Gower on the Silurian. In Cardiff and Bristol, it is conformable on the Lower Old Red. Among the Upper Old Red fossils are *Bothriolepis, Holoptychius* and *Archanodon*. It passes up conformably into the marine Carboniferous. In South Wales the Downtonian is represented by the Lower Red Marls, and the Dittonian by the Upper Red Marls and the Senni Beds, fossiliferous sandy beds formerly included in the Brownstones. The Old Red extends to Pembrokeshire where marine strata occur in the upper beds.

Similar marine deposits in South Ireland are known as the Coomhola Beds. Below them are the fresh-water Kiltorcan Beds with *Coccosteus disjectus* and *Archaeopteris hibernica*. The Irish Old Red rests unconformably on the Dingle Grits and Slates which are conformable to the Silurian.

Unfossiliferous rocks of Old Red types occur at the base of the Carboniferous of North Wales, the Lake district and Isle of Man.

The Old Red reappears in the Cheviots (where it is largely igneous) and on the margins of the Forth and Clyde syncline. Here both Downtonian and Dittonian are recognizable by their fossils. The former follows the Silurian conformably, but is frequently separated from the Dittonian by an unconformity. The latter includes conglomerates, lavas, tuffs and lacustrine deposits, with *Mesacanthus, Cephalaspis lyelli* and *Pteraspis.*

On the Moray Firth, in Caithness, the Orkneys and Shetlands are strata intermediate in age between the Dittonian and Upper Old Red, which are classed as Middle Old Red, but they are more allied to the Upper than to the Lower. In Caithness an unfossiliferous basement series is followed by conglomerate, and arkose, and then by thick beds of bituminous and calcareous flags and sandstones. Characteristic fossils are *Thursius, Dipterus valenciennesi, Mesacanthus, Coccosteus decipiens, Pterichthys, Estheria* and *Palaeospondylus.* A higher horizon, the John o' Groats beds, has a distinct fauna.

The Upper Old Red sandstone of Scotland overlies unconformably the Lower Old Red in the south and the Middle in the north. There are two horizons. The Lower, the Nairn sandstone, contains *Psammosteus tesselatus, Asterolepis maxima,* and the Upper, the Alves or Scaat Craig beds, has *Psammosteus pustulatus, Bothriolepis major* and *Holoptychius nobilissimus.* Only one form, H. *decoratus,* is common to both.

The Downtonian appears to occur in Norway and the Dittonian in Spitsbergen. Upper Old Red with *Holoptychius* and *Archaeopteris* is found in Bear island, associated with thin coals. In Nova Scotia and New Brunswick the Dittonian with *Cephalaspis* and *Pteraspis* rests unconformably on the Silurian. The Upper Old Red also occurs in the latter, and in New York State it is represented by the Oneonta beds with *Estheria,* and the Catskill with *Bothriolepis* and *Holoptychius.*

In Antarctica, the Upper Old Red age of the Beacon sandstone is indicated by the same two forms.

The marine succession sometimes includes continental intercalations, and even in the marine beds, different facies occur according to the varying conditions under which deposition took place.

Nearest to land were the brackish water and littoral deposits, which may show by red or purple coloration the desert origin of their materials. In deeper water and farther from shore terrigenous mud, now shale or slate, was laid down, and, where conditions were favourable, coral reefs or lenticular limestones were formed. At still greater depths and distance from land, calcareous ooze accumulated with thin shelled molluscs, goniatites and simple corals. The position of these different facies was modified by changes in the level of the sea and floor movements. To the former has been attributed the recession of the sea throughout the Northern Hemisphere at the beginning of the period. The shore line of the northern continent then passed south of Ireland, through Cornwall and south Devon, entered northern France near Boulogne, passed by way of Fepin to the north of the massives of the Rhine and Harz, and of Bohemia, then southward to the Dniester region and central Russia, and north-westward to the White sea. In the Middle Devonian an important advance of the sea began and reached its maximum at the close of the Middle or beginning of the Upper Devonian. The shore line of the northern continent then passed across south Ireland, Pembrokeshire, the Bristol channel, Middlesex, north Belgium, the Baltic, Finland, and Lapland. In the later Upper Devonian there was a new retirement of the sea, and the shore line moved southward again—in some places nearly as far as before, in others, as in Bohemia, still farther.

Parallel to the continental shores, the weight of the terrigenous sediments and accumulated limestones caused a sag of the sea bottom in "geosynclines," and this permitted a still heavier accumulation of deposits.

CENTRAL EUROPE

It is in the Palaeozoic massive of the Ardennes and the Rhineland that the marine Devonian has been most studied. There it has been thrown by the subsequent Armorican movements into folds dipping to the south, and it is in the troughs of these folds that the Middle and Upper Devonian are found as outliers in the Lower. On the Meuse are two main synclines, that of Namur in the north and that of Dinant in the south. On the southern limit of the latter the base of the system is formed by a conglomerate and arkose. These are covered by the Mondrepuits shales with *Spirifer sulcatus* (*mercurei*) which are correlated with the Downtonian. They are succeeded by the mottled Oignies shales containing *Pteraspis* and, therefore, presumably Dittonian

The next horizon, the Siegenian, is represented in Belgium by the Anor grits and the Montigny Greywacke, and in the Rhineland by the Taunus quartzite and the Hunsriick slates, or their equivalents, the Siegen slates. Then follows the Emsian with, on the Meuse, the Red shales of Vireux, and on the Rhine, the Lower Coblenz beds. A higher horizon is that of the Hierges Greywacke corresponding to the Coblenz quartzite and Upper Coblenz beds.

On the north of the Dinant syncline and near the former coastline, the Lower Devonian is represented only by the Burnot conglomerate. In the south-eastern Harz, the Lower Devonian has a deep water ("Hercynian") facies with *Spirifer togatus, Sp. hercyniae, Capulus* and *Phacops fecundus.* The same fauna appears in the Konjeprus limestone of Bohemia, Barrande's F_2 zone.

The Middle Devonian is divided into the Eifelian and the Givetian. At the base of the former is the *Spirifer cultrijugatus* zone. Then follow the *Calceola* Beds. The Givetian is distinguished by the large brachiopod *Stringocephalus.* The Middle Devonian is usually more calcareous than the Lower and the Givetian than the Eifelian. In the Namur syncline the *Calceola* beds rest directly, except for a conglomerate, on the Silurian. Still further north in Brabant, the Eifelian is absent and the Givetian is only separated from the Silurian by a similar conglomerate. In south-west Westphalia the Eifelian and Lower Givetian consist of sandy clays often more or less calcareous. They have yielded plants and *Archanodon* and were probably laid down in fresh water. Similarly in the Boulonnais, sandy beds with plants seem to represent the Eifelian as they are overlaid by a limestone with *Stringocephalus.* In the southern Rhineland the middle division consists of deep-water shales and limestones. In Bohemia the Eifelian is represented by Barrande's zones G_1, G_2 and G_3 deep-water limestones; the Givetian, on the other hand, by the zones H_1, H_2 and H_3, shales and sandstones with plants and Stringocephalus. The deep-water Middle Devonian has been zoned by species of goniatites. Of these, *Meneceras* and *Tornoceras* are characteristic of the Upper Givetian.

The Upper Devonian has two main divisions, the Frasnian and the Famennian. The former commences by limestone with *Buchiola retrostriata,* succeeded by the Biidesheim or Matagne shales, with characteristic goniatites, including *Manticoceras intumescens* and *Tornoceras simplex,* and the bituminous Kellwas limestone. Other Frasnian fossils are *Spirifer verneuili,* which extends through all the Upper Devonian and *Phillipsastrea.* The deep-water Famennian is characterized by the prevalence of the *Clymenia* group. In the lower Famennian it is accompanied by the goniatite genus *Cheiloceras* which marks the horizon of the Nehden shales. The Cypridina shales, laid down in shallower water, contain the small bivalve crustacean *Entomis*—formerly *Cypridina—serrato-striata* in large numbers. In the Namur syncline continental conditions prevailed in the upper Famennian with *Holoptychius* and *Archaeopteris,* though in some places littoral forms like *Cucullaea hardingi* are found. In the Boulonnais the *Stringocephalus* limestone is followed by fossiliferous Frasnian limestone, and then reddish shales with *Spirifer verneuili* and sandstone comparable with that of Condroz. In Bohemia there is no evidence of the Upper Devonian, but in the eastern Alps the whole formation is well represented.

In the south-west of England, the Devonian is also strongly folded. The lowest rocks in north Devon and west Somerset are the continental Foreland grits—red sandstones and conglomerates, of which the base is not seen as they form an anticline; they contain only scanty indeterminable fragments of fish and plants. The succeeding Lynton beds appear to include Dittonian beds, with *Pteraspis;* and Siegenian with *Spirifer primaevus* and *Sp.*

		Typical Fossils		Meuse Valley		Rhineland various Localities	Bohemia	North Devon	South Devon and Cornwall	New York State (Marine beds)	
		Continental	Marine	Dinant syncline	Namur syncline						
Upper	Famennian	*Holoptychius* *Bothriolepis*	*Ptychopteria damnoniensis* *Cucullaea hardingi* *Entomis serratostriata* *Clymenia* *Cheiloceras*	Deep water shales	Coudroz Sandstones	Misacarus Sandstones Clymenia beds Nehden shales	Absent	Lower Pilton beds Baggy and Marwood beds Pickwell Down sandstones	Reddish beds with Entomis serratostriata Calcareous slates with Nehden fauna	Chemung sandstone Naples and Ithaca beds	Chautauquan
	Frasnian	*Coccosteus maximus* *C. disjectus*	*Tornoceras* *Manticoceras intumescens* *Buchiola retro striata* *Rhynchonella cuboides* *Phillipsastrea* *Spirifer verneuili*	Shales and limestones More massive limestones	Limestones and Dolomites	Kellwas limestone Budesheim shales Iberg limestone Dorp limestone	Absent	Morte Slates Upper Ilfracombe beds	Slates with Budesheim fauna, limestone	Genesee shales Tully limestone	Senecan
Middle	Givetian	*Dipterus* *Macropterus*	*Stringocephalus* *Menoceras terebratum* *Cyathophyllum quadrigeminum*	Massive limestones Coral and stromatopora limestones Marly limestones	Limestone	Massive limestone Odershaus limestone	Dark shales with plants and Stringocephalus I-4 to H_3	Lower Ilfracombe beds Stringocephalus beds Myalina beds	Limestone	Hamilton calcareous shales	Erian
	Eifelian	*Dipterus valenciennesi* *Mesacanthus peachi* *Coccosteus decipiens* *Pterichthys Thursius*	*Cosmophyllum* *Calceola sandolina* *Spirifer speciosus* *Anarcestes* *Spirifer cultrijugatus*	Marls and limestones of the Calceola beds *Cultrijugatus* zone	Limestone Nannine Conglomerate	Wissenbach shales { Günterod Limestone; Ballersbach Limestone }	Cephalopod Knoll limestone (G_3) Tentaculites Shales (G_2) Knoll limestone and mottled Mnenian limestone (G_1)	Plant beds Trentishoe grits	Calcareous slates Upper Staddon grits	Marcellus shales Onondoga limestone	Ulsterian
Lower Devonian	Emsian (Coblenzian in the wider sense)	?	*Spirifer paradoxus* *Sp. hercynicus* *Athyris undata*	Hierges Greywacke Red shales of Vireux	Absent	Upper Coblenz beds Coblenz quartzite Lower Coblenz beds	White	(?) Upper Lynton beds	Lower Staddon grits and Upper Meadfoot beds	Oriskany sandstone	Oriskanian
	Siegenian	?	*Rensselaeria* *Spirifer primaevus* *Sp. hystericus* *Sp. decheni*	Montigny Greywacke Anor grits	Absent	Hunsriick slates Taunus quartzite	Konjeprus Limestone (F_2)	Middle Lynton beds	Middle Meadfoot beds	Helderberg	Helderbergian
	Dittonian	*Pteraspis* *Cephalaspis murchisoni* *Mesacanthus mitchelli*	*Spirifer togatus* *Phacops fecundus*	St. Hubert shales Oignies shales	Absent	Slates		Lower Lynton beds	Lower Meadfoot beds Dartmouth slates	Limestone	
	Downtonian	*"Anaspida"* *Cephalaspis lyelli*	*Spirifer sulcatus* (mercuri) *Discina (Orbiculoides) forbesi*	Mondrepuits shales Haybes Arkose Fépin conglomerate	Absent	Quartzites		(?) Foreland grits	Portscatho arenaceous slates		

hystericus. They are overlaid by grits resembling the Forelands, and called collectively the Hangman grits. The lower beds, the Trentishoe grits, have yielded no fossils, but at a higher level are sandstones and shales with plant remains and a scale of *Coccosteus*, followed by littoral beds with casts of *Myalina*, *Cucullaea* and *Naticopsis*, and by calcareous grits with *Stringocephalus* which must be Givetian. Above these is a thick succession of grits, slates and limestones, the Ilfracombe beds. They include coral reefs with *Cyathophyllum* (*Phacellophyllum*) *caespitosum*, *Endophyllum*, and *Pachypora cervicornis*. At a somewhat higher horizon occur *Heliophyllum helianthoides* and *Spirifer verneuili*. The latter, at least, indicates the Upper Devonian. The higher beds, which are arenaceous, are succeeded by the smooth Morte slates with *Spirifer verneuili*, and then by the Pickwell Down sandstone, a continental deposit corresponding to the Condroz sandstone.

At the base is a bed of volcanic ash associated with fish remains including *Bothriolepis* and *Holoptychius*. The Pickwell Down sandstone passes up into the littoral Baggy and Marwood beds. These contain two fossils *Ciccullaea unilateralis* and *Ptychopteria damnoniensis*, also found in the marine beds in the Upper Old Red of Pembrokeshire and the Coomhola grits of Ireland. Then follow the Pilton beds which extend up into the Carboniferous, which occupies a great syncline crossing Devonshire from east to west. Beyond this the Devonian reappears in Cornwall and south Devon. In south-west Cornwall it rests on the Silurian, but the rocks are so dislocated that it is impossible to say whether the formations are conformable or not. The Downtonian may be represented by the Portscatho beds, arenaceous slates which pass up into the smooth Falmouth slates, apparently identical with the Dartmouth slates that form an anticline traversing south Devon and Cornwall. They contain *Cephalaspis* and *Pteraspis*, and appear to be fresh-water deposits of Dittonian age, except in south Devon, where the presence of *Bellerophon* and *Loxonema* indicates brackish conditions. The succeeding Meadfoot beds have yielded *Spirifer primaevus*, *Sp. hystericus*, and other marine fossils of Siegenian age. Then follow the Staddon grits which include beds of Emsian age, with *Tropidolephis rhenanus* and others at the base of the Middle Devonian, with *Spirifer cultrijugatus*.

Next are slates and slaty limestones with *Calceola*. There are also great developments of limestone near Plymouth and Torquay in which both Middle and Upper Devonian are represented, for the fossils include *Spirifer curvatus*, *Stringocephalus*, *Spirifer verneuili* and *Rhynchonella (Hypothyris) cuboides*. The Büdesheim horizon is found at Trevona bay, in North Cornwall, and Saltern cove, in South Devon; that of the Nehden shales at Port Quin in north Cornwall. Famennian horizons are also represented by strata with *Clymenia*, *Entomis serrato-striata* and *Styliolina*. The Devonian, south of the syncline, is overlapped by beds high up in the Carboniferous limestone, and the overlap increases to the south, but this relation is obscured by overthursts of the Devonian over the Carboniferous.

Deep under London both continental and marine Upper Devonian are met with. Many horizons of the Devonian occur in Armorican folds of the north-west of France. In the Devonian rocks of southern Europe, the Lower Devonian and Eifelian are represented by limestones and dolomites laid down at moderate depths; the Givetian and Upper Devonian by limestone accumulated in deeper water, with pale reddish or greenish tints, believed to characterize calcareous oozes.

In the Baltic and adjoining areas the Downtonian succeeds to the Silurian, but there is then a break (without unconformity) followed by typical Middle Old Red. This is, however, succeeded by marine Frasnian with *Spirijer Anossofi*, an eastern form. In the Famennian, continental conditions returned. Further south and east, however, there are marine intercalations, and in central Russia and the Urals, the Famennian is wholly marine. Both the Scotch zones of the Upper Old Red are represented in north-eastern Europe — the Nairn sandstone by the Wenden deposits on the Aa in Livonia, and the Alves by those of the Sjass river near Leningrad.

NORTH AMERICA

The seas on the east and west of the position of the present continent of North America were regions of sedimentation and subsidence, and from them the marine transgression spread over the intervening area. The succession in New York State where the beds have been but little disturbed, is given in the table. The Helderbergian consists of deep sea limestones similar to those of the Lower Devonian of Bohemia. It rests conformably on the Silurian, and is succeeded in the east by the Oriskany sandstone which occurs discontinuously as far west as the Mississippi. It resembles the Lower Devonian of the Meuse and Rhine. As the sea deepened and extended, the Onondaga limestone was laid down, which the presence of *Spirijer acuminatus (cultrijugatus)* would place low in the Eifelian. The limestone is represented by shales in the south, and is later itself replaced by the Marcellus shales which are correlated by their goniatites with the Wissenbach shales of Europe. They are followed by the more calcareous Hamilton shales, with increasing depth of the sea, which, at the end of the Middle Devonian, occupied 38% of the area of the present continent. Although the Hamilton was contemporaneous with the Givetian of Europe, the fauna is quite distinct from that of the Stringocephalus beds, which is, however, found in Manitoba. The affinities of the Hamilton are with southern areas.

The Upper Devonian commences with the Tully limestone, the equivalent of the Iberg limestone of Europe, followed by the Genesee bituminous and pyritous shale and the Portage beds with three facies; in the west the deep water Naples shales with *Gephyroceras intumescens;* in the east the Ithaca shales and sandstones with *Tropidoleptus carinatus*, also found in the Hamilton; and still further east the Oneonta. The Famennian is represented by the continental Catskill beds and the marine Chemung, with *Spirijer verneuili*. In Montana shaly marls with *Clymenia* and *Cheiloceras* indicate deeper water.

SOUTH AMERICA AND AFRICA

The most complete 'succession is found in Bolivia. Resting unconformably on the Ordovician are (1) the Icla sandstone with Silurian fossils near its base, (2) the sandy Icla shales, (3) the Huampampa sandstone, and (4) the Sicasica beds. The fauna of the Icla shales and the Huampampa sandstone is widespread through the Southern Hemisphere — in Paraná (Brazil), the Argentine, the Falklands, and the Bokkeveld beds, which overlie the Table Mountain sandstone in South Africa. *Spirifer antarcticus*, *Clzonetes falklandicus*, and *Leptocoelia flabellites* are found throughout. The fauna of the Sicasica beds is essentially Middle Devonian with some lower forms. It has affinities with the Hamilton. The Devonian fossils of the Sahara are related to North and South American forms. The Devonian of the Gold Coast appears to be a littoral facies of the Hamilton, and is linked with the Sicasica by *Homalonotus dehayi*.

The older southern fauna extending from the Sicasica shales to the Bokkeveld beds may be placed at the base of the Middle Devonian or high in the Lower. Its special characters, the scarcity of corals and bryozoa, the number of discinoid brachiopods, the absence of limestones and the dark grey, blue and green colouring have been attributed to polar conditions, a view supported by the occurrence of glaciation in the Table Mountain sandstone. Some indeterminate lamellibranchs at the base of the latter may be Silurian like the Icla sandstone, and not Devonian. The Bokkeveld passes up into the Witteberg, a series of sands and quartzites containing indistinct plant remains, which are believed to represent a passage into the Carboniferous.

Except for the Caledonian movement at its commencement the Devonian was a time of comparative quiet, but of slow movements, affecting the distribution of land and water and causing unconformities and overlaps.

The granite or granodiorite intrusions of the late Silurian in the north of Great Britain continued into the early Devonian. They were associated with volcanic activity, mainly of an andesitic or basaltic character, and minor intrusions of similar composition. In Devon and Cornwall there were, in later Devonian times, submarine outpourings of spilitic pillow lavas accompanied by tuffs.

They resemble the contemporaneous schalsteins of Germany.

ECONOMIC PRODUCTS

There are iron ores of some importance mostly occurring as replacements of limestone. The metalliferous lodes of Cornwall and Devon are largely in rocks of Devonian age, but are the result of Armorican igneous activity. The oil of Ontario has its source in Middle Devonian shales, while that of New York and Pennsylvania may be derived from the black shales of the Upper Devonian.

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DEVONPORT, a seaport, garrison and market town of Devonshire, England, served by the S.R. and G.W.R. Devonport is the seat of one of the royal dockyards, and an important naval and military station. It is situated on the west of Plymouth and the east shore of the Hamoaze (or estuary of the Tamar and the Lynher) at its entrance into Plymouth sound. The "three towns" of Devonport, East Stonehouse (in the middle) and Plymouth now form one unit. Devonport is connected with East Stonehouse by a bridge over Stonehouse pool, an inlet of Plymouth harbour. A ferry across the Hamoaze connects it with the wooded peninsula of Mount Edgcumbe on the Cornish shore, and river steamers ply to Saltash and St. Germans higher up the river; at Morice Town a floating bridge connects with Tor point in Cornwall. Devonport, which owes its origin to the royal dockyard on the Hamoaze, begun in 1689 and now known as the "South Yard," was called Plymouth Dock until 1820, when it changed its name to Devonport. The "old town" which grew up around the dockyard is marked by the fortified "lines," known as the Brickfields, now mostly demolished and providing an open space and parade grounds, with Devonport park (37 ac.) at the northern end. Beyond lie the districts of Stoke or Stoke Damerel, Ford and Morice Town on the Hamoaze to the north. Stoke Damerel, a residential suburb, is the mother parish of Devonport and contains the old parish church of St. Andrew, originally Perpendicular with a 15th century tower. Morice Town is a rapidly growing district which has arisen round Keyham Steam yard, now the "North Yard," the second of the government dockyards, established in 1846, with its own iron and brass foundries, machinery shops, engineer students' shops, and docks and basins along the Hamoaze. St. Budeaux to the north was joined to Devonport in 1914.

There are several points of elevation in Devonport, and the prospect from Mount Wise at the southern extremity of the old town overlooking the harbour and its shores is one of the finest on the south coast. Here, together with a naval signalling station, is the residence of the commander-in-chief, or port admiral, of the Plymouth Naval Command, as well as the headquarters and residence of the general officer commanding the southwestern military area. A national memorial to Capt. R. F. Scott and his four companions of the South Polar expedition was erected here in 1925. From here the Raglan, George Square and other naval and military barracks and quarters extend northwards to the St. Budeaux barracks and naval armament depot at Bull point. Stonehouse pool is lined with the new quays, wharves and boat-building yards; at the northern end is the military hospital (1797) facing the naval hospital in Stonehouse. Among the public buildings and institutions of Devonport are the town hall (1822), market house (1852) and public library, close to which is a granite column, built in 1824, commemorating the renaming of the town, the Royal United Services' and the Royal Dockyard orphanages, as well as the Printe of Wales's hospital buildings and a Sailors' Rest.

Devonport is a station of the Western division of the Home fleet. The admiralty moorings in the Hamoaze extend for 3 miles. Between the South and the North yards is the Gun Wharf (*c.* 21 ac.) on the Hamoaze, first laid out in 1718, with armoury, storehouses, etc., the three establishments, with the naval barracks, known as H.M.S. Drake, being connected by a tunnel In 1907 an extension of 118 ac. was made to the North yard, including a tidal basin of 10 ac. and closed basin of 35½ ac. (with coaling depot and direct access to the Hamoaze), each with a depth of 32 ft. at low-water springs, and affording access to large new graving docks of 700–800 ft. length. The South yard also contains a sail factory and a ropery where a large part of the hempen ropes used in the navy are produced.

By the Reform act of 1832 Devonport became a parliamentary borough including East Stonehouse and returning two members. It was incorporated in 1837. In 1914 it amalgamated with Plymouth. The ground on which it stands is largely the property of the St. Aubyn family (Baron St. Levan), as lords of the manor.

DEVONPORT, EAST and **WEST,** a town of Devon county, Tasmania, Australia, situated on both sides of the mouth of the river Mersey, 193 mi. by rail N.W. of Hobart. Population. 5,153. Devonport ranks as the third port in Tasmania.

DEVONSHIRE, EARLS AND DUKES OF. The Devonshire title, now in the Cavendish family, had previously been held by Charles Blount (1563–1606), 8th Lord Mountjoy, great-grandson of the 4th Lord Mountjoy (d. 1534), the pupil of Erasmus; he was created earl of Devonshire in 1603 for his services in Ireland (1600–03); but the title became extinct at his death. In the Cavendish line the 1st earl of Devonshire was William (d. 1626), second son of Sir William Cavendish (*q.v.*), and of Elizabeth Hardwick, who afterwards married the 6th earl of Shrewsbury. He was created earl of Devonshire in 1618 by James I., and was succeeded by William, 2nd earl (1591–1628), and the latter by his son William (1617–1684).

WILLIAM CAVENDISH, 1st duke of Devonshire (1640–1707), English statesman, eldest son of the earl of Devonshire last mentioned, was born on Jan. 2, 1640. In 1661 he entered parliament, and soon showed himself a determined and daring opponent of the general policy of the court. In 1678 he was one of the committee appointed to draw up articles of impeachment against the lord treasurer Danby. In 1679 he was re-elected for Derby, and made a privy councillor by Charles II.; but he withdrew from the board with his friend Lord Russell, when he found that the Roman Catholic interest uniformly prevailed. He carried up to the House of Lords the articles of impeachment against Lord Chief-Justice Scroggs, and when the king declared his resolution not to sign the bill for excluding the duke of York, afterwards James II., he moved in the House of Commons that a bill might be brought in for the association of all his majesty's Protestant subjects. He appeared in defense of Lord Russell at his trial, and after his condemnation he offered to exchange clothes with him in the prison, remain in his place, and so allow him to effect his escape. In Nov. 1684 he succeeded to the earldom. He opposed arbitrary government under James II. with the same consistency and high spirit as during the previous reign. An imprudent quarrel at court was punished by a fine of £30,000 which he could not pay, and he was in prison for some time. After his discharge the earl occupied himself with the erection of a new mansion at Chatsworth designed by William Talman, with decorations by Verrio, Thornhill and Grinling Gibbons. The revolution again brought him into prominence. He was one of the seven who signed the original paper inviting the prince of Orange from Holland, and was the first nobleman who appeared in arms to receive him at his landing. He received the order of the Garter, and was made lord high steward of the new court. In 1690 he accompanied King William on his visit to Holland.

He was created marquis of Hartington and duke of Devonshire in 1694.

He had married in 1661 the daughter of James, duke of Ormonde, and was succeeded by his eldest son William as 2nd duke, and by the latter's son William as 3rd duke (viceroy of Ireland, 1737–44). The latter's son William (1720–64) succeeded in 1755 as 4th duke; he married the daughter and heiress of Richard Boyle, earl of Burlington and Cork, who brought Lismore castle and the Irish estates into the family; from Nov. 1756 to May 1757 he

was prime minister, mainly in order that Pitt, who would not then serve under the duke of Newcastle, should be in power. His son William (1748–1811), 5th duke, was the husband of the beautiful Georgiana Spencer, duchess of Devonshire (1757–1806), and of the intellectual Elizabeth Foster, duchess of Devonshire (1757–1824), both of whom Gainsborough painted. His son William, 6th duke (1790–1858), died unmarried. The title passed in 1858 to his cousin William (1808–91), 2nd earl of Burlington, as 7th duke, who, in 1829 was second wrangler at Cambridge, first Smith's prizeman and eighth classic, and subsequently became chancellor of the university.

DEVONSHIRE, SPENCER COMPTON CAVENDISH, 8TH DUKE OF (1833–1908), born at Holker Hall on July 23, 1833, was the son of the 7th duke (then earl of Burlington) and his wife, Lady Blanche Howard (sister of the earl of Carlisle). In 1854 Lord Cavendish, as he then was, took a second class in the mathematical tripos at Trinity college, Cambridge; in 1856 he was attached to the special mission to Russia for the new tsar's accession; and in 1857 he was returned to parliament as Liberal member for North Lancashire. At the opening of the new parliament of 1859 the marquis of Hartington (as he had then become) moved the amendment to the address which overthrew the government of Lord Derby. In 1862 he visited the United States, and in 1863 he became first a lord of the Admiralty, and then under-secretary for war in Lord Palmerston's government. and on the formation of the Russell-Gladstone administration at the death of Lord Palmerston he entered it as war secretary. He retired with his colleagues in July 1866 and used his comparative leisure to visit Germany and to meet Bismarck. On Gladstone's return to power in 1868 he became postmaster-general, an office which he exchanged against his own inclination, in 1871, for that of secretary for Ireland. When Gladstone, after his defeat and resignation in 1874, temporarily withdrew from the leadership of the Liberal Party in Jan. 1875, Lord Hartington reluctantly accepted the position of Liberal leader in the House of Commons, Lord Granville being leader in the Lords. W. E. Forster, who had taken a much more prominent part in public life, was the only other possible nominee, but he declined to stand The new leader of the House was a moderate critic of Disraeli's foreign policy in the near East, but emphatically condemned the conduct of Indian affairs which led up to the first Afghan War of 1878. After the Conservative defeat in the general election of 1880, the queen, in strict conformity with constitutional usage (though Gladstone himself thought Granville should have had the preference), sent for him as leader of the opposition, but Hartington declined the request to form a government, in view of Gladstone's position in the party. Hartington joined the new Gladstone government as secretary of State for India, from which office, in Dec. 1882, he passed to the War Office. His administration was responsible for the expeditions of Gen. Gordon and Lord Wolseley to Khartoum.

He shared the responsibility for sending Gordon to evacuate the Sudan, but it must be said that he repeatedly warned the cabinet of the urgency of the Wolseley relief expedition, and threatened resignation when a decision was delayed. In June 1885 he resigned along with his colleagues, and in December was elected for the Rossendale division of Lancashire, created by the new Reform Bill. Immediately afterwards Gladstone's conversion to home rule for Ireland forced on Lord Hartington the great political decision of his life. His refusal to follow his leader in this course inevitably made him the chief of the new Liberal Unionist Party. He moved the first resolution at the famous public meeting at the opera house in the Haymarket (April 14, 1886), when Lord Salisbury also was on the platform. In the House of Commons Hartington moved the rejection of Gladstone's bill on the second reading During the electoral contest which followed, no election excited more interest than Lord Hartington's for the Rossendale division, where he was returned by a majority of nearly 1,500 votes.

In the new parliament he held a position much resembling that which Sir Robert Peel had occupied after his fall from power, the leader of a small, compact party, the standing and ability of whose members were out of all proportion to their numbers, generally esteemed and trusted beyond any other man in the country. yet in his own opinion forbidden to think of office. Lord Salisbury's offers to serve under him as prime minister (both after the general election and again in Jan. 1887, when Lord Randolph Churchill resigned) were declined, and Lord Hartington continued to discharge the delicate duties of the leader of a middle party. It was not until 1895, when the differences between Conservatives and Liberal Unionists had become attenuated by changed circumstances, and the habit of acting together, that the duke of Devonshire, as he had become by the death of his father in 1891, entered Lord Salisbury's third ministry as president of the council, an office which carried at that time the responsibility for education. He also presided over the cabinet committee of defence. In 1892 he succeeded his father as chancellor of the University of Cambridge. In that year too he married the widow of the 7th duke of Manchester.

He continued to hold the office of lord president of the council till Oct. 3, 1903, when he resigned on account of differences with Balfour over the latter's attitude towards free trade. As Chamberlain had retired from the cabinet, and the duke had not thought it necessary to join Lord George Hamilton and Ritchie in resigning a fortnight earlier, the defection was unanticipated, and was sharply criticized by Balfour. But the duke had come to the conclusion that while he himself was substantially a free-trader, Balfour did not mean the same thing by the term. He necessarily became the leader of the Free Trade Unionists who were neither Balfourites nor Chamberlainites, and his weight was thrown into the scale against any association of Unionism with the constructive policy of tariff reform, which he identified with sheer protection. A struggle at once began within the Liberal Unionist organization between those who followed the duke and those who followed Chamberlain; but the latter were in the majority, and the duke resigned his chairmanship of the Liberal Unionist Association (May 1904), and became president of the new organizations, the Unionist Free Food league and the Unionist Free Trade club. In the autumn of 1907 his health gave way, and he wintered in Egypt. He died on his way home at Cannes on March 24, 1908. He had a firm friendship with the prince of Wales, afterwards Edward VII.

There was no issue of his marriage, and his successor as 9th duke was his nephew VICTOR CHRISTIAN CAVENDISH (1868–1938), who had been Liberal Unionist member for West Derbyshire since 1891, and was treasurer of the household (1900–03), financial secretary to the Treasury (1903–05), civil lord of the Admiralty (1915–16) and governor-general of Canada (1916–21); in 1892 he married a daughter of the marquess of Lansdowne. He was succeeded as 10th duke by his son, EDWARD WILLIAM SPENCER CAVENDISH.

See Bernard Holland, *Life of the 8th Duke of Devonshire* (1911).

DEVRIENT, the name of a family of German actors.

LUDWIG DEVRIENT (1784–1832), born in Berlin on Dec. 15, 1784, was the son of a silk merchant. He was apprenticed to an upholsterer, but joined a travelling theatrical company, and first appeared on the stage at Gera in 1804 as the messenger in Schiller's *Braut* von *Messina.* Eventually he obtained a permanent engagement at the ducal theatre in Dessau, where he played till 1809. He then went to Breslau for six years. His success in Shakespeare was such that Iffland feared for his own reputation, but generously recommended Devrient as his successor. On Iffland's death Devrient was summoned to Berlin, where for 15 years he was the popular idol. He died there on Dec. 30, 1832. He was equally good in comedy and tragedy. Falstaff, King Lear, Franz Moor, Shylock and Richard II. were among his best parts. Karl von Holtei in his *Reminiscences* has given a graphic picture of his acting.

See Z. Funck, *Aus dem Leben Zweier Schauspieler, Ifflands und Devrients* (Leipzig, 1838); H. Smidt in *Devrient-Novellen* (3rd ed. 1882); R. Springer, *Devrient und Hoffmann* (1873); Eduard Devrient, *Geschickte der deutschen Schauspielkunst* (Leipzig, 1861); G. Altmann, *Ludwig Devrient* (1926).

Three of the nephews of L. Devrient played an important part in the history of the German stage:—KARL AUGUST DEVRIENT

(1797–1872), whose most famous parts were Wallenstein and King Lear; PHILIPP EDUARD DEVRIENT (1801–1877), director of the court theatre at Dresden (1844–46) and of the Karlsruhe theatre (1852–69) and author of *Geschichte der deutschen Schauspielkunst* (Leipzig, 1848–74); GUSTAV EMIL DEVRIENT (1803–1872), tragedian at the Dresden court theatre (1831–68), whose Hamlet was considered finer than Kemble's or Edmund Kean's. OTTO DEVRIENT (1838–1894), son of P. E. Devrient, translated some plays of Shakespeare into German.

See Eduard Devrient, *Dramatische und dramaturgische Schriften* (10 vols., Leipzig, 1848–73); H. H. Houben, *Emil Devrient* (Frankfurt, 1903); *Brzefwechsel zwischen Eduard und Therese Devrient*, herausg. v. Hans Devrient, (Stuttgart 1903). R. K. Goldschmidt, *Eduard Devrients Buhnenreform am Karlsruher Theater* (Theatergesch. Forschungen No. 32, 1921).

DE **VRIES, HUGO** (1848–1935), Dutch botanist, was born at Haarlem, on Feb. 16, 1848, and educated at Leyden, Heidelberg and Würzburg. In 1871 he became a lecturer at the University of Amsterdam and in 1881 a professor. His attention was drawn to botany and to evolution by discovering on a field trip some new forms growing among a display of Oenothera, a plant that had been introduced from America. This suggested to him a new method of studying evolution, namely the experimental method rather than the old method of observation and inference. This method of investigating evolution may be regarded as his greatest contribution to science. It resulted in a new epoch in the history of evolution. He discovered in his cultures of Oenothera new forms appearing among the hosts of ordinary forms, and this method of producing new forms was named mutation (*q.v.*), as distinct from Darwin's natural selection. He showed that while species vary through natural selection, new species and varieties arise suddenly through mutation. In connection with his experimental work on the mutations of Oenothera, he visited the United States, to investigate the behaviour of this plant in its natural environment. After his retirement from the university of Amsterdam he made his residence in Lunteren, where he continued his experimental work in producing new forms through many generations of culture. His best known works are *Intracellular Pangensis* (1889); *The Mutation, Theory* (1901); and *Plant Breeding* (Chicago, 1907).

DEW. The word "dew" (O.E. *déaw;* cf. Ger. *Tau),* is a very ancient one. The *New English Dictionary* gives "the moisture deposited in minute drops upon any cool surface by condensation of the vapour of the atmosphere; formed after a hot day, during or towards night and plentiful in the early morning." If the deposit is in the form of ice it is called hoarfrost. Aitken's researches (Trans. Roy. Soc. of Edinburgh, xxiii., and "Nature" vol. xxxiii.) suggest that the words "by condensation of the vapour in the atmosphere" might be omitted because the large dewdrops on the leaves of plants, the most characteristic of all dew phenomena, are largely an exudation of water from the plant itself through the leaf-pores and are merely the continuation of the plant's irrigation process for supplying the leaves with water from the soil. The action, set up in full vigour in the daytime, is intended to maintain tolerable thermal conditions of the leaf surface in the hot sun, and continues after sunset.

Nevertheless, the typical experiment to illustrate dew formation is the production of a deposit of minute drops of moisture upon the exterior surface of a glass or polished metal vessel by the cooling of a liquid which it contains. The usual liquids are water, cooled by pieces of ice; or ether, volatilised by bubbling air through it. No deposit is formed by this process until the temperature is reduced to a certain critical level which depends upon the state of the surrounding air. The physical analogy between the natural formation of dew and this artificial production is considered so complete that the critical level below which the temperature of a surface must be reduced in order to obtain the deposit is known as the "dew-point."

Physicists consider the dew-point to be the temperature at which, *by being cooled without change of pressure,* air becomes saturated with water vapour, on account of a reduced capacity of the air at the lower temperature for holding water. It is a well-established proposition that the pressure of the existing water vapour remains constant if the air is cooled without change of its total external pressure, hence the saturation pressure at initial dew-point gives the pressure of the water vapour. Tables of pressures of saturated water vapour for various temperatures have been compiled, thus this mode of determining the dew-point is a recognized method of measuring the pressure, and amount of water vapour in the atmosphere; it is of fundamental importance in hygrometry.

The dew-point is of vital consequence in the matter of the oppressiveness of the atmosphere. High temperature with a low dew-point does not matter, but conditions become unpleasant when the dew-point begins to approach the normal temperature of the human body.

The physical explanation of dew formation is arrived at by determining the manner in which dew-laden objects in the open air have become cooled "below the dew-point."

Formerly, from the time of Aristotle at least, dew was supposed to "fall" ("Meteorologica," Bk. I., ch. 10), and that view of the process was not extinct at the time of Wordsworth. To Charles Wells, Physician to St. Thomas's Hospital, London, belongs the credit of introducing the study of radiation as a meteorological agency. By numerous and careful experiments described in his "Essay on Dew," London, 1814, he made it clear that the deposition of dew could be satisfactorily explained by the cooling of exposed objects on clear nights and his theory of automatic cooling by radiation has found a place in all text-books of physics. The process as represented by Wells is a simple one. All bodies which are at a higher temperature than their surroundings are constantly radiating heat, and cool unless they receive a corresponding amount of heat from other bodies. Good radiators, which are at the same time bad conductors of heat, such as blades of grass, on a clear night, become cooled below the dew-point of the atmosphere by radiation of heat to the surroundings.

The whole question of radiation was very fully studied by Melloni (1798–1854) and by other physicists, but little was added to the explanation given by Wells until in 1880, when John Aitken showed that condensation did not take place even when the air was cooled *below* dew-point if all nuclei for condensation had been removed, but his most important contribution on this matter was in 1885 when he called attention to the question whether the water of dewdrops on plants or stones came from the air or the earth, either by plants exuding dewdrops, or by evaporation and subsequent condensation in the lowest layer of the atmosphere. Aitken's views at least showed that the physical processes operative in the evolution of meteorological phenomena are generally complex. The conditions favourable for the formation of dew are (1) a good radiating surface, (2) a still atmosphere, (3) a clear sky, (4) thermal insulation of the radiating surface, (j) warm moist ground or some other supply of moisture in the surface layers of air, Aitken's main contribution showed that moisture of the ground as well as that of the air was important and that the temperature of both had to be considered. Of the five conditions, the first four are essential, but the fifth is very important for securing a copious deposit. It can hardly be maintained that no dew could form unless there were a supply of water by evaporation from warm ground, but the limited process of condensation which deprives the air of its moisture is soon terminable, while the process of distillation goes on as long as conditions are maintained. This indicates that wet soil can partly protect young plants against night frost. If distillation between the ground and the leaves is set up, the temperature of the leaves cannot fall much below the original dew-point because the requisite supply of water for condensation is kept up, otherwise the dew-point will get progressively lower as the mois-

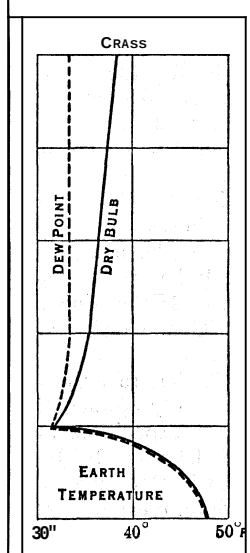

FIG. 1

ture is deposited and the cooling of the plant will continue.

In dew formation comparatively large changes take place within a layer a few inches thick, and for an adequate comprehension of the conditions close consideration is required. Figs. 1 and 2 show the condition of affairs, according to one of Aitken's observations. The vertical scale gives heights in feet, while the horizontal scale shows air temperatures, and the dew-points measured by an ordinary dry-bulb thermometer; their variations with height are represented by the curved lines. The line marked 0 is an arbitrary ground level, a rather indefinite quantity when the surface is grass. The special phenomena which are being considered take place in the layer which represents the rapid transition between the temperature of the ground 3 in. below the surface and that of the air a few inches higher.

If the dew-point curve and the "dry-bulb" curve cut above the surface, mist will result; if they cut at the surface, dew will be formed. Below the surface, it may be assumed that the air is saturated with moisture and any difference in temperature of the dew-point is accompanied by distillation. Incidentally, such distillation between soil layers of different temperatures must transfer considerable quantities of water either upward or downward, the direction varying according to the time of year.

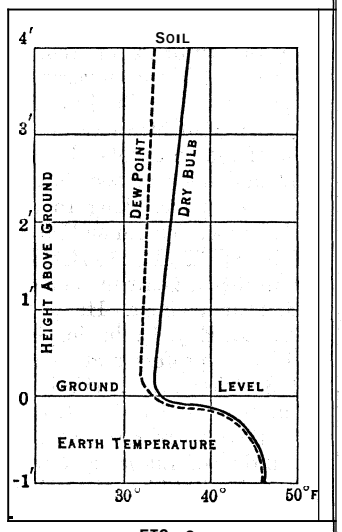

FIG. 2

The diagrams illustrate the importance of the warmth and moisture of the ground. At the surface there is a continual loss of radiated heat and a continual supply of warmth and moisture from below; but while the heat can escape, the moisture cannot. The dry-bulb line is thus deflected to the left as it approaches the surface from above and the dew-point is deflected to the right, consequently the effect of the moisture of the ground is to cause the lines to converge. Fig. 1 shows this and indicates that dew will be deposited. In the case of grass, fig. 2, the deviation of the dry-bulb line shows a sharp minimum of temperature at the surface. The dew-point line is also shown diverted to the left; but that could happen only in the unusual circumstance of so copious a condensation from the atmosphere as to make the air drier at the surface than up above. Along the underground line there must be a gradual creeping of heat and moisture towards the surface by distillation, becoming more rapid for a greater temperature gradient.

The amount of dew deposited may be considerable, and, in tropical countries, is sometimes sufficient to be collected by gutters, but it is not generally regarded as a large percentage of the total rainfall. Loesche probably overestimates a single night's dew deposition on the Loango coast at 3 mm., but measurements show that the aggregate annual deposit of dew corresponds to a depth of 1 to 1·5 in, of water near London (G. Dines), 1·2 in. at Munich (Wollnyj, 0·3 in. at Montpellier (Crova) and 1.6 in. at Tenbury, Worcestershire (Badgley).

The maintenance of "dew ponds" is intimately associated with this matter of total amount. "Dew-ponds" are certain isolated ponds on the upper levels of the chalk downs of the south of England and elsewhere used as a water-supply for cattle. Some of them are very ancient, as the title of a book on *Neolithic Dew-ponds,* London, 1904, 1907, by A. J. and G. Hubbard indicates. Their name implies that they depend upon dew and not entirely upon rain for their maintenance. Though the question has not been settled, the balance of evidence suggests that dew deposits do not make any important contribution to the water supply. The construction of dew ponds is, however, still practised on traditional lines. Although there is some difference of opinion on the matter, it seems necessary for a new dew pond to be filled artificially first as it will not function by a natural accumulation of water in the impervious basin.

DEWAN or **DIWAN,** an Oriental term for finance minister. The word is derived from the Arabian *diwan,* and is commonly used in India to denote a minister of the Mogul Government, or in modern days the prime minister of a native State. It was in the former sense that the grant to the East India Company of the *dewanny* of Bengal, Behar, and Orissa in 1765 first laid the legal foundation of the British Empire in India.

DEWAR, SIR JAMES (1842–1923), British chemist and physicist, was born at Kincardine-on-Forth, Scotland, on Sept. 20, 1842. He was very fond of music as a child, and when he met with an accident which prevented him from playing the flute he practised making fiddles, and so acquired a manual dexterity which served him in good stead in later years. He was educated at Dollar academy and Edinburgh university, being first a pupil, and afterwards the assistant, of Lyon Playfair, then professor of chemistry; he also studied under Kekulé at Ghent. In 1875 he was elected Jacksonian professor of natural experimental philosophy at Cambridge, and in 1877 he succeeded J. H. Gladstone as Fullerian professor of chemistry in the Royal Institution, London. He was president of the Chemical Society in 1897, and of the British Association in 1902, served on the Balfour commission on London water supply (1893–94), and as a member of the committee on explosives (1888–91) invented cordite jointly with Sir Frederick Abel. He was awarded the Rumford medal of the Royal Society in 1894; and the Smithsonian institution, the French Academy of Sciences, the Italian Society of Sciences and the Royal Society of Arts honoured his work. He was knighted in 1904, and died on March 27, 1923.

Dewar's scientific work covers a wide field. His earlier papers deal with organic chemistry, with measurement of high temperatures, with electro-photometry and the chemistry of the electric arc. With J. G. M'Kendrick, of Glasgow, he investigated the physiological action of light, and examined the changes which take place in the electrical condition of the retina under its influence. With G. D. Liveing, of Cambridge, he began in 1878 a long series of spectroscopic observations, the results of which were published in 1915 as *Collected Papers in Spectroscopy.* With *J. A.* Fleming, of University college, London, he investigated the specific inductive capacity of substances at very low temperatures. Dewar is best known for his work on the liquefaction of the so-called permanent gases *(see* LIQUEFACTION OF GASES), and his researches at temperatures approaching the absolute zero. His interest in this branch of inquiry dates back at least as far as 1874, when he discussed the "Latent Heat of Liquid Gases" before the British Association. Subsequently he was stimulated by the work of L. P. Cailletet and R. P. Pictet in 1877, and of Z. F. Wroblewski and K. S. Olszewski a few years later; and by 1891 Dewar had constructed a machine for producing liquid oxygen in quantity. He made use of this liquid for some low temperature experiments on meteorites, and in 1891 showed that both liquid oxygen and ozone are magnetic. About 1892 the idea occurred to him of using vacuum-jacketed vessels for the storage of liquid gases, and so efficient did this device prove in preventing the influx of external heat that it was found possible to preserve the liquids for comparatively long periods; this apparatus which he designed is known as the "Dewar flask," and is invaluable for low temperature work. The principle has been used extensively in the common "thermos" or vacuum flask. He next experimented with a high-pressure hydrogen jet by which low temperatures were realized through the Joule-Thomson effect *(see* THERNODYNAMICS), and the successful results thus obtained led him to build at the Royal Institution the large refrigerating machine by which hydrogen was first liquefied in 1898 and solidified in 1899. He investigated the gas-absorbing powers of charcoal cooled to low temperatures, and applied them to the production of high vacua and to gas analysis.

With collaborators he also studied the physical and chemical properties of iron and nickel carbonyls, the properties of thin films, and atomic heats at low temperatures. Dewar had a fine directing power and was able to do excellent work with competent assistants. His greatest strength was probably in his manipulative skill, and his lectures at the Royal Institution were always remarkable

for the experimental demonstrations which accompanied them. *See* Royal Institution Lecture H. E. Armstrong, Jan. 1924.

DEWAR VESSEL or **THERMOS FLASK,** a vacuum vessel invented by Sir J. Dewar during his research on the liquefaction of gases (*q.v.*).

DEWAS, two Indian states, in the Malwa Political Charge of Central India, founded in the first half of the 18th century by two brothers, Punwar Mahrattas, who came into Malwa with the peshwa, Baji Rao, in 1728. Their descendants are known as the senior and junior branches of the family, and since 1841 each has ruled his own portion as a separate state, though the lands belonging to them are so intimately entangled that even in Dewas, the capital town, the two sides of the main street are under different administrations and have different arrangements for water supply and lighting. The senior branch has an area of 449 sq.mi. (pop. 83,321) while the area of the junior branch is 419 sq.mi. (pop. 70,513). The two chiefs reside in different palaces in the town of Dewas, and each is entitled to a salute of 15 guns.

DEWBERRY or **TRAILING BLACKBERRY,** any blackberry lacking sufficiently woody fibre in the stems to stand more or less erect. In England and other countries of Europe, applied especially to *Rubus caesius,* a trailing plant, common in woods, hedges, and the borders of fields. The leaves have three leaflets, are hairy beneath, and of a dusky green; the flowers which appear in June and July are white, or pale rose-coloured. The fruit is closely embraced by the calyx, and consists of a few drupelets, black with a glaucous bloom; it has an agreeable acid taste. In the eastern, southern, and Pacific areas of the United States several trailing native species of *Rubus,* especially R. *flagellaris, R. baileyanus, R. hispidus, R. enslenii,* and *R. trivialis,* produce excellent fruits, some varieties of which, as the Lucretia (prob. R. *baileyanus* x *R. argutus),* Young (Youngberry), and Boysen (Boysenberry) are extensively cultivated. In the Pacific states various forms of the native trailing blackberry, R. *macropetalus,* are cultivated, as the Ideal Wild and Zielinski, while Cascade and Pacific are varieties derived from Zielinski x Logan (*see* LOGANBERRY). (G. *M.* D.)

DEW-CLAW, the name applied to the functionless toe or toes which do not reach the ground, found in many mammals. In deer there are two, forming the "false hoof." In the dog, the hallux (corresponding to the big toe in man) is the dew-claw.

D'EWES, SIR SIMONDS, BART. (1602–1650), English antiquarian, son of Paul D'Ewes of Milden, Suffolk, sat as member for Sudbury in the Long Parliament of 1640. D'Ewes appears to have projected a history of England based on original documents. But though excelling as a collector of materials, he died without publishing anything except an uninteresting tract, *The Primitive Practice for Preserving Truth* (1645), and some speeches. His *Journals of all the Parliaments during the Reign of Queen Elizabeth* was published in 1682. His large collections, including transcripts from ancient records, many of the originals of which are now dispersed or destroyed, are in the Harleian collection in the British Museum. His unprinted Diaries from 1621–24 and from 1643–47, the latter valuable for the notes of proceedings in parliament, are often the only authority for incidents and speeches during that period, and are amusing from the glimpses the diarist affords of his own character.

Extracts from his *Autobiography and Correspondence* from the mss. in the British Museum were published by J. O. Halliwell-Phillips in 1845, by Hearne in the appendix to his *Historia vitae et regni Ricardi II.* (1729), and in the *Bibliotheca topographica Britannica,* no. 15, vol. vi. (1783); and from a Diary of later date, *College Life in the Time of James I.* (1851). His Diaries have been extensively drawn upon by Forster, Gardiner, and by Sanford in his *Studies of the Great Rebellion.* Some of his speeches have been reprinted in the *Harleian Miscellany* and *Somers Tracts. The Journal of Sir Simonds D'Ewes,* ed. *W.* Notestein (New Haven, 1923).

DE WET, CHRISTIAN (1854–1922), Boer general and politician, was born on Oct. 7, 1854, at Leeuwkop, Smithfield district (Orange Free State) and later resided at Dewetsdorp. He served in the first Anglo-Boer War of 1880–81 as a field cornet, and from 1881 to 1896 he lived on his farm, becoming in 1897 member of the Volksraad. He took part in the earlier battles of the Boer War of 1899 in Natal as a commandant and later, as a general, he went to serve under Cronje in the west. His first successful action was the surprise of Sanna's Post near Bloemfontein, which was followed by the victory of Reddersburg a little later. He became the most formidable leader of the Boers in their guerrilla warfare. Sometimes severely handled by the British, sometimes escaping only by the narrowest margin of safety from the columns which attempted to surround him, and falling upon and annihilating isolated British posts, De Wet struck heavily where he could and evaded every attempt to bring him to bay. He shared in the peace negotiations of 1902, and visited Europe with the other generals. He wrote an account of his campaigns, an English version of which appeared in Nov. 1902 under the title *Three Years' War.* In Nov. 1907 he was elected a member of the first Legislative assembly of the Orange River colony and was appointed minister of agriculture. In 1908–9 he was a delegate to the Closer Union convention. In 1912–13 he supported Gen. Hertzog in his separatist policy, seceded from the South African party and helped to form the Nationalist party. Soon after the outbreak of World War I, De Wet rebelled against the South African Government and was captured at Waterberg on Dec. 1, 1914. On June 10, 1915, he was committed for trial on a charge of high treason, and on June 21 was found guilty on eight of the 10 counts. He was sentenced to six years' imprisonment and fined £2,000, but in the following December was released, on undertaking to abstain from political agitation. He died at Bloemfontein on Feb. 3, 1922.

DE WETTE, WILHELM MARTIN LEBERECHT (1780–1849), German theologian, was born on Jan. 12, 1780, at Ulla, near Weimar. He was educated at Weimar and at Jena, where H. E. J. Paulus inspired his free critical enquiry. In 1807 he became professor at Heidelberg in 1810 at Berlin, where he met Schleiermacher. His letter of consolation to the mother of Sand, the murderer of Kotzebue, led to his dismissal in 1819. After three years' retirement at Weimar, during which he prepared his edition of Luther and wrote the romance, *Theodor oder die Weihe des Zweiflers,* De Wette became professor of theology at Basle university. He died on June 16, 1849.

Wellhausen describes De Wette as "the epoch-making opener of the historical criticism of the Pentateuch." He prepared the way for the Supplement-theory.

BIBLIOGRAPHY.—His most important works *are:—Beitrage zur Einleitung in das Alte Testament* (2 vols., 1806); *Kommentar über die Psalmen* (1811); *Lehrbuch der hebraisch-judischen Archaologie* (1814); *Über Religion und Theologie* (1815); *Lehrbuch der christlichen Dogmatik* (1813–16); *Lehrbuch der historisch-kritischen Einleitung in die Bibel* (1817); *Christliche Sittenlehre* (1819–21); *Einleitung in das Neue Testament* (1826); *Religion, ihr Wesen, ihre Erscheinungsform, und ihr Einfluss auf das Leben* (1827); *Das Wesen des clzristlichen Glaubens* (1846); and *Kurzgefasstes exegetisches Handbuch zum Neuen Testament* (1836–48). De Wette also edited Luther's works (5 vols., 1825–28), and wrote a drama: *Die Entsagung* (1823).

DEWEY, DAVIS RICH (1858–1942), American economist and statistician, was born in Burlington, Vt., April 7, 1858. He was educated at the University of Vermont and at Johns Hopkins university, and afterwards became professor of economics and statistics at the Massachusetts Institute of Technology. He was chairman of the State board on the question of the unemployed (1893), member of the Massachusetts commission on public, charitable and reformatory interests (1897), special expert agent on wages for the 12th census, and member of a State commission (1904) on industrial relations. He wrote a *Syllabus on Political History since 1815* (1887), a *Financial History of the United States* (1902), *National Problems* (1907), and *Banking and Credit* (with M. J. Shugrue, 1922). From 1911 to 1940 he was managing editor of the *American Economic Review.* He died Dec. 13.

DEWEY, GEORGE (1837–1917), American naval officer, was born at Montpelier, Vt., on Dec. 26, 1837. He studied at Norwich university, then at Norwich, Vt., and graduated at the United States Naval Academy in 1858. He was commissioned lieutenant in April 1861, and in the Civil War served on the steamsloop "Mississippi" (1861–63) during Farragut's passage of the forts below New Orleans in April 1862 and at Port Hudson in March 1863; took part in the fighting below Donaldsonville,

La., in July 1863; and in 1864–65 served on the steam-gunboat "Agawam" with the North Atlantic blockading squadron and took part in the attacks on Fort Fisher in Dec. 1864, and Jan. 1865. He became a lieutenant-commander in 1865, commander in 1872, captain in 1884, and commodore in 1896.

In Nov. 1897 he was assigned, at his own request, to sea service, and sent to Asiatic waters. In April 1898, while with his fleet at Hong Kong, he was notified by cable that war had begun between the United States and Spain, and was ordered to "capture or destroy the Spanish fleet" then in Philippine waters. On May 1 he overwhelmingly defeated the Spanish fleet under Admiral Montojo in Manila bay, a victory won without the loss of a man of the American ships (see SPANISH-AMERICAN WAR). Congress, in a joint resolution, tendered its thanks to Commodore Dewey, and to the officers and men under his command, and authorized "the secretary of the navy to present a sword of honour to Commodore George Dewey, and cause to be struck bronze medals commemorating the battle of Manila bay, and to distribute such medals to the officers and men of the ships of the Asiatic squadron of the United States." He was promoted rear-admiral on May 10, 1898. On Aug. 18 his squadron assisted in the capture of the City of Manila. After remaining in the Philippines under orders from his government to maintain control, Dewey received the rank of admiral (March 3, 1899)—that title, formerly borne only by Farragut and Porter, having been revived by act of Congress (March 2, 1899)—and returned home, arriving in New York City, where, on Sept. 30, 1899, he received a great ovation. He was a member (1899) of the Schurman Philippine Commission, and in 1901 acted as president of the Schley court of inquiry.

By special provision Admiral Dewey was not retired, but continued in the service up to his death, being president of the General Board of the Navy for the last seven years of his life. To the end he continued to urge the building of large battleships, citing their superiority in the Battle of Jutland. In 1913 he published his *Autobiography*. He died in Washington, D.C., on Jan. 16, 1917, and was buried in the Arlington National cemetery. His body was transferred March 28, 1925, to the crypt of the Bethlehem chapel of the National Episcopal cathedral in Washington.

See John Barrett, *Admiral George Dewey* (1899); **C. M.** Dewey (ed.) *The Life and Letters of Admiral Dewey* (1899); *T.* **W.** Handford, *Admiral Dewey, the Hero of Manila* (1899); *J.* **L.** Stickney, *Admiral Dewey at Manila* (1899).

DEWEY, **JOHN** (1859–), American philosopher, psychologist and educator, was born in Burlington, Vt., on Oct. 20, 1859. He graduated at the University of Vermont in 1879 and at Johns Hopkins university in 1884. Then he went West, and taught philosophy at the universities of Minnesota (1888–89), Michigan (1889–94) and Chicago (1894–1904). It was as director of the School of Education at the last institution that he first won national fame; he established an experimental school and carried out the ideas of the "new pedagogy." It was in this experience that he came to formulate principles of democratic and occupational instruction which have revolutionized educational practice in America, and influenced many teachers in Europe and Asia. For two years he lectured on education and philosophy at the University of Peking; and the Turkish Government engaged him to draw up a report on the reorganization of its national schools.

Dewey's outlook on education reflects the industrial revolution and the development of democracy; it reacts strongly against the classical approach and authoritarian methods of aristocratic days when education consisted in learning how to talk about things rather than how to do them. The exodus from the field to the factory, the multiplication of machinery and the growing complexity of urban life, required a new curriculum, teaching through practice the arts and discipline of the industrial life. This plea for practicality formed a naturally systematic whole with Dewey's "instrumental" logic, and his lifelong effort to free American philosophy from its sterile preoccupation with German epistemology. In developing his thought out of the German idealism which marked the idealism of his early period—a change due largely to the influence of William James—he retained from it an enduring sense of the value of intelligence.

The starting-point of his system of thought is biological: he sees man as an organism in an environment, remaking as well as made. Things are to be understood through their origins and their functions, without the intrusion of supernatural considerations; even the Schopenhauerian *Wille* and the Bergsonian *Élan* vital are mystical phrases, which the philosopher will avoid. The only reality is experience; and all experience is of objects in relation. It is true that things are known only as known; but this knowledge, to be real, must be functional rather than conceptual; it must see not so much the abstract nature of the thing, as its actual operations and relations in the world of our living experience. Thought is an organ of response, it is an instrument of behaviour, rather than of knowledge in the older sense ("knowledge about"); every idea, to have meaning, must be a way of dealing specifically with actual stimuli and situations. (Here Dewey anticipated "Behaviourism," without falling into its exaggerations.) Thinking begins not with premises, but with difficulties; and it concludes not with a certainty but with an hypothesis that can be made "true" only by the pragmatic sanction of experiment. An idea, then, is true in proportion as it is an effective instrument in the illumination of experience and the realization of desire. Thought should aim not merely to "understand" the world, but to control and refashion it; the Spencerian definition of education as the adaptation of the individual to his environment must be replaced by the practice of education as the development of all those capacities in the individual which will enable him to control his environment and fulfil his possibilities.

Further, since the individual is to live in a society, he is to be studied as a citizen (actual or potential) growing and thinking in a vast complex of interactions and relationships, not as a solitary "self" or "soul." Through education, training, and suggestion of a thousand kinds, he is made in the image of his fellows; and his thinking is largely their thinking through him. If this reduces his uniqueness, it extends the limits of his possible development far beyond those within which it was confined by the old theory of unchangeable heredity. Faith in education as the soundest instrumentality of social, political and moral reconstruction is justified by this malleability of the instincts, and this illimitableness of human growth.

Our difficulties to-day, Dewey believes, are the difficulties of a chaotic adolescence, and the disproportion between our powers and our wisdom. "Physical science," he writes, in a passage that has influenced much later thinking, "has for the time being far outrun psychical. We have mastered the physical mechanism sufficiently to turn out possible goods; we have not gained a knowledge of the conditions through which possible values become actual in life, and so are still at the mercy of habit, of haphazard, and hence of force. . . . With tremendous increase in our control of nature, in our ability to utilize nature for human use and satisfaction, we find the actual realization of ends, the enjoyment of values, growing unassured and precarious. At times it seems as though we were caught in a contradiction; the more we multiply means the less certain and general is the use we are able to make of them." (*Influence of Darwin on Philosophy*, p. 71.)

The task of remaking man to a mental and moral level commensurate with the enlarged and intricate world in which his inventions have enveloped him lies upon democracy and education. Democracy not merely in voting but in opportunity equal to all, in education through comradely occupation, in industry through the replacement of autocracy with voluntary association. in foreign relations through the replacement of war with conference and law. And education not in theory but in specific and experimental thinking; our social ills are to be handled no longer with majestic abstractions like Individualism and Socialism, competition and cooperation, dictatorship and democracy, but with restricted enquiries, specific analysis, careful formulation, patient experimentation, and piecemeal renovation. We must attack the enemy as Napoleon did—in sections and detail.

The great need, then, is intelligence, and Socrates was not far wrong in counting this as the highest virtue. And again, not intellectuality, which is just the opposite of specific and realistic

thought; but that flexibility of mind which can readjust past experience to novel stimuli and purposes. There is no absolute good here, no *summum bonum;* the ethical aim must vary with time and person and place, and only intelligence can specifically and transiently determine it. One thing alone seems universally good, and that is growth. "Not perfection as a final goal, but the ever enduring process of perfecting, maturing, refining, is the aim in living. . . . The bad man is the man who, no matter how good he has been, is beginning to deteriorate, to grow less good. The good man is the man who, no matter how morally unworthy he *has* been, is moving to become better. Such a conception makes one severe in judging himself and humane in judging others." *(Reconstruction in Philosophy,* p. 177.)

It was not till Dewey came in 1904 to join the department of philosophy at Columbia university, that his influence began to reach out from pedagogy to the philosophical and social thought of his time. His classes became the meeting-place of alert students from every part of America; and though he had none of the arts of the popularizer, he left upon many of these students a profound and permanent influence. Through them, as well as through his own writing and speech, he has been one of the great sources of the realistic and experimental mood of the growing American mind.

Dewey's publications include *Leibnitz's Essays Concerning the Human Understanding* (Chicago, 1888); *Psychology* (New York, 1887); *Outlznes of a Critical Theory of Ethics* (Ann Arbor, 1891); *The Study of Ethics* (1894); *The Psychology of Number,* with Jas. A. McLellan (New York, 1895, 1896 and 1909); *Interest as Related to Will* (Bloomington, 1896); "Interpretation of the Culture-Epoch Theory," Natl. Herbart Soc. *Yearbook* (Bloomington, 1896); *My Pedagogic Creed* (New York, 1897); *The Significance of the Problem of Knowledge* (Chicago, 1897); *The Educational Situation* (Chicago, 1902); *Logical Conditions of a Scientific Treatment of Morality* (Chicago, 1903); *Studzes in Logical Theory* (Chicago, 1903–09); "The Philosophical Work of Herbert Spencer," *Phzladelphia Revzew,* vol xiii., No. 2, pp. 159–175 (1904); *The Relation of Theory to Practice in the Education of Teachers* (Chicago, 1904); *The Child and the Curriculum* (Chicago, 1906); *The School and the Child* (London, 1907); *Ethics,* with James *H.* Tufts (New York, 1908); *Ethics* (New York, 1908); "Does Reality Possess Practical Character?" in *Essays Philosophical and Psychological, in Honor of Wm. James* (1908); *Ethical Principles Underlying Education* (1909); *Moral Principles in Education* (Boston, 1909); *The Influence of Darwin on Philosophy* (New York, 1910); *How We Think* (Boston, 1910); *Educational Essays* (1910); *Interest and Effortin Education* (1917); *The School and Society* (Chicago, 1915); *German Philosophy and Politics* (1915); *Schools of Tomorrow,* with Evelyn R. Dewey (New York, 1915); *Democracy and Education* (1916); *Essays in Experimental Logic* (Chicago, 1916); *Creative Intelligence* (1917); *Enlistment for the Farm* (1917); *Reconstruction in Philosophy* (1920); *Letters from Japan,* with Alice Chipman Dewey, edit. by Evelyn Dewey (1920); *Human Nature and Conduct* (1922); supplementary essay by John Dewey in *Chance, Love and Logic,* by Chas. *S.* S. Peirce, edit. by Morris R. Cohen (1927); *Democracy and Education* (1927); *Experience and Nature* (Chicago, 1925); *The Public and Its Problems* (1927); *The Quest for Certainty* (1929).

See L. P. Boggs, *Ueber John Dewey's Theorie des Interesses und seine Anwendung in der Padagogik* (1901); D. Loring Geyer, *The Pragmatic Theory of Truth as Developed by Peiree, James and Dewey* (1916); Wm. James, *Pragmatism* (1907); A. Webster Moore, *Pragmatism and Its Critics* (1910); D. T. Howard, *John Dewey's Logical Theory* (New York, 1918); L. M. A. N. van Schalkwijk, *De Sociale paedagogiek van John Dewey* (1920); *The Philosophy of John Dewey,* selected and edited by Joseph Ratner (New York, 1928); E. E. Slosson, *Six Major Prophets* (Boston, 1917); W. David Frank, *Time Exposures* (New York, 1926); M. H. Thomas and H. W. Schneider, *Bibliography of John Dewey* (1929). (W. Du.)

DEWEY, MELVIL (1851–1931), American librarian, was born at Adams Center (N.Y.) on Dec. 10, 1851. He graduated in 1874 at Amherst college, where he became acting librarian. In 1877 he removed to Boston, there founding and editing *The Library Journal.* He was also one of the founders of the American Library Association. In 1883 he became librarian of Columbia college, and there founded the School of Library Economy, the first institution established for the instruction of librarians.

This school, which was very successful, was re-established in Albany as the State Library School under his direction; from 1889 to 1906 he was director of the New York State Library, from 1889 to 1900 was secretary of the University of the State of New York, and from 1904 to 1906 State director of libraries, completely reorganizing the State library, which he made one of the most efficient in America, and establishing the system of travelling libraries and picture collections. His "Decimal System of Classification" for library cataloguing, first proposed in 1876, is extensively used. Probably more than any other single individual he was responsible for the sound development of library science in America. He died Dec. 26, 1931.

DE WINT, PETER (1784–1849), English landscape painter, of Dutch extraction, son of an English physician, was born at Stone, Staffordshire, on Jan. 21, 1784, and died in London on Jan. 30, 1849. He studied under John Raphael Smith, the engraver, and in 1809 entered the Academy schools. In 1812 he became a member of the Society of Painters in Water-colours, where he exhibited for many years, as well as at the Academy. De Wint ranks as one of the chief English water-colourists. A number of his pictures are in the Tate Gallery and the Victoria and Albert Museum, London.

See William Bell Scott, *Our British Landscape Painters* (1876); W. Armstrong, *Memoir of Peter de Wint* (1888).

DE WINTER, JAN WILLEM (1750–1812), Dutch admiral, was born at Kampen, and in 1761 entered the naval service at the age of 12. He distinguished himself by his zeal and courage, and at the revolution of 1787 he had reached the rank of lieutenant. The overthrow of the "patriot" party forced him to fly to France. Here he threw himself into the cause of the Revolution, and took part under Dumouriez and Pichegru in the campaigns of 1792 and 1793, and was promoted to the rank of brigadier-general. When Pichegru in 1795 overran Holland, De Winter returned with the French army to his native country. The states general now utilized his experience as a naval officer by making him adjunct-general for the reorganization of the Dutch navy. In 1796 he was appointed vice-admiral and commander-in-chief of the fleet. He did his best to improve it and on Oct. 11, 1797, he encountered the British fleet under Admiral Duncan off Camperdown. After an obstinate struggle the Dutch were defeated, and De Winter was taken prisoner. He remained in England until December, when he was liberated by exchange. His conduct at Camperdown was declared by a court-martial to have nobly maintained the honour of the Dutch flag.

From 1798 to 1802 De Winter was ambassador to the French republic, and was then again appointed commander of the fleet. He was sent with a strong squadron to the Mediterranean to repress the Tripoli piracies, and negotiated a treaty of peace with the Tripolitan Government. He enjoyed the confidence of Louis Bonaparte, when king of Holland, and, after the incorporation of the Netherlands in the French empire, in an equal degree of the emperor Napoleon. By the former he was created marshal and count of Huessen, and given the command of the armed forces both by sea and land. Napoleon gave him the Grand Cross of the Legion of Honour and appointed him inspector-general of the northern coasts, and in 1811 he placed him at the head of the fleet he had collected at the Texel. Soon afterwards De Winter was seized with illness and compelled to betake himself to Paris, where he died on June 2, 1812. He had a splendid public funeral and was buried in the Pantheon. His heart was enclosed in an urn and placed in the Nicolaas Kerk at Kampen.

DE WITT, CORNELIUS (1623–1672), brother of John de Witt (*q.v.*), was born at Dort in 1623. In 1650 he became burgomaster of Dort and member of the states of Holland and West Friesland. He was afterwards appointed governor of the land of Putten and bailiff of Beierland. He associated himself closely with his brother, the grand pensionary, and supported him throughout his career with great ability and vigour. In 1667 as deputy chosen by the states of Holland to accompany Admiral de Ruyter in his famous expedition to Chatham, Cornelius de Witt distinguished himself by his coolness and intrepidity. He again accompanied De Ruyter in 1672 and took an honourable part in the great naval fight at Southwold Bay against the united English and French fleets. Compelled by illness to leave the fleet, he found the Orange party on his return to Dort in the ascendant, and himself and his brother the objects of popular suspicion. An account of his imprisonment, trial and death, is given below. (See DUTCH WARS.)

DE WITT, JOHN (1625–1672), Dutch statesman, was born at Dort, on Sept. 24, 1625, being a member of one of the old burgher-regent families of his native town. His father, Jacob, was six times burgomaster of Dort, and for many years sat for the town in the states of Holland. He was a strenuous adherent of the republican or oligarchical states-right party in opposition to the princes of the house of Orange, who represented the federal principle and had the support of the masses of the people. John was educated at Leyden and early displayed remarkable talents, especially in mathematics and jurisprudence. In 1645 he and his elder brother Cornelius visited France, Italy, Switzerland and England, and on his return he lived at The Hague as an advocate. In 16jo he was appointed pensionary of Dort, which made him the leader of the town's deputation in the states of Holland. In this year the states of Holland found themselves engaged in a struggle for provincial supremacy, on the question of the disbanding of troops, with the youthful prince of Orange, William II. William, with the support of the states general and the army, seized five of the leaders of the states-right party and imprisoned them in Loevestein castle; among these was Jacob de Witt. The sudden death of William, at the moment when he had crushed opposition, led to a reaction. He left only a posthumous child, afterwards William III. of Orange, and the principles advocated by Jacob de Witt triumphed, and the authority of the states became predominant in the republic.

It was his father's position which gave John his opportunity, but his own eloquence, wisdom and business ability which caused him to be appointed grand pensionary of Holland on July 23, 1653, at 28. He was re-elected in 1658, 1663 and 1668, and held office until just before his death in 1672. He found in 1653 his country brought to the brink of ruin through the war with England, which had been caused by the keen commercial rivalry of the two maritime states. The Dutch were unprepared and suffered severely through the loss of their carrying trade, and De Witt resolved to bring about peace. He rejected Cromwell's suggestion of the union of England and Holland, but in the autumn of 1654 peace was concluded by which the Dutch made large concessions and agreed to the striking of the flag to English ships in the narrow seas. The treaty included a secret article, which the states general refused to entertain, but which De Witt induced the states of Holland to accept, by which the provinces of Holland pledged themselves not to 'elect a stadtholder or a captain-general. This Act of Seclusion was aimed at the young prince of Orange, whose close relationship to the Stuarts made him an object of suspicion to the Protector. De Witt was favourable to this exclusion of William III. from his ancestral dignities, but he did not prompt Cromwell.

The policy of De Witt after the peace of 1654 was eminently successful. He restored the finances of the State and extended its commercial supremacy in the East Indies. In 1658–59 he sustained Denmark against Sweden, and in 1662 concluded an advantageous peace with Portugal. The accession of Charles II. to the English throne led to the rescinding of the Act of Seclusion; nevertheless De Witt steadily refused to allow the prince of Orange to be appointed stadtholder or captain-general. This led to ill-will between the English and Dutch governments, and to a renewal of the old grievances about maritime and commercial rights, and war broke out in 1665. The grand pensionary himself went to sea with the fleet and inspired all by the example he set of calmness in danger, energy in action, and inflexible strength of will. It was due to his exertions as an organizer and a diplomatist quite as much as to the brilliant seamanship of Admiral de Ruyter, that the treaty of Breda (July 31, 1667), maintaining the status quo was so honourable to the United Provinces. In 1667 he promulgated his eternal edict for the republican administration of Holland. A still greater triumph of diplomatic skill was the conclusion of the Triple Alliance (Jan. 17, 1668) between the Dutch Republic, England and Sweden, which checked the attempt of Louis XIV. to take possession of the Spanish Netherlands in the name of his wife, the infanta Maria Theresa.

In 1672 Louis XIV. suddenly declared war and invaded the United Provinces at the head of a splendid army. The voice of the people called William III. to the head of affairs, and there were violent demonstrations against John de Witt. His brother Cornelius was (July 24) arrested on a charge of conspiring against the prince. On Aug. 4 John de Witt resigned the post of grand pensionary. Cornelius was put to the torture, and on Aug. 19 sentenced to deprivation of his offices and banishment. His brother came to visit him in the Gevangenpoort at the Hague. A vast crowd, hearing this, collected outside and finally burst in, seized the two brothers and tore them to pieces. Their mangled remains were hung up by the feet to a lamp-post. Thus perished, by the savage act of an infuriated mob, one of the greatest statesmen of his age, and of Dutch history.

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DEWLAP, the loose fold of skin hanging from the neck of cattle, also applied to similar folds in the necks of other animals and fowls, as the dog, turkey, etc. The American practice of branding cattle by making a cut in the neck is known as a "dewlap brand." The skin of the neck in human beings often becomes pendulous with age, and is sometimes referred to humorously by the same name.

DEW-POINT: *see* DEW.

DEWSBURY, market town, county and parliamentary borough, West Riding of Yorkshire, England, on the river Calder, 8 mi. south-south-west of Leeds, on the L.N.E. and L.M.S. railways. Pop. (1938) 52,860. Area 9.8 sq.mi. The parish church of All Saints was for the most part rebuilt in the 18th century; the portions still preserved of the original structure are mainly Early English. The chief industries are the making of blankets, carpets, druggets and worsted yarn; and there are iron foundries and machinery works. Coal is worked in the neighbourhood. The parliamentary borough returns one member. Dewsbury was incorporated in 1862 and was created a county borough in 1913. Edwin, king of Northumbria, had a mansion here in the 7th century. At Kirklees may be seen the remains of a Cistercian convent (12th century), in an extensive park, where tradition relates that Robin Hood died and was buried.

DEXIPPUS, PUBLIUS HERENNIUS (*c.* A.D. 210–273), Greek historian, statesman and general, was an hereditary priest of the Eleusinian family of the Kerykes, and held the offices of archon basileus and eponymus in Athens. When the Heruli overran Greece (269), Dexippus was made general and defeated them heavily. A statue was set up in his honour, the base of which, with an inscription recording his services, has been preserved (*Corpus Inscrr. Atticarum,* iii. No. 716). It is remarkable that the inscription is silent as to his military achievements. Photius (*cod.* 82) mentions three historical works by Dexippus, of which considerable fragments remain: (1) Τὰ μετ' Αλέξανδρον, an epitome of a similarly named work by Arrian; (2) Σκυθεκά, a history of the wars of Rome with the Goths (or Scythians) in the 3rd century; (3) Χρονική ἱστορία, a chronological history from the earliest times to the emperor Claudius Gothicus (270), frequently referred to by the writers of the Augustan history. The work was continued by Eunapius of Sardis down to 404. Photius places Dexippus on a level with Thucydides, an opinion by no means confirmed by the fragments (C. W. Muller, F.H.G. iii. 666–687).

DEXTER, HENRY MARTYN (1821–1890), American clergyman and author, was born in Plympton (Mass.), on Aug. 13, 1821. A graduate of Yale and Andover theological seminary, he was pastor of Congregational Churches in Manchester (N.H.), and Boston, and edited various magazines, including the *Congregational Quarterly* and *Congregationalist.* He died in New Bedford (Mass.), on Nov. 13, 1890. He was an authority on the history of Congregationalism and was a lecturer on that subject

at the Andover theological seminary in 1877–79. Dexter left his fine library on the Puritans in America to Yale university. Among his works are: *As to Roger Williams and* ***His*** *"Banishment" from the Massachusetts Colony* (1876); *The Congregationalism of the Last Three Hundred Years, as Seen in Its Literature* (1880); his most important work, *Common Sense as to Woman Suffrage* (1885); and many reprints of colonial pamphlets. His *The England and Holland of the Pilgrims* (1905) was completed by his son, Morton Dexter.

See American Antiquarian Society, *Proc.* (April 1891).

DEXTRIN or **DEXTRINE** is a generic and rather indefinite term applied to certain starch derivatives, intermediate in complexity between starch and sugars. They are usually yellowish or brownish powders, but are white when pure. When starch is acted upon by diastase, it gives ultimately maltose or malt sugar, $C_{12}H_{22}O_{11}$; prolonged action of acids, however, converts starch into glucose or grape sugar, $C_6H_{12}O_6$. By the controlled action of ferments or acids, or by roasting at 220°–230° C, the breakdown of the starch molecule can be arrested at some earlier stage to produce dextrin. Their physical and chemical properties depend upon the stage attained; thus, at one stage erythro-dextrin is produced which gives a red colour with iodine, and at a later stage achroodextrin, which gives *no* colour with iodine. All dextrins dissolve in water to give sticky solutions, and hence their chief use is as glues; they are also used to give glossy surfaces to cardboard, etc., and to produce a "head" on aerated liquids *(See* CARBOHYDRATES.)

DEY, an honorary title formerly bestowed by the Turks on elderly men, and appropriated by the janissaries as the designation of their commanding officers (an adaptation of the Turk. *dāī,* a maternal uncle). In the 17th century the deys of the janissaries in Algeria became the rulers of that country *(see* ALGERIA: *History).* From the middle of the 16th century to the end of the 17th century the ruler of Tunisia was also called dey, a title frequently used during the same period by the sovereigns of Tripoli.

BHAMMAPALA, the name of one of the early disciples of the Buddha, and therefore constantly chosen as their name in religion by Buddhist novices on their entering the brotherhood. The most famous of the Bhikshus so named, probably a Tamil, was the great commentator who lived in the latter half of the 5th century A.D. To him we owe the commentaries on seven of the shorter canonical books, consisting almost entirely of verses, and also the commentary on the Netti, perhaps the oldest Pāli work outside the canon. Dhammapāla confines himself rigidly to questions of the meaning of words, and to discussions of the ethical import of his texts. Other unpublished works, besides those mentioned above, have been ascribed to Dhammapāla.

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DHANIS, FRANCIS, BARON (1861–1909), Belgian administrator, born in London and educated at the Belgian Ecole Militaire, went out to the Congo in 1887, and in 1892–94 commanded an expedition against the slave dealers. He captured in succession the three Arab strongholds at Nyangwe, Kassongo and Kabambari. He was raised to the rank of baron, and in 1895 was made vice-governor of the Congo State. In 1896 he took command of an expedition to the Upper Nile. His troops, largely composed of the Batetela tribes who had only been recently enlisted, and who had been irritated by the execution of some of their chiefs for cannibalism, mutinied and murdered many of their white officers. During 1897–98 he was engaged in a life-and-death struggle with them; eventually he succeeded in breaking up the bands of mutinous soldiers. In 1899 Baron Dhanis returned to Belgium. He died on Nov. 14, 1909

See Sidney Hinde, *The Fall of* ***the*** *Congo Arabs* (1897).

DHANUSHKODI, a seaport of Madras, India, on the island of Rameswaran, at the junction of Palk straits and the Gulf of Manar. The port was brought into being in 1913, when the new direct route of the South Indian railway to Ceylon was opened. The line is carried by an embankment and a bridge to Dhanushkodi, whence steamers run to Talai Manar (22 miles). Coffee, fish, rice, rubber, tea and cotton goods are exported, but no great influx of trade followed the foundation of the port. The population consists largely of railway employees.

DHAR, an Indian state in the Bhopawar agency, Central India. It includes many Rajput and Bhil feudatories, and has an area of 1,778 sq.m. The raja is a Ponwar Mahratta. The founder of the present ruling family was Anand Rao Ponwar, a descendant of the great Paramara clan of Rajputs who from the 9th to the 13th century, when they were driven out by the Mohammedans, had ruled over Malwa from their capital at Dhar. In 1742 Anand Rao received Dhar as a fief from Baji Rao, the peshwa, the victory of the Mahrattas thus restoring the sovereign power to the family which seven centuries before had been expelled from this very city and country. Towards the close of the 18th and in the early part of the 19th century, the state was subject to a series of spoliations by Sindia and Holkar, and was only preserved from destruction by the talents and courage of Anand Rao's widow. By a treaty of 1819 Dhar passed under British protection. The State was confiscated for rebellion in 1857, but in 1860 was restored, with the exception of the detached district of Bairusia, which was granted to the begum of Bhopal. The chief has the style of Maharaja and a salute of 15 guns. In 1931 the population was 243,430. The state includes the ruins of Mandu, or Mandogarh, the Mohammedan capital of Malwa.

The TOWN OF DHAR (pop. [1931] 19,607), is picturesquely situated among lakes and trees surrounded by barren hills, and possesses, besides its old walls, many interesting buildings, Hindu and Mohammedan, some of them containing records of great historical importance. The Lat Musjid, or Pillar Mosque, was built by Dilawar Khan in 1405 out of the remains of Jain temples. It derives its name from an iron pillar, supposed to have been originally set up at the beginning of the 13th century in commemoration of a victory, and bearing a later inscription recording the seven days' visit to the town of the emperor Akbar in 1598. The pillar, which was 43 ft. high, is now overthrown and broken. The Kamal Maula is an enclosure containing four tombs, the most notable being that of Shaikh Kamal Maulvi (Kamal-ud-din), a follower of the famous 13th-century saint Nizam-ud-din Auliya. The mosque known as Raja Bhoj's school was built out of Hindu remains in the 14th or 15th century: its name is derived from the slabs, covered with inscriptions giving rules of Sanskrit grammar, with which it is paved. On a small hill to the north of the town stands the fort, a conspicuous pile of red sandstone, said to have been built by Mohammed ben Tughlak of Delhi in the 14th century. It contains the palace of the raja.

The town is of great antiquity, and was made the capital of the Paramara chiefs of Malwa by Vairisinha II., who transferred his headquarters hither from Ujjain at the close of the 9th century. During the rule of the Paramara dynasty Dhar was famous throughout India as a centre of culture and learning; but, after suffering various vicissitudes, it was finally conquered by the Mohammedans at the beginning of the 14th century. Subsequently, in the time of Akbar, Dhar fell under the dominion of the Moguls, in whose hands it remained till 1730, when it was conquered by the Mahrattas.

DHARAMPUR, native state, India, in the Surat political agency division of Bombay. Area, 704 sq m. Pop. (1931), 54,068. Tribute, with Bauda and Sachin, £610. The chief is a Sesodia Rajput. The State contains one town, Dharampur (pop. in 1931, 7,218). Only a small part of the state, the climate of which is very unhealthy, is cultivated. Rice, millet, pulse, etc., are grown and there are extensive forests.

DHARMSALA, a hill-station and sanatorium of the Punjab, India, situated on a spur of the Dhaola Dhar, 16 m. north-east of Kangra town, at an elevation of some 6,000 ft. Pop. (1931) 6,359 The spur is thickly wooded with oak and other trees; behind it the pine-clad slopes of the mountain tower towards the jagged peaks of the higher range, snow-clad for half the year; while below stretches the luxuriant cultivation of the Kangra valley.

In 1855 Dharmsala was made the headquarters of the Kangra district of the Punjab in place of Kangra, and became the centre of a European settlement and cantonment, largely occupied by Gurkha regiments. The station was destroyed by earthquake in 1905.

DHARWAR, town and district, British India, in the southern division of Bombay. The town (pop. in 1931, 41,671) is a railway centre, formerly headquarters of the Southern Mahratta railway, now amalgamated with the Madras railway. It contains a jail for juvenile criminals, a mental hospital, a college and two training colleges, and is a centre of the Basle mission.

The district of Dharwar has an area of 4,606 sq. miles. In the north and north-east are plains of black soil, favourable to cotton-growing; in the south and west are ranges of low hills, with flat fertile valleys between them. The whole district lies high and has no large rivers. In 1931 the population was 1,102,677. The principal products are millets, pulse, cotton and timber. The centres of the cotton trade are Hubli and Gadag, junctions on the Madras and Southern Mahratta railway, which traverses the district in several directions.

The early history of the territory comprised within the district of Dharwar has been to a certain extent reconstructed from the inscription slabs and memorial stones which abound there. From these it is clear that the country fell in turn under the sway of the various dynasties that ruled in the Deccan, memorials of the Chalukyan dynasty, whether temples or inscriptions, being especially abundant. In the 14th century the district was first overrun by the Mohammedans, after which it was annexed to the newly established Hindu kingdom of Vijayanagar, an official of which named Dhar Rao, according to local tradition building the fort at Dharwar town in 1403. After the defeat of the king of Vijayanagar at Talikot (1565), Dharwar was for a few years practically independent under its Hindu governor; but in 1573 the fort was captured by the sultan of Bijapur, and Dharwar was annexed to his dominions In 1864 the fort was taken by the emperor Aurangzeb, and Dharwar, on the break-up of the Mogul empire, fell under the sway of the peshwa of Poona. In 1764 the province was overrun by Hyder Ali of Mysore, who in 1778 captured the fort of Dharwar. This was retaken in 1791 by the Mahrattas. On the final overthrow of the peshwa in 1817 Dharwar was incorporated with the territory of the East India company.

DHOLE, the "Red Dog" of India, Cyon *dukhunensis.* It is distinguished from the true dog (*Canis*) by possessing one molar less in the lower jaw. A rufous brown in colour, the dhole is somewhat larger than a jackal and hunts in large packs. It is principally found in the Deccan, and is the hero of one of Kipling's best stories. The name may be extended to all species of Cyon.

DHOLPUR, an Indian state in the Rajputana agency, with an area of 1,155 sq.m. All along the bank of the river Chambal the country is deeply intersected by ravines; low ranges of hills in the western portion of the state supply inexhaustible quarries of fine-grained and easily-worked red sandstone. In 1931 the population of Dholpur was 254,986.

The TOWN OF DHOLPUR is 34 m. S. of Agra by rail. Pop. (1931) 19,586. The present town, which dates from the 16th century, stands somewhat to the north of the site of the older Hindu town built, it is supposed in the 11th century by the Tonwar Rajput Raja Dholan (or Dhawal) Deo, and named after him Dholdera or Dhawalpuri. Among the objects of interest in the town may be mentioned the fortified *sarai* built in the reign of Akbar, within which is the fine tomb of Sadik Mohammed Khan (d. 1595), one of his generals.

Local tradition affirms that Dholpur was ruled by the Tonwar Rajputs, who had their seat at Delhi from the 8th to the 12th century. In 1527, after a strenuous resistance, the fort was captured by Baber and with the surrounding country passed under the sway of the Moguls, being included by Akbar in the province of Agra. During the dissensions which followed the death of Aurangzeb in 1707, Raja Kalyan Singh Bhadauria obtained possession of Dholpur, and his family retained it till 1761, after which it was taken successively by the Jat raja, Suraj Mal of Bharatpur, by Mirza Najaf Khan in 1775, by Sindhia in 1782, and in 1803 by the British. It was restored to Sindhia by the Treaty of Sarji Anjangaon, but in consequence of new arrangements was again occupied by the British.

The maharaj rana of Dholpur belongs to the clan of Bamraolia Jats. A sixteenth-century ancestor, Singhan Deo, having distinguished himself in an expedition against the freebooters of the Deccan, was rewarded by the sovereignty of the small territory of Gohad, with the title of *rana.* In 1779 the rana of Gohad joined the British forces against Sindhia, under a treaty which stipulated that, at the conclusion of peace between the English and Mahrattas, all the territories then in his possession should be guaranteed to him, and protected from invasion by Sindhia. This protection was subsequently withdrawn, the rana having been guilty of treachery, and in 1783 Sindhia crushed his Jat opponent and seized the whole of Gohad. In 1804, however, the family were restored to Gohad by the British government; but, owing to the opposition of Sindhia, the rana agreed in 1805 to exchange Gohad for his present territory of Dholpur, which was taken under British protection. The chief has a salute of 15 guns. Kirat Singh, the first maharaj rana of Dholpur, was succeeded in 1836 by his son Bhagwant Singh, who showed great loyalty during the Mutiny of 1857, and was created a K.C.S I. and G.C.S.I. in 1869. He was succeeded in 1873 by his grandson Nehal Singh, who received the C B. and frontier medal for services in the Tirah campaign. He died in 1901 and was succeeded by his eldest son, Ram Singh. His Highness Lt.-Col. Sir Rais-ud-Daula Jai Deo, K.C.S I., K.C.V.O., the present ruler, is the second son of the maharaj rana Nehal Singh and was born on Feb. 12, 1893. On the death of his brother maharaj rana Ram Singh, his Highness succeeded to the gadi in March 1911 and was invested with full ruling powers on Oct. 9, 1913.

DHOW, a type of vessel used throughout the Arabian Sea. The language to which the word belongs is unknown. Used of any craft along the East African coast, it is usually applied to the vessel of about 150 to 200 tons burden with a stem rising with a long slope from the water; dhows generally have one mast with a lateen sail, the yard being of enormous length. Much of the coasting trade of the Red Sea and Persian Gulf is carried on by these vessels. They were the regular vessels employed in the slave trade from the east coast of Africa.

DHRANGADHRA, native state, India, in the Western Indian States Agency, situated in the north of the peninsula of Kathiawar, Bombay. Area is 1,167 sq m. Pop. (1931) 88,961. Tribute, to the British government and Tunagadh, £3,000. There is a state railway (metre gauge) from Wadhwan through the town of Dhrangadhra to Halvad, a distance of 40 m., and a short line to the state salt works was opened in 1923. The chief town, Dhrangadhra, has a population (1931) of 17,538.

The chief of Dhrangadhra, who bears the title of Raj Sahib, with the predicate of His Highness, is head of the ancient clan of Jhala Rajputs, who are said to have entered Kathiawar from Sind in the 8th century. The Raj Sahib who succeeded in 1869 was distinguished for the enlightened character of his administration, and the state continues to make progress under its present ruler, who succeeded in 1911. It came into direct relations with the British Government in 1924.

DHULEEP SINGH (1837–1893), maharaja of Lahore, was born in Feb. 1837, and was proclaimed maharaja on Sept. 18, 1843, under the regency of his mother the rani Jindan, a woman of great capacity and strong will, but extremely inimical to the British. He was acknowledged by Ranjit Singh and recognized by the British Government. After six years of peace the Sikhs invaded British territory in 1845, but were defeated in four battles, and terms were imposed upon them at Lahore, the capital of the Punjab. Dhuleep Singh retained his territory, but it was administered to a great extent by the British Government in his name. This arrangement increased the regent's dislike of the British, and a fresh outbreak occurred in 1848–49. The Sikhs were routed at Gujarat, and in March 1849 Dhuleep Singh was deposed, a pension of £40,000 a year being granted to him and his dependents. He became a Christian and elected to live in England. On coming of age he made an arrangement with the British

Government by which his income was reduced to £25,000 in consideration of advances for the purchase of an estate, and he finally settled at Elveden in Suffolk. In 1864 he married Miss Bamba Müller, a German missionary worker in Egypt, by whom he had six children. After her death he married in 1890 an Englishwoman, Miss Ada Wetherill. The maharaja was passionately fond of sport, and his shooting parties were celebrated, while he himself became a *persona grata* in English society. The result, however, was financial difficulty and in 1882 he appealed to the government for assistance, making various claims based upon the alleged possession of private estates in the Punjab, and upon the surrender of the Koh-i-noor diamond to the British Crown. His demand was rejected, whereupon he started for India, after drawing up a proclamation to his former subjects. But as it was deemed inadvisable to allow him to visit the Punjab, he remained for some time as a guest at the residency at Aden, and was allowed to receive some of his relatives to witness his abjuration of Christianity, which actually took place within the residency itself. As the climate began to affect his health, the maharaja at length left Aden, and returned to Europe. He stayed for some time in Russia, hoping that his claim against England would be taken up by the Russians; but when that expectation proved futile he proceeded to Paris, where he lived for the rest of his life on the pension allowed him by the Indian government. His death from an attack of apoplexy took place at Paris on Oct. 22, 1893

The maharaja's eldest son, Prince VICTOR ALBERT JAY DHULEEP SINGH (1866–1918) was educated at Trinity and Downing colleges, Cambridge. In 1888 he obtained a commission in the 1st Royal Dragoon Guards. In 1898 he married Lady Anne Coventry, youngest daughter of the earl of Coventry. He died without issue on June 7, 1918.

DHULIA, town, British India, administrative headquarters of West Khandesh district in Bombay, on the right bank of the Panjhra river. Pop. (1931) 39.939. Considerable trade is done in cotton and oil-seeds, cotton and wool are woven, cotton ginning and pressing carried on. There is a technical school. A railway connects Dhulia with Chalisgaon, on the main Great Indian Peninsula railway.

DIABASE, in geology, a term which has at different times carried so many meanings that it has now lost all definite significance. Originally it was applied on the Continent to many pre-Tertiary basic igneous rocks, mostly of extrusive character. Later it was widely accepted as the group-name for the basic hypabyssal intrusives now called dolerites. The term is still used fairly often, especially in the literature of mining geology, and is useful as a field-name, if it is clearly understood as indicating only a somewhat decomposed basic igneous rock whose exact nature and origin has not been determined by precise methods. In this sense it is much the same as greenstone (*q.v.*).

The minerals of diabase, have been classed as the same as those of dolerite, viz., olivine, augite, and plagioclase felspar, with subordinate quantities of hornblende, biotite, iron oxides and apatite. To nearly every variety in composition and structure presented by the diabases a counterpart can be found among the Tertiary dolerites. In the older rocks, however, certain minerals are more common than in the newer. Hornblende, mostly of pale green colours and somewhat fibrous habit, is very frequent in diabase; it is in most cases secondary after pyroxene, and is then known as uralite; often it forms pseudomorphs which retain the shape of the original augite. Where diabases have been crushed or sheared, hornblende readily develops at the expense of pyroxene, sometimes replacing it completely. In the later stages of alteration, the amphibole becomes compact and well crystallized; the rocks consist of green hornblende and plagioclase felspar, and are then generally known as epidiorites, or amphibolites. Chlorite is also abundant both in sheared and unsheared diabases, and with it calcite may make its appearance, or the lime set free from the augite may combine with the titanium of the iron oxide and with silica to form incrustations or borders of sphene around the original crystals of ilmenite. Epidote is another secondary lime-bearing mineral which results from the decomposition of the soda lime felspars and the pyroxenes.

Diabases are exceedingly abundant among the older rocks of all parts of the globe. They form excellent road-mending stones, being tough, durable and resistant to wear, so long as they are not extremely decomposed.

DIABELLI, ANTON ANTONIO (1781–1858), composer of pianoforte and church music, was born on Sept. 6, 1781, at Mattsee, near Salzburg, Austria. He was educated in the convent of Raichenhaslach, it being intended that he should become a priest. He abandoned the idea of taking orders, however, on the secularization of the Bavarian convents in 1803. Diabelli went to Vienna where his piano pieces and arrangements became extremely popular. His other compositions included songs and an operetta, *Adam* in *der Klemme,* while his masses, particularly the *Landmessen,* are widely known in Austria.

With the aid of money he earned as a teacher of the guitar and pianoforte, he was able to become a partner of Peter Cappi, the music publisher, in 1818. Six years later the firm became known as Diabelli and Co., which published for Schubert, Czerny, Strauss, Lanner, and others. On a waltz of Diabelli's, Beethoven wrote his 33 Variations (Op. 120).

DIABETES INSIPIDUS is a morbid condition characterized by the passage of excessive amounts of urine of very low specific gravity (1·002–1·005). The urine contains no abnormal constituent. The patient has intense and constant thirst and sometimes health appears to suffer very slightly, for the disease runs a slow course. Nevertheless, its debilitating effects may predispose to serious and fatal complications. It may terminate in diabetes mellitus. The polyuria must be distinguished from that due to chronic granular kidney and lardaceous disease *(see* KIDNEY DISEASES) and from that occurring in some cases of hysteria. It is best treated by tonics and generous diet, and a free supply of water to drink should never be withheld. Valerian has been found a useful drug. The cause is unknown.

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DIABETES MELLITUS is **a** morbid condition in which the body is unable to metabolize sugars efficiently. It is this condition which is commonly termed "diabetes" *(see* METABOLIC DISEASES), and it is believed that it is produced when there is insufficient available insulin (*q.v.*) in the body. The first suggestion that the pancreas is necessary for the complete utilization of carbohydrates in the animal body was made by Brunner in 1682. The relationship of the pancreas to diabetes was first suggested in 1788 by Cowley, an English physician. In 1889 von Mering and Minkowski showed that the complete removal of the pancreas from animals resulted in a condition which is practically identical with diabetes mellitus in man. Although attempts were made to secure an anti-diabetic substance from the pancreas by scores of investigators, this substance was not proven to be present until 1921 *(see* INSULIN).

Diabetes is a common disease more prevalent in towns and especially modern city life than in primitive rustic communities and frequently occurs in Jews. In the United States it is said that it affects 1% of the population. No age is exempt but most sufferers are 50–60 years. Males are affected twice as frequently as females and fair more often than dark people, while obese individuals more often suffer from diabetes than those of normal weight.

Symptoms. — The untreated diabetic patient suffers from extreme thirst, hunger, loss of weight and strength. He excretes abnormally large quantities of urine of high specific gravity (1·030–1·050). He is very susceptible to infection and this condition, when established, is difficult to eliminate. The diabetic is unable to burn sugar. This sugar accumulates in the blood and is excreted in the urine. Not only are the sugars imperfectly

metabolized, the fats are also not utilized in a normal manner and certain products of their abnormal or incomplete decomposition accumulate in the blood and produce the conditions of acidosis and coma.

The diabetic condition is suspected when a patient complains of one or more of the symptoms or signs mentioned above. An analysis of the urine for sugar should always be made. Diabetes may be present and sugar may be found in the urine when the patient is not aware of any of these symptoms. The routine analysis of the urine in life insurance examinations has resulted in the early diagnosis of many cases of diabetes. The prognosis of the early case is, of course, much better than the advanced case since treatment can be instituted earlier in the disease. The amount of sugar in the blood, under certain standard conditions, is a valuable indication of the severity of the disease. The presence in the urine of the acetone bodies formed from the abnormal breakdown of fats is a warning that acidosis or coma is imminent. The presence of these substances in the body can sometimes be suspected by the characteristic odour which they impart to the breath.

By evaporation crystals of sugar may be obtained from diabetic urine, which also yields the characteristic chemical tests of sugar. The quantity of sugar passed daily may vary from a few ounces to two or more pounds, and is markedly increased after saccharine or starchy food has been taken. Sugar may also be found in the blood, saliva, tears, and in almost all the excretions.

Diabetes as a rule advances comparatively slowly except in the young, in whom its progress is often rapid. The complications of the disease are many and serious. It may cause impaired vision by weakening the muscles of accommodation, or by lessening the sensitiveness of the retina to light. Also cataract is very common. Skin affections of all kinds may occur and prove very intractable. Boils, carbuncles, cellulitis and gangrene are all apt to occur as life advances. Diabetics are especially liable to phthisis and pneumonia, and gangrene of the lungs may set in if the patient survives the crisis in the latter disease. Digestive troubles, kidney diseases and heart failure due to fatty heart are all of common occurrence. But the most serious complication of all is diabetic coma, which is very commonly the final cause of death. The onset is often insidious, but may be indicated by loss of appetite, a rapid fall in the quantity of both urine and sugar, and by either constipation or diarrhoea. More rarely there is most acute abdominal pain. At first the condition is rather that of collapse than true coma, though later the patient is absolutely comatose. The patient suffers from a peculiar kind of dyspnoea, and the breath and skin have a sweet ethereal odour. The condition may last from twenty-four hours to three days only very rarely longer, but is almost invariably the precursor of death.

Treatment.— Patients suffering from diabetes mellitus are treated by dietetic measures, and if the condition is severe, by the administration of insulin. Before the discovery of insulin the methods of treatment introduced by Allen and Joslin of drastic restrictions in diet prolonged the lives of many severe diabetics.

Several important principles underlie the dietetic treatment of this disease. The diet must supply sufficient calories to the patient in order that his weight may be kept constant at the proper level. Protein, preferably as lean meat, eggs or milk, must not be reduced below a certain minimum value. If this substance is unduly reduced, the tissue protein of the patient's body is utilized. The carbohydrates and fats of the diet must be in a certain fixed proportion to each other. If the fats are present in excess of this proportion, there is danger of the production of the poisonous acetone bodies. In calculating the sugar in a diet, it is necessary to remember that sugar is formed from protein and to a lesser extent from fat, as well as from the carbohydrate of the diet. The diabetic patient is given as much sugar-forming food as he can utilize. Sugar in excess of what is utilized is excreted in the urine. The amount of excess sugar can therefore be determined by analysis.

Dietetic Measures.—The diabetic diet should consist as far as possible of easily available seasonable foods along the line of a normal diet. It is much more satisfactory for the patient to obtain the essentials of his diet from among these natural foods than to be dependent upon specially prepared diabetic foods. The diabetic diet need not be monotonous.

Mild cases of diabetes can be successfully treated by dietetic measures. If a patient excretes sugar on a diet which is sufficient only for his needs insulin must be supplied. The amount necessary is proportional to the severity of the disease. Insulin, which is distributed as a sterile, watery solution, is administered hypodermically. It is not effective when given by mouth. Insulin is usually administered twice a day, 15 to 30 minutes before breakfast and again before the evening meal. Some patients require only one dose per day, while in very severe cases three doses are necessary.

If the diabetic patient is using a diet which is too high in fats or too low in sugar, coma may develop. A large percentage of diabetics died of coma before insulin was discovered. The treatment of coma was to put the patient to bed, to supply fluids and alkalis, heat and stimulants and to give sugar by mouth or into a vein. These measures are still necessary. Insulin has proved a specific drug in the treatment of this condition and, when administered sufficiently early, and in large doses, the results have been very successful.

Insulin is a very powerful drug. A very serious condition may be produced by the administration of an overdose. This may be avoided on the physician's part by a very careful balancing of diet against dosage of insulin employed, and on the patient's part by a close and intelligent observance of the diet, together with a thorough understanding of the premonitory symptoms of a beginning hypoglycaemic reaction. These symptoms of slight hypoglycaemia are sudden hunger, fatigue, a peculiar restlessness often described by the patient as a feeling of "inward trembling," pallor or flushing of the face, and an increased pulse rate which is a valuable sign in children. If the overdose of insulin is large and corrective measures are not taken, the patient may show profuse perspiration, tremor, emotional disturbances, collapse and unconsciousness. The treatment of mild degrees of hypoglycaemia consists of the administration of carbohydrate in any convenient form, such as sugar candy. Should the more serious symptoms develop, orange juice with sugar added, or corn syrup, may be given by mouth. In the very severe cases, sterile dextrose is given intravenously.

In the past, less than 20% of patients suffering from severe diabetes lived more than 10 years. Children, who usually have the disease in a severe form, seldom lived for more than 6 years. The diabetes which develops in individuals over 50 years of age is usually mild and the patients may live their allotted span of years. It is not possible to state definitely as yet the exact effect of insulin on diabetic mortality. It is certain, however, that thousands are now alive who would have died had it not been for insulin. In some cases it appears that patients need less insulin than they required when treatment with the material was commenced. In the great majority of cases, however, the insulin requirement has not been markedly reduced. The severe diabetic receiving insulin is now able to live practically a normal life, but the insulin treatment cannot be discontinued.

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(C. H. B.)

DIABOLO, a game played with a sort of top in the shape of two cones joined at their apices, which is spun, thrown, and caught by means of a cord strung to two sticks. The idea of the game appears originally to have come from China. In 1812 it became popular in France under the name of *"le diable."* In 1906 Gustave Phillipart, a French engineer, devised a top with a double cone and, for a short period, the game was extremely popular in France and England.

DIACONICON, in the Greek Church, the name given to a chamber on the south side of the central apse, where the sacred utensils, vessels, etc., of the church were kept. In the reign of Justin II. (565–574), owing to a change in the liturgy, the diaconicon was located in an apse at the east end of the south aisle; a similar apse at the east end of the north aisle was used as the prothesis (*q.v.*)—the place where the elements of the Communion were prepared. In the churches in central Syria, of slightly earlier date, there is only one apse and the diaconicon is rectangular. (T. F. H.)

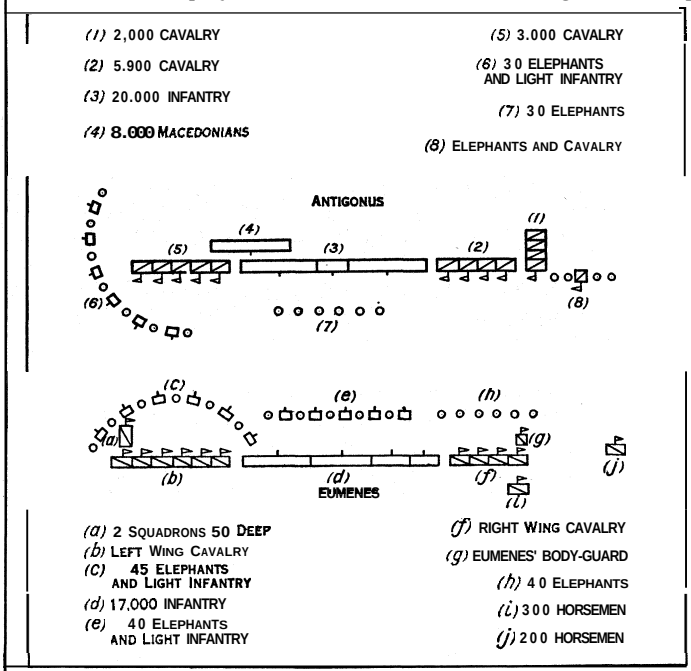
DIADOCHI, *i.e.,* "Successor" (Gr. διαδέχεσθαι), the name given to the Macedonian generals who fought for the empire of Alexander after his death in 323 B.C. The name includes Antigonus and his son Demetrius Poliorcetes, Antipater and his son Cassander, Seleucus, Ptolemy, Eumenes and Lysimachus. The kingdoms into which the Macedonian empire were divided under these rulers are known as Hellenistic. The chief were Asia Minor and Syria under the Seleucid dynasty (*q.v.*), Egypt under the Ptolemies (*q.v.*), Macedonia under the successors of Antigonus Gonatas, Pergamum (*q.v.*) under the Attalid dynasty. Gradually these kingdoms were merged in the Roman empire. (See MACEDONIAN EMPIRE.) (X.)

DIADOCHI, WARS OF (323–281 B.C.). The wars of the Diadochi, or Successors, though outwardly civil wars ending in the disruption of the Alexandrine empire, were inwardly the birth pangs of a new civilization begotten by Persian gold set into circulation through strife. Few periods in history have produced so many great generals, the reason being that the chief participators in these wars, namely, Antipater, Craterus, Perdiccas, Ptolemy, Lysimachus, Seleucus and Eumenes had all been selected by Alexander and trained in his campaigns.

To *the Death* of *Perdiccas*, 321 B.C.—Alexander died in June 323, but before the year was out civil war was raging throughout Greece. This conflagration was known as the Lamian war, and to quell it Antipater sent for Craterus then in Cilicia on his way back to Greece with Alexander's discharged veterans. On his arrival he met the Grecian allied forces on the plains of Crannon and routed them. Free of this menace, Antipater and Craterus, fearing the growing power of Perdiccas, entered into a league with Ptolemy, who was nervous lest Perdiccas should attempt to dispossess him of Egypt. Nor were his fears unfounded, for in the spring of 321 Perdiccas, accompanied by Philip Arrhidaeus, the weak-minded half-brother of Alexander, marched against Egypt, whereupon Craterus and Neoptolemus invaded Asia, both being killed in a battle with Eumenes. Perdiccas did not, however, live to hear of this victory, for on the Pelusiac branch of the Nile his men mutinied and assassinated him. The battle fought by Eumenes is mainly of strategical interest, since Perdiccas and Eumenes held a central position and were threatened by Antipater from the west and by Ptolemy from the south. Antipater's plan was first to smash Eumenes and hold off Perdiccas, secondly to concentrate against the latter. Perdiccas attempted to counter this plan by sending Eumenes to hold back Antipater's two generals whilst he fell upon Ptolemy. Both coalitions aimed at destroying each other in detail, the one working on interior lines and the other on exterior. From the very outset of this war we find strategy dominating tactics, the reason being that all the generals concerned are men of high military ability.

To *the Death* of *Eumenes*, 316 B.C.—By the death of Perdiccas the preponderance of power was thrown into the hands of Antipater, Ptolemy and Antigonus. As Antipater had just suffered a reverse, Antigonus, seeing Eumenes without an ally, marched against him. Eumenes, robbed of the fruits of his victory, was faced by a mutinous army. Putting to death the ringleaders he turned to meet Antigonus, whereupon his cavalry under Apollonides deserted to the enemy. This compelled Eumenes to seek refuge in the fortress of Nora, which was at once besieged by Antigonus. Meanwhile Antipater died, but shortly before his death he set aside his son Cassander and appointed as his successor Polysperchon. Antigonus, hearing of the differences between these two, saw a chance of increasing his dominion, and to be quit of the siege he proposed favourable terms to Eumenes, who was at once bought over by Polysperchon, who sent to him the Argyraspides (Silver Shields), a formidable body of Alexander's veterans. A series of manoeuvres now took place, the two antagonists coming into contact in Media. Eumenes had 35,000 foot, 6,100 horse, and 114 elephants; and Antigonus 82,000 foot, 8,500 horse and 65 elephants. The orders of battle of the two armies are given in the diagram.

The tactics of this battle are interesting. Antigonus, seeing that Eumenes had deployed his best horsemen on his right, drew up



PLAN OF THE FIRST BATTLE BETWEEN EUMENES AND ANTIGONUS

1,000 horse archers and 1,000 lancers in columns of squadrons so that they could "charge in manner of a running fight, wheeling off one after another, and so still renew the fight by fresh men." He did this to hold his enemy's main attack. Eumenes, to protect his left wing, drew up his elephants in a demi-lune, from which it may be inferred that this wing was to be refused. Antigonus in order to protect his right wing, which was to deliver the main attack, extended his elephants in a semi-circle on its outer flank.

Antigonus advanced with his right leading, but not being able to encounter the elephants he wheeled outwards and poured showers of arrows on to his enemy's left flank. Eumenes, withdrawing a force of cavalry from his right, fell upon the flank and rear of Antigonus's right wing and pursued it into the mountains. The phalanxes now clashed together, the Silver Shields carrying all before them. Antigonus was advised to retire, but he was too good a soldier to take this course. He noticed that the pursuit of Eumenes and the movement of the Silver Shields had created a gap between the phalanx and the left wing cavalry. Through this gap he charged, and struck Eumenes' right flank in rear driving it from the field. The battle was indecisive, and during the night both armies retired. Eumenes was now compelled to disperse his force in order to live. Antigonus, determining to take advantage of this, abandoned the main road for a little-known desert track. Learning of this, Eumenes lit fires "within the compass of 70 furlongs," which so completely deceived Antigonus that he abandoned the track; this allowed Eumenes to concentrate his forces. The armies now met, that of Antigonus numbering 22,000 foot, goo horse, and 65 elephants; and that of Eumenes 36,700 foot, 6,050 horse, and 114 elephants. (See plan below.)

Eumenes, hearing that Antigonus was with his right wing, faced him with his left, in front of which he drew up in a half-moon formation, the bulk of his elephants linking them up with light infantry. In his centre he marshalled his targeteers in front, the Silver Shields behind them, and the "foreigners" in rear. In front of the targeteers he extended a line of elephants and light troops, his right wing being ordered "to retire leisurely as he fought, and

diligently to observe the events of the other side." As the elephants advanced on each other a tremendous dust was raised, under cover of which Antigonus sent out a force of cavalry to pass round the enemy's flank and seize his baggage camp. Eumenes charged forward through the dust, a large number of his horse deserting him. He was followed by the Silver Shields who once again carried all before them, but on account of the flight of Eumenes' cavalry they were surrounded by the enemy's. Learning that their baggage and wives were in the enemy's hands they were thrown into consternation. Thereupon Antigonus offered to hand their camp back to them if they would desert and surrender Eumenes. This they agreed to do, and after a week's captivity Eumenes was put to death by his guard.

To the Death of Heracles, 310 B.C.—Whilst Eumenes was warring in Asia, Olympias, the mother of Alexander, put to death Philip Arrhidaeus. Thereupon Cassander, who by bribery had won over many of Polysperchon's soldiers, besieged her in the fortress of Pydna. In the spring of 316, with Roxana and her child (Alexander's widow and son), she surrendered to him and shortly after was assassinated. The death of Eumenes having freed Antigonus from opposition in Asia, he made the assassination of Olympias an excuse to destroy Cassander. Through self-preservation, Lysimachus, Ptolemy and Seleucus formed an alliance against him, and in 314, to weaken Cassander, Antigonus promised freedom to the Grecian cities. The result of this was that the Aetolians entered into alliance with him, and Cassander was forced to march against them. Meanwhile Seleucus gained over Babylonia and founded the Seleucid dynasty.

In 311, Cassander having defeated the Aetolians, a temporary peace was patched up, the terms of which were: That Cassander was to hold Macedonia until Roxana's child should come of age; Lysimachus to govern Thrace; Ptolemy to retain Egypt, and Antigonus to rule all the provinces of Asia. No sooner was this peace agreed upon than Cassander assassinated Roxana and her child, whereupon Polysperchon, influenced by Antigonus, espoused the cause of Heracles the pretender, proclaiming him Alexander's son by his mistress Barsine. Cassander, whose position was insecure, offered Polysperchon complete control of the Peloponnesus if he would put Heracles out of the way, which was promptly done.

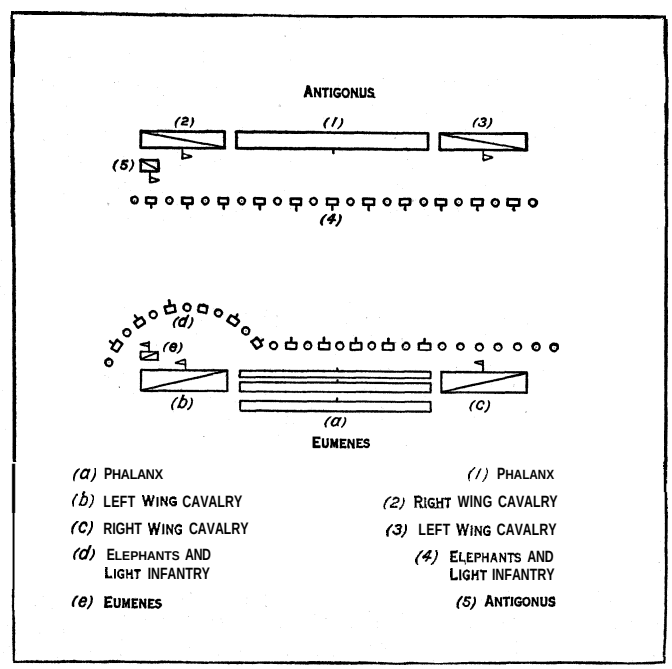
To the Death of Antigonus, 300 B.C.—To punish Cassander, in 307 B.C., Antigonus sent his son Demetrius to the Peiraeeus. The Athenians mistaking his fleet for that of Ptolemy allowed him to enter the port, whereupon Athens opened her gates to him. The next three years were spent by Demetrius in a series of campaigns. At the battle of Gaza, 312 B.C., he was defeated by Ptolemy and Seleucus, captured and at once released. Concentrating his main cavalry force in his right wing, Ptolemy protected it against Demetrius's elephants by a palisade pointed with iron spikes, in front of which he placed his light infantry. As the elephants advanced they were plied with darts, and when they struck the iron spikes they were thrown into such confusion that the Demetrians lost heart and withdrew.

In 308 B.C. Demetrius, realizing that Ptolemy's strength lay in his command of the sea, defeated him in a naval battle off Cyprus, and in the following year he set sail for Rhodes, the siege of which was the greatest exploit of his eventful life. At this siege every type of device was made use of by besieged and besieger. Demetrius employed 30,000 artificers and workmen to build his towers and engines; Helepolis, the largest tower he built, required 3,400 men to move it. He constructed a ram 18oft. long which was moved on wheels by 1,000 men. In place of ramming his enemy's war galleys, he cleared their decks by veritable broadsides of missiles, and Plutarch tells us that he built galleys of 13 banks of oars, and some of even 15 and 16 which "were as wonderful for their speed . . . as for their size." Nevertheless, in spite of his inventive genius, in the autumn of 302 B.C. he was compelled to raise the siege, for Ptolemy, still controlling the seas, resupplied the city,

Returning to Athens, in April 301, as he was marching into Thessaly to meet Cassander, Demetrius was recalled to Asia by Antigonus. The reason for this was that Ptolemy, Seleucus and Lysimachus, fearing that should Cassander be defeated Greece would be added to the kingdom of Antigonus, determined to relieve the pressure by attacking Antigonus in Asia. In the spring of 300 B.C. the opposing forces met at Ipsus, in Phrygia. Demetrius with the main force of cavalry charged Antiochus, the son of Seleucus, routed him, and then pursued him. Seeing what had happened Seleucus blocked his return by a line of elephants, and then in place of charging Antigonus threatened him with attack, so giving time to such of the enemy who wished to desert to come over. This a large body did, and when a strong force of the enemy drew up to charge Antigonus, one of those about him cried out: "Sir, they are coming upon you!" To which the old general replied dryly: "What else should they do?" and was at once smitten down by a multitude of darts. His kingdom was then broken up, chiefly to the profit of Seleucus.

To the Death of Seleucus, 281 B.C.—In 296 B.C. Cassander died, and Demetrius returning to Greece became master of Macedonia. There he prepared to invade Asia, which threat resulted in an alliance between Seleucus, Ptolemy and Lysimachus. Demetrius, forsaken by his troops, surrendered himself to Seleucus, who kept him a prisoner until his death in 283 B.C. In 277 B.C. his son Antigonus Gonatas regained the throne of Macedonia, and his descendants, the Antigonid kings, held it until the battle of Pydna, in 168 B.C. In 283 B.C., Ptolemy, king of Egypt, died at the age of 84, and two years later, at the battle of Coron, Lysimachus, at the age of 80, was killed by Seleucus, who himself was murdered by Reraunos, the eldest son of Ptolemy, in 281 B.C. Thus perished the last of the Diadochi.

The Art of War of the Period.—In spite of their many brilliant episodes, the wars of the Diadochi constituted a period of military decadence. The first cause for this rot was the sudden loss of Alexander's genius; the second, the imitation by the Successors of his actions without understanding them, and, lastly, the immense influx of Persian gold.



PLAN OF THE SECOND BATTLE BETWEEN EUMENES AND ANTIGONUS, 316 B.C.

When Alexander died his art died with him; and though several of his generals showed true knowledge of the art of war and on occasion actually improved on his minor tactics, they lacked his vision, and after his death the glamour they had gathered was lost and only a dream was left, which as years passed by grew fainter and more obscure. Eumenes was an able leader, full of resources and craftiness, yet in his first battle with Antigonus he merely copied the Alexandrine tactics in place of breathing out their spirit. He made his right wing the decisive attack, as Alexander had done; but Alexander always struck at his enemy's command,

the decisive point, and as Antigonus was commanding his own right wing Eumenes should have attacked him with his left. In his second battle he does not repeat this mistake, which shows how little of essential value is learnt even by intelligent soldiers until disaster hammers knowledge home.

The Persian gold, with which Alexander intended to develop his empire, was spent in war. The mercenary now came into his own, and not only was he bought and sold on the battlefield, which if it did not destroy discipline destroyed all reliance in it, but he changed the art of leadership and of military organization. A mercenary army will serve any master for pay, and when a general is forced to hire mercenaries he looks for the most formidable type of troops. In this day the sarissa armed hoplites were of this category, consequently a man who looked for employment as a mercenary knew that as a hoplite he would command higher pay than as an archer or a peltast. The result was a disruption of Philip of Macedon's organization and a steady return to the Spartan tactics.

In the army of Alexander leadership was based on heroism, but in the armies of the Diadochi it was based on pay. The result of this was that heroism was replaced by craft. Warfare, in a low and underground way, became more intellectual, and leadership had to follow suit. The leader was no longer a hero but a diplomatist, and as he led by gold in place of by valour, he crept behind his men, or, more frequently still, hired a hero to lead them, and from a safe distance instructed him what to do. Thus the mercenary separated leadership from command, and the whole art of war changed. Another influence of gold was that warfare became mechanized. Gold stimulated invention, and invention stimulated industry, and industry was applied to war. Projectile weapons came more and more into use, and as they were difficult to move on the battlefield they induced generals more and more to adopt defensive tactics. The anti-elephant palisades at the battle of Gaza are an example of this.

The whole tendency of this period is one from prowess to cunning. Under the Diadochi we see strategy steadily coming to the fore. Antipater and Ptolemy go into league against Perdiccas, and their movements, as well as their ideas, are combined. At the battle of Ipsus it is the same, and out of these various transient combinations may be seen evolved from cunning a definite conception of the balance of power, in the making and unmaking of which more and more does command of the sea play a decisive part. Ptolemy holds it, then Antigonus attempts to wrest it from him; such was the cause of the siege of Rhodes. Each king wants to secure his frontiers, and the only one who succeeds in doing so is Ptolemy—as long as he can command the sea. With this command Egypt is virtually an island. Surrounded by deserts, it is all but unassailable save from the sea. The result of this security is immense prosperity, which gives birth to an economic and ethical outlook on war. Ptolemy from a leader steps into the position of a modern commander, a true general in chief. He is a statesman, and he understands that ethics may be used as a weapon—witness his treatment of Demetrius after the battle of Gaza, and this was not an isolated case. He knows the value of his immense resources, and to him they are weapons of war. He saves Rhodes by means of dried peas, and not by pikes, and plans campaigns whilst his generals fight his battles. Thus we see, in many unlooked for ways, how the unleashing of the power of gold transformed civilization and with it the art of war

The Foundations of Modern Europe.—The influence on western civilization of these 40 years of incessant war was profound. Alexander had dreamt of a world empire through a fusion of races, and, curious as it may seem, it was through the wreck of his empire that this idea took form. At his death Greece and Persia disappeared and the Hellenistic world was established in their stead, a world of decadence and of progress which was destined to fertilize Rome, and later on Arabia. "As Greece had transmuted the barbaric tinsels of the Orient into rich gold, so the East once more seized upon the jewels of Greece and wove them into mystic cabalistic webs, into its gnosticisms and theologies." Without Alexander and his Successors there would have been no Christian religion nor would there have been an Arabian civilization—in fact the world to-day would not be the world we know. (J. F. C. F.)

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DIAGHILEV, SERGEI PAVLOVICH (1872–1929), Russian ballet producer, was born in the province of Novgorod, Russia, March 19, 1872. After studying law and music he organized art exhibitions in St. Petersburg (Leningrad). In 1899 he founded the review *Mir Iskusstra* (The World of Art), to which Somov and Bakst contributed, and which exercised a powerful influence on Russian art. From 1907 onwards he occupied himself with musical and theatrical productions and organized a number of Russian concerts in Paris; there he produced in 1908 and 1909 Russian operas *(Boris Godunov* and *The Maid* of *Pskof)* and ballets. Subsequently he organized successful ballet and opera seasons in London, Paris, Berlin, America and elsewhere. One of his most successful operatic productions was that of Moussorgsky's *Khovanshtchina.* In England the originality of his conceptions may be said to have effected a revolution in choreographic art, and further put new life into stage dancing, which by the end of the 19th century had degenerated into a spectacular show of little artistic significance. Among his numerous successful ballets may be mentioned: *Carnaval* (music by Schumann), *Scheherazade* (music by Rimsky-Korsakov), *Petrouschka* (music by Stravinsky), *La Boutique Fantasque* (music by Rossini) and *The Three Cornered Hat* (music by de Falla)—to name but a few of a very large number. In 1904 M. Diaghilev produced a valuable book on the painter Levitsky. A collection of photographs and drawings illustrating the ballet, *Les Biches,* was published in 1924 by B. Koshno. *(See* also **BALLET.**) He died at Lido, Aug. 19, 1929.

DIAGNOSIS, or the process of identifying the disease by consideration of the history (*anamnesis*), symptoms, physical signs and examination in every way of the patient, includes differential diagnosis or its distinction from other diseases.

Importance in Treatment.—Diagnosis is essential for rational treatment, for without a knowledge of its cause treatment of a morbid symptom is merely empirical or, as it is often called, symptomatic, and, if beneficial, is so for the time being only and is not curative. The ideal of diagnosis is the discovery, as early as possible, of the disturbing factor at work, so that it may be removed or neutralized before structural damage results. In most diseases symptoms precede the signs or evidence of organic change in the body; but correlation of the earlier symptoms with the later physical signs indicating the presence of structural change has made it possible to predict the nature, course and proper treatment of the disease. This knowledge is more advanced in acute than in chronic diseases, in which the processes are less obvious and may be more complicated. It is therefore important to study the earliest manifestations of disordered function and by keeping the patient under observation to collect data for the recognition of the beginnings of chronic disease. This was one of the objects of the clinic at St. Andrews, inspired and opened by the late Sir James Mackenzie in 1919. Diagnosis is a logical process based on all the available data and is the outcome of their analysis in the light of knowledge gained by experience; diagnosis therefore leads to prognosis.

Methods and Symptoms.—Diagnostic methods include investigation of the patient's past history and of his environmental conditions, of the symptoms of which he complains, and methodical examination of the patient and of his organs and of the manner in which they are performing their functions. This examination is physical and physiological; an example of the physical signs is a tumour which can be felt; the physiological method is seen in the estimation of the functional efficiency of the heart or nervous system by means of exercises or special tests. Physical examination detects gross organic changes; functional tests reveal the disordered action of the organs, which is present in the earlier stage of symptoms without physical signs, mainly before structural damage has been produced. But it must be

admitted that the sequence of symptoms first and bodily changes with physical signs later is not invariable; for a slow change in the organs or tissues of the body may be accompanied by compensatory processes so complete as to prevent any functional impairment; thus an innocent tumour may grow to considerable size before it produces any symptoms, which may then be mechanical. A patient's past history is important not only as regards bodily illnesses, but with reference to mental experiences, which having become subconscious memories may be responsible for neurosis; Freud and his followers, by psycho-analysis (*q.v.*), have brought the trauma buried in the subconscious into the field of consciousness when other psychotherapeutic means can be employed.

Use of Physical Signs.—Physical signs, in contradistinction to subjective symptoms of which the patient complains, are observed by the medical man. First, inspection in a good light may give a shrewd idea of what is the matter—for example severe anaemia, the pigmentation of Addison's disease, the cachexia of advanced malignant disease, the bony changes in acromegaly, the swollen features of myxoedema and cretinism and the shrivelled, sharp-featured countenance of acute peritonitis (*facies Hippocratica*). Facial diagnosis without further examination is not without its fallacies, but an experienced practitioner may possess "clinical instinct" which, without a conscious logical process, at once tells him what is the matter, and is probably due to recognition by the subconscious mind of a similar condition seen years before but forgotten. The use of vision in diagnosis has been greatly extended in recent years. The ophthalmoscope, invented by Charles Babbage (1792–1871) and modified by Helmholtz, enables the retina at the back of the eye, which is an expansion of the brain, to be seen in all its details, similarly the laryngoscope, and more recently the bronchoscope, oesophagoscope, sigmoidoscope, endoscope for lighting up and bringing before the observer's eye the interior of the bronchial tubes, the gullet, the lower part of the bowel, and of the urinary bladder, have greatly facilitated the detection of disease in these situations. Endoscopes have also been introduced into the chest (thoracoscopy) and into the abdomen (laparoscopy or coelioscopy).

Skiagraphy.—Skiagraphy or examination of the body by X-rays (see ANATOMY; RÖNTGEN RAYS) has revolutionized diagnosis by rendering the greater part of the body translucent while the bony skeleton and certain abnormal formations remain opaque; X-rays provide a photograph or skiagram of great use in diagnosis; thus fractures can be shown, and similarly tumours, foreign bodies, certain morbid conditions, such as abscesses and collections of fluid, stones in the kidney and bismuth when introduced into the alimentary canal appear dark, while the surrounding parts are light. In this way malignant disease, aneurysms, tuberculosis and other diseases of the lungs, and the condition of the alimentary canal can be recognized. Further by introducing air into the abdomen the picture produced is rendered much clearer; recently the ingestion of dyes (tetraiodophenolphthalein or tetrabromphenolphthalein) which are excreted into the bile have been found to show up the gall bladder (cholecystography).

Use of Instruments of Precision.—The well-established and obvious method of palpation or examination of the body by the hand has been greatly supplemented by the introduction of instruments of precision which record the movements of the heart, arteries and muscles; graphic records of the pulse by the polygraph, of blood pressure by the sphygmomanometer and of the heart by the electrocardiograph have added accuracy to the unaided but trained senses. The various forms of cardiac irregularity have thus become clearly unravelled, and fresh information about the condition of the heart muscle and its beats, such as the *pulsus alternans* and auricular fibrillation, has been secured. The electrocardiograph requires special technical skill (see HEART, DISEASES OF THE); but when once the existence of the underlying condition has been definitely established in diseases also accompanied by more obvious manifestations, the presence of the latter has now become sufficient to justify a diagnosis of the primary cause, and so to indicate its prognosis and appropriate treatment. This simplification of diagnosis by associated phenomena will, it is to be hoped, follow in many diseases, in which the full explanation can originally be provided only by laboratory methods too elaborate for ordinary practice.

Laboratory Tests.—These methods of physical diagnosis are clinical and have been increasingly supplemented by tests adopted from those carried out in laboratories. The distinction between the clinical and laboratory methods of diagnosis is one of degree, for some, such as the counting of blood corpuscles and the detection of various animal parasites, do not require the help of a specialized laboratory: hence clinical laboratories have now become an essential part of the equipment of a modern hospital or clinic. But other valuable tests are not possible in less favourable circumstances. The chemical examination of the blood for its content or' sugar and non-protein nitrogen has an invaluable bearing on diabetes and renal disease; the examination of the blood for antibodies has enabled the diagnosis of infectious diseases to be made when ordinary clinical methods fail, for example the Wassermann reaction in the detection of syphilis, and the Widal (also a complement-fixation) test in the diagnosis of enteric fever. Bacteriological examination of discharges and excretions, such as swabs from the throat in diphtheria, of the expectoration in pulmonary consumption, of the urine and of the blood, of the cerebrospinal fluid and of the faecal excreta, has enormously advanced the exact diagnosis of infectious diseases. Thus to take an example, diseases which formerly were sometimes with difficulty distinguished by clinical examination (enteric fever, generalized tuberculosis, malaria and malignant endocarditis) can now be identified readily by examination of the blood. Chemical investigation of, and examination of the cells in, the blood, the fluids already mentioned and especially of the gastric juice by the method of fractional test meals have also rendered eminent service in the diagnosis of many diseases.

Immunity **Tests.**—Immunology (see IMMUNITY) or the science of the reactions given by persons who are immune or susceptible to certain infections or poisons has made it possible to say whether a person is liable to contract certain infections; thus by the Widal complement-fixation test to determine whether or not an individual is protected against enteric fever, by the Schick test, against diphtheria and by the Dick test against scarlet fever. In the two Iatter the diphtheria toxin or the scarlatina1 haemolytic streptococcus toxin is injected between the layers of the skin; a local reaction shows that the individual is susceptible to the disease, against which he can then be protected by injections into his muscles of the corresponding toxin. This protective diagnosis will no doubt become more general in application.

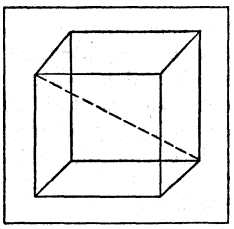
Individual Idiosyncrasies.—The exact cause of idiosyncrasies to certain foods, for example eggs, or to animal or vegetable substances, such as hair, feathers and pollen, can be determined by rubbing on the abraded skin extracts of substances likely to be the exciting cause of one of the "toxic idiopathies," such as asthma or nettlerash. If an individual suspected to be hypersensitive to, say, the dandruff of horses, is thus tested with such an extract, the appearance at the point inoculated of a red area or wheal, much larger and more prominent than that produced on a control area of skin similarly treated, except that saline solution is applied, strongly suggests that the disorder, such as asthma, is due to hypersensitiveness to this particular foreign protein.

General Disease.—General ill-health (dis-ease, want of ease), often of a vague character as shown by undue fatigue, but sometimes severe and prominent, such as pernicious anaemia or ulcerative endocarditis, and also local affections, such as arthritis, are commonly due to some primary condition often in a distant part of the body, such as disease of the tonsils, in connection with the teeth, the gall bladder or the vermiform appendix. The symptoms are frequently, especiaily in the examples first mentioned, due to some local infection providing micro-organisms or their poisons only, which when carried to other parts of the body, *e* g., the central nervous system, the blood-forming organs, the heart or the joints, set up changes and attract attention, while

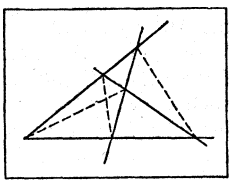
the fons *et origo* remains latent. In such cases, and they are numerous, of secondary disease, search for the primary infective focus is the scientific method of diagnosis, and may require expert advice from the laryngologist, dentist, the radiologist or other specialists. In other instances the primary cause sets up, through the nervous system, symptoms often in a comparatively remote part, which are described as due to disordered reflex action; just as a decayed tooth may cause headache, a blow on the ulnar nerve at the elbow (the "funny bone") tingling and pain in the little finger, so may a stone in the kidney show itself by pain in the testicle on the same side, or a chronically inflamed appendix or gall bladder be responsible for dyspepsia.

Conclusions. — The foregoing examples show that with the advance and necessary specialization of medicine diagnosis may make demands which no one man can efficiently meet, and that in certain cases a satisfactory solution can be obtained only after examination and report by specialists. He is a wise man who knows enough to recognize his limitations and to call for such assistance, whereas the converse course leads to the empirical treatment of symptoms, the continued discomfort and dependence, if nothing worse, of the patient and eventually perhaps to the doctor's discredit. Recognizing this, hospitals have long carried out the combined diagnostic method, and more recently, especially in America, groups of doctors, each proficient in some branch of the healing art, have amalgamated to form "diagnostic clinics" and to practise "group medicine."

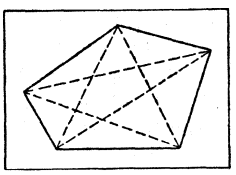
(H. R.)



DIAGONAL OF CUBE



DIAGONALS OF A COMPLETE QUADRILATERAL



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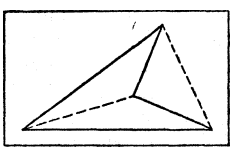


DIAGONALS OF A RE-ENTRANT QUADRILATERAL

DIAGONAL, in geometry, a line joining the intersections of two pairs of sides of a rectilinear figure (Gr. διά, through, γωνία, a corner).

DIAGORAS, of Melos, surnamed the Atheist, poet and sophist, flourished in the second half of the 5th century B.C. Religious in his youth and a writer of hymns and dithyrambs, he became an atheist because a great wrong done to him was left unpunished by the gods. In consequence of his blasphemous speeches, and especially his criticism of the Mysteries, he was condemned to death at Athens, and a price set upon his head (Aristoph. *Clouds*, 830; *Birds*, 1,073 and Schol.). He fled to Corinth, where he is said to have died. His work on the Mysteries was called Φρύγιοι λόγοι or Ἀποπυργίζοντες, in which he probably attacked the Phrygian divinities.

DIAGRAM, a figure drawn so that geometrical relations among its parts illustrate relations among the objects represented by the figure, supplemented sometimes by numerical or other entries on the figure itself to show relations not represented graphically by the figure. The purpose of a diagram is to present vividly to the eye the principal relations on which one desires to fix attention and even sometimes to show, by measurements on the figure, the exact numerical values of certain important quantities associated with the object which it represents. Owing to the generality of the concept, diagrams are useful for a great variety of specific purposes.

Mathematical Diagrams. — In mathematical treatises diagrams are used principally to help the reader follow the reasoning. Figures are drawn to represent to the eye the relations among the parts involved in a proposition to be proved and in the auxiliary propositions employed in the demonstration. In the proof itself attention is fixed upon the relations which are relevant to the matter in hand so that the demonstration is made general and is quite independent of the extraneous properties involved in the form of the particular figure employed. The construction of the figure is usually so well defined in words that the reader could easily draw one for himself if the author did not supply it. Such a diagram is a good one if it sets forth clearly those features which are involved in the proposition to be demonstrated.

Diagrams in Chemistry and Crystallography. — John Dalton (*q.v.*) published many diagrams setting forth his conception of the configurations of the atoms in a large number of common chemical compounds; and the method has since been widely used by chemists. With the advance of chemistry it has been found that there are many pairs of substances such that the two substances in a given pair have the same molecular formula while they differ widely in some of their important properties. This difference of properties, where there is identity of molecular formulae and where we are forced to admit the same atomic linking, can be explained only by ascribing the difference to a different space distribution of the atoms in the molecule. This has given rise to the development of a branch of chemistry dealing with stereo-isomerism, a subject in which the space diagrams of the positions of atoms play an important rôle in the explanation of structure. Similarly, in crystallography (*q.v.*) diagrams are likewise employed freely in the explanation of crystal structure. In recent years we have had a like analysis of atomic structure itself by means of diagrams.

Diagrams Showing Measurements. — In a quite different way, diagrams may be used for purposes of measurement; they are then called *metrical diagrams.* The plans and designs of architects and engineers, necessarily drawn to scale and made as accurate as possible, are employed in determining various dimensions of the objects represented, by measuring the lengths of corresponding lines in the diagrams. Such diagrams serve a purpose far beyond that of mere illustration; they afford a means of actual measurements relating to the objects themselves. They are strongly contrasted with diagrams of illustration, which are suggestive merely and need not show the forms of the parts provided only their relevant connections are properly exhibited. Of the latter kind are many diagrams in the mathematical subject of analysis situs (*q.v.*) and also those employed to show electrical connections, as, for instance, in the descriptions of radio receivers

Geographical maps afford examples of diagrams of still another sort. In these the distances and relative positions among places on the earth are exhibited by their positions on the maps. By means of colours important features of various areas are often indicated, as, for instance, their political connections, or their geological character, or the distribution of rainfall or other climatic features, or the distribution of terrestrial magnetism, or the variation of elevation above sea level. The heights of places above sea level are often indicated also by the insertion of numbers on the map to indicate the number of feet above sea level of each place so designated. Another (and more effective) method of serving the same purpose is that in which a line called a contour line is drawn through all places on the map having the same height above sea level. When such contour lines are drawn sufficiently close together and when each of them is marked in one or more places with a number to denote the height above sea level of the places through which it passes, we may obtain from them precise information concerning the character of the surface of the country. In this method the diagram is partly graphical and partly symbolic, and some things are presented by the contour lines and accompanying numbers which are not shown by the relations among the parts of the diagram itself.

Diagrams for Objects Having Three Dimensions. — It is possible to use a system of diagrams for the graphical representation of the relations among any set of magnitudes involving more than two variables. In particular, to represent the relations among the parts of an object having a distribution in three dimensions we may employ two or more diagrams, each of them showing the relations of parts in a single plane or plane section of the object. Thus construction engineers employ plans and elevations and sections in diifferent planes. In such a system of diagrams a definite indication must be given of the way in which the diagrams are severally related to the structure as a whole and to each other. Examples of this type are afforded by the plans for buildings or

for bridge construction. (*See* BRIDGES and ARCHITECTURE.)

But it is also possible to represent solids and other figures in three dimensions by means of a single diagram drawn in a plane. One of the objects of descriptive geometry (*q.v.*) is to develop methods for attaining this end.

The stereoscope (*q.v.*) furnishes a means for the use of two diagrams for the representation of three-dimensional objects in such a way that their forms are readily recognized. The two diagrams are two plane projections of the bodies taken from separated points of view which are yet near to each other. These two plane figures are nearly alike, their difference being due to the difference in point of view. When these two figures are placed in the stereoscope one of them is seen with one eye and the other with the other eye, in such a way that we intuitively identify the corresponding parts of the two figures. In pure geometry the method of projections, which underlies the diagrams used in the stereoscope, has led to many extensions of the science. In fact, on it are founded the principles and results of projective geometry (*q.v.*).

Diagrams in Mechanics. — It is probably in mechanics (*q.v.*), both theoretical and applied, that diagrams have been used for the greatest variety of specific purposes. Their application to statics is particularly convenient, owing to the fact that there is no motion of parts in a statical system. Consequently there has arisen an important branch of knowledge under the name of Graphic Statics. In the *diagram of configuration* it is convenient to represent the objects by points and to denote their relative positions by means of the relative positions of these points. This method is also applicable to the case of bodies in motion, the diagram of configuration then representing the relative positions of the objects at a given instant. If several diagrams of configuration are constructed, one for each of several given instants of time, then, by a comparison of these diagrams, it is possible to see the relative displacements which have taken place in the various intervals of time involved; but the system of configurations will not give the details of the motion during the interval between two consecutive instants for which diagrams of configuration have been constructed.

As an example of a different kind, let us consider the diagram in fig. 1. This is a parallelogram formed from two directed lines *AB* and *AC*, issuing from a common point *A*, by drawing the related lines *CD* and *BD*. Attention is also placed on the directed diagonal *AD* issuing from *A*. We may use *AB* to denote a force applied to an object at *A*, the direction of *AB* representing the direction in which the force acts and the length of *AB* denoting the magnitude of the force. Similarly, *AC* will denote, in magnitude and direction, another force operating upon the same object at *A*. In mechanics it is shown that these two forces operating upon the body at *A* are equivalent, so far as their effect upon *A* is concerned, to a single force operating in the direction of the diagonal *AD* and of a magnitude represented by the length of *AD*. Thus a simple diagram enables us readily to find the (so-called) resultant force *AD* which is equivalent to the two given forces *AB* and *AC*.

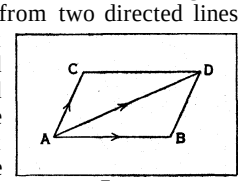


FIG. 1

Now *BD* is equivalent, in direction and length, to *AC*. Hence we might think of the resultant force *AD* as the third side of the triangle determined by the given forces *AB* and *BD*, where it is understood that the force represented by *BD* operates at *A*. Then we may call *ABD* the *triangle of forces*, whereas *ABDC* would be called the *parallelogram of forces*. Now the triangle of forces is capable of a ready generalization, which we shall describe by aid of fig. 2. Let several forces all operate upon an object at *A;* and let the magnitudes and directions of these forces be respectively those which are indicated by the directed lines *AB, BC, CD, DE*, placed end to end as in the figure. (These lines may or may not be in one plane.) Then *AE* will represent, both in magnitude and direction, a single force which is equivalent, in its effect upon the object at *A*, to the combined effects of the several forces denoted by *AB, BC, CD* and *DE*, respectively. This figure *ABCDE* is called a *polygon of forces*. If there is added to the system of given forces already described a single force *EA* acting upon *A* but having the direction and magnitude denoted by EA, then the new system of forces will be in equilibrium in the sense that their combined effect upon the object *A* will be to leave that object undisturbed in position. The diagram afforded by the polygon of forces furnishes one of the most important means in mechanics for the analysis of the relations of forces.

Now the meaning of a diagram depends upon the point of view from which one considers it. This is well illustrated by the diagrams afforded by figs. 1 and 2, as we shall now show by giving interpretations of them in terms of velocities and accelerations. If *AB* and *AC* in fig. 1 denote velocities, both in magnitude and in direction, then *AD* denotes the resultant velocity. Thus if *AB* denotes the velocity of a ship relative to the earth and if *AC* denotes the velocity with which one is walking relative to the deck of the ship, then *AD* will represent, both in magnitude and in direction, the velocity of the walker relative to the earth. The combination, or *composition*, of several velocities is represented in a similar way by the polygon in fig. 2. Again, if *AB* and *AC* in fig. 1 denote accelerations, then *AD* denotes the resultant acceleration which is equivalent to a combination of the two given accelerations; and this may of course be extended to the case of the polygon of accelerations. These diagrams afford one of the most important means for the investigation of velocities and accelerations.

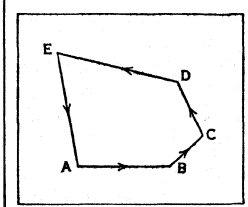


FIG. 2

Work and the Indicator Diagram. — If *AB*, in fig. 3, represents the path of a moving body and if for each position P of that body the force acting upon it, in the line of motion and opposed to its motion, is represented in any convenient scale by the length of the perpendicular PO from *AB* to the curve *COD*, then the area of the figure *ABDC* represents (in a corresponding scale) the work required to be done upon the moving body during its motion from *A* to *B*.

If the piston of an engine is moving back and forth along the line *AB* in fig. 4 and if the area *ABDEC* represents the work done on the piston in moving from *A* to *B* while the area *ABDFC* represents the work done by the piston against retarding forces on its return stroke, then the area *CFDEC* will represent the effective work which may be accomplished by the piston thrust in a single back and forth motion. The figure by means of which this effective work done by the piston is shown is known as the *indicator diagram* of the motion of the piston. It is of fundamental importance in analysing the effective working capacity of the engine.

Other Diagrams. — Brief definitions of various other diagrams will now be given. In an *Argand diagram* the complex numbers $x+yi$ are represented by corresponding points (x, y) with reference to a system of rectangular co-ordinates in a plane. An *automatic diagram* is one which is constructed automatically by a machine to show the related variations of two variables, as, for instance, the change of temperature with time during the day; in these cases the completed diagram often consists of a graph drawn automatically upon specially prepared co-ordinate paper. In many cases of this sort a piece of paper is made to move (uniformly or otherwise) in a given direction, let us say horizontally, while a tracing pencil point is made to move vertically across it, the height of the tracing point varying proportionately to the magnitude of the quantity whose variation is to be registered. Machines of this sort are employed for the automatic registration of phenomena of many kinds, from those in meteorology and the theory of magnetism and electricity to those connected with the movements of plants and animals.

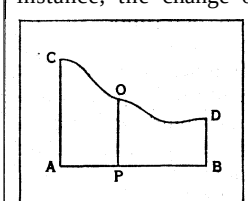


FIG. 3

An *entropy diagram* shows the change of entropy in a thermodynamic cycle. *Euler's diagram* gives a graphic representation of logical relations, circles or other figures being used to denote (by their enclosed surfaces) the classes of objects to which given pred-

icates apply; many other logical relations have also been denoted by various diagrams. In a *frame diagram* the positions of joints are shown by points and the connecting links by lines; it is often united with a diagram of forces showing the components of force through the various joints. *Hertz's diagram* represents the changes of temperature, pressure and moisture of a given mass of air when its volume is changing adiabatically; and *Neuhoff's diagram* is analogous to it. In *Newton's diagranz* colours are represented by points, with weights attached to them to denote intensities of luminosity, while the arrangement of points is such that those which are on the same straight line can be produced by the mixtures of two colours. The *Puiseux diagram* is a certain collocation of points employed in mathematics in the study of functions. In two *reciprocal diagrams* each point of junction of lines in either diagram corresponds to a closed polygon in the other.

A strain diagram is a figure which shows the relation between the amount of stress applied by pressure or otherwise to a test piece of material and the strains which it undergoes on account of this stress. It is usually drawn automatically by means of an instrument attached to the machine and the piece being tested, the deformations being amplified by aid of a suitable mechanism. A *stress diagram* is a figure in which each joint of a framework is represented by a funicular polygon (such a figure as is formed by a string supported at the ends and acted on by several pressures), while each link in the frame is represented by a line belonging to one or more of the funicular polygons; it is also called a *funicular diagram. A variation diagranz* sets forth the changes in the indicator diagram of an engine for successive strokes of the piston; it is used to determine whether the governor is acting properly. The word *diagram* is also used in numerous other combinations many of which are self-explanatory.

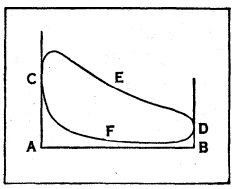


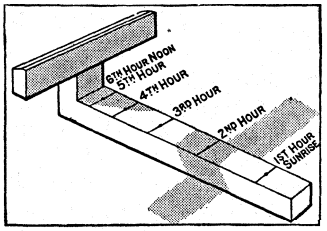
FIG. 4

Diagrams appear in literature mainly as incidental to the subjects in connection with which they are employed, as has been indicated in the course of the article. Consequently the bibliographies are to be found by consulting the articles dealing with these subjects. (R. D. CA.)

DIALA, the largest tributary of the Tigris rises in the Persian highlands near Merivan and, for a short distance south of Haleboja, forms the Perso-Iraq frontier. It joins the Tigris just south of Baghdad. After leaving the Jebel Hamrin the river runs over shingle deposits and is extensively used for irrigation. The principal canals are the Beled Ruz and the Khorassan on the left bank and the Khalis and its branches on the right. Baquba lies at the end of the Khorassan canal, 52 miles from the mouth. This region is extremely fruitful and the river is navigable as far as this point from December to April. The metre gauge railway operating from Baghdad to Kirkuk runs along the valley of the Diala and offers a further outlet for the development of this well watered region.

DIAL and **DIALLING.** Dialling, sometimes called gnomonic~treats of the construction of sundials, that is, of those instruments, either fixed or portable, which determine the divisions of the day (Lat. *dies)* by the motion of the shadow of some object on which the sun's rays fall. It must have been one of the earliest applications of a knowledge of the apparent motion of the sun; though for a long time men would probably be satisfied with the division into morning and afternoon as marked by sun-rise, sun-set and the greatest elevation.

History. — The earliest mention of a sundial has been thought to be found in Isaiah xxxviii. 8: "Behold, I will bring again the shadow of the degrees, which is gone down in the *sundial* of Ahaz, ten degrees backward." But a more correct translation may be "down the *steps* of Ahaz, 10 steps backwards." The date of this would be about 700 years before the Christian era, but there is no evidence that there was a sundial. The earliest of all sundials of which we have any certain knowledge is a ⌐-shaped Egyptian dial in the Berlin museum, in which the upright of the ⌐ throws longer or shorter shadows along the horizontal limb which is divided into six hours. Another early classical type was the hemicycle, or hemisphere, of the Chaldean astronomer Berosus, who probably lived about 300 B.C. It consisted of a hollow hemisphere placed with its rim perfectly horizontal, and having a style, the point of which was at the centre. So long as the sun remained above the horizon the shadow of the point would fall on the inside of the hemisphere, and the path of the shadow during the day would be approximately a circular arc. This arc, divided into 12 equal parts, determined 12 equal intervals of time for that day. Now, supposing this were done at the time of the solstices and equinoxes, and on as many intermediate days as might be considered sufficient, and then curve lines drawn through the corresponding points of division of the different arcs, the shadow of the bead falling on one of these curve lines would mark a division of time for that day, and thus we should have a sundial which would divide each period of daylight into 12 equal parts. These equal parts were called *temporary hours;* and, since the duration of daylight varies from day to day, the temporary hours of one day would differ from those of another; but this inequality would probably be disregarded at that time, and especially in countries where the variation between the longest summer day and the shortest winter day is much less than in our climate.



AFTER A RESTORATION BY BREASTED FROM ORIGINAL IN BERLIN MUSEUM

FIG. 1.— EARLY EGYPTIAN SUNDIAL OF PERIOD OF THOTHMES III., *c.* 1500 B.C.

In the morning the crosspiece was turned to the east. and in the afternoon to the west

The dial of Berosus remained in use for centuries. The Arabians, as appears from the work of Albategnius, still followed the same construction about the year A.D. 900.

Herodotus recorded that the Greeks derived from the Babylonians the use of the gnomon, but the great progress made by the Greeks in geometry enabled them in later times to construct dials of great complexity and ingenuity. Ptolemy's *Almagest* treats of the construction of dials by means of his *analemma,* an instrument which solved a variety of astronomical problems. The constructions given by him were sufficient for regular dials, that is, horizontal dials or vertical dials facing east, west, north, or south, and these are the only ones he treats of. It is certain, however, that the ancients were able to construct declining dials, as is shown by that most interesting monument of ancient gnomics — the Tower of the Winds at Athens. This is a regular

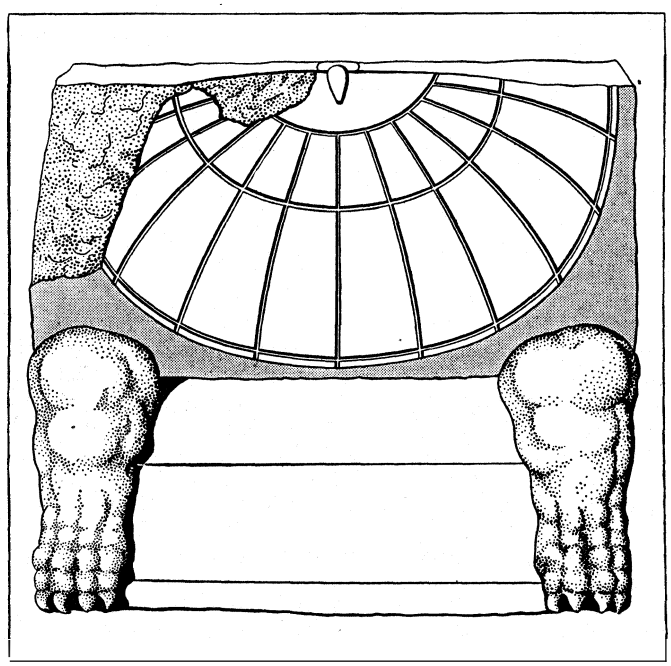


FIG. 2.— HEMICYCLIC DIAL. FOUND IN POMPEII IN 1854

octagon, on the faces of which the eight principal winds are represented, and over them eight different dials—four facing the cardinal points and the other four facing the intermediate directions. The date of the dials is apparently coeval with that of the tower; for there has been found at Tenos a marble block with similar dials inscribed with the name of Andronicus Kyrrhestes, the builder of the tower. The hours are still the temporary hours or *hectemoria.*

The first sundial erected at Rome was in the year 290 B.C., and this Papirius Cursor had taken from the Samnites; but the

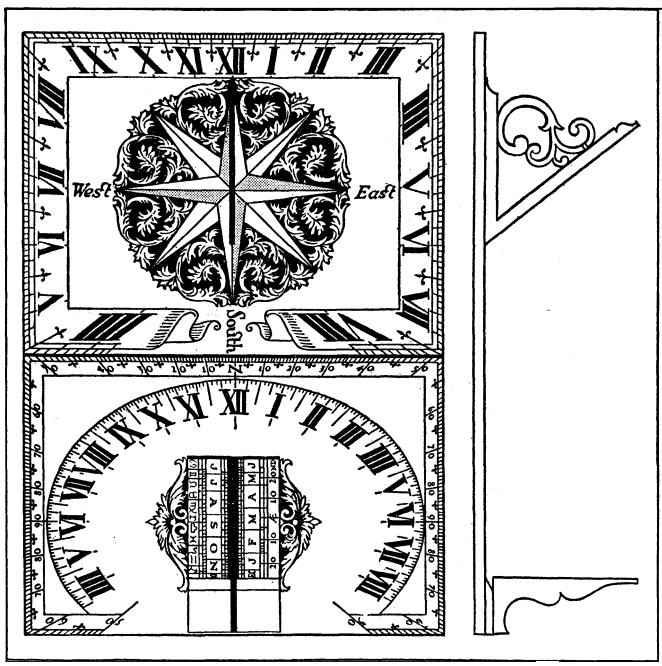


FIG. 3.— PORTABLE ANALEMMATIC SUNDIAL OF THE 16TH CENTURY
This consists of two dials. When they have been so adjusted that the two readings agree, the correct time is indicated

first dial actually constructed for Rome was made in 164 B.C., by order of Q. Marcius Philippus. Vitruvius mentions 13 kinds of dials, including portable dials, the most interesting examples of which are the "Ham" dial, excavated at Herculaneum and the adjustable circular dial in the Lewis Evans collection at Oxford.

The Arabians were much more successful. They attached great importance to gnomonics, the principles of which they had learned from the Greeks; but they greatly simplified and diversified the Greek constructions. One of their writers, Abu'l Hassan, who lived about the beginning of the 13th century, taught them how to trace dials on cylindrical, conical, and other surfaces. He even introduced *equal* or *equinoctial hours* which were used for astronomical purposes while the temporary hours alone continued in use.

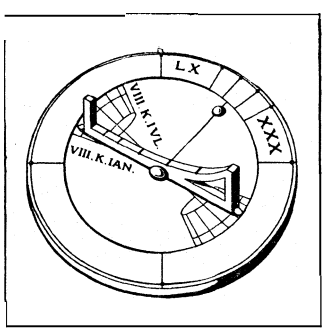


FIG. 4.— ROMAN PORTABLE DIAL
Portable dials were generally of pocket size. The one above dates from about A.D. 250 and has adjustments for the seasons and for latitude from 30° to 60°

The great and important step already conceived by Abu'l Hassan, and perhaps by others, of reckoning by *equal* hours, was probably adopted between the 13th to the beginning of the 16th century. The change would necessarily follow the introduction of striking clocks in the earlier part of the fourteenth century; for, however imperfect these were, the hours they marked would be of the same length in summer and in winter, and the discrepancy between these equal hours and the temporary hours of the sundial would soon be too important to be overlooked. Now, we know that a striking clock was put up in Milan in 1336, and we may reasonably suppose that the new sundials came into general use during the 14th and 15th centuries.

Among the earliest of the modern writers on gnomonics was Sebastian Miinster (*q.v.*), who published his *Horologiographia* at Basle in 1531. He gives a number of correct rules, but without demonstrations. Among his inventions was a moon-dial. A dial

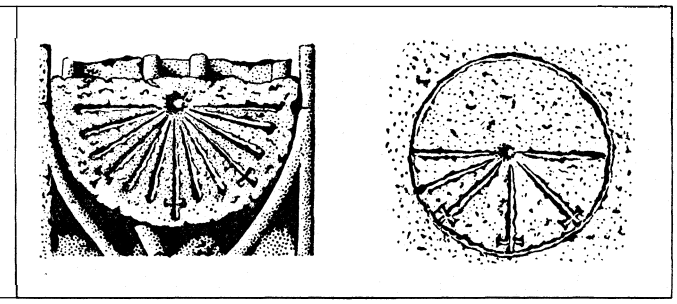
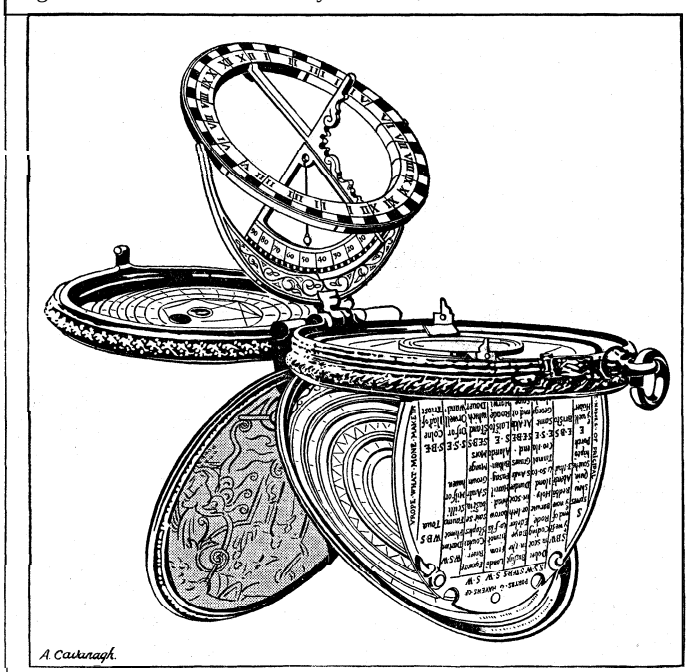


FIG. 5.— EARLY SUNDIALS WITH TIDE-LINES (LINES WITH CROSSES) MARKING THE FOUR "TIDES" INTO WHICH THE SAXONS DIVIDED THEIR DAY
Left: Earliest English Sundial, Bewcastle Cross. Right: Saxon Sundial at Daglingworth, Gloucestershire

adapted for use as a moon-dial when the moon's age is known, may be seen in Queens' college, Cambridge.

During the 17th century dialling was a special branch of education. The great work of Clavius, a quarto volume of 800 pages, was published in 1612, and may be considered to contain all that was known at that time.

In the 18th century clocks and watches began to supersede sundials, and the latter gradually fell into disuse, except dials in a garden or in remote country districts, where the old dial on the



BY COURTESY OF THE SOCIETY OF ANTIQUARIES OF LONDON, FROM ARCHAEOLOGIA, VOL. 76
FIG. 6.— DRAKE'S PORTABLE DIAL BY HUMPHREY COLE. A.D. 1569
The Equatorial Dial is set for latitude by the quadrant, and in the meridian by the magnetic compass. The instrument includes a tide-table, a nocturnal, a diagram of planetary aspects, and a circumferentor

church tower still serves as an occasional check on the modern clock by its side.

General Principles.— The daily and the annual motions of the earth are the elementary astronomical facts on which dialling is founded. That the earth turns upon its axis uniformly from west to east in 24 hours and that it is carried round the sun in one year at a nearly uniform rate is the correct way of expressing these facts. But the effect will be precisely the same, and it will suit our purpose better and make our explanations easier, if we adopt the ideas of the ancients, of which our senses furnish apparent confirmation, and assume the earth to be fixed Then, the sun and

stars revolve round the earth's axis uniformly from east to west once a day—the sun lagging a little behind the stars, making its day some four minutes longer—so that at the end of the year it finds itself again in the same place, having made a complete revolution of the heavens relatively to the stars from west to east.

The fixed axis about which all these bodies revolve daily is a line through the earth's centre; but the radius of the earth is so small, compared with the enormous distance of the sun, that, if we draw a parallel axis through any point of the earth's surface, we may safely look on that as being the axis of the celestial motion. The error in the case of the sun would not, at its maximum, that is, at 6 A.M. and 6 P.M., exceed half a second of time, and at noon would vanish. An axis so drawn is in the plane of the meridian, it points to the pole, and its elevation is equal to the latitude of the place.

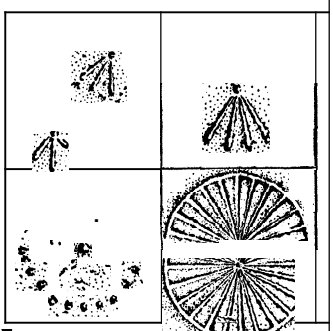


FIG. 7.—SCRATCH DIALS, COMMON UPON EARLY ENGLISH CHURCH WALLS

The diurnal motion of the stars is strictly uniform, and so would that of the sun be if the daily retardation of about four minutes, spoken of above, were always the same But this is constantly altering, so that the time, as measured by the sun's motion, and also consequently as measured by a sundial, does not move on at a strictly uniform pace. This irregularity, which is slight, would be of little consequence in the ordinary affairs of life, but clocks and watches being mechanical measures of time could not, except by extreme complication, be made to follow it.

A clock is constructed to mark uniform time in such wise that the length of the clock day shall be the average of all the solar days in the year. Four times a year the clock and the Sundial agree exactly; but the sundial, now going a little slower, now a little faster, will be sometimes behind, sometimes before the clock—the greatest accumulated difference being about 16 minutes for a few days in November. The four days on which the two agree are April 15, June 15, Sept. 1 and Dec. 24.

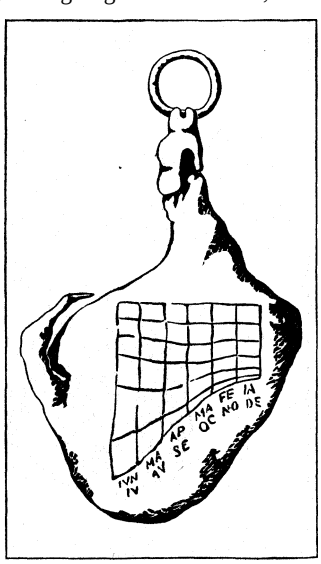


FIG. 8.— HAM DIAL, C. A.D. 50

The index on the left, having been brought over the vertical line of the appropriate month, casts a shadow on the oblique

Clock time is called mean time, that marked by the sundial is called apparent time, and the difference between them is the equation of *time.* It is given in most calendars and almanacs, frequently under the heading "clock slow," "clock fast." When the time by the sundial is known, the equation of time will at once enable us to obtain the corresponding clock time, or vice versa.

The general principles of dialling will now be readily understood. The problem before us is the following.--A rod, or *style,* as it is called, being firmly fixed in a direction parallel to the earth's axis, we have to find how and where hour-lines of reference must be traced on some fixed surface behind the style so that when the shadow of the style falls on a certain one of these lines we may know that at the moment it is solar noon—that is, that the plane through the style and through the sun then coincides with the meridian; again, that when the shadow reaches the next line of reference it is 1 o'clock by solar time, or, which comes to the same thing, that the above plane through the style and through the sun has just turned through the 24th part of a complete revolution; and so on for the subsequent hours, the hours before noon being indicated in a similar manner.

The position of an intended sundial having been selected, the surface must be prepared, if necessary, to receive the hour-lines. The style must be accurately fixed in the meridian plane, and must make an angle with the horizon equal to the latitude of the place. The latter condition will offer no difficulty, but the exact determination of the meridian plane which passes through the point where the style is fixed to the surface is not so simple.

The position of the XII o'clock line is the most important to determine accurately, since all the others are usually made to depend on this one. R e cannot trace it correctly on the dial until the style has been itself accurately fixed in its proper place. When that is done the XII o'clock line will be found by the intersection of the dial surface with the vertical plane which contains the style; and the most simple way of drawing it on the dial will be by suspending a plummet from some point of the style whence it may hang freely, and waiting until the shadows of both style and plumb-line coincide on the dial. This single shadow will be the XII o'clock line In one class of dials, namely, all the vertical ones, the XII o'clock line is simply the vertical line from the centre; it can, therefore, at once be traced on the dial face by using a fine plumbline. The XII o'clock line being traced, the easiest and most accurate method of tracing the other hour lines would, at the present day when good watches are common, be marking where the shadow of the style falls, when 1, 2, 3, etc., hours have elapsed since noon, and the next morning by the same means the forenoon hour lines could be traced; and in the same manner the hours might be subdivided into halves and quarters, or even into minutes. But formerly, when watches did not exist, the tracing of the I, II, III, etc., o'clock lines was done by calculating the angle each would make with the XII o'clock line.

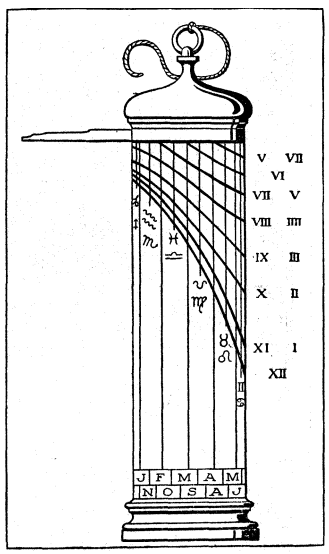


FIG 9.—CYLINDER OR SHEPHERD'S DIAL, A.D. 1531

The artist has shown all the months of the year on one side of the cylinder. In modern examples of the dial used in the Pyrénées, the lines for 6 months only would appear on one side

Dials received different names according to their position:—*Horizontal* dials, when traced on a horizontal plane; Vertical dials, when on a vertical plane facing one of the cardinal points; Vertical declining dials, when on a vertical plane not facing a cardinal point; Inclining dials, when traced on planes neither vertical nor horizontal (these were further distinguished as reclining when leaning backwards from an observer, *proclining* when leaning forwards); Equinoctial dials, when the plane is at right angles to the earth's axis, etc.

There are many early vertical south dials of great archaeological interest on the walls of English churches. The simplest of all are the Anglo-Saxon dials, in which the day is divided into four tides of three hours each. A good example may be seen at Daglingworth. In the dial on Bewcastle Cross of the 7th century, hour lines have been intercalated between the early tide lines, which are marked with crosses. Upon church walls of the Early English period Scratch dials or Mass dials of various types are often found. In their simplest form they consist of a few hour lines radiating from a central hole in which a wooden style would have been inserted. A vertical noon line is always present. Lines at right angles to it would have been for 6 A.M. and 6 P.M., and one half way between the former and the noon line would have been for 9 A.M. Occasionally a circle of holes takes the place of the hour lines

In the commonest type of horizontal dials the dial plate is of metal, as well as the vertical piece upon it, and they may be purchased ready for placing on the pedestal, the dial with all the

hour lines traced on it and the style plate firmly fastened in its proper position, or cast in the same piece with the dial plate.

When placing it on the pedestal care must be taken that the dial be perfectly horizontal and accurately oriented. The levelling will be done with a spirit level and the orientation will be best effected either in the forenoon or in the afternoon, by turning the dial plate till the time given by the shadow (making the small

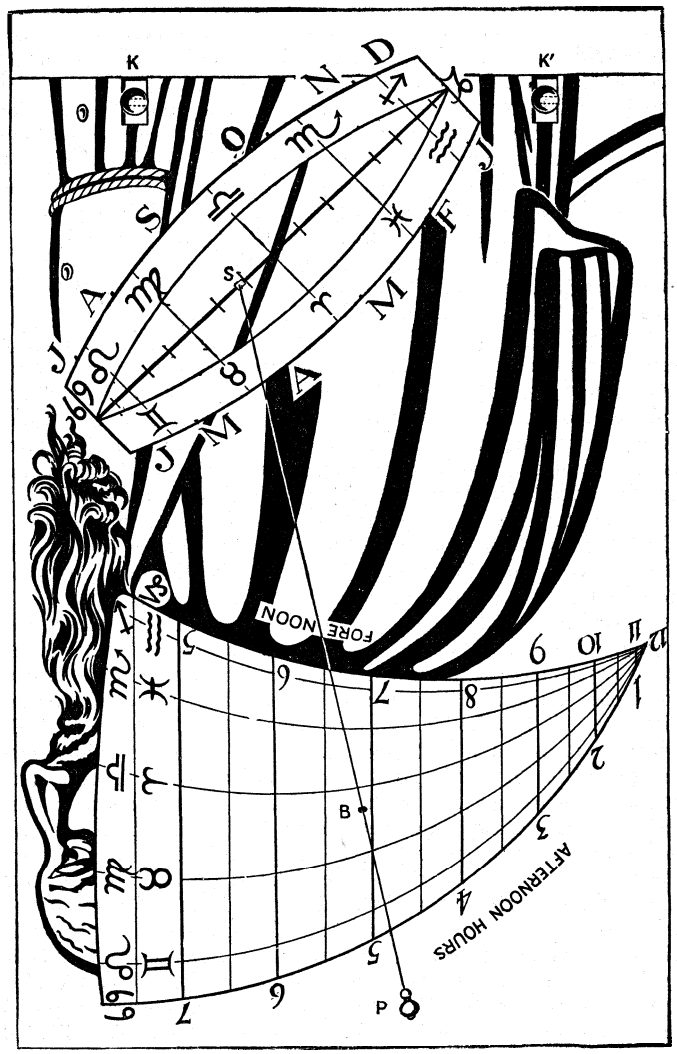


FIG. 10.—THE CAPUCHIN. A FLAT ALTITUDE DIAL OF THE 17TH CENTURY
In use, the end S. of the plumb line, SP, is moved along a slot to the day of the month, and the bead, B', is shifted to the hour 12. The sights, KK', at the upper edge, are then pointed at the sun, and the bead on the plumb line will show the hour. In Sir John Findlay's Collection

correction mentioned above) agrees with a good watch whose error on solar time is known. It is, however, important to bear in mind that a dial, so built up beforehand, will have the angle at the base equal to the latitude of some selected place, such as London, and the hour lines will be drawn in directions calculated for the same latitude. Such a dial, therefore, could not be used near Edinburgh or Glasgow, although, it would, without appreciable error, be adapted to any place whose latitude did not differ more than 20 or 30m. from that of London.

Portable Dials were made generally of a small size, so as to be carried in the pocket; and these, so long as the sun shone, answered the purpose of a watch. The description of the portable dial has often been mixed up with that of the fixed dial, as if it had been merely a special case, and the same principle had been the basis of both; but although some are like the fixed dials, with the addition of some means for orientating the dial, others depend on the *very irregularly* varying zenith distance of the sun.

Portable dials fall into two main classes: *Altitude Dials* and *Compass Dials*.

I. Altitude Dials find the time from the altitude of the sun, allowance being made for the season of the year. An early example was the Roman Ham dial excavated at Herculaneum under the Vesuvian muds of the eruption of A.D. 79. It is marked with the months of July and August and must therefore be more recent than 27 B.C. It was only serviceable in one latitude. A more useful type of altitude dial "for all climates," as Vitruvius describes it, is a Roman dial of about A.D. 250 in the Lewis Evans collection, which has adjustments both for the seasons and for latitude from 30° to 60°. Another form of altitude dial is known as the Shepherd's dial or Cylinder dial. The earliest description of them is by Hermannus Contractus (1013–1054), and they are still in use among the peasants in the Pyrénées.

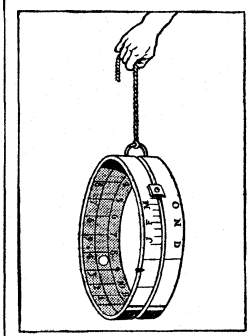


FIG. 11.—ENGLISH RING DIAL, WHICH ALLOWS FOR CORRECTIONS FOR DAYS OF THE YEAR AND FOR LATITUDE ADJUSTMENT

In this type there is a horizontal gnomon and the hour lines are curves of the length of the shadow of this gnomon on a vertical surface, according to the hour and season. These curves are drawn either on a cylinder or a flat surface. The seasons are represented by vertical lines, and the gnomon is moved to the appropriate line, the dial being so placed that the shadow falls perpendicularly and the hour read on the hour line.

A very neat and ingenious flat altitude dial on *a Card* is attributed by Ozanam to a Jesuit Father, De Saint Rigaud, but it dates from the time of Regiomontanus. It was sometimes called the capuchin, from some fancied resemblance to a cowl thrown back.

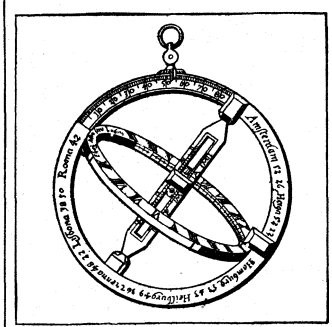


FIG. 12.—ASTRONOMICAL RING DIAL MADE BY ELIAS ALLEN
The outer ring shows approximate latitudes of Amsterdam, The Hague, Hamburg, Heilburg, Vienna. Lisbon and Rome

Other altitude dials are the Quadrant dials, Ring dials, and Universal Ring dials. The Ring dial consists of a ring of brass that can be suspended by a small loop. A second, sliding ring within the first is drilled with a conical hole, with its apex towards the inside. When the sun's rays pass through this hole they make a spot of light upon the opposite inner surface of the ring, which is divided by hour lines. The time can thus be read off. The sliding ring is for adjustment for the latitude of the place, and the hour lines run diagonally for correction for the season of the year.

In the Universal Astronomical Ring dial a metal ring represents the meridian, and is suspended by a small ring and shackle adjustable for latitude. Pivoted to the meridian ring, so that it will fold within it when not in use, is a second or equatorial ring, divided into the 24 hours. On the line of the polar axis is a flat metal plate with a longitudinal slot, in which slides a block with a pinhole in it. This being adjusted for the sun's declination by means of a scale on the plate, and the instrument suspended with its meridian circle in the meridian, the rays of the sun passing through the pinhole will fall on the hour of the equatorial circle.

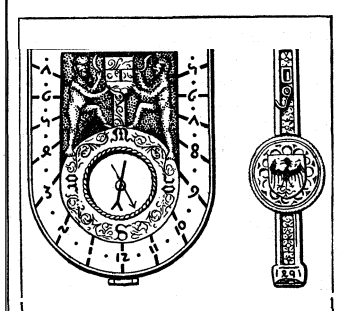


FIG. 13.—THE OLDEST KNOWN COMPASS DIAL. A.D. 1451
This was probably made at Nuremberg, and is now at Innsbruck

II. *Compass Dial;* made their appearance in the 15th century, some 150 years after the description of the magnetic compass by Peter Peregrinus. In their simplest form they consist merely of a horizontal dial and a compass; but to these numerous acces-

sories were added in rapid succession, the most important being an adjustment for change of latitude, a plummet for levelling, subsidiary vertical and other dials for showing the various kinds of hours in use, a wind rose, volvelles for showing the phases of the moon or for use as adjustable calendars. These and other devices exercised the ingenuity of the master craftsmen of Augsburg and Nuremberg, who vied with one another in the construction of a beautiful series of timepieces, which passed into all the countries of Europe. They were made of metal, wood, or ivory and the gnomons were either of metal or of a string that could be threaded through holes so as to vary the inclination with the latitude.

A second type of compass dial is the Equatorial dial, in which the plane of the dial is at right angles to the style and can be adjusted parallel to the equator. It is the- simplest of all- dials. A circle, divided into 24 equal arcs, is placed at right angles to the style, and hour divisions are marked upon it. Then, if care be taken that the style point accurately to the pole and that the noon division lies in the meridian plane, the shadow of the style will fall on the other divisions, each at its proper time. The divisions must be marked on both sides of the dial, because the sun will shine on opposite sides in the summer and in winter.

Equatorial dials were very widely used in the 17th and 18th centuries and were sometimes combined with geared clock movements, by which the hour and minute could be read on a clock face.

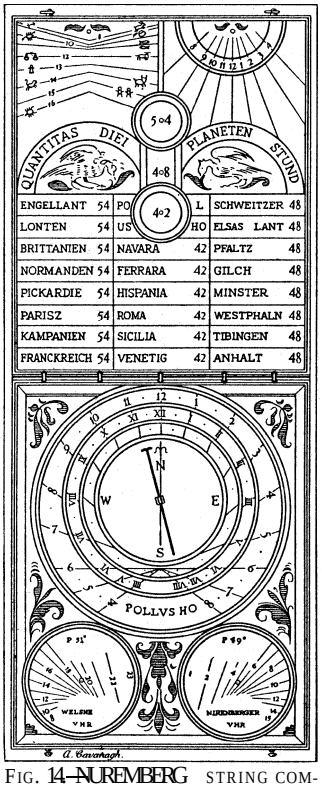


FIG. 14.—NUREMBERG STRING COMPASS DIAL, c. A.D. 1570

This was made in ivory by Hans Ducher. In the four corners are (1) Dial showing length of day. (2) Dial for "ancient" or "planetary" hours. (3) Dial for Italian hours for latitude 51°. (4) Dial for Babylonian hours for latitude 49°. The table of latitudes of towns is for setting the string gnomon of the compass dial

The Analemmatic Sundial differs from other portable sundials in that it can be set for finding the time without a compass. It includes two dials, an ordinary horizontal dial and an elliptical dial with a perpendicular gnomon which is set to the declination on a scale of months and days engraved along the minor axis of the ellipse. In use, the two styles cast two shadows on their respective hour scales. The instrument is then turned about until the two readings agree; when this happens the hour indicated is the correct time and the central line is true north and south.

Nocturnals were dials used for finding time by certain circumpolar stars.

BIBLIOGRAPHY.—The following list includes the principal writers on dialling whose works have come down to us, and to these we must refer for descriptions of the various constructions, some simple and direct, others fanciful and intricate, which have been at different times employed: Ptolemy, *Analemma,* restored by Commandine; Vitruvius, *Architecture;* Regiomontanus, *Calendarum Romanum;* Sebastian Miinster, *Horologiographia;* Orontius Fineus, *De horologiis solaribas;* Mutio Oddi da Urbino, *Horologi solari;* Dryander, *De horologiorum comporitione;* Conrad Gesner, *Pandectae;* Andrcas Schöner, *Gnomonicae; F.* Commandine, *Horologiorum descriptio;* Joan. Bapt. Benedictus, *De gnomonurn usu;* Georgius Schomberg, *Exegesis fundamentorum gnomonicorum;* Joan Solomon de Caus, *Horologes solaires;* Joan. Bapt. Trolta, *Praxis horologiorum;* Desargues, *Manière universelle pour poser l'essieu,* etc.; Ath. Kircher, *Ars magna lucis et Umbrae;* Hallum, *Explicatio horologii in horto regio Londini;* Joan. Mark, *Tractatus horologiorum;* Clavius. *Gnomonices de horologiis.* Also among more modern writers, Deschales, Ozanam, Schottus, Wolfius, Picard, Lahire, Walper; in German, Paterson, Michael, Miiller; in English, Foster, Wells, Collins, Leadbetter, Jones, Leybourn, Emerson, Ferguson, Evans and Sir J. Findlay. *See* also Gatty, *Book of Sundials* (enlarged, 1900); Horne, *Scratch Dials* (Taunton, 1917); Drecker, *Theorie der Sonnenuhren* and *Zeitmessung* (1925). (H. Go.; R. T. G.)

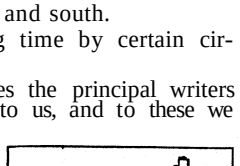


FIG. 15.—A NUREMBERG STRING COMPASS DIAL

DIALECT, a characteristic manner of speech, so any variety of a language (from Gr. **διάλεκτος,** conversation, manner of speaking). In its widest sense languages which are branches of a common or parent language are its "dialects" as Attic, Ionic, etc. and the various Romance languages of Latin. Where there have existed side by side, as in England, various branches of a language, such as the languages of the Angles, the Jutes or the Saxons, and the descendant of one particular language has predominated, the traces of the others remain in the "dialects" of the districts where once the original language prevailed. Thus "dialect" varieties of a language need not, historically, represent degradations. **A** "literary" accepted language, such as modern English, represents the original language spoken in the Midlands, with accretions of various sources, while the present-day "dialects" preserve traces of the original local variety of the language. See the articles on languages (English, French, etc.).

DIALECTIC (DIALECTICS), a logical term, generally used in common parlance in a contemptuous sense for verbal or purely abstract disputation devoid of practical value (from Gr. **διάλεκτος,** discourse, debate; **ἡ διαλεκτική, *sc.* τέχνη,** the art of debate). According to Aristotle, Zeno of Elea "invented" dialectic, the art of disputation by question and answer, while Plato developed it metaphysically in connection with his doctrine of "Ideas" as the art of analysing ideas in themselves and in relation to the ultimate idea of the Good (*Repub.* vii.). The special function of the so-called "Socratic dialectic" was to show the inadequacy of popular beliefs. Aristotle himself used "dialectic," as opposed to "science," for that department of study which examines the presuppositions lying at the back of all the particular sciences. Each particular science has its own subject matter and special principles (**ἴδιαι ἀρχαί**) on which the superstructure of its special discoveries is based. The Aristotelian dialectic, however, deals with the universal laws (**κοιναὶ ἀρχαί**) of reasoning, which can be applied to the particular arguments of all the sciences. The sciences, for example, all seek to define their own species; dialectic, on the other hand, sets forth the conditions which all definitions must satisfy whatever their subject matter. Again, the sciences all seek to educe general laws; dialectic investigates the nature of such laws, and the kind and degree of necessity to which they can attain. To this general subject matter Aristotle gives the name "Topics" (**τόποι,** loci, communes loci). "Dialectic" in this sense is the equivalent of "logic." Aristotle also uses the term for the science of probable reasoning as opposed to demonstrative reasoning (**ἀποδεικτική**). The Stoics divided **λογική** (logic) into rhetoric and dialectic, and from their time till the end of the middle ages dialectic was either synonymous with, or a part of, logic.

In modern philosophy the word has received certain special meanings. In Kantian terminology Dialektik is the name of that portion of the Kritik der *reinen Vernunft* in which Kant discusses the impossibility of applying to "things-in-themselves" the principles which are found to govern phenomena. In the system of Hegel the word resumes its original Socratic sense, as the name of that intellectual process whereby the inadequacy of popular conceptions is exposed. The word, together with other Hegelian terminology was taken over by Karl Marx (*q.v.,* for "Marxian dialectic").

DIALLAGE, a variety of monoclinic pyroxene (*q.v.*) usually aluminous (see AUGITE), characterized by a prominent parting parallel to the orthopinacoid (100) and often showing a fibrous structure. The schiller appearance of diallage is due as in bronzite (*q.v.*) to the interposition along the plane (100) of thin plates of ilmenite, which facilitate mechanical separation along this plane. Lamellar twinning on (100) is also not uncommon. These inclusions probably result from unmixing in the solid state of ilmenite in solid solution in diallage at the temperature of crystallization. Fine parallel intergrowths of diallage and rhombic pyroxene are not infrequent in gabbros, of which diallage is

especially characteristic. It is scarcely represented among the younger volcanic rocks.

DIALOGUE, properly the conversation between two or more persons, reported in writing, a form of literature invented by the Greeks for purposes of rhetorical entertainment and instruction, and scarcely modified since the days of its invention. A dialogue is in reality a little drama without a theatre, and with scarcely any change of scene.

The systematic use of dialogue as an independent literary form is commonly supposed to have been introduced by Plato, whose earliest experiment in it is believed to survive in the *Laches.* The Platonic dialogue, however, was founded on the mime, which had been cultivated half a century earlier by the Sicilian poets, Sophron and Epicharmus. The works of these writers, which Plato admired and imitated, are lost, but it is believed that they were little plays, usually with only two performers. The recently-discovered mimes of Herodas (Herondas) give us some idea of their scope. Plato further simplified the form, and reduced it to pure argumentative conversation, while leaving intact the amusing element of character-drawing. He must have begun this about the year 405 B.C., and by 399 B.C. he had brought the dialogue to its highest perfection, especially in the cycle directly inspired by the death of Socrates. All his philosophical writings, except the *Apology,* are cast in this form. In the 2nd century A.D., Lucian of Samosata achieved a brilliant success with his ironic dialogues "Of the Gods," "Of the Dead," "Of Love" and "Of the Courtesans." In some of them he attacks superstition and philosophical error with the sharpness of his wit; in others he merely paints scenes of modern life. The title of Lucian's most famous collection was borrowed in the 17th century by two French writers of eminence, each of whom prepared *Dialogues des morts.* These were Fontenelle (1683) and Fénelon (1712). In English non-dramatic literature the dialogue had not been extensively employed until Berkeley used it, in 1713, for his Platonic treatise, *Hylas and Philonus.* Landor's *Imaginary Conversations* (1821–28) is the most famous example of it in the 19th century. In Germany, Wieland adopted this form for several important satirical works published between 1780 and 1799. In Spanish literature, the dialogues of Valdés (1528) and those on painting (1633) by Vincenzo Carducci, are celebrated. In Italian, collections of dialogues, on the model of Plato, have been composed by Torquato Tasso (1586), by Galileo (1632), by Galiani (1770), by Leopardi (1825), and by a host of lesser writers. In modern times the French have returned to the original application of dialogue, and the inventions of "Gyp," of Henri Lavedan and of others, in which a mundane anecdote is wittily and maliciously told in conversation, would probably present a close analogy to the lost mimes of the early Sicilian poets, if we could meet with them.

DIALYSIS, in chemistry, a process invented by Thomas Graham for separating colloidal and crystalline substances. If a salt solution be placed in a drum provided with a parchment bottom, termed a "dialyser," and the drum and its contents placed in a larger vessel of water, the salt will pass through the membrane; hence the derivation (from the Gr. διά, through, λύειν, to loosen). If the salt solution be replaced by one of glue, gelatin or gum, it will be found that the membrane is impermeable to these solutes. To the first class Graham gave the name "crystalloids," and to the second "colloids." By adding hydrochloric acid to a dilute solution of an alkaline silicate, no precipitate will fall, and the solution will contain hydrochloric acid, an alkaline chloride, and silicic acid. If the solution be transferred to a dialyser, the hydrochloric acid and alkaline chloride will pass through the parchment, while the silicic acid will be retained.

DIAMAGNETISM. Substances which, like iron, are attracted by the pole of an ordinary magnet are commonly spoken of as magnetic, all others being regarded as non-magnetic. It was noticed by A. C. Becquerel in 1827 that a number of so-called non-magnetic bodies, such as wood and gum lac, were influenced by a very powerful magnet, and he appears to have formed the opinion that the influence was of the same nature as that exerted upon iron, though much feebler, and that all matter was more or less magnetic. Faraday showed in 1845 *(Experimental Researches,* vol. iii.) that while practically all natural substances are indeed acted upon by a sufficiently strong magnetic pole, it is only a comparatively small number that are attracted like iron, the great majority being repelled. Bodies of the latter class were termed by Faraday *diamagnetics.* The strongest diamagnetic substance known is bismuth, its susceptibility being—0·000014, and its permeability 0.9998. The diamagnetic quality of this metal can be detected by means of a good permanent magnet, and its repulsion by a magnetic pole had been more than once recognized before the date of Faraday's experiments. *(See* MAGNETISM.)

DIAMANTE, JUAN BAUTISTA (1640?–1684?), Spanish dramatist, was born at Castillo about 1640, entered the army, and began writing for the stage in 1657. Like many other Spanish dramatists of his time, Diamante is deficient in originality, and his style is riddled with affectations; *La Desgraciada Raquel,* which was long considered to be his best play, is really Mira de Amescua's *Judia de Toledo* under another title; and the earliest of Diamante's surviving pieces, *El Honrador de su padre* (1658), is virtually a free translation of Corneille's *Le Cid.* Diamante is historically interesting as the introducer of French dramatic methods into Spain.

DIAMANTINA (formerly called *Tejuco*), a mining town of the State of Minas Gerais, Brazil, in the northeastern part of the State, 3,710 ft. above sea level. Pop. about 8,000; the municipality (1940) 53,764. Diamantina is built partly on a steep hillside overlooking a small tributary of the Rio Jequitinhonha (where diamond-washing was once carried on), and partly on the level plain above. The town is roughly but substantially built, with broad streets and large squares. It is the seat of a bishopric, with an episcopal seminary, and has many churches, a lunatic asylum, a theatre, military barracks, hospitals and a secondary school. There are several small manufactures, including cotton-weaving, tanning and shoemaking, and diamond-cutting is carried on. Diamantina is the commercial centre of an extensive region, and has long been noted for its wealth.

The present name of the town was assumed (instead of Tejuco) in 1838, when it was made a *cidade.*

(See MINAS GERAIS.)

DIAMANTINO, a small town of the State of Mato Grosso, Brazil, near the Diamantino river, about 6 mi. above its junction with the Paraguay, in 14° 24′ 33″ S., 56° 8′ 30″ W.

The population of the municipality (1940) is 5,442, mostly Indians. It stands in a broken sterile region 1,837 ft. above sea level and at the foot of the great Mato Grosso plateau. The first mining settlement dates from 1730, when gold was found in the vicinity. On the discovery of diamonds in 1746 the settlement drew a large population and for a time was very prosperous.

The mines failed to meet expectations, however, and the population declined; it has grown slowly since 1880.

Ipecacuanha and vanilla beans are the principal articles of export.

DIAMETER, in geometry, a straight line passing through the centre of a conic section and terminated by the curve (from the Gr. διά, through, μέτρον, measure). The "principal diameters" of the ellipse and hyperbola coincide with the "axes" and are at right angles; "conjugate diameters" are such that each bisects chords parallel to the other. The diameter of a quadric surface is a line at the extremities of which the tangent planes are parallel. Newton defined the diameter of a curve of any order as the locus of the centres of the mean distances of the points of intersection of a system of parallel chords with the curve. The word is also used as a unit of linear measurement of magnifying power.

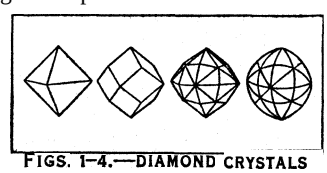
In architecture, the term is used with reference to the lower part of the shaft of a column. It is employed by Vitruvius (iii. 2) to determine the height of a column, and it is generally the custom to fix the lower diameter of the shaft by the height required and the Order employed. Thus the diameter of the Roman Doric should be about one-eighth of the height, that of the Ionic one-ninth and of the Corinthian one-tenth. *(See* ORDER.)

DIAMOND, mineral universally recognized as chief among precious stones; it is the hardest, the most imperishable, and also the most brilliant of minerals. These qualities alone have made it

supreme as a jewel since early times, and yet the real brilliancy of the stone is not displayed until it has been faceted by the art of the lapidary (*q.v.*) and this was scarcely developed before the year 1746. The consummate hardness of the diamond, in spite of its high price, has made it most useful for purposes of grinding, polishing and drilling. Numerous attempts have been made to manufacture the diamond by artificial means, and these attempts have a high scientific interest on account of the mystery which surrounds the natural origin of this remarkable mineral. Its physical and chemical properties have been the subject of much study, and have a special interest in view of the extraordinary difference between the physical characters of the diamond and those of graphite (blacklead) or charcoal, with which it is chemically identical, and into which it can be converted by the action of heat or electricity.

The name *Ἀδάμας* "the invincible," was probably applied by the Greeks to hard metals, and thence to corundum (emery) and other hard stones. According to Charles William King, the first undoubted application of the name to the diamond is found in Manilius (A.D. 16)—Sic *Adamas, punctum lapidis; pretiosior* auro, —and Pliny (A.D. 100) speaks of the rarity of the stone, "the most valuable of gems, known only to kings." Pliny described six varieties, among which the Indian, having six pointed angles, and also resembling two pyramids (turbines, whip-tops) placed base to base, may probably be identified as the ordinary octahedral crystal (fig. 1). The diamond (Yahalom) in the breastplate of the high priest (Ex. xxxix. 11) was certainly some other stone, for it bore the name of a tribe, and methods of engraving the true diamond cannot have been known so early. The stone can hardly have become familiar to the Romans until introduced from India, where it was probably mined at a very early period. But one or other of the remaining varieties mentioned by Pliny (the Macedonian, the Arabian, the Cyprian, etc.) may be the true diamond, which was in great request for the tool of the gem-engraver. Later Roman authors mentioned various rivers in India as yielding the *Adamas* among their sands. The name *Adamas* became corrupted into the forms adamant, diamaunt, *diamant,* diamond; but the same word, owing to a mediaeval misinterpretation which derived it from *adamare* (compare the French word *aimant*), was also applied to the lodestone.

Scientific Characters.— Diamond is almost always found in single crystals, which show no signs of previous attachment to any matrix; the stones were, until the discovery of the South African mines, almost entirely derived from sands or gravels, but owing to the hardness of the mineral it is rarely, if ever, waterworn, and the crystals are often very perfect. The crystals belong to the cubic system, generally assuming the form of the octahedron (fig. 1), but they may, in accordance with the principles of crystallography, also occur in other forms symmetrically derived from the octahedron; e g, the cube, the 12-faced figure known as the rhombic dodecahedron (fig. 2), or the 48-faced figure known as the hexakis-octahedron (fig. 3), or in combinations of these. The octahedron faces are usually smooth; most of the other faces are rbunded (fig. 4). The cube faces are rough with protruding points. The cube is sometimes found in Brazil, but is very rare among the South African stones; and the dodecahedron is perhaps more common in Brazil than elsewhere. The crystals are sometimes tetrahedral in aspect. There are also "twins" of diamond in which two octahedra (fig. 5) are united by contact aiong a surface parallel to an octahedron face; sometimes they interpenetrate. They are generally flattened along the plane of union. The crystals often display triangular markings, either elevations or pits, upon the octahedron faces (fig. 6). They have probably been produced by the action of some solvent. The actual arrangement of the carbon atoms in the crystal has now been ascertained by means of X-ray investigations.



FIGS. 1–4.—DIAMOND CRYSTALS

From left to right, octahedron, eight-faced; rhombic dodecahedron, 12-faced: hexakis-octahedron. 48-faced: and rounded

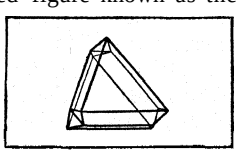


FIG. 5.—TWIN DIAMOND, SHOWING TWO OCTAHEDRA JOINED ALONG A SURFACE PARALLEL TO AN OCTAHEDRON FACE

Diamond possesses a brilliant "adamantine" lustre, but this tends to be greasy on the surface of the natural stones and gives the rounded crystals somewhat the appearance of drops of gum. Absolutely colourless stones are not so common as cloudy and faintly coloured specimens; the usual tints are grey, brown, yellow or white; and as rarities, red, green, blue and black stones have been found. The colour can sometimes be removed or changed at a high temperature, but generally returns on cooling. It is therefore more probably due to metallic oxides than to hydrocarbons. Sir William Crookes has, however, changed a pale yellow diamond to a bluish-green colour by keeping it embedded in radium bromide for 11 weeks. Diamond may break with a conchoidal fracture, but the crystals always cleave readily along planes parallel to the octahedron faces; of this property the diamond cutters avail themselves when reducing the stone to the most convenient form for cutting; a sawing process, however, has now been introduced, which is preferable to that of cleavage. It is the hardest known substance (though tantalum, or an alloy of tantalum, now competes with it) and is chosen as ten in the mineralogist's scale of hardness; the Borneo stones are said to be harder than others. The specific gravity ranges from 3.56 to 3·50, generally about 3·52. The co-efficient of expansion increases very rapidly above 750°, and diminishes very rapidly at low temperatures; the maximum density is attained when a temperature of about −42° Centigrade is reached.

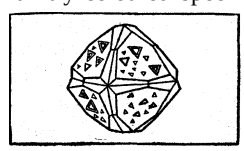
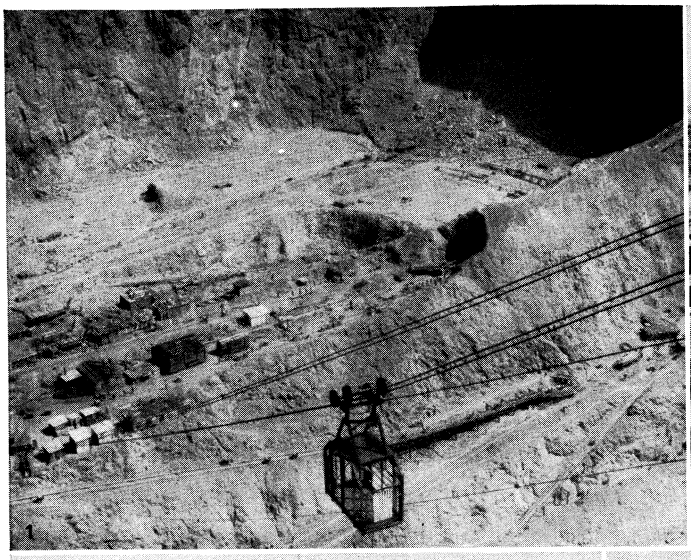


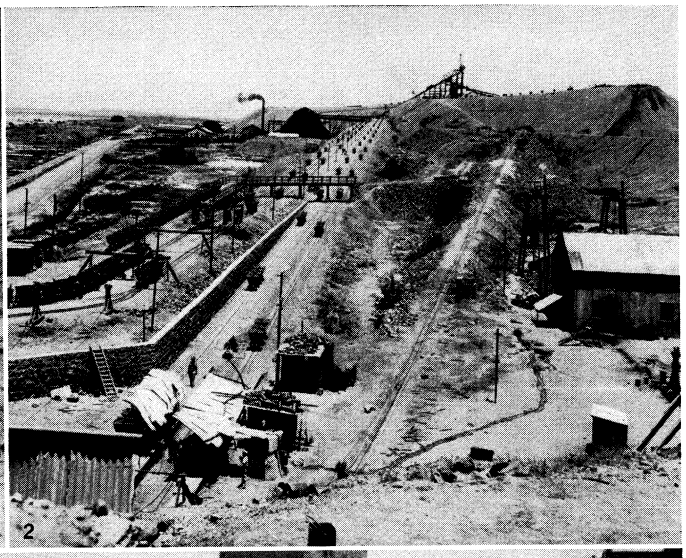
FIG. 6.—DIAMOND CRYSTAL, OCTAHEDRON, SHOWING TRIANGULAR MARKINGS

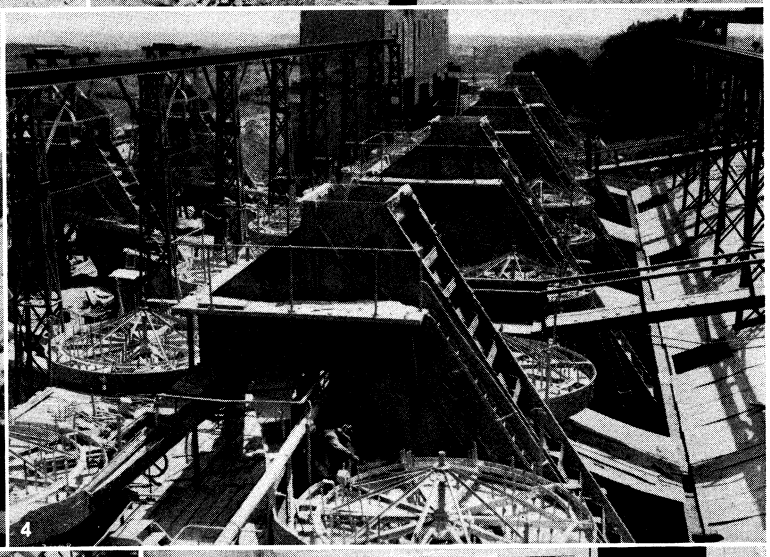
Brilliancy and "Fire."—The very high refractive power (index=2·417 for sodium light) gives the stone its extraordinary brilliancy; for light incident within a diamond at a greater angle than 24½° is reflected back into the stone instead of passing through it; the corresponding angle for glass is 40½°. The very high dispersion (index for red light= 2·402, for blue light= 2.460) gives it the wonderful "fire"—or display of spectral colours. Unlike other cubic crystals, diamond experiences a diminution of refractive index with increase of temperature. It is very transparent for Rontgen rays, whereas paste imitations are opaque. It is a good conductor of heat, and therefore feels colder to the touch than glass and imitation stones. The diamond has also a somewhat greasy feel. The specific heat increases rapidly with rising temperature up to 60° C., and then more slowly. Crystals belonging to the cubic system should not be birefringent unless strained; diamond often displays double refraction particularly in the neighbourhood of inclusions, both liquid and solid; this is probably due to strain, and the spontaneous explosion of diamonds has often been observed. Diamond differs from graphite in being a bad conductor of electricity; it becomes positively electrified by friction. The electrical resistance is about that of ordinary glass, and is diminished by one-half during exposure to Rontgen rays; the dielectric constant (16) is greater than that which should correspond to the specific gravity.

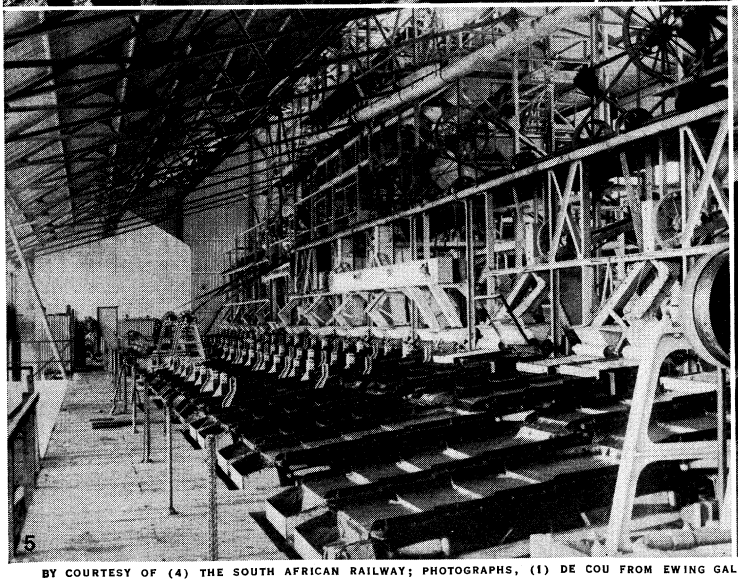
The phosphorescence produced by friction has been known since the time of Robert Boyle (1663); the diamond becomes luminous in a dark room after exposure to sunlight or in the presence of radium; and many stones phosphoresce beautifully (generally with a pale green light) when subjected to the electric discharge in a vacuum tube. Some diamonds are more phosphorescent than others, and different faces of a crystal may display different tints. The combustibility of the diamond was predicted by Sir Isaac Newton on account of its high refractive power; it was first established experimentally by the Florentine academicians in 1694. In oxygen or air diamond burns at about 850°, and only continues to do so if maintained at a high temperature; but in the absence of oxidizing agents it may be raised to a much higher temperature. It is, however, infusible at the temperature of the electric arc, but becomes blackened superficially. Experiments on the combustion of diamond were made by Smithson Tennant (1797) and Sir Humphry Davy (1816), with the object of proving that

DIAMOND







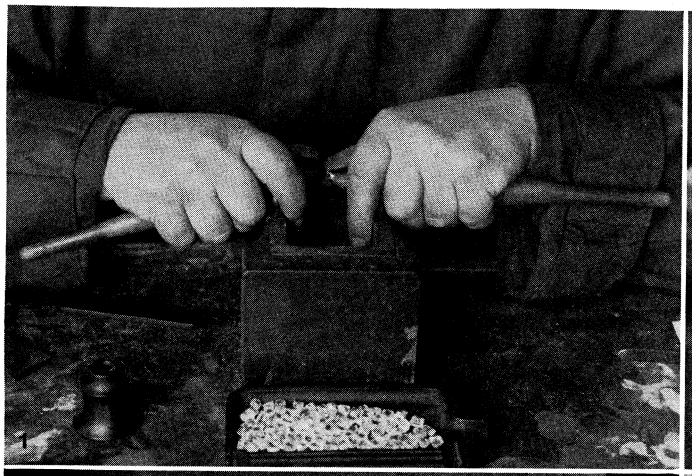


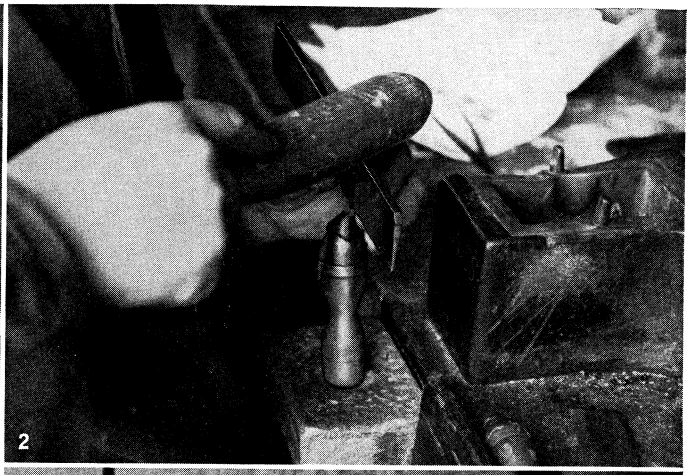
BY COURTESY OF (4) THE SOUTH AFRICAN RAILWAY; PHOTOGRAPHS, (1) DE COU FROM EWING GALLOWAY, (2, 6) EWING GALLOWAY, (3) BURTON HOLMES FROM EWING GALLOWAY

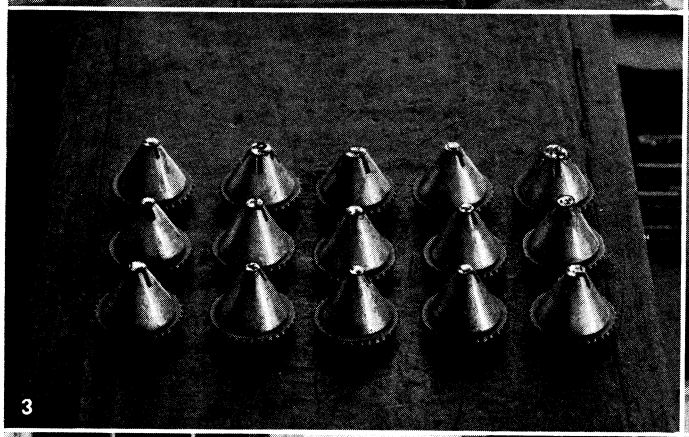
SOUTH AFRICAN DIAMOND MINES

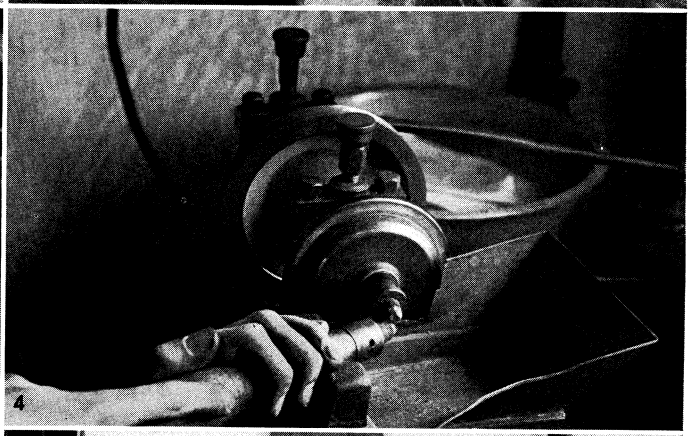
1. Looking down into the Premier diamond mine, Transvaal
2. A general view of the De Beers diamond mine at Kimberley
3. Mine cars which bring in the diamond-bearing gravel at the Kimberley mines in Orange Free State
4. Washing plant, with pans for washing blue ground
5. Greased tables (pulsators) for separating diamonds
6. Sorting diamonds

DIAMOND









BY COURTESY OF (1-3) W. S. HIATT, (5, 6) EICHBERG & CO., PHOTOS BY HANDY & BOESSER; PHOTOGRAPH, (4) EWING GALLOWAY

PROCESSES IN DIAMOND FINISHING

1. Notching the stones for cleaving by a single blow. Before cleaving, the stones must be notched or grooved so that they will break on the exact line which the operator desires. Cleavage takes place along planes parallel to the octahedron faces of the crystal
2. Splitting or cleaving diamonds. After the diamond has been notched to determine its plane of cleavage, it is held in the instrument illustrated and split by a single sharp blow
3. The metal clutch which holds the diamond in secure position for cutting. The gem is placed between the Prongs of the apparatus, and the teeth are tightened by screwing down on the ring at the base. This holds the stone firmly clamped
4. Turning on a lathe; the abrasive used in the cutting process must be another diamond, which is the hardest substance known
5. Inspecting the work of a group of diamond cutters
6. Diamond polishers giving the gems their final polish under the eyes of an inspector

it is pure carbon. Diamond is insoluble in acid and alkalis, but is oxidized on heating with potassium bichromate and sulphuric acid.

Uses of the Diamond. — The use of the diamond for other purposes than jewellery depends upon its extreme hardness: it has always been the only material used for cutting or engraving the diamond itself. The employment of powdered bort (*q.v.*) and the lapidary's wheel for faceting diamonds was introduced by L. von Berquen of Bruges in 1476. Diamonds are now employed not only for faceting precious stones, but also for cutting and drilling glass, porcelain, etc.; for fine engraving such as scales; in dentistry for drilling; as a turning tool for electric-light carbons, hard rubber, etc.; and occasionally for finishing accurate turning work. It is also used for bearings in watches and electric meters. The best glaziers' diamonds are chosen from crystals such that a natural curved edge can be used. For rock drills, and revolving saws for stone cutting, either diamond, bort or carbonado (*q.v.*) is employed, set in steel tubes, discs or bands. Rock drilling is the most important industrial application; and for this, owing to its freedom from cleavage, the carbonado is more highly prized than diamond. Another application of the diamond is for wire drawing; a hole tapering towards the centre is drilled through a diamond, and the metal is drawn through this. No other tool is so durable, or gives such uniform thickness of wire.

Distribution and Mining. — The most important localities for diamonds have been: (1) India, where they were mined from the earliest times till the close of the 19th century; (2) South America, where they have been mined since the middle of the 18th century; and (3) South Africa, to which almost the whole of the diamond-mining industry has been transferred since 1870.

Indian Diamonds. — The diamond is here found in ancient sandstones and conglomerates, and in the river gravels and sands derived from them. The sandstones and conglomerates belong to the Vindhyan formation and overlie the old crystalline rocks: the diamantiferous beds are well defined, often not more than 1ft. in thickness, and contain pebbles of quartzite, jasper, sandstone, slate, etc. The mines fall into five groups situated on the eastern side of the Deccan plateau. The mining has always been carried on by natives of low caste, and by primitive methods which do not differ much from those described by the French merchant, Jean Baptiste Tavernier (1605–89), who paid a prolonged visit to most of the mines between 1638 and 1665 as a dealer in precious stones.

At some of the Indian localities spasmodic mining has been carried on at different periods for centuries; at some the work which had been long abandoned was revived in recent times, at others it has long been abandoned altogether. Many of the large stones of antiquity were probably found in the Kollar group, where Tavernier found 60,000 workers in 1645 (?), the mines, according to native accounts, having been discovered about 100 years previously. Golconda was the fortress and the market for the diamond industry at this group of mines, and so gave its name to them. Very few Indian diamonds now find their way out of the country, and so far as the world's supply is concerned, Indian mining of diamonds may be considered extinct. The first blow to this industry was the discovery of the Brazilian mines in Minas Gerais and Bahia.

Brazilian Diamonds. — Diamonds were found about 1725 at Tejuco (now Diamantina) in Minas Gerais, and the mining became important about 1740. The Rio Abaete district was worked on a considerable scale between 1785 and 1807, but is now abandoned. Diamantina is at present the most important district; it occupies a mountainous plateau, and the diamonds are found both on the plateau and in the river valleys below it. The mountains consist here of an ancient laminated micaceous quartzite, which is in parts a flexible sandstone known as itacolumite. and in parts a conglomerate. The diamond is found under three conditions: (1) in the gravels of the present rivers, embedded in a ferruginous clay-cemented conglomerate known as *cascalho;* (2) in terraces occupying higher levels; (3) in plateau deposits embedded in the red clay which cements the larger blocks. The terraces are probably a first concentration of the plateau material by the old rivers; and the *cascalho* a second concentration by the modern rivers.

In recent years the Minas Gerais mines have been rivalled by the yield in Bahia. The diamond here occurs in river gravels and sands associated with the same minerals as in Minas Gerais; since 1844 the richest mines have been worked in the Serra de Cincora, where the mountains are intersected by the River Paraguassu and its tributaries; it is said that there were as many as 20,000 miners working here in 1845, and it was estimated that 54,000 carats were produced in Bahia in 1858. But the enormous development of the South African mines, which in 1906 supplied about 90% of the world's produce, has thrown the Brazilian production into the shade.

African Diamonds. — The first discovery was made in 1867 by Dr. W. G. Atherstone, who identified as diamond a pebble obtained from a child in a farm on the banks of the Orange river and brought by a trader to Grahamstown; it was bought for £500 and displayed in the Paris Exhibition of that year. In 1869 a stone weighing 83½ carats was found near the Orange river; this was purchased by the earl of Dudley for £25,000 and became famous as the "Star of South Africa." A rush of prospectors at once took place to the banks of the Orange and Vaal rivers, and resulted in considerable discoveries, so that in 1870 there was a mining camp of no less than 10,000 persons on the "River Diggings." In the River Diggings the mining was carried on in the coarse river gravels, and by the methods of the Brazilian negroes and of gold placer-miners. A diggers' committee limited the size of claims to 30ft. square, with free access to the river bank; the gravel and sand were washed in cradles provided with screens of perforated metal, and the concentrates were sorted by hand on tables by means of an iron scraper.

But towards the close of 1870 stones were found at Jagersfontein and at Dutoitspan, far from the Vaal river, and led to a second great rush of prospectors, especially to Dutoitspan, and in 1871 to what is now the Kimberley mine in the neighbourhood of the latter. At each of these spots the diamantiferous area was a roughly circular patch of considerable size, and in some it occupied the position of one of those depressions or "pans" so frequent in South Africa. These "dry diggings" were therefore at first supposed to be alluvial in origin like the river gravels; but it was soon discovered that, below the red surface soil and the underlying calcareous deposit, diamonds were also found in a layer of yellowish clay about soft. thick known as "yellow ground." Below this again was a hard bluish-green serpentinous rock which was at first supposed to be barren bed-rock; but this also contained the precious stone, and has become famous. under the name of "blue ground," as the matrix of the South African diamonds. The yellow ground is merely decomposed blue ground. In the Kimberley district five of these round patches of blue ground were found within an area little more than 3m. in diameter; that at Kimberley occupying ten ac., that at Dutoitspan 23 acres. There were soon 50,000 workers on this field, the canvas camp was replaced by a town of brick and iron surrounded by the wooden huts of the natives, and Kimberley became an important centre.

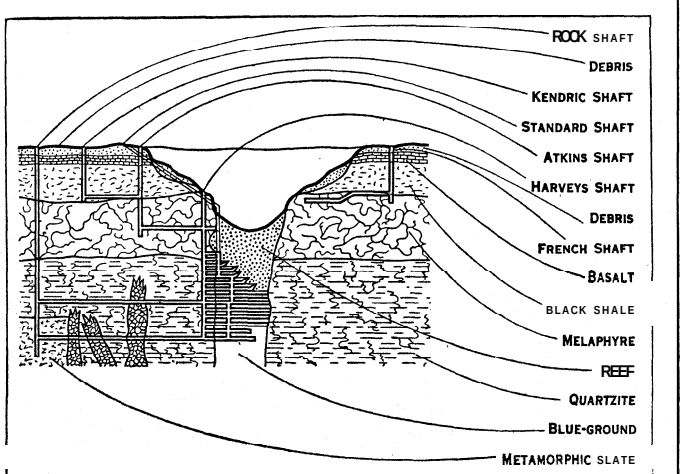
It was soon found that each mine was in reality a huge vertical funnel or crater descending to an unknown depth, and filled with diamantiferous blue ground. At first each claim was an independent pit 31ft. square sunk into the blue ground; the diamantiferous rock was hoisted by bucket and windlass, and roadways were left across the pit to provide access to the claims. But the roadways soon fell in, and ultimately haulage from the claims could only be provided by means of a vast system of wire ropes extending from a triple staging of windlasses erected round the entire edge of the mine, which had by this time become a huge open pit; the ropes from the upper windlasses extended to the centre, and those from the lower tier to the sides of the pit; covering the whole mass like a gigantic cobweb of taut steel ropes. The buckets of blue ground were hauled up these ropes by means of horse whims, and in 1875 steam winding engines began to be employed. By this time also improved methods in the treatment of the blue ground were introduced. It was carried off in carts to open spaces. where an exposure of some weeks to the air was found to pulverize

the hard rock far more efficiently than the old method of crushing with mallets. The placer-miner's cradle and rocking-trough were replaced by puddling troughs stirred by a revolving comb worked by horse power; reservoirs were constructed for the scanty water-supply, bucket elevators were introduced to carry away the tailings; and the natives were confined in compounds. For these improvements co-operation was necessary; the better claims, which in 1872 had risen from £100 to more than £4,000 in value, began to be consolidated, and a mining board was introduced.

In a very few years, however, the open pit mining was rendered impossible by the mud rushes, by the falls of the masses of barren rock known as "reef," which were left standing in the mine, and by landslips from the sides, so that in 1883, when the pit had reached a depth of about 400ft., mining in the Kimberley crater had become almost impossible. By 1889, in the whole group of mines, Kimberley, Dutoitspan, De Beers and Bultfontein, open pit working was practically abandoned. Meanwhile mining below the bottom of the pits by means of shafts and underground tunnels had been commenced; but the full development of modern methods dates from the year 1889 when Cecil Rhodes and Alfred Beit, who had already secured control of the De Beers mine, acquired also the control of the Kimberley mine, and shortly afterwards consolidated the entire group in the hands of the De Beers Company (see KIMBERLEY).

The scene of native mining was now transferred from the open pit to underground tunnels; the vast network of wire ropes disappeared, and with it the cosmopolitan crowd of busy miners working like ants at the bottom of the pit. In place of all this, the visitor to Kimberley encounters at the edge of the town only a huge crater, silent and apparently deserted, with no visible sign of the great mining operations which are conducted far below the surface.

A vertical shaft through the basalt, shale and granite is sunk in the vicinity of the mine, and from this horizontal tunnels are driven into the pipe at different levels separated by intervals of 40 feet. Through the blue ground itself on each level a series of parallel tunnels about 120ft. apart are driven to the opposite side of the pipe, and at right angles to these, and 36ft. apart, another series of tunnels. When the tunnels reach the side of the mine



FROM GARDNER WILLIAMS, "DIAMOND MINES OF SOUTH AFRICA" (MACMILLAN & CO.)

FIG 7.— SECTION OF THE KIMBERLEY DIAMOND MINE IN SOUTH AFRICA
From vertical shafts sunk near the mine, horizontal tunnels are driven into the pipe of blue ground, at levels 40 ft. apart, the excavated material being brought up through the rock shafts

they are opened upwards and sideways so as to form a large chamber, and the overlying mass of blue ground and dkbris is allowed to settle down and fill up the gallery. On each level this process is carried somewhat farther back than on the level below (fig. 7); material is thus continually withdrawn from one side of the mine and extracted by means of the rock shaft on the opposite side, while the superincumbent débris is continually sinking, and is allowed to fall deeper on the side farthest from the shaft as the blue ground is withdrawn from beneath it. In 1905 the main shaft had been sunk to a depth of 2,600ft. at the Kimberley mine.

For the extraction and treatment of the blue ground the De Beers Company in its great winding and washing plant employs labour-saving machinery on a gigantic scale. The ground is transferred in trucks to the shaft where it is automatically tipped into skips holding 96 cu. ft. (six truck loads); these are rapidly hoisted to the surface, where their contents are automatically dumped into side-tipping trucks, and these in turn are drawn away in a continual procession by an endless wire rope along the tram lines leading to the vast "distributing floors." These are open tracts upon which the blue ground is spread out and left exposed to sun and rain until it crumbles and disintegrates, the process being hastened by harrowing with steam ploughs; this may require a period of three or six months, or even a year. The stock of blue ground on the floors at one time in 1905 was nearly 4,500,000 loads. The disintegrated ground is then brought back in the trucks and fed through perforated cylinders into the washing pans; the "hard blue" ground which has resisted disintegration on the floors, and the lumps which are too big to pass the cylindrical sieves, are crushed before going to the pans. These are shallow cylindrical troughs containing muddy water in which the diamonds and other heavy minerals (concentrates) are swept to the rim by revolving toothed arms, while the lighter stuff escapes near the centre of the pan. The concentrates are then passed over sloping tables (pulsator) and shaken to and fro under a stream of water which effects a second concentration of the heaviest material.

Until recently the final separation of the diamond from the concentrates was made by hand picking, but even this has now been replaced by machinery, owing to the remarkable discovery that a greased surface will hold a diamond while allowing the other heavy minerals to pass over it. The concentrates are washed down a sloping table of corrugated iron which is smeared with grease, and it is found that practically all the diamonds adhere to the table, and the other minerals are washed away. At the large and important Premier mine in the Transvaal the Elmore process, used in British Columbia and in Wales for the separation of metallic ores, has been also introduced. In the Elmore process oil is employed to float off the materials which adhere to it, while the other materials remain in the water, the oil being separated from the water by centrifugal action.

In all the South African mines the diamonds are not only crystals of various weights from fractions of a carat to 150 carats, but also occur as microscopic crystals disseminated through the blue ground. In spite of this, however, the average yield in the profitable mines is only from 0·2 carat to 0·6 carat per load of 1,600 lb., or on an average about 1½ grs. per ton. The annual output of diamonds from the De Beers mines was valued in 1906 at nearly £5,000,000; the value per carat ranging from about 35 to 70 shillings.

Pipes similar to those which surround the Kimberley have been found in other parts of South Africa. One of the best known is that of Jagersfontein, which was really the first of the dry diggings (discovered in 1870). This large mine is near Fauresmith and 80m. to the south of Kimberley. In 1905 the year's production from the Orange River Colony mines was more than 320,000 carats, valued at £938,000. But by far the largest of all the pipes hitherto discovered is the Premier mine in the Transvaal, about 300m. to the east of Kimberley. This was discovered in 1902 and occupies an area of about 75 acres. Comparatively few of the pipes which have been discovered are at all rich in diamonds, and many are quite barren; some are filled with "hard blue" which, even if diamantiferous, may be too expensive to work.

The most competent South African geologists believe all these remarkable pipes to be connected with volcanic outbursts which occurred over the whole of South Africa during the Cretaceous period (after the deposition of the Stormberg beds), and drilled these enormous craters through all the later formations. Over a great part of Cape Colony have been discovered what are probably similar pipes filled with agglomerates, breccias and tuffs, and some with basic lavas.

The River Diggings on the Vaal river are still worked upon a small scale, but the production from this source is so limited that they are of little account in comparison with the mines in the blue

ground. The stones, however, are good; since they differ somewhat from the Kimberley crystals it is probable that they were not derived from the present pipes. Considerable finds of diamonds were reported in 1905 and 1906 from gravels at Somabula near Gwelo in Rhodesia. Diamonds have also been reported from kimberlite "pipes" in Rhodesia.

The South African output in 1926 was 3,000,000 carats. Diamonds have been found in considerable numbers in sand near Liideritz bay in South-West Africa (1908); the output from this district in 1926 was 515,000 carats. The Congo has become an important source since the first discovery in 1903; the diamonds are found in alluvial deposits of the River Kasai and its affluents. The output in 1926 was 1,108,000 carats from Belgian Congo, and 150,000 carats from Angola. Other African localities are the Gold Coast and Tanganyika.

Other Localities. — In addition to the South American localities mentioned above, small diamonds have also been mined since their discovery in 1890 on the River Mazaruni in British Guiana, and finds have been reported in the gold washings of Dutch Guiana. The output from British Guiana in 1926 was 182,000 carats. Borneo has possessed a diamond industry since the island was first settled by the Malays. Australia has yielded diamonds in alluvial deposits near Bathurst (where the first discovery was made in 1851) and at other places in New South Wales; in South Australia; in Victoria; in Western Australia; and in Queensland. In Tasmania also diamonds have been found in the Corinna goldfields. Europe has produced few diamonds. They have been found (1829) in the gold washings of Bissersk, and at other spots in the Urals. Also in Lapland and Siberia. In North America small stones have been found in alluvial deposits, mostly auriferous, in Georgia, North and South Carolina, Kentucky, Virginia, Tennessee, Wisconsin, California, Oregon and Indiana. Considerable interest attaches to the diamonds found in Wisconsin, Michigan and Ohio near the Great Lakes, for they are here found in the terminal moraines of the great glacial sheet which is supposed to have spread southwards from the region of Hudson bay.

Origin of the Diamond in Nature. — It appears from the foregoing account that at most localities the diamond is found in alluvial deposits probably far from the place where it originated. The minerals associated with it do not afford much clue to the original conditions; they are mostly heavy minerals derived from the neighbouring rocks, in which the diamond itself has not been observed.

There are only a few localities at which the diamond has been supposed to occur in its original matrix — in India, in Minas Gerais, and at Inverell in New South Wales, but the evidence is certainly not sufficient to establish the presence of an original matrix. Finally there is the remarkable occurrence in the blue ground of the African pipes.

There has been much controversy concerning the nature and origin of the blue ground itself; and even granted that (as is generally believed) the blue ground is a much serpentinized volcanic breccia consisting originally of an olivine-bronzite-biotite rock (the so-called kimberlite), it contains so many rounded and angular fragments of various rocks and minerals that it is difficult to say which of them may have belonged to the original rock, and whether any were formed in *situ,* or were brought up from below as inclusions. Carvill Lewis believed the blue ground to be true eruptive rock, and the carbon to have been derived from the bituminous shales of which it contains fragments. The Kimberley shales, which are penetrated by the De Beers group of pipes, were, however, certainly not the source of the carbon at the Premier (Transvaal) mine, for at this locality the shales do not exist. The view that the diamond may have crystallized out from solution in its present matrix receives some support from the experiments of W. Luzi, J. Friedlander, R. von Hasslinger and J. Wolff. E. Cohen, who regarded the pipes as of the nature of a mud volcano, and the blue ground as a kimberlite breccia altered by hydrothermal action, thought that the diamond and accompanying minerals had been brought up from deep-seated crystalline schists. Other authors have sought the origin of the diamond in the action of the hydrated magnesian silicates on hydrocarbons derived from bituminous schists, or in the decomposition of metallic carbides.

Of great scientific interest in this connection is the discovery of small diamonds in certain meteorites, both stones and irons; *e.g.,* in the stone which fell at Novo-Urei in Penza, Russia, in 1886, in a stone found at Carcote in Chile, and in the iron found at Cañon Diablo in Arizona. Graphitic carbon in cubic form (cliftonite) has also been found in certain meteoric "irons," and is now generally believed to be altered diamond. The claim by H. Moissan to have produced the diamond artificially, by allowing dissolved carbon to crystallize out at a high temperature and pressure from molten iron, coupled with the occurrence in meteoric iron, has led Sir William Crookes and others to conclude that the mineral may have been derived from deep-seated iron containing carbon in solution *(see* the article GEM, ARTIFICIAL).

On the other hand, the occurrence in meteoric stones, and the experiments mentioned above, show that the diamond may also crystallize from a basic magma, capable of yielding some of the metallic oxides and ferro-magnesian silicates; a magma, therefore, which is not devoid of oxygen. This is still more forcibly suggested by the remarkable eclogite boulder found in the blue ground of the Newlands mine, not far from the Vaal river, and described by T. G. Bonney. The boulder is a crystalline rock, and is studded with diamond crystals; a portion of it is preserved in the British Museum (Natural History). Similar boulders have also been found in the blue ground elsewhere. It seems therefore that a holo-crystalline pyroxene-garnet rock may be one source of the diamond found in blue ground. Some regard the eclogite boulders as derived from deep-seated crystalline rocks, others as concretions in the blue ground. None of the inclusions in the diamond gives any clue to its origin.

Finally, then, both experiment and the natural occurrence in rocks and meteorites suggest that diamond may crystallize not only from iron but also from a basic silicate magma, possibly from various rocks consisting of basic silicates. The blue ground of South Africa may be the result of the serpentinization of several such rocks, and although now both brecciated and serpentinized some of these may have been the original matrix. A circumstance often mentioned in support of this view is the fact that the diamonds in one pipe generally differ somewhat in character from those of another, even though they be near neighbours.

History of Diamonds. — All the famous diamonds of antiquity must have been Indian stones. The first author who described the Indian mines at all fully was the Portuguese, Garcia de Orta (1565), who was physician to the viceroy of Goa. Before that time there were only legendary accounts like that of Sindbad's "Valley of the Diamonds," or the tale of the stones found in the brains of serpents. V. Ball thinks that the former legend originated in the Indian practice of sacrificing cattle to the evil spirits when a new mine is opened; birds of prey would naturally carry off the flesh, and might give rise to the tale of the eagles carrying diamonds adhering to the meat.

The following are some of the famous diamonds of the world:—

A large stone found in the Golconda mines and said to have weighed 787 carats in the rough, before being cut by a Venetian lapidary, was seen in the treasury of Aurangzeb in 1665 by Tavernier, who estimated its weight after cutting as 280 (?) carats, and described it as a rounded rose-cut-stone, tall on one side. The name *Great Mogul* has been frequently applied to this stone. Tavernier states that it was the famous stone given to Shah Jahan by the emir Jumla. The *Orloff,* stolen by a French soldier from the eye of an idol in a Brahmin temple, stolen again from him by a ship's captain, was bought by Prince Orloff for £90,000, and given to the empress Catharine II. It weighs $194\frac{3}{4}$ carats, is of a somewhat yellow tinge, and is among the Russian Crown jewels The *Koh-i-nor,* which was in 1739 in the possession of Nadir Shah, the Persian conqueror, and in 1813 in that of the raja of Lahore, passed into the hands of the East India Company and was by them presented to Queen Victoria in 1850. It then weighed $186\frac{1}{16}$ carats, but was recut in London by Amsterdam workmen, and now weighs $106\frac{1}{16}$ carats. There has been much discussion concerning the possibility of this stone and the Orloff being both fragments of the Great Mogul. The Mogul Baber in his memoirs (1526)

relates how in his conquest of India he captured at Agra the great stone weighing 8 mishkals, or 320 ratis, which may be equivalent to about 187 carats. The Koh-i-nor has been identified by some authors with this stone and by others with the stone seen by Tavernier. Tavernier, however, subsequently described and sketched the diamond which he saw as shaped like a bisected egg, quite different therefore from the Koh-i-nor. Nevil Story Maskelyne has shown reason for believing that the stone which Tavernier saw was really the Koh-i-nor, and that it is identical with the great diamond of Baber; and that the 280 carats of Tavernier is a misinterpretation on his part of the Indian weights. He suggests that the other and larger diamond of antiquity which was given to Shah Jahan may be one which is now in the treasury of Teheran, and that this is the true Great Mogul which was confused by Tavernier with the one he saw. *(See* Ball, Appendix I. to Tavernier's *Travels* (1889); and Maskelyne, *Nature,* 1891, 44, p 555.)

The *Regent* or *Pitt* diamond is a magnificent stone found in either India or Borneo; it weighed 410 carats and was bought for £20,400 by Pitt, the governor of Madras; it was subsequently, in 1717, bought for £80,000 (or, according to some authorities. £135,000) by the duke of Orleans, regent of France; it was reduced by cutting to 136$\frac{14}{16}$ carats; was stolen with the other Crown jewels during the Revolution, but was recovered and is still in France. The *Akbar Shah* was originally a stone of 116 carats with Arabic inscriptions engraved upon it; after being cut down to 71 carats it was bought by the gaikwar of Baroda for £35,000. The *Nizam,* now in the possession of the nizam of Hyderabad, is supposed to weigh 277 carats; but it is only a portion of a stone which is said to have weighed 440 carats before it was broken. The *Sancy,* weighing 53$\frac{12}{16}$ carats, is said to have been successively the property of Charles the Bold, de Sancy, Queen Elizabeth, Henrietta Maria, Cardinal Mazarin, Louis XIV.; to have been stolen with the *Pitt* during the French Revolution; and subsequently to have been the property of the king of Spain, Prince Demidoff and an Indian prince.

The *Great Table,* a rectangular stone seen by Tavernier in 1642 at Golconda, was found by him to weigh 242$\frac{3}{16}$ carats; Maskelyne regards it as identical with the *Darya-i-nur,* which is also a rectangular stone Weighing about 186 carats in the possession of the shah of Persia. Another stone, the *Taj-e-mah,* belonging to the shah, is a pale rose pear-shaped stone and is said to weigh 146 carats.

Coloured Indian diamonds of large size are rare; the most famous are: a beautiful blue brilliant, 67$\frac{2}{16}$ carats, cut from a stone weighing 112$\frac{3}{16}$ carats brought to Europe by Tavernier. It was stolen from the French Crown jewels with the *Regent* and was never recovered. The *Hope,* 444 carats, has the same colour and is probably a portion of the missing stone: it was so-called as forming part of the collection of H. T. Hope bought for £18,000, and was sold again in 1906 (resold 1909). Two other blue diamonds are known, weighing 13$\frac{3}{4}$ and 1$\frac{3}{4}$ carats, which may also be portions of the French diamond. The *Dresden Green,* one of the Saxon Crown jewels, 40 carats, has a fine apple-green colour. The *Florentine,* 133$\frac{1}{8}$ carats, one of the Austrian Crown jewels, is a very pale yellow.

The most famous Brazilian stone was the *Star of the South,* found in 1853, when it weighed 254$\frac{1}{2}$ carats and was sold for £40,000; when cut it weighed 125 carats and was bought by the gaikwar of Baroda for £80,000.

The Largest Diamond. — Many large stones have been found in South Africa; some are yellow but some are as colourless as the best Indian or Brazilian stones. The most famous are the following: — The *Star of South Africa,* or *Dudley,* mentioned above, 83$\frac{1}{2}$ carats rough, 46$\frac{1}{2}$ carats cut. The *Stewart,* 288$\frac{3}{8}$ carats rough, 120 carats cut. Both these were found in the river diggings. The *Porter Rhodes* from Kimberley, of the finest water, weighed about 1jo carats. The *Victoria,* 180 carats, was cut from an octahedron weighing 457$\frac{1}{2}$ carats, and was sold to the nizam of Hyderabad for £400,000. The *Tiffany,* a magnificent orange-yellow stone, weighs 125$\frac{1}{2}$ carats cut. A yellowish octahedron found at De Beers weighed 428$\frac{1}{2}$ carats, and yielded a brilliant of 228$\frac{1}{2}$ carats. Some of the finest and largest stones have come from the Jagersfontein mine; one, the *Jubilee,* found in 1895, weighed 634 carats in the rough and 239 carats when cut. Until 1905 the largest known diamond in the world was the *Excelsior,* found in 1893 at Jagersfontein by a native while loading a truck. It weighed 969$\frac{1}{2}$ carats, and was ultimately cut into ten stones weighing from 68 to 13 carats. But all previous records were surpassed in 1905 by the *Cullinan Diamond* more than three times the size of any known stone, which was found in the yellow ground at the newly discovered Premier mine in the Transvaal. It was purchased by the Transvaal Government in 1907 and presented to King Edward VII. It was sent to Amsterdam to be cut, and in 1908 was divided into nine large stones, the four largest weighing 516$\frac{1}{2}$ carats, 309$\frac{3}{16}$ carats, 92 carats and 62 carats respectively, and a number of small brilliants. The Jonker diamond, weighing 726 carats, was found in Elandsfontein in 1934, and was sold in May, 193j, to an American for about £150,000.

Diamonds are invariably weighed in carats. One English carat = 3·17 grains = ·2,053 grams. One metric carat (now nearly universally used) = ·200 grams or 200 milligrams. *(See* CARAT.)

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DIAMOND MATCH COMPANY, THE, largest match company in the United States, was incorporated on December 26, 1930, under the laws of the State of Delaware, succeeding an Illinois corporation of the same name. It is engaged in the manufacture and the sale of matches, of match-making machinery, of lumber and lumber products, and of other similar products.

The company holds a minority interest in the British Match Corporation, Limited, of Great Britain and, with that firm and several others, in the Eddy Match Company, Limited, located in Canada.

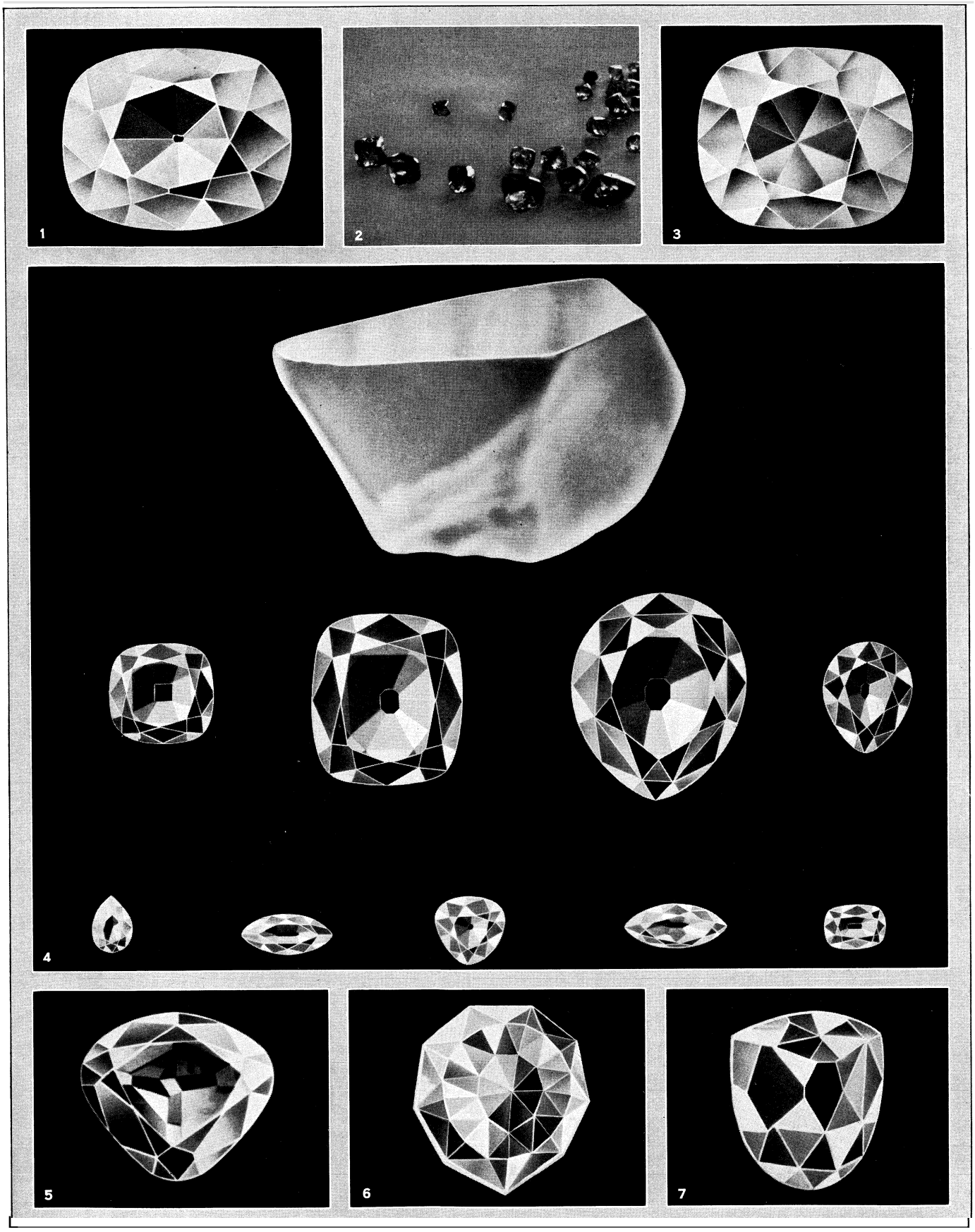
The properties of The Diamond Match Company and its subsidiaries include factories in nine different States of the Union, namely: New York, Maine, Massachusetts, Ohio, Wisconsin, New Jersey, Utah, Washington and California; they include also large timber tracts in the States of Maine, Georgia, Idaho, California and Washington; 64 lumber yards owned and operated in the Sacramento valley, California, and 22 in the New England states. and in addition a large card-board operating, printing and book match assembly plant at Springfield, Massachusetts.

The following figures give a comprehensive view of the extensive financial operation of the company: the total current assets as of December 31, 1939, were $27,448,793.33; the total assets, $34,380,742.16; the net working capital, $26,050,559.14; the net income, $2,136,750.49; the total surplus, $3,466,833.31.

The aggregate net income for the five years from 1935–1939, inclusive, was $10,654,906.53, making an annual average, for that five-year period, of the sum of $2,130,981.30.

The headquarters of the company are in the city of New York.

(W. W. H.)



BY COURTESY OF (1, 3, 4, 5, 6 7) W S HIATT, (2) THE SOUTH AFRICAN RAILWAYS

CUT AND UNCUT DIAMONDS

1. The "Koh-i-Nor," re-cut in 1862, as a shallow brilliant, weighing 106 carats. 2. Rough diamonds from mines at Kimberley, South Africa, the world's richest diamond centre. 3. The "Excelsior," discovered in the Jagersfontein mine. Weight in the rough, 971 carats. 4. The "Cullinan," the world's largest diamond, showing the rough gem and stones cut from it. 5. The "Nassak," weight 89.59 carats. brought to New York in 1927. 6. The "Florentine," or "Tuscany," weight 133⅛ carats, formerly owned by the Austrian Imperial Family. 7. The "Sancy," 53 carats, a gem which has had many historic owners, among them Cardinal Mazarin, Louis XIV. and Elizabeth of England

DIAMOND NECKLACE, THE AFFAIR OF THE, a mysterious incident at the court of Louis XVI. of France, which involved the queen, Marie Antoinette. The Parisian jewellers Boehmer and Bassenge had spent some years collecting stones for a necklace which they hoped to sell to Mme. Du Barry, the favourite of Louis XV., and after his death to Marie Antoinette. They were considerably embarrassed by their failure to do so.

Since his recall in disgrace from Vienna in 1774, Louis, cardinal de Rohan, had been anxious to be reconciled to the queen. In March 1784 he took as mistress a certain Jeanne de St. Remy de Valois, who had married a *soi-disant* comte de Lamotte. She persuaded him that she had been received by the queen and enjoyed her favour, and carried on for him a pretended correspondence with the queen, the adventuress duly producing replies to Rohan's notes in the queen's name. The tone of the letters became very warm, and the cardinal, convinced that Marie Antoinette was in love with him, became ardently enamoured of her. A secret meeting took place in Aug. 1784, in a grove in the garden at Versailles, between Rohan and a lady whom the cardinal believed to be the queen herself. Rohan offered her a rose, and she promised him that she would forget the past. The jewellers also believed in the relations of the countess with the queen, and they resolved to use her to sell their necklace. She agreed, and shortly after Rohan purchased it for 1,600,000 livres, payable in instalments. He said that he was authorized by the queen, and showed the jewellers the conditions of the bargain approved in the handwriting of Marie Antoinette. The necklace was given up. Rohan took it to the countess's house, where a man, in whom Rohan believed he recognized a valet of the queen, came to fetch it. Boehmer and Bassenge, before the sale, in order to be doubly sure, had sent word to the queen of the negotiations in her name. Marie Antoinette allowed the bargain to be concluded, and after she had received a letter of thanks from Boehmer, she burned it.

When the time came to pay, the comtesse de Lamotte presented the cardinal's notes; but these were insufficient, and Boehmer complained to the queen, who told him that she had received no necklace and never ordered it. Then followed a coup de *théâtre.* On Aug. 15, 1785, Assumption Day, when the whole court was awaiting the king and queen in order to go to the chapel, the cardinal de Rohan, who was preparing to officiate, was arrested and taken to the Bastille. The police also arrested Mme. de Lamotte, and some minor accomplices. A sensational trial before the *parlement* of Paris resulted (May 31, 1786) in the acquittal of the cardinal. The comtesse de Lamotte was condemned to be whipped, branded and shut up in the Salpetrière. Her husband, who is believed to have escaped with the necklace to London, was condemned, in his absence, to the galleys for life. Various circumstances fortified the popular belief that Marie Antoinette, in her hatred of the cardinal, had deliberately trapped Rohan—her disappointment at Rohan's acquittal, the fact that he was deprived of his charges and exiled to the abbey of la Chaise-Dieu, and finally the escape of the comtesse de Lamotte from the Salpetrière, with the connivance, as people believed, of the court. Mme. de Lamotte, having taken refuge abroad, published *Mémoires,* in which she accused the queen.

See Emile Campardon, *Marie Antoinette et le procès du collie?* (1863); F. d'Albini, *Marie Antoinette and the Diamond Necklace from another Point of View* (1900); *M.* Tourneux, *Marie Antoinette devant l'histoire: Essai bibliographique* (2nd ed., 1901); P. Audebert, *L'Affaire du collier de la reine, d'après la correspondance inddite du chevalier de Pujol* (Rouen, 1901); Funck-Brentano, *L'Affaire du collier* (1903); *A.* Lang, *Historical Mysteries* (1904).

DIAN, a patrilineal people closely related to the Lobi and the Gan but more advanced, living near Diebougou, Gaoua district, Upper Volta, Africa.

See Labouret, "La Terre, la chasse et la guerre parmi les populations du Lobi," *Annuaires et Mémoires, Comité Études Hist. et Scient.* (Dakar, 1916–17).

DIANA, in Roman mythology, an Italian goddess in later times identified with the Greek Artemis (q.v.). That she was originally an independent Italian deity is shown by the presence of her cult at Nemi, which shows no foreign influence. This was in a grove beside the lake of (Nemus) Nemi, near Aricia (whence her title of Nemorensis). Here she was worshipped side by side with an obscure male deity, Virbius (q.v.). Her priest, called *Rex Nemorensis,* who was a runaway slave, was obliged to qualify for office by slaying his predecessor in single combat (Strabo v. 239; Suetonius, *Caligula,* 35). This led to the identification of Diana with the Tauric Artemis, whose image was said to have been removed by Orestes to the grove of Aricia (see ARICINI).

After the destruction of Alba Longa, this grove was for a long time the united sanctuary of the Latin League, until Rome became supreme. The festival of the goddess was on the ides (13th) of August, the full moon of the hot season. She was worshipped with torches, her aid was sought by women seeking a happy deliverance in childbirth, and many votive offerings have been found on the site. The worship of Diana was brought to Rome, and her temple on the Aventinc was founded, according to tradition, by Servius Tullius, originally as a sanctuary of the Latin League (Dion. Halic. iv. 26,3). On the day of its dedication (Aug. 13) the slaves kept holiday (Plutarch, Quaest. *Rom.,* 100), which was explained as a reference to the founder's servile origin. Another celebrated sanctuary of Diana was that on the slopes of Mount Tifata, near Capua, where she was worshipped under the name of Tifatina.

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DIANA MONKEY, a west African guenon monkey (*q.v.*), taking its name, Cercopithecus diana, from the white crescent on the forehead; another characteristic feature being the pointed white beard. The general colour is greyish, with a deep tinge of chestnut on the hinder back. Together with C. neglectus of east and central Africa, C. *ignitus* of Liberia, and C. roloway of the Gold Coast, the diana represents the subgenus Pogonocebus.

DIANE DE FRANCE (1538–1619), duchess of Montmorency and Angoulême, was the natural daughter of Henry II. of France and a young Piedmontese, Filippa Duc. She was a beautiful and accomplished girl. She married in 1553 Horace Farnese, son of the duke of Parma, who was killed at the siege of Hesdin shortly after the marriage. In 1559 she married François de Montmorency, one of the leaders of the *politiques.* After her husband's death she exercised a wise and moderating influence at the courts of Henry III. and Henry IV. successively.

See Brantome, ed. *by* Lalanne in the *Coll. de* la *société d'histoire de France,* Vol. viii. (1875); J. de Thou, *Historia sui temporis . . .* (1733); Matthieu de Morgues, *Oraison funèbre de Diane de France* (Paris, 1619).

DIANE DE POITIERS (1499–1566), duchess of Valentinois, mistress of Henry II. of France, was the daughter of Jean de Poitiers, seigneur de St. Vallier, who came of an old family of Dauphin&. In 1515 she married Louis de Brézé, grand seneschal of Normandy, by whom she had two daughters. After her husband's death in 1533, she became the mistress of Prince Henry, who became dauphin in 1536. She inspired in the young prince, who was ten years her junior, a passion which lasted until his death. The accession of Henry II. in 1547 was also the accession of Diane: she was virtual queen, while Henry's lawful wife, Catherine de'Medici, lived in comparative obscurity. Diane devoted her energies chiefly to augmenting her income, and providing for her family and friends. Henry gave her the duchy of Valentinois. Catherine drove her from the court after Henry's death, and forced her to restore the crown jewels and to accept Chaumont in exchange for Chenonceaux. Diane retired to her château at Anet, where she died in 1566.

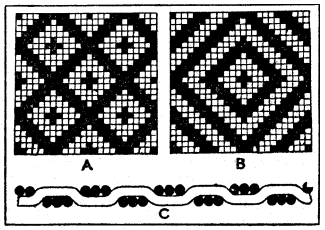
The story that she had been the mistress of Francis I., in order to obtain the pardon of ner father, who had been condemned to death as an accomplice of the constable de Bourbon, has no serious foundation. Diane was a patroness of the arts. She entrusted to Philibert de l'Orme the building of her chbteau at Anet, and it was for her that Jean Goujon executed his masterpiece, the statue of Diana, now in the Louvre.

See G. Guiffrey, *Lettres inédites de Diane de Poytiers* (1866) and *Procès criminel de Jehan de Poytiers* (1867); Capefigue, *Diane de Poitiers* (1860); Hay, *Madame Dianne de Poytiers* (1900).

DIANTHUS: *see* CARNATION.

DIAPASON (Gr. διά πασῶν, through all), a term in music originally denoting the interval of an octave. The Greek is an abbreviation of ἡ διὰ πασῶν χορδῶν συμφωνία, a consonance through all the tones of the scale. In this sense it is only used now, loosely, for the compass of an instrument or voice, or for a harmonious melody. The name is given to the two foundation stops of an organ, the open and the stopped diapason *(see* ORGAN) and to a standard of musical pitch, as in the French *diapason normal (see* PITCH, MUSICAL).

DIAPER, the name given to a textile fabric, formerly of a rich and costly nature with embroidered ornament, but now of linen or cotton, with a simple woven pattern; and particularly restricted to small napkins. In architecture, the term "diaper" is given to any small pattern of a conventional nature repeated continuously and uniformly over a surface; the designs may be purely geometrical, or based on floral forms, and in early examples were regulated by the process of their textile origin. Subsequently similar patterns were employed in the middle ages for the surface decoration of stone, as in Westminster Abbey and Bayeux cathedral in the spandrils of the arcades of the choir and nave; also in mural painting, stained glass, incised brasses, encaustic tiles, etc. Probably in most cases the pattern was copied, so far as the general design is concerned, from the tissues and stuffs of Byzantine manufacture, which came over to Europe and were highly prized as ecclesiastical vestments.



DIAPER, A AND B SHOW TWO VARIETIES OF DIAMOND PATTERN DIAPERS, AND C SHOWS THE WARP AND WEFT

In its textile use, the term diaper was originally applied to silk patterns of a geometrical pattern; it is now almost exclusively used for diamond patterns made from linen or cotton yarns. An illustration of two patterns of this nature is shown in the figure. The floats of the warp and the weft are mostly in three; indeed the patterns are made from a base weave which is composed entirely of floats of this number. It will be seen that both designs are formed of what may be termed concentric figures—alternately black and white. Pattern B differs from pattern A only in that more of these concentric figures are used for the complete figure. If pattern B, which shows only one unit, were extended, the effect would be similar to A, except for the size of the unit. In A there are four complete units, and hence the pattern appears more striking. Again, the repeating of B would cause the four corner pieces to join and to form a diamond similar to the one in the centre. The two diamonds in B would then alternate diagonally to left and right. Special names are given to certain kinds of diapers, *e.g.*, "bird's-eye," "pheasant's eye"; these indicate, to a certain extent, the size of the complete diamond in the cloth—the smaller kind taking the name "bird's-eye." The size of the pattern on paper has little connection with the size of the pattern in the cloth, for it is clearly the number of threads and picks per inch which determine the size of the pattern in the cloth from any given design. Although A is larger than what is usually termed the "bird's-eye" pattern, it is evident that it may be made to appear as such, provided that the cloth is fine enough. These designs, although adapted mostly for cloths such as nursery-diapers, for pinafores, etc., are sometimes used in the production of towels and table-cloths. In the figure, the first pick in A is identical with the first pick in B, and the part C shows how each interweaves with the 24 threads.

DIAPHONIA, in Greek musical terminology, dissonance, as opposed to consonance. Later, that is, in the early middle ages, the term signified one of the earliest kinds of descant (*q.v.*), also known as organum, in which the parts moved by unvaried parallel motion in fourths and fifths.

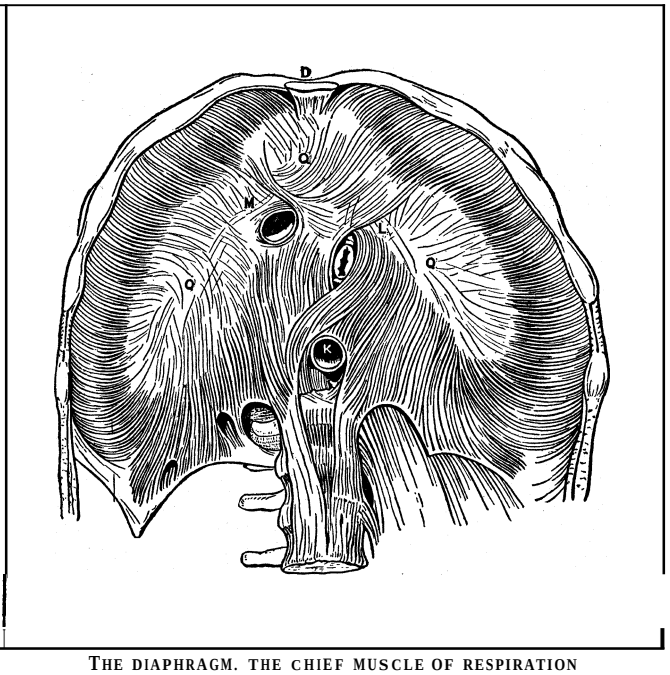
DIAPHORETICS, the name given to those remedies which promote perspiration. Among the best known are vapour or hot-water baths, or that part of the process of the Turkish bath which consists in exposing the body to a dry and hot atmosphere. Such measures, particularly if followed by the drinking of hot liquids and the wrapping of the body in warm clothing, seldom fail to excite copious perspiration. Numerous medicinal substances have the same effect.

DIAPHRAGM (dī'ă-frăm) (or midriff). In human anatomy a large fibro-muscular partition between cavities of the thorax and abdomen; it is convex toward the thorax, concave toward the abdomen, and consists of a central tendon and a muscular margin. The *central tendon (see* fig.) is trefoil in shape. The fleshy fibres rise, in front, from the back of the xiphoid cartilage, laterally by six serrations, from the inner surfaces of the lower six ribs, posteriorly from the five arcuate ligaments, two external, two internal, and one median. There are three large openings in the diaphragm; the *aortic* is behind the middle arcuate ligament and transmits the aorta, the vena azygos major, and the thoracic duct. In the right leaflet is an opening for the inferior vena cava and a branch of the right phrenic nerve, while in front and a little to the left of the aortic opening is one for the oesophagus and the two pneumogastric nerves.

Through the crura pass the splanchnic nerves. The sympathetic nerves usually enter the abdomen behind the internal arcuate ligaments. The phrenic nerves, which are the main supply of the diaphragm, divide before reaching the muscle and pierce it in a number of places to enter its abdominal surface, but some of the lower intercostal nerves assist in the supply.

For the action of the diaphragm *see* RESPIRATORY SYSTEM, ANATOMY OF.

Embryology.—The diaphragm is at first developed in the neck region of the embryo, and this accounts for the phrenic nerves, which supply it, rising from the fourth and fifth cervical. With growth of the body and development of the lungs the diaphragm shifts its position downwards. *(See* A. Keith, "On the Development of the Diaphragm," *Jour. of Anat. and Phys.* vol. *39.)* A. Paterson has recorded cases in which the left half of the diaphragm is wanting (*Proceedings* of the Anatomical Society of Gt. Britain, June 1900; *Jour. of Anat. and Phys.* vol. 34), and occasionally deficiencies are found elsewhere, especially in the sternal portion.



THE DIAPHRAGM. THE CHIEF MUSCLE OF RESPIRATION
Abdominal surface, showing origin of central tendons (Q) from xiphoid cartilage (D), and openings for aorta (K), inferior vena cava (M), pneumogastric nerves (L), and oesophagus

Comparative **Anatomy.**—A complete diaphragm is characteristic of the Mammalia; it usually has the human structure and relations except that below the Anthropoids it is separated from the pericardium by the azygous lobe of the lung. In some Mam-

mals, *e.g.*, Echidna and Phocoena, it is entirely muscular. In the Cetacea it is remarkable for its obliquity; this allows a larger lung space in the dorsal than in the ventral part of the thorax, and may be concerned with the equipoise of the animal. Below the mammals incomplete partitions are found in chelonians, crocodiles and birds, and in amphibians (*Xenopus* and *Pipa*).

DIAPHRAGM (in physics), the thin sheet of metal or other material used in the telephone (*q.v.*), microphones (*q.v.*), gramophones (*q.v.*) and loud speakers, whose function is to convert the electric oscillations into sound waves or vice versa.

DIARBEKR[1] or DIYARBEKIR, chief town of a vilayet of Turkey, situated on a basaltic plateau on the right bank of the Tigris, which there flows in a deep open valley. The town is still surrounded by the masonry walls of black basalt which give it the name of *Kara* or Black Amid; they are well built and imposing on the west facing the open country, but almost in ruins where they overlook the river. A mass of gardens and orchards covers the slope down to the river on the southwest. Pop. (1940) 43,264. The streets are narrow, badly paved and dirty; the houses and shops are low, mostly of stone, and some of stone and mud. The bazaar is a good one, and gold and silver filigree work is made, peculiar in character and design. Fruit is good and abundant as the rich volcanic soil is well watered from the town springs. The size of the melons is specially famous. To the south, the walls are some 40 ft. high, faced with large cut stone blocks of very solid construction, with towers and square bastions rising to 500 ft. There are four gates: on the north the Kharput gate, on the west the Rum, on the south the Mardin and on the east the Yeni Kapu or new gate. A citadel enclosure stands at the northeast corner and is now partly in ruins, but the interior space is occupied by the government konak. The summer climate in the confined space within the town is excessively hot and unhealthy. Winters are frequently severe but do not last long. The town is supplied with water both by springs inside the town and by aqueducts from fountains at Ali Punar and Hamervat. The principal exports are wool, mohair and copper ore, and imports are cotton and woollen goods, indigo, coffee, sugar, petroleum, etc. Cereals, cotton, tobacco, rice and silk are produced, and a school has been opened to give villagers instruction in silkworm culture. An exceptionally rich copper mine exists at Arghana Maden; galena mineral oil and silicious sand are also found. Scorpions noted for their virulence abound.

The Great Mosque, Ulu Jami, formerly a Christian church, occupies the site of a Sassanian palace and was built with materials from an older palace, probably that of Tigranes II. The churches of greatest interest are those of SS. Cosmas and Damian (Jacobite) and the church of St. James (Greek). In the 19th century Diarbekr was one of the largest and most flourishing cities of Asia. It is at the head of the navigation of the Tigris, which is traversed downstream by *keleks* or rafts supported by inflated skins. There is a good road to Aleppo and Alexandretta on the Mediterranean, and to Samsun on the Black sea by Kharput, Malatia and Sivas. There are also routes to Mosul and Bitlis. Railroad service to Diarbekr from Ankara was inaugurated on Nov. 22, 1935.

Diarbekr became a Roman colony in A.D. 230 under the name of Amida. It was enlarged and strengthened by Constantius II, in whose reign it was taken after a long siege by Shapur (Sapor) II, king of Persia. The historian Ammianus Marcellinus, who took part in the defense, gives a detailed account of it. In the later wars between the Persians and Romans it more than once changed hands. Though ceded by Jovian to the Persians it again became annexed to the Roman empire, and in the reign of Anastasius (A.D. 502) was once more taken by the Persians. It was taken c. 638 by the Arabs, and afterwards passed into the hands of the Seljuks and Persians, from whom it was finally captured by Selim I in 1515; and since that date it has remained under Ottoman rule. About 2 mi. below the town is a masonry bridge over the Tigris, the older portion being probably Roman, and the western part, which bears a Kufic inscription, being Arab.

(C. W. W.; F. R. M.)

[1]From *Diar,* land, and **Bekr** (*i.e.,* Abu **Bekr, the caliph).**

DIARRHOEA, an excessive looseness of the bowels, a symptom of irritation which may be due to various causes, or may be associated with some specific disease. The treatment in such latter cases necessarily varies, since the symptom itself may be remedial, but in ordinary cases depends on the removal of the cause of irritation by the use of aperients, various sedatives being also prescribed. In chronic diarrhoea careful attention to the diet is necessary, and careful search must be made for the underlying cause; it may be very serious.

DIARY, the book in which are preserved the daily memoranda regarding events and actions which come under the writer's personal observation, or are related to him by others. The person who keeps this record is called a diarist.

It is not until the close of the Renaissance (but *see* COMMENTARII) that we find diaries beginning to have literary value. In the 17th century they began to be largely written in England, although in most cases without any idea of even eventual publication. Sir William Dugdale (1605–86) had certainly no expectation that his slight diary would ever see the light. Bulstrode Whitelocke (1605–75), whose *Memorials of the English Affairs* covers the ground from 1625–60, was a genuine diarist. So was the elder George Fox (1624–91), who kept not merely "a great journal," but "the little journal books," and whose work was published in 1694. The famous diary of John Evelyn (1620–1706) professes to be the record of 70 years, and, although large tracts of it are covered in a very perfunctory manner, while in others many of the entries have the air of having been written in long after the event, this is a very interesting and amusing work; it was not published until 1818. It would hold a still higher position in the history of literature than it does if it were not overshadowed by what is unquestionably the most illustrious of the diaries of the world, that of Samuel Pepys (1633–1703) (*q.v.*). This was begun on Jan. 1, 1660, and was carried on until May 29, 1669. The extraordinary value of Pepys' diary consists in its fidelity to the portraiture of its author's character. In the age which succeeded that of Pepys, a diary of extraordinary emotional interest was kept by Swift from 1710 to 1713, and was sent to Ireland in the form of a *Journal to Stella;* it is a surprising amalgam of ambition, affection, wit and freakishness. John Byrom (1692–1763), the Manchester poet, kept a journal, which was published in 1854. The diary of the celebrated dissenting divine, Philip Doddridge (1702–51), was printed in 1829. Of far greater interest are the admirably composed and vigorously written journals of John Wesley (1703–91). But the most celebrated work of this kind produced in the latter half of the 18th century was the diary of Fanny Burney (Madame d'Arblay), published in 1842–46. It will be perceived that, without exception, these works were posthumously published. Boswell's *Journal of* a *Tour to the Hebrides* (1785), a genuine diary though somewhat expanded, was published during the author's lifetime.

Many of the diaries described above were first published in the opening years of the 19th century, and the interest which they awakened led to their imitation. Diaries ceased to be rare, but as a rule the specimens which have hitherto appeared have not presented much literary interest. Sir Walter Scott's *Journal* (published in 1890) and the diaristic portions of R. B. Haydon's *Autobiography and Journal* are eminent exceptions. Exception must also be made in favour of the journals of two minor politicians, Charles Greville (1794–1865) and Thomas Creevey (1768–1838), whose indiscretions have added much to the gaiety of nations; the papers of the former appeared in 1874–87, those of the latter in 1903. The diary of Henry Crabb Robinson (1775–1867), printed in 1869, contains excellent biographical material. Tom Moore's journal, published in 1856 by Lord John Russell, disappointed its readers. Darwin's historic *Voyage round the World* is written in diary form. Emerson's *Journals* are the notebook of an author rather than a book of intimate confessions. In the 20th century many men and women have published their diaries during their lifetime. Colonel Repington's *Diary* of World War I was a monument of indiscretion. "W. N. P. Barbellion" was still alive when his tragic *Diary of* a *Disappointed Man* was published. Of recent diaries none has possessed more

literary grace than the *Journal of Katherine Mansfield*.

It was natural that the form of the diary should appeal to a people so sensitive to social peculiarities as the French. A mediaeval document of immense value is the diary kept by an anonymous curé during the reigns of Charles VI. and Charles VII. This *Journal d'un bourgeois de Paris* was kept from 1409–31, and was continued by another hand down to 1449. The marquis de Dangeau (1638–1720) kept a diary from 1684 till the year of his death; this is an inexhaustible storehouse of facts about the reign of Louis XIV. Saint-Simon's own brilliant memoirs, written from 1691 to 1723, may be considered as a sort of diary. The lawyer, Edmond Barbier (1689–1771), wrote a journal of anecdotes from 1718–62. The song-writer, Charles Collé (1709–83), kept a *journal historique* from 1758–82; it is full of vivacity, but very scandalous. Petit de Bachaumont (1690–1771) had access to remarkable sources of information, and his *Mémoires secrets* contains a valuable mass of documents. In recent times the posthumous publication of the diaries of the Russian artist, Marie Bashkirtseff (1860–84), produced a great sensation in 1887. The brothers Jules and Edmond de Goncourt kept a very minute diary of artistic and literary Paris: after the death of Jules, in 1870, this was continued by Edmond, who published the three first volumes in 1888.

DIASPORE, a native aluminium hydroxide, AlO (OH) or $Al_2O_3{\cdot}H_2O$, crystallizing in the orthorhombic system and isomorphous with goethite and manganite. It occurs sometimes as platy crystals, but usually as lamellar or scaly masses, the flattened surface being a direction of perfect cleavage on which the lustre is markedly pearly in character. It is colourless or greyish-white, yellowish, sometimes violet in colour, and varies from translucent to transparent. It may be readily distinguished from other colourless transparent minerals, with a perfect cleavage and pearly lustre—mica, talc, brucite, gypsum—by its greater hardness of 6½–7. The specific gravity is 3·4. When heated before the blowpipe it decrepitates violently, breaking up into white scales.

DIASTYLE, an intercolumniation (*q.v.*) of three or four diameters.

DIATHERMY, a term first applied by Nagelschmidt in 1908 to the use of high frequency currents for heating locally the tissues of the body. The frequencies employed are 300,000 per sec. or above, which are too rapid to affect the nerve endings. Hence currents of an ampere or more can be used, the patient feeling only a sensation of warmth. The currents are generated in a coil of appreciable inductance and very low resistance by the oscillatory discharge of a condenser. The condenser is charged to a high voltage by a step-up transformer on an A.C. supply, and the discharge is produced by the passage of a spark through a multiple tungsten-faced spark gap. The oscillations are of the necessary high frequency and are maintained continuously by the spark discharge. The currents are led to the patient by pads or flexible metal sheets. (*See* ELECTROTHERAPY.)

DIATOMACEAE: *see* BACILLARIALES.

DIATONIC, a musical term signifying literally "through the tones," otherwise music in the case of which the notes employed are confined to those of the key, major or minor as the case may be, in which it is written. Hence diatonic music gives a general impression of strength, simplicity and solidity as distinguished from the more restless and poignant character of that in which notes from foreign keys are introduced by accidentals (*q.v.*).

DIAULOS, originally, in Greece, a race of twice the usual length, or two stadia; also, in architecture, the colonnade surrounding the great court of the Greek palaestra. so-called because its total circuit was about two stadia, or about 1,200 feet.

DIAVOLO, FRA (1771–1806), the popular name given to a famous Italian brigand. His real name was Michele Pezza, and he was born of low parentage at Itri; he had committed many murders and robberies in the Terra di Lavoro, but escaped capture, whence his name, popular superstition having invested him with the characters of a monk and a demon, and it seems that at one time he actually was a monk. Fra Diavolo was made leader of one of the bands raised by the Bourbon king, Frederick IV. against the French occupation, and succeeded in interrupting the enemy's communications between Rome and Naples. But although he wore a military uniform and held military rank, and was even created duke of Cassano, his atrocities were worthy of a bandit chief. On one occasion he threw some of his prisoners, men, women and children, over a precipice, and on another he had a party of 70 shot. He was for a short time imprisoned in the castle of St. Angelo, but was soon liberated. Joseph Bonaparte put a price on Fra Diavolo's head. For some time he evaded his pursuers, but at length, hungry and ill, he went in disguise to the village of Baronissi, where he was arrested, tried by an extraordinary tribunal, condemned to death and shot. His name has gained a world-wide celebrity as the title of a famous opera by Auber.

See A. Luzio, *Profili e bozzetti storici* (Milan, 1906).

DIAZ, ARMANDO (1861–1928), Italian marshal, was born in Naples on Dec. 6, 1861. He served in the Italo-Turkish War, and in 1914 was promoted to major-general. On Italy's entry into the World War he was director of military operations, and in 1916 became lieutenant-general in command of the 49th Division. In 1917 he was put in command of the XXIII. Corps and saw much hard fighting on the Carso. In Nov. 1917, after Caporetto, Diaz succeeded Cadorna as chief of the general staff. Under him the battle front was successfully reconstituted, and the Austrian armies were destroyed at Vittorio Veneto (Oct.–Nov. 1918). Diaz had proved himself not only a great commander in the field, but an organizer who saw that the army was well provided. After the signature of the Armistice he became inspector-general of the army. He received many honours, Italian and foreign, and in 1921 was created Duca della Vittoria. On the advent of the Fascist Government he was appointed minister of war, and held that appointment until ill health obliged him to resign in April 1924. On Nov. 4, 1924, the newly created rank of marshal was conferred on him. He died on Feb. 29, 1928, at Milan.

DÍAZ DEL CASTILLO (c. 1492–*c.* 1593), Spanish soldier and author, was born at Medina del Campo. In 1514 he visited Cuba and five years later accompanied Cortez to Mexiço where he died. He is known chiefly by his *True Account of the Discovery of New Spain* (3 vols., 1632; critical edition by Garcia, Mexico, 1904; Eng. trans. by Maudslay, 3 vols., 1908).

DIAZ, NARCISSE VIRGILE (1809–1876), French painter of the Barbizon school, was born in Bordeaux of Spanish parents, on Aug. 25, 1809. At first a figure-painter who indulged in strong colour, in his later life Diaz became a painter of the forest and a "tone artist" of the first order. He had an unhappy childhood. He lost a leg through a badly dressed insect-bite, and worked for some time as a porcelain painter at Sèvres. About 1831 Diaz encountered Théodore Rousseau, for whom he entertained a great veneration, although Rousseau was four years his junior. Ten years later Diaz found Rousseau painting his wonderful forest pictures, and determined to paint in the same way if possible. Rousseau was touched with the passionate words of admiration, and finally taught Diaz all he knew. Diaz exhibited many pictures at the Paris Salon, and was decorated in 1851. After 1871 he became fashionable and he worked constantly and successfully. In 1876 he caught cold at his son's grave, and on Nov. 18 of that year he died at Mentone. Diaz's finest pictures are his forest scenes and storms. There are several fairly good examples of his work in the Louvre, and three small figure pictures in the Wallace collection, Hertford House, London. Perhaps the most notable of Diaz's works are "La Fée aux Perles" (1857), in the Louvre; "Sunset in the Forest" (1868); "The Storm," and "The Forest of Fontainebleau" (1870) at Leeds. Diaz had no well-known pupils, but Léon Richet followed markedly his methods of tree-painting, and J. F. Millet at one period painted small figures in avowed imitation of Diaz's then popular subjects.

See A. Hustin, *Les Artistes célèbres: Diaz;* J. Claretie, *Peintres et sculpteurs contemporains: Diaz* (1882); D. Croal Thomson, *The Barbizon School of Painters* (1890); J. W. Mollett, *Diaz* (1890).

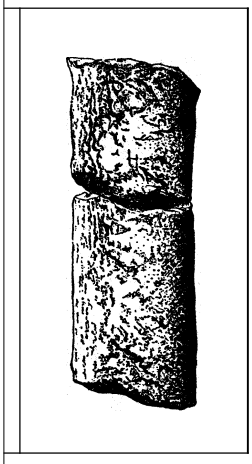
DÍAZ, JOSÉ DE LA CRUZ PORFIRIO (1830–1915), Mexican soldier and statesman, born in the city of Oaxaca, State of Oaxaca, Sept. 15, 1830. His family was poor, and his mother was part Indian. He was educated for the church, then the only career open to a youth without wealth. At the age of

fifteen he entered the Seminario Pontifical in Oaxaca, but in 1849, falling under the influence of Benito Juárez, rector of the university, he relinquished his clerical ambitions to undertake the study of law with Juárez in the Institute of Arts and Sciences, where he passed his examinations in civil and canon law in 1853. But he was pre-eminently a man of action. During the war with the United States (1847–48) he left home to serve in the army. In the plebiscite of 1855 he repudiated the dictatorship of Santa Anna. When the anti-clerical measures of the Constitution of 1857 resulted in the War of Reform (1858–61), Diaz supported Juirez, now president of the country, and aided materially in the overthrow of the clerical revolution and the final establishment of the Reform Laws. He was one of the first to oppose the French invasion of 1862, and after the establishment of Maximilian in Mexico in 1864, he was the most prominent figure in the struggle against the empire. He defeated a French attack upon Puebla in 1862, and in 1865, when the republican fortunes seemed at their nadir, he formed the "army of the east," recaptured Puebla in the spring of 1867, and on June 21, 1867, two days after the execution of Maximilian at Querétaro, re-entered the capital. Placing the city under martial law he maintained order until he was able to hand over his command to Juirez. Then he resigned his position in the army and retired to Oaxaca. He took no part in the Government until 1871. Dissatisfied with Juárez's policy, he appeared as a candidate for the presidency against Juárez and Lerdo de Tejada, and when congress proclaimed the re-election of Juárez, led an unsuccessful revolt in protest. In 1872 Lerdo succeeded as president in an administration which brought discord and disorder, and when he attempted to be re-elected in 1876, Diaz took the leadership of a revolution, proclaimed the principle of non-re-election, and defeated the Government forces in the battle of Tecoac, on Nov. 16, 1876. He was elected president in May 1877, and at once forged ahead with financial and political reform, the centralization of the Government, the re-establishment of public security, the scrupulous settlement of all national debts, and the building of railroads and telegraphs. His rule was stern, his methods sometimes brutal, but he achieved amazing results. In 1880 he was succeeded by Manuel González, the former minister of war, in whose cabinet he sat for some time as minister of *Fomento*, but in 1884 was unanimously re-elected to the presidency. Continuing his programme of political reorganization and economic reform, he opened the nation's natural resources to the world, succeeded in attracting great quantities of foreign capital, and won for Mexico, for the first time in her history, a position of respect among the nations. Political crises which arose with Guatemala, Austria and the United States he handled to the advantage of Mexico. In 1887 and 1892 the Constitution was amended to permit his re-election and from 1884 until 1911 he was continuously in office. But material prosperity was achieved at the cost of repression and increasing discontent. The land problem became acute, education was inadequate, and agitators fomented wide-spread dissatisfaction at the alleged control of the country by foreign capitalists. An incipient revolt headed by Gen. Bernardo Reyes in 1903 was quickly crushed, but in 1910 the standard of agrarian revolt was raised; the movement spread swiftly over the country; the Government was unable to control the army, and on May 4, 1911, Díaz resigned his post and left for Europe. He died in Paris on July 2, 1915, having seen destroyed most of the stability which he had brought to his country.

See Mrs. Alec Tweedie, *Porfirio Diaz, Seven Times President of Mexico* (1906) and *Mexico as I saw it* (1901); Dr. Noll, *From Empire to Republic* (1890); Lieut. Seaton Schroeder, *Fall of Maximilian's Empire* (New York, 1887); R. de Z. Enriquez, *P. Diaz* (1908); David Hannay, *Diaz* (1917); and an article by Percy Martin in *Quarterly Review* (Oct. 1909). Porfirio Diaz, *Memorias, 1830–1867* (2 vol., 1922–23); H. H. Bancroft, *Vida de Porfirio Diaz* (1887); F. Bulnes, *El verdadero Díaz y la revolucidn* (1920); J. H. Cornym, *Diaz y Mexico* (1911); J. Creelman, *Diaz, Master of Mexico* (1911); F de la Colina, *Madero y el Gral. Diaz* (1913); L. Lara y Prado, *De Porfirio Diaz a Francisco Madero* (1912); F. Madero, *La sucesión presidencial en 1910* (1909); J. López-Portillo y Rojas, *Elevación y caida de Porfirio Diaz* (1921); S. Quevedo y Zubieta, *Porfirio Díaz, septiembre 1830–septiembre 1865* (1906), and *El caudillo* (1909); J. Sesto, *A Través de América* (1909); A. L. Velasco, *Porfirio Diaz* (1892); and *Porfirio Diaz y su gabinete* (1889); E. Zayas, *Porfirio Diaz* (1908); C. de Fornaro, *Diaz Czar of Mexico, an Arraignment* (1909); J. F. Godoy, *Porfirio Diaz* (1910: Eng. trans. also 1910); A. González-Blanco, *Un déspota y un libertador* (1916); G. García, *Porfirio Díaz, sus padres, niñez y juventud* (1908); R. Rodriguez, *Historia autentica de la administración del Sr. Gral. Porfirio Diaz* (2 vol. 1904), which contains the presidential messages of Diaz.

DIAZ DE NOVAES, BARTKOLOMEU (*fl.* 1481–1500), Portuguese explorer, discoverer of the Cape of Good Hope, was probably a kinsman of João Diaz, one of the first Portuguese to round Cape Bojador (1434), and of Diniz Diaz, the discoverer of Cape Verde (1445). In 1478 a Bartholomeu Diaz, probably identical with the discoverer, was exempted from certain customary payments on ivory brought from the Guinea coast. In 1481 he commanded one of the vessels sent by King John II. under Diogo d'Azambuja to the Gold Coast. On Oct. 10, 1486, he received an annuity of 6,000 reis from King John for "services to come"; and some time after receiving the money he left Lisbon with three ships fully manned and equipped to carry on the work of African exploration which had been so greatly advanced by Diogo Cão (1482–86).

Passing Cão's farthest point near Cape Cross (in the modern German South-west Africa and in 21° 50′ S.), he erected a pillar on what is now known as Diaz Point, south of Angra Pequena or Luderitz bay, in 26" 38' S.; of this fragments still exist. From this point (according to De Barros) Diaz ran 13 days southwards, in a comparatively high southern latitude, considerably south of the Cape. Failing, after several days' search, to find land, the Portuguese turned north, and so struck the south coast of Cape Colony at Mossel bay (Diaz' Bahia dos Vaqueiros), half way between the Cape of Good Hope and Port Elizabeth (Feb. 3, 1488). Thence they coasted eastward, passing Algoa bay (Diaz' Bahia da Roca). The officers and men now began to insist on return, and Diaz could only persuade them to go as far as the estuary of the Great Fish river. Here, however, half way between Port Elizabeth and East London, the north-easterly trend of the coast became unmistakable: the way round Africa had been definitely laid open by the Portuguese explorer.



BY COURTESY OF SOCIEDADE DE GEOGRAFIA DE LISBOA

FRAGMENTS OF A PILLAR ERECTED BY DIAZ IN 1487 AT ANGRA PEQUENA OR LÜDERITZ BAY, SOUTH-WEST AFRICA

On his return Diaz perhaps named Cape Agulhas after St. Brandan; while on the southernmost projection of the modern Cape peninsula, whose remarkable highlands doubtless impressed him as the practical termination of the continent, he bestowed, says De Barros, the name of Cape of Storms (*Cabo Tormentoso*); this name was changed by King John to that of Good Hope (*Cabo* da Boa *Esperança*). Some authorities, however, make Diaz himself give the Cape its present name. After touching at the Ilha do Principe (Prince's island, south-west of the Cameroons) as well as at the Gold Coast, he returned to Lisbon in Dec. 1488. He had discovered 1,260 m. of hitherto unknown coast; and his voyage, taken with the letters soon afterwards received from Pero de Covilhão (who by way of Cairo and Aden had reached Malabar on one side and the "Zanzibar coast" on the other as far south as Sofala, in 1487–88) was rightly considered to have solved the question of an ocean route round Africa to the Indies and other lands of South and East Asia.

No record has yet been found of any adequate reward tendered to Diaz for his great achievement; on Cabral's voyage of 1500 it has been recorded he was indeed permitted to take part in the discovery of Brazil (April 22), and thence should have helped to guide the fleet to India; but he perished in a great storm off his own Cabo Tormentoso, now known as Good Hope, and which he discovered in 1488. As Galvano says, he was allowed to see the

Promised Land, but not to enter in.

See João de Barros, *Asia,* Dec. I. bk. iii. ch. 4. (ed. A. A. Grillo and G. A. Grillo, 1866, etc.); Duarte Pacheco Pereira, *Esmeraldo de situ orbis (see* Raphael Basto, *Introduction* to his edition, 1892; also ed. A. da Silva Dias, 1905). A marginal note, probably by Christopher Columbus himself, on fol. 13 of a copy of Pierre d'Ailly's *Imago mundi,* now in the Colomhina at Seville, fixes Diaz's return to Lisbon in Dec. 1488. The writer says he was present at Diaz's interview with the King of Portugal, when the explorer described his voyage and showed his route upon the chart he had kept. *See* also the *Journal of the First Voyage of Vasco de Gama* (Hakluyt Society, ed. E. G. Ravenstein, 1898); F. Lopes de Castanheda, *Historia* (bk. i., Coimbra 1551); A. Galvão, *Descobrimentos (Discoveries of the World)* (Hakluyt Society, 1862); E. G. Ravenstein, "Voyages of Cão and Dias" in *Geographical Journal* (vol. xvi., 1900).

DIAZO-COMPOUNDS, in organic chemistry, compounds containing the characteristic group –N:N–, generally, although not invariably, joined to only one carbon atom, the other valency being satisfied either by (1) an electro-negative or acidic radical, as in the diazonium salts; (2) an oxygen atom in the diazohydroxides $R{\cdot}N_2{\cdot}OH$ and diazo-oxides, $R'{\cdot}N_2{\cdot}OR$; or (3) a nitrogen atom in the diazo-amino-compounds (diazo-amines). The diazo-compounds are not only of scientific interest but of considerable industrial importance, for they are essential to the manufacture of azo-dyes—the largest group of synthetic colouring matters. *(See* DYES, SYNTHETIC.) These diazo-compounds were discovered by P. Griess (1858), who pursued this investigation while engaged as chemist in the brewery of Allsopp & Co. of Burton-on-Trent.

The diazotization of aniline and other similarly constituted aromatic primary amines is carried out on a manufacturing scale as a necessary step in the production of colouring matters. More than 1,000 tons of para-nitraniline are diazotized annually in the formation on cotton fibre of "para-nitraniline red."

AROMATIC DIAZONIUM SALTS

In diazotizing aniline and other aromatic amines the base is first converted into its salt, usually the hydrochloride, by the addition of excess of acid (3 molecular proportions of hydrochloric acid). The solution or suspension is cooled and aqueous sodium nitrite is added with stirring, when the nitrous acid liberated substitutes one nitrogen atom for three hydrogen atoms present in the molecule of the organic salt:

$$C_6H_5{\cdot}NH_3Cl+HNO_2=C_6H_5{\cdot}N_2{\cdot}Cl+2H_2O.$$

It is on account of this replacement of hydrogen by nitrogen, which becomes attached to the nitrogen atom already present in the molecule, that the products now containing a double portion of nitrogen (azote) are termed diazo-compounds. *Benzenediazonium chloride,* represented by the above formula, is an extremely soluble salt of explosive character, and for ordinary synthetic and industrial purposes it is not necessary to isolate it. This and other diazonium salts have, however, been prepared in an anhydrous condition by diazotizing the amine salt in alcohol or glacial acetic acid with methyl, ethyl or amyl nitrite, when the diazonium salt is precipitated on the addition of ether (E. Knoevenagel, E. Bamberger, A. Hantzsch).

Diazonium salts have been obtained with a large variety of acid radicals but, being endothermic compounds, they are all liable to explode in the dry state; and since the diazonium chromates and perchlorates detonate with considerable violence, these salts have been suggested for use as explosives. When a diamine not containing its amino-groups in either ortho- or peri-positions is wholly diazotized a bisdiazonium salt results. If the two amino-groups are in the same nucleus a mixture of mono- and bisdiazonium salts is frequently produced, as in the case of paraphenylenediamine hydrochloride. When the amino-groups are in different aromatic rings, the bisdiazonium salt is produced with much greater facility. Benzidine, dianisidine and tolidine are the most outstanding examples of readily diazotizable diamines, and their bisdiazonium salts are largely employed in the manufacture of certain azo-dyes which, having considerable affinity for cotton fibre, are termed direct cotton dyes.

In addition to the employment of diazonium salts in colour making, these reactive compounds are utilized in many synthetic operations both in the laboratory and in the works. Their application to synthesis depends on the fact that through the diazo-reaction the amino-group originally present in an aromatic amine becomes replaceable by other elementary or compound radicals.

Reactions.— (I) *Decontposition by water:*

$$R{\cdot}N_2{\cdot}HSO_4+H_2O=R{\cdot}OH+N_2+H_2SO_4.$$

On boiling with water the diazonium salt (preferably the sulphate) loses nitrogen and its inorganic acidic radical and furnishes the phenol, $R{\cdot}OH$, corresponding with the original base, $R{\cdot}NH_2$. Guaiacol, $CH_3O{\cdot}C_6H_4{\cdot}OH$, is thus obtained through the diazonium salt of ortho-anisidine. The manufacture of α-naphtholsulphonic acids from the diazo-derivatives of the α-naphthylaminesulphonic acids is an industrial application of this decomposition by water. *(See* NAPHTHALENE.)

(2) *Replacentent of the diazo-group by hydrogen.* The amino-group of the aromatic amine can be replaced by hydrogen when the diazonium salt is treated with a reducing agent (aluminium powder, sodium stannite, hypophosphorous acid) or by boiling with alcohol. In the latter process the product is frequently a mixture of hydrocarbon and mixed ether, the alcohol behaving partly as a reducing and partly as an etherifying agent.

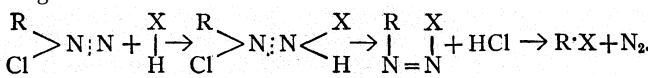
(3) *Replacement of the diazo-group by halogen, cyanide, cyanate and thiocyanate radicals.* Fluorine may be introduced into the aromatic nucleus by treating diazonium salts or diazo-amino-compounds *(see* below) with hydrofluoric acid. A more convenient method depends on the use of diazonium borofluorides (G. Balz and G. Schiemann, 1927), $R{\cdot}N_2BF_4$, which are readily obtainable in a solid state. When heated these salts decompose in the following manner and introduce fluorine into the aromatic nucleus: $R{\cdot}N_2BF_4=R{\cdot}F+N_2+BF_3$. Chlorine and bromine radicals are introduced into aromatic nuclei by warming diazonium salts with acid solutions of the corresponding cuprous salt (T. Sandmeyer, 1884) or with copper powder (L. Gattermann, 1890). Iodine is readily substituted for the diazo-group by adding potassium iodide to the solution of diazonium sulphate. Appropriate modifications of the Sandmeyer and Gattermann reactions furnish means for the introduction of cyanide, cyanate, thiocyanate and selenocyanate radicals into the aromatic nucleus.

(4) *Replacement* of the *diazo-group* by *sulphur* and *sulphur-containing radicals.* When copper powder is added to a solution of diazonium sulphate saturated with sulphur dioxide, nitrogen is eliminated and an aromatic sulphinic acid is produced. Aromatic thiophenols or disulphides are obtained by adding potassium xanthate, $C_2H_5{\cdot}CS{\cdot}SK$, to diazonium salts with subsequent hydrolysis of the resulting aromatic xanthate (Leuckart, 1887).

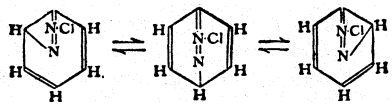
(5) *Replacement of the diazo-group by a nitro-group.* Potassium mercuric nitrite gives with aqueous benzenediazonium nitrate the double salt $C_6H_5N_2{\cdot}NO_3{,}Hg(NO_2)_2$, which on being warmed with copper powder yields nitrobenzene (A. Hantzsch, 1900). The treatment of a diazonium sulphate with cuprosocupric sulphite and alkali nitrite leads to exchange of the diazo-radical for the nitro-group.

Constitution.—On account of their condensation to form azo-compounds (*q.v.*) and their reduction to hydrazines, $R{\cdot}NH{\cdot}NH_2$, diazonium salts were assumed by A. Kekule (1866) to be compounds having the general formula $R{\cdot}N{:}N{\cdot}Cl$, but this formulation hardly accounts satisfactorily for their physical and chemical properties. Benzenediazonium chloride and its analogues dissolve in water to neutral solutions in which, as determinations of electrical conductivity indicate, their salts are highly ionized. The rate of migration of the benzenediazonium ion, $C_6H_5{\cdot}N_2$, has been ascertained to be 45.7 at 25°, and is thus comparable with the rates of migration of methylpyridinium and tetramethylammonium ions, which are respectively 44.3 and 43·6. The striking similarity in the properties of dissolved diazonium and quaternary ammonium salts suggests the presence of quinquevalent nitrogen in the former series, and for these reasons the diazonium formula first proposed by Blomstrand (1869) has been adopted generally, $C_6H_5{\cdot}\overset{\displaystyle N}{\underset{\displaystyle N}{\vdots\!\vdots}}{\cdot}Cl$.

Hantzsch explains the characteristic reactions of the diazonium compounds by the assumption that an addition compound is first formed, which breaks down with the elimination of the hydride of the acid radical, and the formation of an unstable syn-diazo-compound, which, in its turn, decomposes with evolution of nitrogen.

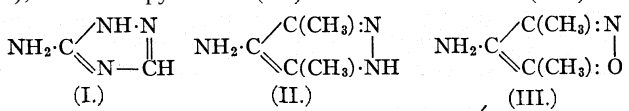


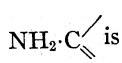
This conception of diazonium structure fails, however, to express one important point, namely, the dependence of the stability of the diazo-group on its attachment to an unsaturated organic radical. Accordingly, J. C. Cain proposed an alternative para-quinonoid formula for diazonium salts, and subsequently G. T. Morgan and F. M. G. Micklethwait (1908) developed the idea that diazonium salts may possess a dynamic constitution, Cain's structure representing the middle phase of the molecular oscillation,



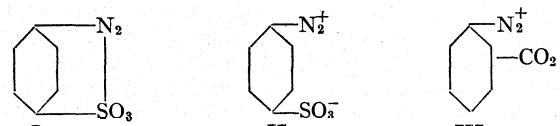
This idea of a rhythmic change of structure in diazonium salts is comparable with the dynamic conception of the benzene molecule advanced by Kekulé in propounding his cyclic theory of the constitution of aromatic hydrocarbons. These quinonoid formulations are supported by the fact that, although the simpler benzenoid diazonium salts are colourless, yet in the diphenyl, naphthalene and carbazole series such salts are frequently coloured.

Non-aromatic Diazonium Salts.—The foregoing conception of the structure of diazonium salts, which bases their existence on the unsaturated nature of associated organic complex, derives additional support from the fact that many non-aromatic amines containing unsaturated organic groups are diazotizable. Among the simplest bases which display this property are aminotriazole (I.), the aminopyrazoles (II.) and aminoisoxazole (III.).



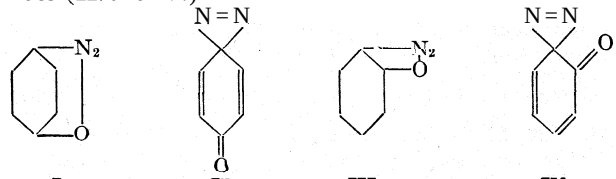
It will be noticed that the grouping  is common to all diazotizable arnines.

Internal **Diazonium Salts.**—Sulphonated amines of the benzene and naphthalene series give rise to industrially important diazo-derivatives which are erroneously termed diazo-sulphonic acids although actually internal diazonium sulphonates, formerly formulated as cyclic compounds (I.).



But in accordance with current views on the electronic nature of valency, such substances are more correctly represented as containing two bound ions, the two groups N_2 and SO_3 being associated, not by a valency linking, but by the transfer of an electron from the diazonium group to the sulphonate ion (II.). Somewhat allied to these internal diazonium sulphonates are the internal diazonium carboxylates (III.) and the diazo-oxides derived from ortho- and para-aminophenols.

Internal Diazo-oxides.—These diazo-oxides have been formulated either as cyclic derivatives (I. and III.) or as quinone-diazides (II. and IV.).



Two outstanding facts support the foregoing quinone-diazide formulae. These diazo-oxides are all yellow substances and they are never obtained from meta-aminophenols in which quinonoid formulation would be impossible. A similar group of diazoimines and diazoimides has been recorded (G. T. Morgan and F. M. G. Micklethwait and others, 1908–18). These substances may be represented by two alternative formulae (V. and VI.).

The latter formulation derives support from the circumstance that the diazoimines and diazoimides are yellow and obtainable only from para-diamines and not from meta-diamines.

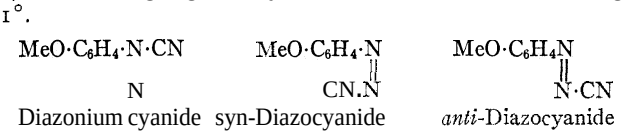
Cyclic Diazo-compounds.—When nitrous acid reacts with the salt of an orthodiamine or a peridiamine (see NAPHTHALENE), cyclic diazo-compounds are produced, *ortho-phenylenediamine* yielding phenylene-o-diazoimine (aziminobenzene, Formula I.), and peri- or 1:8-naphthylenediamine giving rise to naphthylene-1:8-diazimine (1:8-aziminonaphthalene, Formula II.).

The nitrogenous rings in these cyclic diazo-compounds are very inert and the substances do not couple with phenols or amines to yield azo-dyes.

Metallic Derivatives of Diazo-compounds.—In 1894 Schraube and Schmidt found that by adding aqueous *p*-nitrobenzenediazonium chloride to warm sodium hydroxide solution a well-defined salt separated in yellowish bronzy leaflets. Its composition corresponded with the formula $NO_2{\cdot}C_6H_4{\cdot}NNa{\cdot}NO,H_2O$. When treated with dilute acetic acid this salt yields a nitrosamine, $NO_2{\cdot}C_6H_4{\cdot}NH{\cdot}NO$, but with hydrochloric acid it reverts to the diazonium chloride, $NO_2{\cdot}C_6H_4{\cdot}N_2Cl$. The yellow sodium salt is a very stable substance and has been employed industrially in the production of para-nitraniline red. Homologues of this metallic diazo-salt are used increasingly in conjunction with Naphthol AS (see NAPHTHALENE) for dyeing cotton in fast red shades.

These stable metallic diazo-salts are produced from diazonium salts and warm caustic alkali, but another less stable series of metallic diazo-salts is formed by the use of cold alkali. A. Hantzsch suggested that the two series were stereoisomeric, but this view is not universally held.

Diazo-cyanides.—This group of substances having the general formula Ar.N,.CN, where Ar is an aromatic group, are diazo-compounds in which the azo-group is attached on both sides to carbon. In this respect they represent an intermediate group between ordinary diazo-derivatives and azo-compounds (*q.v.*) Moreover, the diazo-cyanides are of interest as furnishing the best example of Hantzsch's theory of stereoisomeric diazo-compounds. Thus from p-anisidine he obtained three isomeric diazo-cyanides: the colourless diazonium cyanide, an electrolyte obtained in the form of a double salt, $CH_3O{\cdot}C_6H_4{\cdot}N_2{\cdot}CN,HCN,2H_2O$, and two reddish insoluble diazo-cyanides, the unstable syn-form melting at 51°, which changes gradually to the stable anti-form melting at 121°.



Similar stereoisomeric relationships have been detected but with less certainty among diazo-sulphonates, $Ar{\cdot}N{:}N{\cdot}So_3K$.

Diazoamines.—The diazoamines, $R{\cdot}N_2{\cdot}NHR$, may be prepared by the action of the primary and secondary amines on the diazonium salts, or by the action of nitrous acid on the free primary amine. In the latter reaction it is assumed that the isodiazohydroxide $R{\cdot}N{:}NOH$ first formed is immediately attacked by a second molecule of the amine. They are yellow crystalline solids, which do not unite with acids. They are readily converted into the isomeric aminoazo-compounds, either in alcoholic solution or by warming with a mixture of the parent base and its hydrochloride; the diazo-group preferably going into the para-position to the amino-group. When the para-position is occupied the diazo-group takes the ortho-position. H. Goldschmidt and R. U. Reinders have shown that the transformation is a unimolecular reaction, the velocity of transformation in moderately dilute solution being independent of the concentration, but proportional to the amount of the catalyst present (amine hydrochloride) and to the temperature. Diazoaminobenzene, $C_6H_5N_2{\cdot}NHC_6H_5$, crystallizes from light petroleum or benzene in golden yellow laminae. Concentrated hydrochloric acid converts it into chlorobenzene, aniline and nitrogen. Zinc dust and alcoholic acetic acid reduce it to aniline and phenylhydrazine. The mixed diazoimines exhibit tautomerism (*q.v.*) behaving as if they had the dual structures $X{\cdot}N_2{\cdot}NHY$ and $XNH{\cdot}N_2Y$.

Azimino- or Triazo-compounds, $R{\cdot}N_3$, may be regarded as derivatives of azoimide (*q.v.*); they are formed by the action of ammonia on the diazoperbromides, by the action of hydroxylamine on the diazonium sulphates, and by adding sodium oxide to solutions of diazonium salts. Diazobenzeneimide, $C_6H_5N_3$, is a yellowish oil of stupefying odour. It boils at 59° C (12mm.), and explodes when heated. Concentrated hydrochloric acid decomposes it with formation of chloroanilines and elimination of nitrogen, whilst on being heated to boiling point with sulphuric acid it is converted into aminophenols.

ALIPHATIC DIAZO-COMPOUNDS

The esters of the aliphatic amino-acids may be diazotized in a manner similar to the primary aromatic amines, a fact discovered by T. Curtius. The first aliphatic diazo-compound to be isolated was *diazoacetic ester*, $N_2{\cdot}CH{\cdot}CO_2C_2H_5$, which is prepared by the action of potassium nitrite on the ethyl ester of glycine hydrochloride, $HCl{\cdot}NH_2{\cdot}CH_2{\cdot}CO_2C_2H_5 + KNO_2 = CHN_2{\cdot}CO_2C_2H_5 + KCl + 2H_2O$. It is a yellowish oil which melts at −24° C; it boils at 143–144° C, but cannot be distilled safely as it decomposes violently, giving nitrogen and ethyl fumarate. It explodes in contact with concentrated sulphuric acid. On reduction it yields ammonia and glycine. The diazo-ester condenses with benzene and its homologues giving rise to esters containing seven-membered hydrocarbon rings (Bucherer, 1896). The constitution of the diazo-fatty esters is inferred from the fact that the two nitrogen atoms, when split off, are replaced by two univalent elements or groups, thus leading to the formula $\begin{matrix}N\\ \|\\ N\end{matrix}\!\!>\!CH{\cdot}CO_2C_2H_5$, for diazoacetic ester.

Diazomethane, CH_2N_2, was first obtained in 1894 by H. v. Pechmann. It is prepared by the action of aqueous or alcoholic solutions of the caustic alkalis on the nitroso-acidyl derivatives of methylamine (such, for example, as *nitrosomethyl urethane*, $NO{\cdot}N(CH_3){\cdot}CO_2C_2H_5$, which is formed on passing nitrous fumes into an ethereal solution of methyl urethane). E. Bamberger regards it as the anhydride of iso-diazomethane, $CH_3{\cdot}N{:}N{\cdot}OH$, and has prepared it by a method similar to that used for the preparation of iso-diazobenzene. By the action of bleaching powder on methylamine hydrochloride there is obtained a volatile liquid *methyldichloroamine*, $CH_3{\cdot}NCl_2$, boiling at 58–60° C, which explodes violently when heated with water, yielding hydrocyanic acid ($CH_3NCl_2 = HCN + 2HCl$). Well-dried hydroxylamine hydrochloride is dissolved in methyl alcohol and mixed with sodium methoxide; a solution of methyldichloroamine in absolute ether is then added and an ethereal solution of diazomethane distils over. Diazomethane is a yellow inodorous gas, very poisonous and corrosive. It may be condensed to a liquid, which boils at about 0° C. It is a powerful methylating agent, reacting with water to form methyl alcohol, and converting acetic acid into methyl-acetate, hydrochloric acid into methyl chloride, hydrocyanic acid into acetonitrile, and phenol into anisole, nitrogen being eliminated in each case. It is reduced by sodium amalgam (in alcoholic solution) to *methylhydrazine*, $CH_3{\cdot}NH{\cdot}NH_2$. It unites directly with acetylene to form pyrazole.

See G. T. Morgan, *B.A. Rep.* (1902); J. Cain, *The Chemistry and Technology of the Diazo-compounds* (1920); T. E. Thorpe, *Dictionary of Applied Chemistry*, "Diazo-compounds" (1921). **(G. T. M.)**

DIBDIN, CHARLES (1745–1814), British musician, dramatist, novelist, actor and songwriter, the son of a parish clerk, was born in Southampton on or before March 4, 1745, and was chorister at Winchester from 1756 to 1759. At the age of 1j, he was engaged to sing at Covent Garden. His first work, an operetta entitled *The Shepherd's Artifice*, with words and music by himself, was produced there on May 21, 1762. Dibdin was connected with Drury Lane, both as composer and as actor for some years, and produced during this period two of his best known works, *The Waterman* (1774) and *The Quaker* (1775). A quarrel with Garrick led to the termination of his engagement. In *The Comic Mirror* he ridiculed prominent contemporary figures through the medium of a puppet show. In 1782 he became joint manager of the Royal circus, afterwards known as the Surrey theatre. In three years he lost this position owing to a quarrel with his partner. His opera *Liberty Hall*, containing the successful songs "Jock Ratlin," "The High-mettled Racer," and "The Bells of Aberdovey," was produced at Drury Lane theatre on Feb. 8, 1785. In 1788 he sailed for the East Indies, but the vessel having put in to Torbay in stress of weather, he changed his mind and returned to London. In a musical variety entertainment called *The Oddities*, he introduced the popular songs: "'Twas in the good ship 'Rover,'" "Saturday Night at Sea," "I Sailed from the Downs in the 'Nancy' " and the immortal "Tom Bowling," written on the death of his eldest brother, Capt. Thomas Dibdin, at whose invitation he had planned to visit India. In a series of monodramatic entertainments which he gave at his theatre, Sans Souci, he first introduced many of those sea-songs which stimulated the spirit of the navy during the war with France. Dibdin died of paralysis in London on July 25, 1814. Besides his *Musical Tour through England* (1788), his *Professional Life*, an autobiography published in 1803, a *History of the Stage* (1795), and several smaller works, he wrote upwards of 1,400 songs and about 30 dramatic pieces. His sons, Charles and Thomas John Dibdin (*q.v.*), were also popular dramatists in their day.

DIBDIN, THOMAS FROGNALL (1776–1847), English bibliographer, born at Calcutta, was the son of Thomas Dibdin, the sailor brother of Charles Dibdin. He was educated at St. John's college, Oxford, and was entered at Lincoln's Inn. After an unsuccessful attempt to obtain practice as a provincial counsel at Worcester, he was ordained at the close of 1804, being appointed to a curacy at Kensington. In 1823 he received the living at Exning, in Sussex. Soon afterwards he was appointed by Lord Liverpool to the rectory of St. Mary's, Bryanston square, which he held until his death. The first of his numerous bibliographical works was his *Introduction to the Knowledge of Editions of the Classics* (1802), which brought him under the notice of the third Earl Spencer, who threw open to him the rich library at Althorp; he spent much of his time in it, and in 1814–15 published his *Bibliotheca Spenceriana*. In 1818 he was commissioned by Earl Spencer to purchase books for him on the Continent, an expedition described in his sumptuous *Bibliographical, Antiquarian and Picturesque Tour in France and Germany* (1821). Dibdin was the originator and vice-president of the Roxburghe Club, founded in 1812.

Other works of his are *Bibliomania* **(1809)**; *Reminiscences of a Literary Life* (1836), and *Bibliographical, Antiquarian and Picturesque Tour in the Northern Counties of England and Scotland* **(1838)**.

DIBDIN, THOMAS JOHN (1771–1841), English dramatist and song-writer, son of Charles Dibdin, the song-writer, the composer of "Tom Bowling," was born on March 21, 1771.

He was apprenticed to his maternal uncle, a London upholsterer, and later to William Rawlins, afterwards sheriff of London, from whose service he ran away to join a company of country players. He returned to London in 1795, having married two years before; and in the winter of 1798–99 his Jew and the Doctor was produced at Covent Garden. His 70 comedies, operas and farces brought immense popularity to the writer and immense profits to the theatres. It is stated that the pantomime of Mother Goose (1807) produced over £20,000 for the management at Covent Garden theatre, and The High-mettled Racer, adapted as a pantomime from his father's play, £18,000 at Astley's. Dibdin was prompter and pantomime writer at Drury Lane until 1816, when he took the Surrey theatre. This venture proved disastrous. After this he was manager of the Haymarket, but without his old success, and his last years were passed in comparative poverty. In 1827 he published two volumes of Reminiscences. Of his songs "The Oak Table" and "The Snug Little Island" are well known. He died in London on Sept. 16, 1841.

See Reminiscences of Thomas Dibdin **(1827)**; and **E.** R. Dibdin The Dibdins **(1888)**.

DIBRA (Serbian Debar), a fortified city in S. Serbia, Yugoslavia, and the key to the upper valley of the Black Drin. Pop. (1931) 6,913, of Albanians, Bulgars and Serbs. There are two Serbian schools. Cattle breeding is the chief occupation but some maize and tobacco are grown. There are sulphurous springs in the neighbourhood. It was captured by the Serbs in the Balkan Wars (1912–13) and assigned to them by the Treaty of Bucharest (1913). It was occupied by Bulgaria in 1941.

DIBRUGARH, a town of British India, headquarters of the Lakhimpur district of Assam, on the Dibru river about 4 m. above its confluence with the Brahmaputra. Pop. (1931) 18,734. It is the terminus of steamer navigation on the Brahmaputra, and also of a railway line, which connects with the Assam-Bengal system. The town contains a cantonment, the headquarters of the Assam Valley Light Horse and various educational institutions. In 1900 a medical school was established from a bequest by J. Berry-White, to train hospital assistants for the tea gardens.

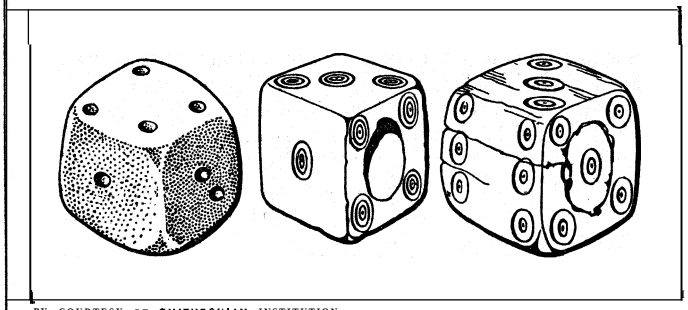
DICAEARCHUS, of Messene in Sicily, Peripatetic philosopher and pupil of Aristotle, historian, and geographer, flourished about 320 B.C. He was a friend of Theophrastus, to whom he dedicated the majority of his works. Of his writings only the titles and a few fragments survive. The most important of them was his *βίος τῆς Ἑλλάδος* (Life in Greece), in which the moral, political, and social condition of the people was fully discussed. In his Tripolitikos he described the best form of government as a mixture of monarchy, aristocracy, and democracy, and illustrated it by the example of Sparta. Among the philosophical works of Dicaearchus may be mentioned the Lesbiakoi, a dialogue in three books, showing that the soul is mortal, to which he added a supplement called Korinthiakoi. He also wrote a Description of the *World,* illustrated by maps, in which was probably included his *Measurements* of Mountains. A description of Greece (150 iambics, in C. Miiller Frag. *hist.* Graec. i. 238–243) was formerly attributed to him, but was really the work of Dionysius, son of Calliphon. The De *republica* is supposed to be founded on one of Dicaearchus's works.

The best edition of the fragments is by M. Fuhr (1841), a work of great learning; see also a dissertation by F. G. Osann, Beitriige *zur* rom. und griech. Literatur, ii. pp. 1–117 **(1839)**; Pauly-Wissowa, Realencyklopadie der *klass. Altertumswiss,* v. pt. 1 (1905).

DICE, small cubes of ivory, bone, wood or metal used in gaming (O.Fr. de, derived from Lat. dare, to give). The six sides of a die are each marked with a different number of incised dots in such a manner that the sum of the dots on any two opposite sides shall total seven. Dice seem always to have been employed, as they still are, for gambling, and in games like backgammon. There are many methods of playing, from one to five dice being used, the dice being thrown on to a smooth surface either from the hand or dice-box.

It is a remarkable fact that, wherever dice have been found, whether in the tombs of ancient Egypt, of classic Greece, or of the far East, they differ in no material respect from those in use to-day, the elongated ones with rounded ends found in Roman graves having been not dice but tali, or knuckle-bones. Eight-sided dice have comparatively lately been introduced in France as aids to children in learning the multiplication table. The teetotum, or spinning die, used in many modern games, was known in ancient times in China and Japan.

The increased popularity of the more elaborate forms of gaming has resulted in the decline of dicing. One method is to throw three



BY COURTESY OF SMITHSONIAN INSTITUTION

SIX-SIDED EARLY EGYPTIAN DICE AND TWO ROMAN DICE

Dice similar to those used to-day have been used from the earliest times. being found among ancient relics in Egypt, the Mediterranean and the Far East

times with three dice. If one or more sixes or fives are thrown the first time, they may be reserved, the other throws being made with the dice that are left. The object is to throw three sixes=18 or as near that number as possible.

The most popular form of pure gambling with dice at the present day is craps, or *crap-shooting,* a simple form of hazard, of French origin. Two dice are used. Each player puts up a stake and the first player may cover any or all of the bets. He then "shoots," *i.e.,* throws the dice from his open hand upon the table. If the sum of the dice is 7 or 11 the throw is a nick, or natural, and the player wins all stakes. If the throw is either 2, 3 or 12 it is a *crap,* and the player loses all. If any other number is thrown it is a point, and he continues until he throws the same number again, in which case he wins, or a 7, in which case he loses. Poker dice are marked with ace, king, queen, jack, ten and nine spot. Five are used and the object is, in three throws, to make pairs, triplets, full hands or fours and fives of a kind, five aces being the highest hand. Straights do not count.

History.—Dice were probably evolved from knucklebones. The antiquary Thomas Hyde, in his *Syntagma,* records his opinion that the game of "odd or even," played with pebbles, is nearly coeval with the creation of man. It is almost impossible to trace clearly the development of dice as distinguished from knucklebones, on account of the confusing of the two games by the ancient writers. It is certain, however, that both were played in times antecedent to those of which we possess any written records. Sophocles, in a fragment, ascribed their invention to Palamedes, a Greek, who taught them to his countrymen during the siege of Troy, and who, according to Pausanias (on Corinth, xx.), made an offering of them on the altar of the temple of Fortune. Herodotus (Clio) relates that the Lydians, during a period of famine in the days of King Atys, invented dice, knucklebones and indeed all other games except chess. The fact that dice have been used throughout the Orient from time immemorial, as has been proved by excavations from ancient tombs, seems to point clearly to an Asiatic origin. Dicing is mentioned as an Indian game in the Rig-veda. In its primitive form knucklebones was essentially a game of skill, played by women and children, while dice were used for gambling, and it was doubtless the gambling spirit of the age which was responsible for the derivative form of knucklebones, in which four sides of the bones received different values, which were then counted, like dice.

Gambling with three, sometimes two, dice (*κύβοι*) was a very popular form of amusement in Greece, especially with the upper classes, and was an almost invariable accompaniment to the symposium, or drinking banquet. The dice were cast from conical beakers, and the highest throw was three sixes, called *Aphrodite,* while the lowest, three aces, was called the dog. Both in Greece

and Rome different modes of counting were in vogue. Roman dice were called *tesserae* from the Greek word for four, indicative of the four sides. The Romans were passionate gamblers, especially in the luxurious days of the empire, and dicing was a favourite form, though it was forbidden except during the Saturnalia. The emperor Augustus wrote in a letter to Suetonius concerning a game that he had played with his friends: "Whoever threw a *dog* or a six paid a *denarius* to the bank for every die, and whoever threw a *Venus* (the highest) won everything." In the houses of the rich the dice-beakers were of carved ivory and the dice of crystal inlaid with gold. Mark Antony wasted his time at Alexandria with dicing, while, according to Suetonius, the emperors Augustus, Nero and Claudius were passionately fond of it, the last named having written a book on the game. Caligula notoriously cheated at the game; Domitian played it, and Commodus set apart special rooms in his palace for it. The emperor Verus, adopted son of Antoninus, is known to have thrown dice whole nights together.

Fashionable society followed the lead of its emperors, and, in spite of the severity of the laws, fortunes were squandered at the dicing-table. Horace derided the youth of the period, who wasted his time amid the dangers of dicing instead of taming his charger and giving himself up to the hardships of the chase. Throwing dice for money was the cause of many special laws in Rome, according to one of which no suit could be brought by a person who allowed gambling in his house, even if he had been cheated or assaulted. Professional gamblers were common, and some of their loaded dice are preserved in museums. The common public-houses were the resorts of gamblers, and an old fresco is extant showing two quarrelling dicers being ejected by the indignant host. That the barbarians were also given to gaming, whether or not they learned it from their Roman conquerors, is proved by Tacitus, who states that the Germans were passionately fond of dicing, so much so, indeed, that, having lost everything, they would even stake their personal liberty. Centuries later, during the middle ages, dicing became the favourite pastime of the knights, and both dicing schools *(scholae deciorum)* and guilds of dicers existed. In France both knights and ladies were given to dicing, which repeated legislation did not abolish. In India and the Far East dice have always been popular and are still.

Dice-boxes have been made in many shapes and of various materials, such as wood, leather, agate, crystal, metal or paper, and many of them contain bars within to ensure a proper agitation of the dice, and thus defeat trickery. Some, formerly used in England, were employed with unmarked dice which were thrown upon a board marked with squares numbered from 1 to 6.

See L. Becq de Fouquières, *Les Jeux des Anciens* (1869); Bolle, *Das Knöcheispiel der Alten* (Wismar, 1886); Stewart Culin, *Chinese Games with Dice* (Philadelphia, 1889); *Korean Games* (Philadelphia, 189;); R. F. Foster, *Encyclopaedia of Indoor Games* (new ed. 1916). *Historie du Canada,* etc., par Gabriel Sagard Theodat (new ed. Paris, 1866, vol. 1, pp. 243–4).

North American Indians are said to have played dice as far back as 1636. In his revelations of the time, Father Brebeuf gives long accounts of the game, the causes for its being played and the excesses in gambling to which it led. Even up to about 1860, the Indians were known to stake all they had, frequently losing all their earthly possessions. Dice or *Craps* was a popular game among the American soldiers in France during the World War, the Afro-Americans possessing a marked fondness for the "bones."

DICENTRA, a genus of perennial herbs of the fumitory family (Fumariaceae), containing 1 j species, natives of Asia and North America, 8 of which occur in the United States and Canada. They are mostly low or stemless plants, a few of which are cultivated for their attractive deeply cut or dissected foliage and handsome irregular flowers. The familiar bleeding-heart (D. *spectabilis)* of the gardens, with showy rose-red, heart-shaped flowers, an inch or more long, is a native of Japan. The eastern bleeding-heart (D. *eximia),* with pink, narrow, heart-shaped flowers, about ¾ in. long, of the Allegheny Mountain region, and the western bleeding-heart (D. *formosa),* with similar rose-purple flowers, of mountain woods from California to British Columbia, are both more or less cultivated. Other noteworthy American species are the Dutchman's breeches *(D. cucullaria),* one of the most attractive wild flowers of eastern North America; the squirrel-corn (D. *canadensis),* of similar range, the small tubers of which resemble grains of Indian corn (maize); and the golden ear-drops (D. *chrysantha),* a smooth, stiff-stemmed plant, 2 ft. to 5 ft. high, with large panicled clusters of yellow flowers, widely distributed in California. *(See* DUTCHMAN'S BREECHES.)

DICETO, RALPH DE (d. c. 1202), dean of St. Paul's, London, and chronicler, is first mentioned in 1152, when he received the archdeaconry of Middlesex. He was probably born between 1120 and 1130; of his parentage and nationality nothing is known. Diceto was selected, in 1166, as the envoy of the English bishops when they protested against the excommunications launched by Becket. About 1180 he became dean of St. Paul's. In this office he distinguished himself by careful management of the estates, by restoring the discipline of the chapter, and by building at his own expense a deanery-house. Diceto's most important historical works, the *Abbreviationes Chronicorum* and the *Ymagines Historiarum,* cover the history of the world from the birth of Christ to the year 1202. The former, which ends in 1147, is a work of learning and industry, but almost entirely based upon extant sources. The latter, beginning as a compilation from Robert de Monte and the letters of Foliot, becomes an original authority about 1172, and a contemporary record about 1181. The *Ymagines* is a valuable authority for the last years of the reign of Henry II. and for the reign of Richard I.

See the introduction to W. Stubbs's edition of the *Historical Works* of Diceto (Rolls ed. 1876, 2 vols.). Diceto's fragmentary Domesday of the capitular estates has been edited by Archdeacon Hale in *The Domesday of St. Paul's,* pp. 109 ff. (Camden Society, 1858).

DICEY, EDWARD (1832–1911), English writer, son of T. E. Dicey of Claybrook Hall, Leicestershire, was born on May 1 j, 1832, and educated at Trinity college, Cambridge, where he took mathematical and classical honours. He visited the United States in 1862, and in 1863 wrote *Six months in the Federal States,* in which he took the part of the North. He was called to the bar in 1875, became a bencher of Gray's Inn in 1896. and was treasurer in 1903–04. He was connected with the *Daily Telegraph* from 1862 onwards as leader writer and then as special correspondent, and after a short spell in 1870 as editor of the *Daily News,* he became editor of the *Observer,* a position which he held for 19 years. Of his many books on foreign affairs perhaps the most important are his *England and Egypt* (1884), *Bzilgaria, the Peasant State* (1895), *The Egypt of the Future* (1907). He died in London on July 7, 1911.

His brother ALBERT VENN DICEY (1835–1922), English jurist, was educated at Balliol college, Oxford, and was called to the bar at the Inner Temple in 1863. He held fellowships successively at Balliol, Trinity and All Souls', and from 1882 to 1909 was Vinerian professor of law. He became Q.C. in 1890. His chief works are the *Introduction to the Study of the Law of the Constitution* (1885; 6th ed. 1902), a standard work on the subject; *England's Case against Home Rule* (1886); *A Digest of the Law of England with Reference to the Conflict of Laws* (1896), and *Lectures on the Relation between Law and Public Opinion in England during the 19th century* (1905). He died on April 7, 1922.

DICHOTOMY, literally a cutting asunder, the technical term for a form of logical division, consisting in the separation of a class into two sub-classes, one of which has and the other has not a certain quality or attribute (Gr. δίχα, apart, τέμνειν, to cut). Men may be thus divided into white men and men who are not white; each of these may be subdivided similarly. On the principle of contradiction this division is both exhaustive and exclusive; there can be no overlapping, and no members of the original genus or the lower groups are omitted. This method of classification, though formally accurate, has slight value in the exact sciences, partly because at every step one of the two groups is merely negatively characterized and may be unreal; it is useful, however, in setting forth clearly the gradual descent from the most inclusive genus (*summum genus*) through species to the lowest class (*infima species),* which is divisible only into individ-

ual persons or things. (*See* DIVISION.) In astronomy the term is used for the aspect of the moon or of a planet when apparently half illuminated, so that its disc has the form of a semicircle.

DICK, ROBERT (1811–1866), Scottish geologist and botanist, was born in Tullibody, Clackmannanshire, the son of an officer of excise. He became a baker and worked at his trade until his death in Thurso on Dec. 24, 1866. He never published anything, but from 1835 onwards, when he first discovered fossils in the Caithness flags, he sent his specimens to Hugh Miller and others. His herbarium, which consisted of about 200 folios of mosses, ferns and flowering plants, is now stored, with many of his fossils, in the museum at Thurso.

See Samuel Smiles, *Robert Dick, Baker of Thurso, Geologist and Botanist* **(1878).**

DICKCISSEL (*Spiza americana*), a common North American bird between the Rockies and the Alleghenies from Minnesota and Western Ontario southwards. It is recognized by its yellow breast, wing-band, sides of throat and eye-streak, and is slightly over 6in. long.

DICKENS, CHARLES JOHN HUFFAM (1812–1870), the most popular and perhaps the greatest of English novelists, was born on Feb. 7, 1812 in Landport, a division of Portsea; in a house in Mile End terrace, Commercial road. The house can be identified and is in some sense a popular shrine or memorial, enabling the sightseer to link up in one journey two of the most romantic national names, associating Dickens with Portsea and Nelson with Portsmouth. But beyond this symbolic and almost legendary local interest, the actual address indicates little more than the drifting and often decaying fortunes of the class and family from which he came. It would be an exaggeration to compare it to Lant street, in the Borough, of which, it will be remembered, "the inhabitants were migratory, disappearing usually towards the verge of quarter-day." But there is the note of something nomadic about the social world to which he belonged. We talk of the solid middle class; he belonged, one might almost say, to the liquid middle class; certainly to the insecure middle class. His father, John Dickens, was a clerk in the Navy-Pay Office, and all through life a man of wavering and unstable status, partly by his misfortunes and partly by his fault. It is said that Dickens sketched him in a lighter spirit as Micawber and in a sadder and more realistic aspect as Dorrit. The contrast between the two men, as well as the two moods, should be a warning against the weakness of taking too literally the idea of Dickensian "originals." The habit has done grave injustice to many people, such as Leigh Hunt; and it may involve a grave injustice to John Dickens; and perhaps an even graver injustice to Mrs. John Dickens, née Elizabeth Barrow, whom a similar rumour reports as the real Mrs. Nickleby. Some may question, not without grief, whether there really could be a real Mrs. Nickleby. But in any case there certainly could not be a man who was both Dorrit and Micawber. The truth is that we shall misunderstand from the beginning the nature of the Dickensian imagination, if we suppose these things to be mechanical portraits in black and white, taken by "the profeel machine," as Mr. Weller said. It is the whole point of Dickens that he took hints from human beings; and turned them, one may say, into superhuman beings. But it is true that John Dickens was of the type that is often shifted from place to place; and this is the chief significance of Charles Dickens's connection with Portsea, or rather of his lack of connection with it. He can only have been two years old when the household moved for a short time to London and then for a longer time to Chatham. It was perhaps lucky that the formative period of his first childhood was also the most fortunate period of his not very fortunate family. The dockyard of Chatham, the towers of Rochester, the gardens and the great roads of Kent remained to him through life as the only normal memory of a nursery and a native soil; his house in later years looked down on the great road from Gads hill and the cathedral tower rose again in his last vision, in the opium dream called "Edwin Drood." Here he had leisure to learn a little from books, who was so soon to learn only from life; first in the stricter sense of school-books, from a Mr. Giles, a Baptist minister in Chatham; and second, and probably with greater profit, from a random heap of old novels that included much of the greatest English literature and even more of the type of literature from which he could learn most; *Roderick Random* and *Robinson Crusoe* and *Tom Jones* and *The Vicar of Wakefield.*

He can hardly have been ten years old when the household was once more upon the march. John Dickens had fallen heavily into debt; he continued the tendency to change his private address; and his next private address was the Debtors' Prison of the Marshalsea. His wife, the mother of eight children of whom Charles was the second; had to encamp desolately in Camden Town and open a dingy sort of "educational establishment." Meanwhile the unfortunate Charles was learning his lessons at a very different sort of educational establishment. After helping his mother in every sort of menial occupation, he was thrown forth to earn his own living by tying and labelling pots of blacking in a blacking warehouse at Old Hungerford Stairs. The blacking was symbolical enough; Dickens never doubted that this piece of his childhood was the darkest period of his life; and he seems indeed to have been in a mood to black himself all over, like the Othello of the Crummles Company. Of his pessimistic period, of the heartrending monotony and ignominy, he has given little more than a bitter abbreviation in *David Copperfield.* But he was storing up much more than bitterness; it is obvious that he had already developed an almost uncanny vigilance and alertness of attention. By the time his servitude came to an end, by his father falling into a legacy as he had fallen into a jail (there was really a touch of Micawber in the way in which things turned up and turned down for him) the boy was no longer a normal boy, let alone a child. He called his wandering parent "the Prodigal Father"; and there was something of the same fantastic family inversion in the very existence of so watchful and critical a son. We are struck at once with an almost malicious maturity of satire; some of the best passages of the prison life of the Pickwicks and the Dorrits occur in private letters about his own early life. He had shared, of course, the improvement in the family condition; which was represented in his case by a period of service as a clerk to a Mr. Blackmore, a Grays Inn solicitor, and afterwards in the equally successful, and much more congenial, occupation of a newspaper reporter and ultimately a Parliamentary reporter. His father had taken up the trade; but his son was already making a mark in it, as reporter to *The True Sun, The Mirror of Parliament* and *The Morning Chronicle.* In all these aspects and attitudes, at this time, he appears as alert, sharp-witted and detached; recalling that sort of metallic brightness which an observer at this period so often saw flash upon his face. It is worthy of note, because certain healthy social emotions which he always championed have somewhat falsified his personality in the eyes of the prigs whom he loved to rap over the head. He was a genuine champion of geniality; but he was not always genial; certainly not only genial. One of his earliest sketches, published not long after this time, was a defence of the Christian festivity of Christmas against the Puritans and the Utilitarians; it was called "Sunday Under Three Heads." All his life he defended valiantly the pleasures of the poor; and insisted that God had given ale and rum, as well as wine, to make glad the heart of man. But all this has clouded his character with fumes of mere conviviality and irresponsibility which were very far from being really characteristic Even in youth, which is the period of irresponsibility, Dickens appears in some ways as highly responsible. He was in sharp reaction against the futility of his family; he was both ambitious and industrious; and there were some who even found him hard. In many moods he had as angry a dislike of the Skimpoles as of the Gradgrinds.

Indeed he had come in more ways than one to the high turning-point of his fortunes. His marriage and his first real literary work can be dated at about the same time. He had already begun to write sketches, chiefly in *The Old Monthly Magazine,* which were in the broadest sense caricatures, of the common objects of the street or the market-place. They were illustrated by Cruikshank; and in these early stages of the story the illustrator is often more important than the author. This was notoriously true of his next

and perhaps his greatest experiment; but it is typical in any case of his time and his time of life. The prose sketches were signed "Boz" and the signature had become a recognized pseudonym when Messrs. Chapman and Hall, the publishers, approached him with the suggestion of a larger scheme. A well known humorous artist of that epoch, Seymour, was to produce a series of plates illustrating the adventures, or misadventures, of the Nimrod Club, a group of amateur sportsmen, destined to dwindle and yet to grow infinitely greater in the single figure of Mr. Nathaniel Winkle. Dickens consented to write the letter-press, which was little more than a running accompaniment like an ornamental border around the drawings; and in that strange fashion, secondary, subordinate and even trivial, first formed itself in the human fancy the epic and pantomime of *Pickwick* (1837). Dickens persuaded the publishers to let the Pickwick Club represent more varied interests or eccentricities, retained Mr. Winkle to represent or misrepresent the original notion of sport; and by that one stroke of independence cut himself free from a stale fashion and started a new artistic adventure and revolution. He gave as one of his reasons the fact that he had no special knowledge of sports or games, and proceeded to drive his argument home triumphantly by his description of the cricket-match at Dingley Dell. And yet that cricket-match alone might illustrate exactly the game which Dickens so gloriously won; and why that wild and ill-instructed batsman has had so many thousand runs and is not out. What did a few mistakes in the description of cricket, or even in the description of real life, matter in a man who could invent that orator at the cricket-dinner, who complimented the defeated eleven by saying, with the gesture of Alexander, "If I were not Dumkins, I would be Luffey; if I were not Podder, I would be Struggles"? Men do not read that sort of thing to learn about cricket, or even about life, but to find something more living than either. There had broken through the entanglements of that trumpery bargain a force of comic genius which swallowed up its own origin and excuses; a wild animal big enough to eat all its direction labels. People forgot about Seymour; forgot about sport; forgot about the Nimrod Club; soon forgot about the Pickwick Club. They forgot all that he forgot and followed whatever he followed; much bigger and wilder game than any aimed at by the mere gun of Mr. Winkle. The track of the story wandered; the tone of the story changed; a servant whom Pickwick found cleaning boots in an inn-yard took the centre of the stage and towered even over Pickwick; Pickwick from being a pompous buffoon became a generous and venerable old English gentleman; and the world still followed that incredible transformation-scene and wishes there were more of it to this day. This was the emergence of Dickens into literature. It had, of course, many secondary effects in life. One was the first and almost the most bitter of his quarrels; Seymour may be excused for having been annoyed at the relations of artist and author being thus turned upside down in a whirlwind; but Seymour was not therefore necessarily justified in saying, as he did say and his widow long continued to say, that Dickens had gained glory from another man's ideas. Nobody, we may well imagine, believes that the oration of Sergeant Buzfuz or the poem of Mrs. Leo Hunter, were Mr. Seymour's ideas. Dickens had an inexhaustible torrent of such ideas; and no man on earth could pretend to have provided them. But it is true that in this quarrel, as in others, some found a touch of sharpness and acid self-defence in Dickens; and he was never without his enemies. His ideal was certainly the leisure and geniality of Pickwick; but he was fighting rather too hard for his own hand and had too much at stake and too pressing a knowledge of poverty to be anything but practical.

As Pickwick was the foundation of his public life, his marriage was naturally the foundation of his private life; and in this also he has been an object of criticism as he was certainly an object of sympathy. Very little good is done by making guesses about a story of which the spiritual balance and proportion were probably never known to more than three or four people. It is sufficiently significant that those who were nearest to it, and who survive to speak or rather to be silent, agree in laying no very heavy blame upon anyone involved One of the principals of the *Morning Chronicle*, George Hogarth, had been so much struck by the "Boz" sketches as to insist on an improvement in the payment of the writer; he introduced Dickens to his family and especially (we may say) to his daughters, with all of whom the young journalist seems to have been on very friendly and even affectionate terms. One of them, Catherine, he married, and certainly married for love; but not perhaps with the sort of love which gives a man a full and serious realization of what he is doing. It is the pathos of the story that in a sense the friendship outlasted the love; for another sister, who understood him better, remained his friend long after his marriage had become a prolonged misunderstanding. All this, however, happened long afterwards; for the moment his marriage may be taken as marking his step into security and success; especially as he was probably stimulated and, as it were, intoxicated, by a romance that brought him into more refined social surroundings than his o n. From that moment he was launched as a popular writer and a power in the world; and he never went back, until he died of popularity thirty years afterwards.

It is notable that his next work was *Oliver Twist* (1838); which might be meant for a contrast to *Pickwick*. If the first trick had succeeded, nobody could accuse the conjurer of trying the same trick twice. He was probably proud of proving his range; but he was certainly courageous in testing his popularity. It is true that Oliver Twist consists of a queer mixture of melodrama and realism; but both the realism and the melodrama are deliberately dark and grim. Nevertheless it is fortunate that with his second book he thus brought into play what may be called his second talent. It is too common to compare his humour with his pathos; for indeed there is no comparison. But there really is a comparison between his humour and his horror; and he really had a talent for a certain sort of horror, which is exactly rendered by the popular phrase of supping on horrors. For there is a sort of lurid conviviality that accompanies the panic; as if the nightmare could accompany and not follow the heavy meal. This suppressed vitality is due to his never for an instant losing the love of life; the love of death, which is despair and pessimism, was meaningless to him till he died. The sort of horror which afterwards conceived the death of Krook is already found in Oliver Twist; as in that intolerable repetition throbbing in the murderer's ears; "will wash out mud-stains, blood-stains" and so on. For the rest, the plot is preposterous and the flashes of fun excellent but few; yet there is another aspect of the book which makes it important in the story of Dickens. It is not only the first of his nightmare novels, but also the first of his social tracts. Something of social protest could be read between the lines of Pickwick in prison; but the prison of Pickwick was very mild compared with the charitable almshouse of Oliver. Dickens is witness, with Hood and Cobbett and many others, that the workhouse was felt by all generous people as something quite unnaturally new and hard and inhuman. It is sometimes said that he killed Bumble; it would be truer to say that, by making Bumble live, he created something by which it will always be possible to kill bureaucracies.

Whether we call the transition from *Pickwick* to *Oliver Twist* a change from comedy to tragedy, or merely a change from farce to melodrama, it is notable that the next act of Dickens is to mix the two in about equal proportions. Having shown how much he can vary, he tries to show how well he can combine. It is worth noting because it explains much of the failure as well as the success of his art as a whole. We may even say that, to the last, this sort of exhibition of power remained his principal weakness. When the critics, like those of *The Quarterly*, called him vulgar, it meant nothing except that the critics themselves were snobbish. There is nothing vulgar about drinking beer or describing the drinking of beer, or enjoying the humours of really humorous people who happen to black boots, like Sam Weller. But there is something just a little vulgar about professing to be a Universal Provider; a man who writes not only something that he wants to write, but anything that anybody wants to read. Anything in his work that can really be called failure is very largely due to this appetite for universal success. There is nothing

wrong about the jester laughing at his own jokes; indeed they must be very poor jokes if even he cannot laugh at them. Dickens, in one of those endless private letters which are almost more entertaining than his published novels, describes himself as "a gentleman with rather long hair and no neckcloth, who writes and grins, as if he thought he was very funny indeed"; and so he was. But when he set out to prove that he was not only very funny, but very pathetic, very tragic, very powerful, he was not always enjoying the sense of power over his work, he was enjoying the sense of power over his audience. He was an admirable actor in private theatricals; and sometimes, unfortunately, they were public theatricals. And on this side of his character he had the proverbial itch of Toole to act Hamlet. When he was rendering the humours of the crowd, he was that rather rare thing, a real democrat. But when he was trying to command the tears and thrills of the crowd, he was something of a demagogue; that is, not one mingling with the crowd, but one trying to dazzle and to drive it. One of the ways in which he displayed this attribute, if not of vulgarity at least of vanity, was in his habit, from this time onwards, of running side by side in the same book about five different stories in about five different styles. It pleased the actor in him to show his versatility and his ease in turning from one to the other. He did not realize clearly enough that in some of the parts he was a first-rate actor and in some a second-rate and in some a fifth-rate actor. He did not remind himself that though he turned to each topic with equal ease, he did not turn to each with equal effect. But, whatever the disadvantages of the universal ambition, it definitely dates from the period of his next book. *Pickwick* has a prevailing tint of gaiety and Oliver *Twist* of gravity, not to say grimness; but with Nicholas *Nickleby* (1839) we have the new method, which is like a pattern of bright and dark stripes. The melodrama is if possible even more melodramatic than in Oliver *Twist;* but what there is of it is equally black and scowling. But the comedy or farce has already displayed the rapid ripening of his real genius in letters. There is no better company in all literature than the strolling company of Mr. Vincent Crummles; though it is to be hoped that in any convivial meeting of it, Miss Snevellicci will remember to invite her incomparable papa. Mr. Mantalini also is one of the great gifts of Dickens to the enduring happiness of humanity. For the rest, it is very difficult to take the serious part of the story seriously. There is precious little difference between the rant and claptrap of the Crummles plays, which Dickens makes fun of, and the rant and claptrap of Ralph Nickleby and Mulberry Hawke which Dickens gravely narrates to us. All that, however, was of little consequence either immediate or permanent. Dickens was not proving that he could write smooth and probable narratives, which many people could do. He was proving that he could create Mantalini and Snevellicci, which nobody could do.

Nevertheless, this pretence of providing for all tastes, which produced the serio-comic novel, is also the explanation of the next stage of his career. There runs or recurs throughout his whole life a certain ambition to preside over a more or less complex or many-sided publication; a large framework for many pictures; a system of tales within tales like the Arabian Nights or the tales of the Tabard. It is the ambition that he afterwards gratified by becoming the editor of two magazines, *Household Words* and All the Year Round. But there is here something of a shadow of the original meaning of the word magazine, in the sense of a shop; and another hint of that excessive desire to keep a shop that sells everything. He had been for a time editor of something of the sort in *Bentley's Miscellany,* but the final form taken by this mild and genial megalomania (if we may so describe it) was the plan which Dickens formed immediately after the success of Nicholas Nickleby. The serial scheme was to be called, "Master Humphrey's Clock," and was to consist of different stories told by a group of friends. With the idea of making them the more friendly he turned some of them into old friends; reintroducing Mr. Pickwick and the two Wellers, though these characters were hardly at their best, the author's mind being already on other things. One of these things was a historical novel, perhaps conceived more in the romantic manner of Scott than the prosaic manner of Smollett, which Dickens generally followed. It was called Barnaby Rudge (1840) and the most interesting part of it perhaps is the business of the Gordon Riots; and the mob that has a madman for its mascot and a penny-dreadful prentice for its comic relief. But there is also a plot as complicated as, though rather clearer than, that of Oliver Twist; a plot that intensely interested the detective mind of Poe. *Barnaby Rudge,* however, is not so directly Dickensian as the romance that preceded or the romance that followed it. The second story, somewhat insecurely wedged into the framework of Master *Humphrey's* Clock, was The Old *Curiosity* Shop (1841), as the opening and some of the references in the story still vaguely attest. The public reception of this story very sharply illustrates what has been said about the double character of his success. On the one side was his true success as a craftsman carving figures of a certain type, generally gargoyles and grotesques. On the other side was his inferior success as a jack-of-all-trades tending only too much to be a cheapjack. As a matter of fact, The Old *Curiosity* Shop contains some of the most attractive and imaginative humour in all his humorous work; there is nothing better anywhere than Mr. Swiveller's imitation of the brigand or Mr. Brass's funeral oration over the dwarf. But in general gossip and association, everything else in the story is swallowed up in the lachrymose subject of Little Nell. There can be no doubt that this unfortunate female had a most unfortunate effect on Dickens's whole conception of his literary function. He was flattered because silly people wrote him letters imploring him not to let Little Nell die; and forgot how many sensible people there were, only hoping that the Marchioness would live for ever. Little Nell was better dead, but she was an unconscionable long time dying; and we cannot altogether acquit Dickens of keeping her lingering in agony as an exhibition of his power. It tended to fix him in that unfortunate attitude, of something between a showman and a magician, which explains almost all the real mistakes of his life.

About this time a very determining event interrupted his purely literary development, his first visit to America. It was destined to have, apart from any other results, a direct effect upon his next book, which was Martin *Chuzzlewit* (1844). There were, of course, many purely practical and personal elements in the criticism which he directed against the western democracy. An unjust copyright law, or one which he at any rate thought very unjust, had enabled Americans to pirate his most popular works; and it would seem that the people he met were, in their breezy way, but little inclined to apologize for the anomaly. But it would be very unjust to Dickens to deny that his sense and sensibility were alike irritated by some real divisions in the international relation. There were things in the American culture, or lack of culture, which he could not be expected to understand but which he might reasonably be expected to dislike. His English law-abiding liberalism would in any case have been startled by a certain streak of ferocity and persecution that there really is in the Americans; just as he might have recoiled from the same fierceness in the Irish or the Italians. But in the Americans it was also connected with something crude and incomplete in the society, and was not softened by tradition or romance. He was also both annoyed and amused at the American habit of uttering solemn idealistic soliloquies and of using rhetoric very rhetorically. But all these impressions are important chiefly as they changed the course of his next important narrative; and illustrated a certain condition or defect of his whole narrative method.

All these early books of Dickens, from Pickwick onward, appeared, it must always be remembered, serially and in separate parts. They were anticipated eagerly like bulletins; and they were often written up to time almost as hastily as newspaper reports. One effect of this method was that it encouraged the novelist in a sort of opportunism and something of a hand to mouth habit of work. And a character that always belonged, in varying degrees, to his novels is first and most sharply illustrated in Martin *Chuzzlewit.* The earlier numbers, though they contained the two superb caricatures called Pecksniff and Mrs. Gamp, had not for some reason been so popular as the caricatures called Pickwick and Miss Squeers. Dickens was already beginning

to show something of that feverish fatigue which was the natural reaction of his fervid industry. He feared that the public was bored with the book; he became perhaps subconsciously a little bored with it himself. He conceived the bold idea of breaking the story in the middle and putting in a purple patch woven from his wild memories of the Yankees. It was completely successful, in the comedy sense; but it is worth noting that Dickens did something curiously Dickensian in thus suddenly sending Martin Chuzzlewit across the sea to America. It is not easy to imagine Thackeray suddenly hurling Pendennis from Mayfair into the middle of Australia; or George Eliot dislodging Felix Holt and flinging him as far as the North Pole. The difference was partly the result of the Dickensian temper and partly of the method of publication. But it will be well to remember it: for there is more than one example of what looks like a positive change of plan in the Dickens stories, made more possible by this early habit of not producing the work of art as a whole. Some have suggested that the degeneration of Boffin was originally meant to be real, and his rather clumsy plot an afterthought: and the same idea has figured in the reconstructions of *Edwin Drood*.

At this point there is a break in the life of Dickens, in more ways than one. It is represented by his decision to live abroad for a time, chiefly on grounds of economy; the last lingering results of the relative failure of *Martin Chuzzlewit*. He took a villa in the neighbourhood of Genoa in 1844; and he and his family, already a fairly large one, settled down there with a certain air of finality that deserved for a time the name of exile. But it is curious to note that the literary work done there has something of the character of an interlude, and indeed of a rather incongruous interlude. For it was in that Italian landscape that he concentrated on a study so very domestic, insular and even cockney as *The Chimes* (1845); and industriously continued the series of short Christmas stories which had recently begun in the very London fog of *A Christmas Carol* (1843). Whatever be the merits or demerits of the *Christmas Carol*, it really is a carol; in the sense of being short and direct and having the same chorus throughout. The same is true in another way of *The Chimes;* and of most things that occupied him in his Italian home. He had not settled down to another long and important book; and it soon became apparent that he had not settled down at all. He returned to London, the landscape which for him was really the most romantic and even historic; and did something so ominously typical of the place and time as almost to seem like tempting Providence. He became the first editor of the *Daily News*, a paper started to maintain those Liberal, if not Radical opinions of which he always shared the confident outlook and the humane simplicity. He did not long remain attached to the editorial chair or even to the metropolis, for this was the most restless period in all his restless life. He immediately went back to Lausanne and immediately wanted to go back to London. It seems probable that this break in his social life corresponded to a break in his artistic liie: which was in a sense just about to begin all over again and begin at the other end. He did indeed write one more full-size novel of the earlier type, *Dombey and Son* (1846–48); but it has very much the character of the winding up of an old business, like the winding up of the Dombey firm at the end of it. It is comic as the earlier books were comic, and no praise can be higher; it is conventional as the earlier plots were conventional, and never really pretended to be anything else; it contains a dying child upon the pattern of Little Nell; it contains a very amusing major much improved from the pattern of Mr. Dowler. But underneath all this easy repetition of the old dexterity and the old clumsiness the mind of the conjurer is already elsewhere. *Dombey and Son* was more successful in a business sense than *Martin Chuzzlewit;* though really less successful in many others. Dickens settled again in England in a more prosperous style; sent his son to Eton and, what was more sensational, took a rest. It was aiter a long holiday at Broadstairs, in easier circumstances more favourable to imaginative growth and a general change of view, that there appeared in 1849 an entirely new novel in an entirely new style.

There is all the difference between the life and adventures of David Copperfield and the life and adventures of Nicholas Nickleby, that there is between the life of Charles Dickens and the life of Amadis of Gaul. The latter is a good or bad romance; the former is a romantic biography, only the more realistic for being romantic. For romance is a very real part of liie and perhaps the most real part of youth. Dickens had turned the telescope round or was looking through the other end of it; looking perhaps into a mirror, looking in any case out of a new window. It was life as he saw it, which was somewhat fantastically; but it was his own life as he knew it, and even as he had lived it. In other words, it is fanciful but it is not fictitious; because not merely invented in the manner of fiction. In Pickwick or Nickleby he had in a sense breathed fresh imaginative life into stock characters, but they were still stage characters; in the new style he may be extravagant, but he is not stagey. That vague glow of exaggeration and glamour which lies over all the opening chapters of *David Copperfield,* which dilates some figures and distorts others, is the genuine sentimentalism and suppressed passion of youth; it is no longer a convention or tradition of caricature. There are men like Steerforth and girls like Dora; they are not as boys see them; but boys do see them so. This passionate autobiography, though it stiffens into greater conventionality at the real period of passion, is really, in the dismally battered phrase, a human document. But something of the new spirit, more subtle and sympathetic but perhaps less purely creative, belongs to all the books written after this date. The next of the novels in point of time was *Bleak House* (1853), a satire chiefly directed against Chancery and the law's delay, but containing some brilliant satire on other things, as on the philanthropic fool whose eyes are in the ends of the earth. But the description of the feverish idleness of Rick has the new note of one for whom a well-meaning young man is no longer merely a "first walking gentleman." After a still more severe phase in *Hard Times* (1854) (historically important as the revolt of a Radical against the economic individualism which was originally identified with Radicalism) he continued the same tendency in *Little Dorrit* (1857), the tone of which is perhaps as sad as anything illustrated by Dickensian humours can be; broke off into an equally serious and more sensational experiment in historical romance in *A Tale of Two Cities* (1859), largely an effect of the influence of Carlyle; and finally reached what was perhaps the height of his new artistic method in a purely artistic sense. He never wrote anything better, considered as literature, than the first chapters of *Great Expectations* (1861). But there is, after all, something about Dickens that prevents the critic from being ever quite content with criticizing his work as literature. Something larger seems involved, which is not literature, but life; and yet the very opposite of a mere recorded way of living. And he who remembers Pickwick and Pecksniff, creatures like Puck or Pan, may sometimes wonder whether the work had not most life when it was least lifelike.

The stretch of stories following on *David Copperfield,* from 1850 onwards, fall into the framework of another of Dickens's editorial schemes; and this time a much more successful one. He began to edit *Household Words,* in which some, though not all of his later tales appeared; and continued to do so until he exchanged it in 1859 for another and similar periodical called *All the Year Round*. Just as we find him about this time induced at last to settle down finally in a comparatively comfortable editorial chair, so we find him at last settled more comfortably in a domicile that could really be called a home, when, returning at last to his beloved Rochester district on the great road of Kent, he set up his house at Gads hill. It is sad to realize that this material domestic settlement had followed on a moral unsettlement; and the separation of Dickens and his wife, by agreement (of which the little that needs saying has already been said) had already taken place in 1856. But indeed, even apart from that tragedy, it is typical of Dickens that his repose could never be taken as final. His life was destined to end in a whirlwind of an entirely new type of activity; which none the less never interrupted that creative work which was the indwelling excitement of all his days. He wrote one more complete novel, *Our Mutual*

Friend (1864–65), and it is more complete than most. Indeed it is one of the best though not one of the most Dickensian of the Dickens novels. He then turned his restless talent to something in the nature of a detective story, more in the manner of his friend Wilkie Collins; the sort of story which begins by asking a question; in this case a question about the secret and the sequel of the fate of the hero, Edwin Drood. The question will never be answered; for it was cut short by the only thing that could be more dramatic than the death of the hero; the death of the author. Charles Dickens was dead.

He died very suddenly, dropping from his chair at the dinner-table, in the year 1870 at the comparatively early age of fifty-eight. A death so abrupt, and essentially so premature, could not but raise doubts about the wisdom of his impetuous industry and debates almost as varied as those round the secret of Edwin Drood. But without exaggerating any one of the elements that contributed to it, we may note that the very last phase of his life was a new phase; and was almost entirely filled with his new activity in giving public readings from his works. He had gone to America once more in the November of 1867, with this particular purpose; and his campaign of public speaking in this style was truly American in its scope and scale. If he had indeed been unjust to America as a writer, it is curious that he should have reached his final popularity and perhaps his final collapse, in a character so supremely American. Differences exist about how far he exaggerated the function or how far his biographer exaggerated the danger; but his own letters, ragged with insomnia and impatience, full of desperate fatigue and more desperate courage, are alone enough to show that he was playing a very dangerous game for a man approaching sixty. But it is certainly true, as is alleged on the other side, that this was nothing new in the general conduct of Dickens; that he had long ago begun burning the candle at both ends; and there have been few men, in the matter of natural endowments, with so great and glorious a candle to burn.

He was buried in the Poet's Corner of Westminster Abbey; and new and vulgar as many critics had called his work, he was far more of a poet than many who were buried there as poets. He left a will commending his soul to God, and to the mercy of Jesus Christ, and leaving his works to the judgment of posterity; and in both respects the action was symbolic and will remain significant in history. Intellectually limited as he was by the rather cheap and cheery negations of an age of commercial rationalism, he had never been a bitter secularist or anti-clerical; he was at heart traditional and was drawn much more towards Anglican than Puritan Christianity; and his greatest work may yet prove to be the perpetuation of the joyful mystery of Christmas. On the other side, he has suffered and may suffer again the changes in the mere fashions of criticism; but his work was creative, it added something to life; and it is hard to believe that something so added will ever be entirely taken away. The defects of his work are glaring; they hardly need to be detected; they need the less to be emphasized because, unfortunately, he always emphasized them himself. It may be a fault, it is certainly a fact, that he enjoyed writing his worst work as much as his best.

The charge of exaggeration is itself exaggerated. It is also, which is much more important, merely repeated mechanically, without any consideration of its true meaning. Dickens did exaggerate; but his exaggeration was purely Dickensian. In this sense his very vulgarity had the quality of distinction. Mere overstatement, to say that a tall man is ten feet high, to say that a frosty morning froze Niagara; this is something relatively easy to do, though sometimes very cleverly done, especially by Americans. But the distinction of Dickens can be stated even in the common charge against him. He is said to have turned men into monsters of humour or horror, whereas the men were really commonplace and conventional persons in shops and offices. If any critic depreciates the Dickensian method as mere overstatement, the answer is obvious: let him take some of these commonplace people and overstate them. He will soon discover that he has not the vaguest notion of what to overstate. He will soon realise that it is not a simple matter of mere exaggeration, in the sense of mere extension. It is not a matter of making a man a little taller or a morning a little colder; the challenge to imagination is not whether he can exaggerate, but whether he can find anything worth exaggerating. Now the genius of Dickens consisted in seeing in somebody, whom others might call merely prosaic, the germ of a sort of prose poem. There was in this or that man's attitude, or affectation, or habit of thought, something which only needed a touch of exaggeration to be a charming fantasy or a dramatic contradiction. The books of Dickens are in fact full of bores; of bores who do not bore us, merely because they did not bore him. We have all of us heard a hundred times the tiresome trick of public speakers, of asking themselves rhetorical questions which they do not want answered. Any of us might have heard a fat Dissenting minister doing it at a tea-party and thankfully forgotten all about him. But Dickens seized on the fallacy and turned it into a fantasy; into Mr. Chadband's demands to know why he could not fly, or his wild and beautiful apologue about the elephant and the eel. We talk of the power of drawing people out; and that is the nearest parallel to the power of Dickens. He drew reels and reels of highly coloured caricature out of an ordinary person, as dazzlingly as a conjurer draws reels and reels of highly coloured paper out of an ordinary hat. But if anybody thinks the conjuring-trick is easy to perform, let him try it with the next ordinary person he sees. The exaggeration is always the logical extension of something that really exists; but genius appears, first in seeing that it exists, and second in seeing that it will bear to be thus exaggerated. That is something totally different from giving a man a long nose; it is the delicate surgical separation or extension of a living nerve. It is carrying a ludicrous train of thought further than the actual thinker carries it; but it requires a little thinking. It is making fools more gloriously foolish than they can be in this vale of tears; and it is not every fool who can do it.

There were other reasons for the injustice in the particular case of Dickens. Though his characters often were caricatures, they were not such wild caricatures as was supposed by those who had never met such characters. And the critics had never met the characters; because the critics did not live in the common life of the English people; and Dickens did. England was a much more amusing and horrible place than it appeared to the sort of man who wrote reviews in The Quarterly; and, in spite of all scientific progress or social reform, it is still. The poverty and anarchy of Dickens's early life had stuffed his memory with strange things and people never to be discovered in Tennysonian country houses or even Thackerayan drawing-rooms. Poverty makes strange bedfellows, the same sort of bedfellows whom Mr. Pickwick fought for the recovery of his nightcap. In the vivid phrase, he did indeed live in Queer street and was acquainted with very queer fish. And it is something of an irony that his tragedy was the justification of his farce. He not only learnt in suffering what he taught in song, but what he reridered, so to speak, in a comic song.

It is also true, however, that he caught many of these queer fish because he liked fishing in such troubled waters. A good example of this combination of opportunity and eccentricity is to be found in his affection for travelling showmen and vagabond entertainments of all sorts, especially those that exhibited giants and dwarfs and such monstrosities. Some might see in this truth a sort of travesty of all his travesties. It would be easy to suggest a psychological theory, by which all his art tended to the antics of the abnormal; it would also be entirely false. It would be much truer to say that Dickens created so many wild and fantastic caricatures because he was himself commonplace. He never identifies himself with anything abnormal, in the more modern manner. In his travelling show, the Giant always falls far short of being a Superman. And though he was tempted only too easily to an obvious pathos, there was never anything particularly pathetic about his dwarfs. His fun is more robust; and even, in that sense, more callous. The truth is that Dickens's attitude to the abnormal has been misunderstood owing to the modern misunderstanding of the idea of the normal. He was in many ways a wild satirist, but still a satirist; and satire is founded on sanity. He had his real

Cockney limitations. But his moderation was not a limitation but a liberty; for it allowed him to hit out in all directions. It was precisely because he had an ordinary and sensible view of life that he could measure the full madness both of Gradgrind's greed or Micawber's improvidence. It was because he was what we call commonplace that Dombey appeared to him so stiff or Jellaby so slovenly. In a later generation a real person often assumed such an unreal pose and lost the power of merely laughing at it; as, for example, when Oscar Wilde said seriously all that Skimpole had said absurdly. The Victorian commonsense was not a complete commonsense; and Dickens did suffer from having a narrower culture than Swift or Rabelais. But he did not suffer from being sensible; it was even more from his sense than his sensibility, it was from a sort of inspired irritation and impatience of good sense, that he was able to give us so radiant a fairyland of fools.

His literary work produced of course much more than a literary effect. He was the last great poet, in the true sense of maker, who made something for the people and was in the highest sense popular. He still gives his name, not to a literary clique, but to a league or fellowship numbering thousands all over the world. In this connection it is often noted that he achieved many things even considered as a practical political and social reformer. He let light into dark corners, like the dens of dirt and brutality often called schools, especially in Yorkshire; he probably had much to do with making the professional nurse a duller but more reliable person than Mrs. Gamp; it is likely enough that his vivid descriptions, assisted by the whole trend of the time, hastened the extinction of ordinary imprisonment for debt and clarified much of the original chaos of Chancery. But precisely because this has often been said, it will be well not to say it too often. It has the effect of making his satire appear much more superficial and utilitarian than it really was; for the great satirist is concerned with things not so easily destroyed. We do more honour to Dickens in noting the evils he did not destroy than those he did. The eager worship of a man merely wealthy, however dull and trivial, which appears in the affair of Merdle, has by no means disappeared from our own more recent affairs. The pompous old Barnacle and the agreeable young Barnacle are still almost as much alive as in Dickens's day. The sweeping away of a genuine gentry, in the person of Mr. Twemlow, on the tide of a new plutocracy, represented by Mr. Veneering, has gone much further than in Dickens's day. But this makes Dickens's satire the more rather than the less valuable to posterity. The other mood, which pictures all such abuses as things of the past, tends not to reform but only too much to repose; and to the perpetuation of a rather snobbish and paltry version of the Dickensian tradition. In that spirit we may hear to this day a Stiltstalking telling the House of Commons that Stiltstalkings have perished before the march of progress; or in the law courts a Buzfuz quoting Buzfuz and jeering at himself as an extinct monster.

The future of the fame of Dfckens is no part of the Dickens record and a very dubious part of the Dickens criticism. Some have suggested that his glory will fade as new fashions succeed those he satirized; others have said, at least equally reasonably, that the difference itself fades when all the fashions have grown old; and that Aristophanes and Cervantes have outlived their descendants as well as their contemporaries. But there can be no question of the importance of Dickens as a human event in history; a sort of conflagration and transfiguration in the very heart of what is called the conventional Victorian era; a naked flame of mere natural genius, breaking out in a man without culture, without tradition, without help from historic religions or philosophies or from the great foreign schools; and revealing a light that never was on sea or land, if only in the long fantastic shadows that it threw from common things. (G. K. C.)

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DICKINSON, EMILY (1830–1886), American poet, was born on Dec. 10, 1830, at Amherst, Mass., where her grandfather, Samuel Fowler Dickinson, had been one of the founders of the town, church and college. Her father, Edward Dickinson, was a lawyer and treasurer of the college; her mother, Emily Norcross Dickinson, a model New England housewife who "did not care for thought." In all her heredity, according to her biographer, traced back nine generations in America and 13 in England, there is nothing to explain her genius—nor to confute it. As a child she went to public school, went berrying and chestnutting, learned the household arts and crafts. As a girl she made a herbarium, embroidered the usual book-marks, and wrote sentimental letters in the verbose style of the time. In the fall of 1847 she entered South Hadley seminary, where she studied chemistry, physiology and English composition, and where she was "cramped, curbed and repressed in every natural desire or impulse." She left the seminary in 1848, re-entered Amherst academy for a while, and then, except for the lectures of the resident and visiting professors and her own reading, her education was finished. The winter of 1853 she spent in Washington, where her father was serving two terms in Congress, and on a visit to Philadelphia in the spring experienced an unhappy love affair—she firmly renouncing the man because she would not "wreck another woman's life." This possibly influenced the change from an apparently normal, witty young woman, to an increasingly mystical poet. By 1862 she had practically withdrawn from the world, venturing out of her father's house only at dusk to attend to her plants, but remaining always the "ecstatic daredevil, shy paradox," to her brother's family and to a very few intellectual friends. She died at Amherst on May 16, 1886. During her lifetime she had allowed only three or four of her poems to be published. In 1892 her friend, Col. Thomas Wentworth Higginson, published a small collection with a success almost unparalleled in American literature, but it was not until 1924 that her complete poems and her *Letters* were published, making her work generally accessible. Her poetry has been described as suggestive of William Blake in its "flashes of wholly original and profound insight into nature and life." She herself has been described as the epigrammatical Walt Whitman, and she remains a strange and entirely original genius, "defiant of outward form, sometimes obscure, at times inscrutable," but more often with a perfection in the mating of word and idea that has rarely been achieved.

See *The Complete Poems of Emily Dickinson,* edited by Martha Dickinson Bianchi (Boston, 1925); Martha Dickinson Bianchi, *Life and Letters of Emily Dickinson; T.* W. Higginson, *Carlyle's Laugh* (Boston, 1909). (W. Tu.)

DICKINSON, JOHN (1732–1808), American statesman and pamphleteer, was born in Talbot county, (Md.) Nov. 8, 1732. He removed with his father to Kent county (Del.), in 1740, studied under private tutors, read law, and, in 1753, entered the Middle Temple, London. Returning to America in 1757, he practised law in Philadelphia and started, in 1760, his long public career. Since Pennsylvania and Delaware were under the same proprietor and the same governor, he acted in the same capacity at various times for both colonies—member of the assembly, president of the executive council, and representative in the Continental Congress. He was sent from Pennsylvania to the Stamp Act Congress (1765), served for a time as private, and later as brigadier-general, in the Delaware militia, and represented Delaware at the Annapolis Convention of 1786 and the Federal Constitutional Convention of 1787. He was most important, however, as the "Penman of the Revolution." Scarcely any other writer of the day presented arguments so numerous so timely and so popular. He drafted the "Declaration of Rights" of the Stamp Act Congress, the "Petition to the King" and the "Address to the Inhabitants of Quebec" of the Congress of 1774, the second "Petition to the Ring" and "Articles of Confederation" of the Second Congress. Most influential of all, however,

were The Letters of a Farmer in *Pennsylvania* written in 1767–68 in condemnation of the Townsend Acts of 1767, in which he rejected speculative natural rights theories, and appealed to the common sense of the people through simple legal arguments. By opposing the Declaration of Independence, he lost his popularity and never entirely regained it. As the representative of a small state, he championed the principle of state equality in the Constitutional Convention; but he was one of the first to advocate the compromise, which was finally adopted, providing for equal representation in one house and proportional representation in the other. After the adjournment of the convention he defended its work in a series of forceful letters signed "Fabius." Largely through his influence Delaware and Pennsylvania were the first two states to ratify the Constitution. Dickinson's interests were not exclusively political. He helped to found Dickinson college (named in his honour) at Carlisle (Pa.), in 1783, was the first president of its board of trustees, and was for many years its benefactor. He died Feb. 14, 1808, and was buried in the Friends' burial ground in Wilmington (Del.).

See C. J. Stillé, "Life and Times of John Dickinson" *(Memoirs of the Historical Society of Pennsylvania,* vol. xiii., Philadelphia, 1891); P. L. Ford, editor, "The Writings of John Dickinson," *(ibid.,* vol. xiv., 1895); and R. R. Richards, "The Life and Character of John Dickinson" (Delaware Historical Society, *Papers,* No. 30).

DICKINSON, a city in the south-western part of North Dakota, U.S.A., on the Heart river and Federal highway 10, at an altitude of 2,430ft.; the county seat of Stark county. It is a division point on the Northern Pacific Railway, which has repair shops here. The population in 1940 federal census was 5,839. Dickinson is the shipping-point for a farming and grazing region; and has foundry and machine shops, brick works, flour-mills, lignite coal mines and a plant for the manufacture of briquettes. One of the State normal schools is located here, and the State agricultural college has established here a branch of the agricultural experiment station. The city was settled about 1882 and incorporated in 1900. It was named after W. S. Dickinson of Malone, N.Y., an enthusiastic advocate of the country west of the Missouri.

DICKSEE, SIR FRANCIS BERNARD (1853–1928), English painter, born in London on Nov. 27, 1853, son of Thomas Dicksee, artist, was President of the Royal Academy in 1924. He belongs to the older academic school, whoseaim was to express poetic sentiments in a realistic pictorial form. His pictures are painted with extreme sensibility and his execution is always skilful and competent. Two of his principal works were bought under the Chantrey bequest for the Tate gallery: "Harmony" (1877) and "The Two Crowns" (1900). He died Oct. 17, 1928.

DICKSON, SIR ALEXANDER (1777–1840), British artillerist, passed out of the Royal Military academy into the Royal Artillery in 1794. He served in Minorca (1798), at Malta (1800), in the Montevideo expedition (1806–7), and in 1809 accompanied Howorth to the Peninsula as brigade-major of the artillery. In the end he became commander of the whole of the artillery of the allied army, and though still only a substantive captain in the British service he had under his orders some 8,000 men. At Vitoria, the battle of the Pyrenees and Toulouse he directed the movements of the artillery. He served on the artillery staff at Quatre Bras and Waterloo, and subsequently commanded the British battering train at the sieges of the French fortresses left behind the advancing allies. He died, a major-general and G.C.B., in 1840. He was an early fellow of the Royal Geographical Society.

His diaries kept in the Peninsula were the main source of information used in Duncan's *History of the Royal Artillery.*

DICKSON, SIR JAMES ROBERT (1832–1901), Australian statesman, was born in Plymouth on Nov. 30, 1832. In 1854 he emigrated to Victoria, but after some years spent in that colony and in New South Wales, he settled in 1862 in Queensland, where he was connected with the Royal Bank of Queensland. He entered the Queensland house of assembly in 1872, and became minister of works (1876), treasurer (1876–1879, and 1883–1887), acting premier (1884), but resigned in 1887 on the question of taxing land. In 1889 he retired from business, and spent three years in Europe before resuming political life. He fought for the introduction of Polynesian labour on the Queensland sugar plantations at the general election of 1892, and was elected to the house of assembly in that year and again at the elections of 1893 and 1896. He became secretary for railways in 1897, minister for home affairsin 1898, represented Queensland in the federal council of Australia in 1896 and at the postal conference at Hobart in 1898, and in 1898 became premier. His energies were now devoted to the formation of an Australian commonwealth. He secured the reference of the question to a plebiscite, the result of which justified his anticipations. He resigned the premiership in Nov. 1899, but in the ministry of Robert Philp, formed in the next month, he was reappointed to the offices of chief secretary and vice-president of the executive council which he had combined with the office of premier. He represented Queensland in 1900 at the conference held in London to consider the question of Australian unity, and on his return was appointed minister of defence in the first government of the Australian commonwealth. He died at Sydney on Jan. 10, 1901, in the midst of the festivities attending the inauguration of the new state.

DICKSON CITY, a borough of Lackawanna county, Pa., U.S.A., in the anthracite region. It is on the Lackawanna river, 5m. N.E. of Scranton, and is served by the Delaware and Hudson, the Erie, and the New York, Ontario and Western railways. The population in 1930 was 12,395 and in 1940, 11,548.

DICOTYLEDONS, in botany, the larger of the two great classes of angiosperms (*q.v.*), embracing most of the common flower-bearing plants. The name expresses the most universal character of the class, the importance of which was first noticed by John Ray namely, the presence of a pair of seed-leaves or cotyledons, in the plantlet or embryo contained in the seed. The embryo is generally surrounded by a larger or smaller amount of foodstuff (endosperm) which serves to nourish it in its development to form a seedling when the seed germinates; frequently, however, the whole of the nourishment for future use is stored in the cotyledons themselves, which then become thick and fleshy. In germination of the seed the rudimentary root at the distal end of the hypocotyl develops the primary root; this is usually followed by growth of the hypocotyl which carries the cotyledons above ground, where they become the first green leaves of the plant. Lying between the bases of the cotyledons and terminating the axis of the plant is the first stem bud (epicotyl of the embryo).

Size and manner of growth of the adult plant show variety, from the small herb lasting for one season only, to the forest tree living for centuries. The arrangement of the conducting tissue in the Stem is characteristic; a transverse section of the very young stem shows a number of distinct conducting strands—vascular bundles—arranged in a ring round the pith; these soon become united to form a closed ring of phloem and wood, separated by a layer of cambium. In perennials the stem shows a regular increase in thickness each year by the addition of a new ring of wood outside the old one—for details of structure see PLANTS: Anatomy. A similar growth occurs in the root. This increase in the diameter of stem and root is correlated with the increase in leaf-area each season, due to the continued production of new leaf-bearing branches. A characteristic of the class is afforded by the complicated network formed by the leaf-veins,—well seen in a skeleton leaf, from which the soft parts have been removed by maceration. The parts of the flower are most frequently arranged in fives, or multiples of fives; for instance, a common arrangement is as follows,—five sepals, succeeded by five petals, ten stamens in two sets of five, and five or fewer carpels. An arrangement in fours is less frequent, while the arrangement in threes, so common in monocotyledons, is rare in dicotyledons. In some families the parts are numerous, chiefly in the case of the stamens and the carpels, as in the buttercup and other members of the Ranunculaceae and in the Rosaceae. The characters of the flower and fruit are described in the articles FLOWER; FRUIT and SEED.

DICTATING MACHINES: see OFFICE APPLIANCES.

DICTATOR, in modern usage, a ruler enjoying extra-constitutional power, in ancient times, an extraordinary magistrate

in the Roman commonwealth (from the Lat. *dictare,* frequentative of *dicere*). The earlier official title was *magister populi,* which may mean "head of the host" as opposed to his subordinate, the *magister equitum,* who was "head of the cavalry." Emphasis was thus laid on the military aspect of the dictatorship, and, in fact, the office seems to have been instituted for the purpose of meeting a military crisis too serious for the annual consuls with their divided command. The repression of civil discord was one of the motives for the institution of a dictatorship. Such is the view expressed by Cicero in the *De legibus* (iii., *3, 9*) and by the emperor Claudius in his extant *Oratio* (i., 28). This function of the office is attested by the internal history of Rome. In the crisis of the agitation at the time of the Licinian laws (367 B.C) a dictator was appointed, and in 314 B.C. a dictator was created for purposes of criminal jurisdiction *(quaestionibus exercendis).* The dictator appointed to meet the dangers of war, sedition, or crime was described as "the administrative dictator" *(rei gerundae causa).* For minor purposes we find dictators appointed to hold the elections, to celebrate games, to establish festivals, and to drive the nail into the temple of Jupiter—an act of natural magic which was believed to avert pestilence. These dictators retired from office as soon as their function was completed. The "administrative dictator" held office for six months.

The powers of a dictator were a temporary revival of those of the kings, with some limitations. He was never concerned with civil jurisdiction. His military authority was confined to Italy; and his power of life and death was limited. By the *lex Valeria* of 300 B.C. he was made subject to the right of criminal appeal (*provocatio*) within the limits of the city. But all the magistrates of the people were regarded as his subordinates. The dictator was nominated by one of the consuls. But the senate claimed authority over the magistrates, and suggested not only the nomination but also the name of the nominee. After the nomination, the imperium of the dictator was confirmed by a *lex curiata (see* COMITIA). To emphasize the superiority of this imperium, the dictator might be preceded by twenty-four lictors, and, at least in the earlier period of the office, these lictors bore the axes, the symbol of life and death, within the city walls.

The first dictator is said to have been created in 501 B.C.; the last of the "administrative" dictators belongs to the year 216 B.C. The epoch of the Second Punic War was marked by experiments with the office, such as the election of Q. Fabius Maximus by the people, and the co-dictatorship of M. Minucius. The emergency office of the early and middle republic has little in common with the dictatorship as revised by Sulla and by Caesar. Sulla's dictatorship was the form taken by a provisional government. He was created "for the establishment of the republic." Caesar's renewed dictatorships created a temporary monarchy, whatever may have been his wishes as to its permanency. Ostensibly to prevent its further use for such a purpose, M. Antonius in 44 B.C. carried a law abolishing the dictatorship.

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DICTIONARY, a book containing a collection of the words of a language, arranged alphabetically or in some other definite order, with explanations of their meanings and often with other information concerning them, in the same or another language. Besides the meanings, there may be given, and usually is in the larger dictionaries; much additional information, such as pronunciation, etymology, illustrative quotations, synonyms and idiomatic phrases. The word is used also, especially when accompanied by a qualifying term, to mean a word-book or lexicon of the terms used in some subject or some part or form of a language, as a dictionary of music, of law, of etymology or of a dialecl. A geographical dictionary is generally called a *gazetteer.* An *index* is an alphabetical arrangement of selected words of some book or author with references to the place where they occur. When under each word the phrases containing it are added together with references, the work is called a *concordarice.* When the words are few in number, being only a small part of those belonging to the language or subject, or when they are given with little or no explanation, the work is called a *vocabulary.* When the work is merely a list of explanations of the difficult words and expressions in some particular subject or writing, it is called a *glossary.*

The first dictionaries explained only the words, or certain words, of a language. But as the names of things, persons and places are words and often require explanation even more than other classes of words, dictionaries gave increasing attention to things, persons and places. In time, books were devoted to them alone, sometimes limited to special subjects, and these books have so multiplied that they now rival in number and variety dictionaries of words or of languages, and often far surpass them in bulk. There are dictionaries of biography and history, real and fictitious, general and special, relating to men of all countries, characters and professions; the English *Dictionary of National Biography* is an outstanding instance of one form of these. There are dictionaries of bibliography, relating to all books, or to those of some particular kind or country; dictionaries of geography *(gazetteers)* of the whole world, of particular countries, of small districts, of towns and of villages; dictionaries of philosophy; of the Bible; of mathematics; of zoology; of botany; of chemistry, geology and mineralogy; of architecture, painting and music; of medicine; and of very many other subjects. And lastly, there are dictionaries of the arts and sciences, and their comprehensive offspring, *encyclopaedias* (*q.v.*), which include in themselves every branch of knowledge. This article is confined to an account of those dictionaries which are primarily word-books. This is practically the most convenient distinction from the subject-book or encyclopaedia. The two characters are often combined in one work; thus the *Century Dictionary* has encyclopaedic features, while the present edition of the *Encyclopedia Britannica,* embodies dictionary features. The tendency of general dictionaries as they become larger is to unite in themselves all the peculiar features of special dictionaries.

English lexicography began with attempts to explain Latin words by giving English equivalents. In the *Promptorium Parvulorum,* compiled in 1440 by Galfridus Grammaticus, a Dominican monk of Lynn Episcopi, in Norfolk, and printed by Pynson in 1499, English words were explained in Latin. The first dictionaries of English words were not meant to be complete, but were limited to "hard" words, typically those derived from foreign languages, words in common use being presumed to require no attention; thus Edward Phillips, nephew of John Milton, described his *New World of English Words* (1658) as "containing the interpretation of such hard words as are derived from other languages." The first approach to success in collecting and defining all words in good usage in the English language was made by Nathan Bailey in his folio dictionary published in 1730.

The lexicographer was long expected to register only words deemed "good" for literary use, with their "proper" meanings; it was his duty to sift and refine, to decide authoritatively questions of usage, and thus to fix the language as completely as might be possible within the limits determined by the literary taste of his time. Thus the Accademia della Crusca, founded near the close of the 16th century, was established for the purpose of purifying in this way the Italian tongue, and in 1613 the *T'ocabolorio degli Accademici della Crusca,* long the standard of that language, was published. The Académie Française, the first edition of whose dictionary appeared in 1694, had a similar origin. In England the idea of constructing a dictionary upon this principle arose during the second quarter of the 18th century. It was imagined by men of letters—among them Addison, Swift and Pope—that the English language had then attained such perfection that further improvement was hardly possible, and it was feared that if it were not fixed by lexicographic authority deterioration would soon begin. Since there was no English "academy," it was necessary that the task should be entrusted to some one whose learning would command respect, and the man who was chosen was Samuel Johnson. His dictionary, the first edition of which, in two folio volumes, appeared in 1755, was for its quotations and pithy

definitions admirable, but it was inadequate even as a standard of the then existing literary usage. Johnson himself did not long entertain the belief that the natural development of a language can be arrested in that or in any other way. His work was, however, generally accepted as a final authority, and the ideas upon which it was founded dominated English lexicography for more than a century.

The first effective protest in England against the supremacy of this literary view was made by Dean (later Archbishop) Trench, in a paper on "Some Deficiencies in Existing English Dictionaries" read before the Philological Society in 1857. "A dictionary," he said, "according to that idea of it which seems to me alone capable of being logically maintained, is an *inventory of the language;* much more, but this primarily. . . . It is no task of the maker of it to select the *good* words of the language. . . The business which he has undertaken is to collect and arrange *all* words, whether good or bad, whether they commend themselves to his judgment or otherwise. . . *He is an historian of* (the language), *not a critic."* In other words, for the literary view of the chief end of the general dictionary should be substituted the philological or scientific, In Germany this substitution had already been effected by Jacob and Wilhelm Grimm in their dictionary of the German language, the first volume of which appeared in 1854. In brief, then, the philologist's view is that the general dictionary of a language should be a record of all the words — current or obsolete — of that language, with all their meanings and uses, but should not attempt to be, except secondarily or indirectly, a guide to "good" usage.

This theoretical requirement must, of course, be modified considerably in practice. The date at which a modern language is to be regarded by the lexicographer as "beginning" must, as a rule, be somewhat arbitrarily chosen; while considerable portions of its earlier vocabulary cannot be recovered because of the incompleteness of the literary record. Moreover, not even the most complete dictionary can include all the words which the records — earlier and later — actually contain. Many words, that is to say, which are found in the literature of a language cannot be regarded as, for lexicographic purposes, belonging to that language; while many more may or may not be held to belong to it, according to the judgment of the lexicographer. This is especially true of English.

Another important principle upon which Trench insisted, and which also expresses a requirement of modern scientific philology, is that the dictionary shall be not merely a record, but also an *historical* record of words and their uses. From the literary point of view the most important thing is present usage. To that alone the idea of a "standard" has any application. Dictionaries of the older type, therefore, usually make the common or "proper" meaning of a word the starting point of its definition and arrange its other senses in a logical or accidental order, commonly ignoring the historical order in which the various meanings arose. The philologist, however, for whom the growth, or progressive alteration, of a language is a fact of central importance, regards no record of a language as complete which does not exhibit this growth in its successive stages. He desires to know when and where each word, and each form and sense of it, are first found in the language; if the word or sense is obsolete, when it died; and any other fact that throws light upon its history and implications. He requires, accordingly, of the lexicographer that, having ascertained these data, he shall make them the foundation of his exposition — in particular, of the arrangement of his definition, that sense being placed first which appeared first in time.

The adoption of the historical principle involves a further noteworthy modification of older methods, namely, an important extension of the use of quotations. To Dr. Johnson belongs the credit of showing how useful, when properly chosen, quotations may be, not only in corroborating the lexicographer's statements, but also in revealing special shades of meaning or variations of use which his definitions cannot well express. No part of Johnson's work is more valuable than this. The idea was more fully developed and applied by Dr. Charles Richardson. whose *New Dictionary of the English Language . . . Illustrated by Quotations from the Best Authors* (1837) still remains a most valuable collection of literary illustrations. Until recently, however, with few exceptions lexicographers have employed quotations chiefly for the ends just mentioned — as instances of use or as illustrations of correct usage — with scarcely any recognition of their value as historical evidence; and they have taken them almost exclusively from the works of the "best" authors. But since the data upon which conclusions with regard to the history of a word can be based must be collected chiefly from the literature of the language, it is evident that, in so far as the lexicographer is required to furnish evidence for an historical inference, a quotation is the best form in which he can give it. A further rule of scholarly lexicography, accordingly, is that quotations should be used, primarily, as historical evidence, and that the history of words and meanings should be exhibited by means of them. The earliest instance of use that can be found, and (if the word or sense is obsolete) the latest, are as a rule to be given; while in the case of an important word or sense, instances taken from successive periods of its currency also should be cited. Moreover, a quotation which contains an important bit of historical evidence must be used, whether its source is "good," from the literary point of view, or not — whether it is a classic of the language or from a daily newspaper; though where choice is possible, preference should, of course, be given to quotations from the best writers.

Lastly, a much more important place in the scheme of the dictionary is now assigned to the *etymology* of words. This may be attributed, in part, to the rapid development of etymology as a science, and to the greater abundance of trustworthy data; but chiefly to the fact that from the historical point of view the connection between that section of the biography of a word which lies within the language and its antecedent history has become more vital and interesting. Etymology, in other words, is essentially the history of the *form* of a word up to the time when it became a part of the language, and is, in a measure, an extension of the history of the development of the word in the language. Moreover, it is the only means by which the exact relations of allied words can be ascertained, and the separation of words of the same form but of diverse origin (homonyms) can be effected, and is thus, for the dictionary, the foundation of all *family history* and correct *genealogy*. Related to the etymology of words are the changes in their form which may have occurred while they have been in use as parts of the language — modifications of their pronunciation, changes resulting from analogy, and the like.

The ideal thus developed is primarily that of the general dictionary of the purely philological type. The encyclopaedic type of dictionary, although it has often been criticized as hybrid — as a mixture of two things which should be kept distinct — is entirely defensible. Between the dictionary and the encyclopaedia the dividing line cannot be sharply drawn. There are words the meaning of which cannot be explained fully without some description of things, and, on the other hand, the description of things and processes often involves the definition of names. The large vocabulary of the general dictionary makes it possible to present certain kinds of encyclopaedic matter with a degree of fulness and a convenience of arrangement which are possible in no single work of any other class. In fact, it may be said that if the encyclopaedic dictionary did not exist it would have to be invented: that its justification is its indispensableness. Not the least of its advantages is that it makes legitimate the use of diagrams and pictorial illustrations, which are valuable aids to definition.

On its practical side the advance in lexicography has consisted in the elaboration of methods long in use rather than in the invention of new ones. The only way to collect the data upon which the vocabulary, the definitions and the history are to be based is, of course, to search for them in the written monuments of the language. But the wider scope and special aims of the new lexicography demand that the investigation shall be vastly more comprehensive, systematic and precise. It is necessary, in brief, that, as far as may be possible, records of every kind and of every period shall be examined systematically, in order that all the words, and senses and forms of words, which have existed may be found, and that enough excerpts to cover all the essential facts

shall be made. The books, pamphlets, journals, newspapers, documents and so on which must thus be searched will be numbered by thousands, and the quotations selected may (as in the case of the Oxford *New English Dictionary)* be counted by millions. This task is beyond the powers of any one man, even though he be a Johnson, a LittrC or a Grimm, and it is now assigned to a corps of readers whose number is limited only by the ability of the editor to profit by such assistance. The modern method of editing the material thus accumulated — the actual work of compilation — also is characterized by the application of the principle of co-operation. Johnson boasted that his dictionary was written with but little assistance from the learned, and the same was in large measure true of that of LittrC. Such attempts on the part of one man, with a few assistants, to write practically the whole of a general dictionary are no longer possible, not merely because of the vast labour necessitated by modern aims, but more especially because the immense development of the vocabularies of the special sciences, arts and technology renders indispensable the assistance, in the work of definition, of persons who are expert in their intricacies. The tendency, accordingly, has been to enlarge greatly the editorial staff, scores of sub-editors and contributors being now employed where a dozen or fewer were formerly sufficient. In other words, the making of a dictionary has become a co-operative enterprise, to the success of which workers in all the fields of knowledge contribute.

The most complete exemplification of these principles and methods is the Oxford *New English Dictionary, on historical principles, founded mainly on the materials collected by the Philological Society.* This monumental work originated in the suggestion of Trench, in 1857, that an attempt should be made, under the direction of the Philological Society, to complete the vocabulary of existing dictionaries and to supply the historical information which they lacked. The suggestion was adopted, considerable material was collected, and Mr. Herbert Coleridge was appointed general editor. He died in 1861, and was succeeded by Dr. F. J. Furnivall. Little was done, however, beyond the collection of about 2,000,000 quotations, until in 1878 the expense of printing and publishing the proposed dictionary was assumed by the delegates of the Oxford University Press, and the editorship was entrusted to Dr. (afterwards Sir) J. A. H. Murray. As the historical point of beginning, the middle of the 12th century was selected, all words that were obsolete at that date being excluded, though the history of words that were current both before and after that date is given in its entirety; and it was decided that the search for quotations — which, according to the original design, was to cover the entire literature down to the beginning of the 16th century and as much of the subsequent literature (especially the works of the more important writers and works on special subjects) as might be possible-:should be made more thorough. More than 800 readers, in all parts of the world, offered their aid; and when the preface to the first volume appeared in 1888, the editor was able to announce that the readers had increased to 1,300 and that 3,500,000 quotations, taken from the writings of more than 5,000 authors, had already been amassed. The whole work was planned to be completed in ten large volumes, each issued first in smaller parts. The first part was issued in 1884, and the dictionary, in ten full volumes or twenty half-volumes, was completed in 1928. The historical method of exposition, particularly by quotations, is applied in the Oxford *New English Dictionary,* if not in all cases with entire success, yet, on the whole, with a regularity and a precision which leave little to be desired. Special features of the book are the completeness with which variations of orthography (with dates) are given; the fullness and scientific excellence of the etymologies, which abound in new information and correction of old errors; the phonetic precision with which the present (British) pronunciation is indicated; and the elaborate subdivision of meanings. The definitions as a whole are marked by a high degree of accuracy, though in a certain number of cases (not explicable by the dates of the volumes) the meanings are not so full as one would expect. Work of such magnitude and quality is possible, practically, only when the editor of the dictionary can command not merely the aid of a very large number of scholars and men of science, but their gratuitous aid. In this the Oxford *New English Dictionary* was singularly fortunate. The conditions under which it originated, and its aim, interested scholars everywhere and led them to contribute their knowledge and time. The long list of names of such helpers in Sir J. A. H. Murray's preface is in curious contrast with their absence from Dr. Johnson's and the few which are given in that of LittrC. Dr. Murray's chief collaborators and successors were Dr. Henry Bradley, Dr. William A. Craigie and Mr. Charles T. Onions. Of the dictionary as a whole it may be said that it is one of the greatest achievements of modem scholarship and research.

In the *Deutsches Worterbuch* of Jacob and Wilhelm Grimm the scientific spirit, as was said above, first found expression in general lexicography. The desirability of a complete inventory and investigation of German words was recognized by Leibnitz and by various 18th century scholars, but the plan and methods of the Grimms were the direct product of the then new scientific philology. Their design, in brief, was to give an exhaustive account of the words of the literary language (New High German) from about the end of the 15th century, including their earlier etymological and later history, with references to important dialectal words and forms; and to illustrate their use and history abundantly by quotations. The first volume appeared in 1854. Jacob Grimm (died 1863) edited the first, second (with his brother, who died in 1859) and third volumes and a part of the fourth; the others have been edited by various distinguished scholars.

These general principles lie also at the foundation of the scholarly *Dictionnaire de la langue française* of *E.* LittrC, though they are there carried out less systematically and less completely. In the arrangement of the definitions the first place is given to the most primitive meaning of the word instead of to the most common one, as in the dictionary of the Academy; but the other meanings follow in an order that is often logical rather than historical. Quotations also are frequently used merely as literary illustrations, or are omitted entirely; in the special paragraphs on the history of words before the 16th century, however, they are put to a strictly historical use. This dictionary — perhaps the greatest ever compiled by one man — was published in 1863–72.

In the making of all these great dictionaries the needs of the general public as well as those of scholars were kept in view. But the type to which the general dictionary designed for popular use has tended more and more to conform is the *encyclopaedic.* This combination of lexicon and encyclopaedia is exhibited in an extreme form in the *Grand dictionnaire universal du XIX siècle* of Pierre Larousse. Besides common words and their definitions, it contains a great many proper names, with a correspondingly large number of biographical, geographical, historical and other articles, the connection of which with the strictly lexicographical part is purely mechanical. Its great utility makes it a model in many respects. Fifteen volumes were published (1866–76), and supplements were brought out later. The *Nouveau Larousse illustré* started publication in 1901, and was completed in seven volumes in 1904. This was not an abridgment or a fresh edition of the *Grand Dictionnaire* of Pierre Larousse, but a distinct publication, as is also the *Larousse Universel* in two volumes (1923).

The notable work of this class in English is the *Century Dictionary,* an American product, edited by Professor W. D. Whitney, and published in 1889–91 in six volumes, containing 7,046 pages (large quarto). It conforms to the philological mode in giving with great fullness the older as well as the present vocabulary of the language, and in the completeness of its etymologies; but it does not attempt to give the full history of every word within the language. Among its other more noteworthy characteristics are the inclusion of a great number of modern scientific and technical words, and the abundance of its quotations. The quotations are for the most part provided with references, but they are not dated. The *Century's* great merits are the excellent enumeration of meanings and the accuracy of its explanations. In the application of the encyclopaedic method the *Century* is conservative, restricting, for the most part, the encyclopaedic matter to descriptive and other details which may legitimately be added to the definitions. Its pictorial illustrations are very numerous

and well executed. In the manner of its compilation it is a good example of modern co-operative dictionary-making, being the joint product of a number of specialists.

No account of the dictionary would be complete that did not mention its educational influence in America. From the appearance of the *American Dictionary of the English Language* by Noah Webster, in 1828, the dictionary has served in America, in offices, schools and homes, as a working tool for masses of people with a common interest in understanding and using their mother tongue. The American dictionary, typically in one large volume, is, then, not primarily for a literary class, as Dr. Johnson's dictionary was, and is not primarily, like the Oxford dictionary, a contribution to linguistic scholarship. It gives citations, since, as Voltaire said, a dictionary without them is a skeleton; but it does not necessarily retain obsolete spelling in citations or use space in dating them and in giving precise references to edition and page. It seeks to register the forms in which words are currently written and printed, the pronunciations that are acceptable and the recognized meanings. Its compactness, considering its comprehensiveness, is attained by technique in editing and typography. In addition to the *New International Dictionary*, which continues with honourable distinction the work begun by Noah Webster, an outstanding dictionary of this type is the *Standard Dictionary* (1893 *seqq.*).

DICTUM DE OMNI ET NULLO. This is the name of the alleged Aristotelian principle of deductive inference. There are various formulations of it. That given by Crackenthorpe is perhaps as near to Aristotle's meaning as any: *Quidquid affirmatur (sive negatur) universaliter de aliquo, idem affirmatur (sive negatur) etiam de omni de quo illud praedicatur.* The more usual and concise form is, *Quod de aliquo omni praedicatur, praedicatur etiam de qualibet eius* parte—"What is predicated of any whole is predicated of any part of it." If "whole" be taken to mean "a kind" (or "class" in the sense of a "kind" or "type," *see* CLASS), then the *dictum* may be said to express the principle, that is, the form or spirit, of *deductive* inference. It is invariably treated as formulating the principle of *syllogistic* inference; but this is not quite correct, as it does not apply to syllogisms composed of singular terms, and, on the other hand, it applies to the immediate inference of a particular or singular proposition from a general proposition as much as to deductive syllogisms.

See H. W. *B.* Joseph, *Introduction to Logic* (1916); *A.* Wolf, *Essentials of Logic* (1926).

DICTYONEMA. A genus of important fossils composed of a network of filaments radiating from a base of cell-bearing branches, their structure being similar to *Fenestella. (See* also GRAPTOLITES.) It is characteristic of the uppermost Cambrian in Europe and America and in Silurian formation. *Dictyonema* is also the name of a genus of lichens (*q.v.*).

DICTYS CRETENSIS, of Cnossus in Crete, the supposed companion of Idomeneus during the Trojan War, and author of a diary of its events. The ms. of this work, written in Phoenician characters was translated into Greek by the order of Nero. In the 4th century A.D. a certain Lucius Septimius brought out *Dictys Cretensis Ephemeris belli Troiani,* which professed to be a Latin translation of the Greek version. Possibly the Latin Ephemeris was the work of Septimius himself. Its chief interest lies in the fact that (with Dares Phrygius's *De excidio Troiae)* it was the source from which the Homeric legends were introduced into the romantic literature of the middle ages.

BIBLIOGRAPHY.—Best edition by F. Meister (1873), with short but useful introduction and index of Latinity; *see* also G. Korting, *Diktys und Dares* (1874), with concise bibliography; E. Collilieux, *Etude sur Dictys de Crète et Darès de Phrygie* (1887), with bibliography; F. Colagrosso, "Ditte Cretese" in *Atti della r. Accademia di Archeologia* (Naples, 1897, vol. 18, pt. ii. 2); N. E. Griffin, *Dares and Dictys, Introduction to the Study of the Medieval Versions of the Story of Troy* (1907).

DICUIL (*fl.* 825), Irish monk, grammarian and geographer. His *De mensura orbis terrae,* finished in 825, contains the earliest notice of a European discovery of and settlement in Iceland and the most definite Western reference to the old fresh-water canal between the Nile and the Red sea, blocked up in 767. In 795 Irish hermits had visited Iceland, where they marvelled at the perpetual day of midsummer. Relics of their settlements were found by the permanent Scandinavian colonists of Iceland in the 9th century. Of the old Egyptian fresh-water canal Dicuil learnt from one "brother Fidelis," probably another Irish monk, who, on his way to Jerusalem, sailed along the "Nile" into the Red sea—passing on his way the "Barns of Joseph" or Pyramids of Giza, which are well described. Dicuil's reading was wide; he quotes from, or refers to, 30 Greek and Latin writers, the patristic St. Isidore and Orosius, and his contemporary the Irish poet Sedulius; he professes to utilize the alleged surveys of the Roman world executed by order of Julius Caesar, Augustus and Theodosius (whether Theodosius the Great or Theodosius II. is uncertain).

A short astronomical treatise written between A.D. 814 and 816 and dedicated to Louis le Debonnaire, the Frankish king in whose kingdom Dicuil was teaching, has been edited by Mario Esposito in the *Proceedings of the Royal Irish Academy,* vol. xxvi. s. C. (1907). Editions of the *De Mensura* were made by C. A. Walckenaer (Paris, 1907), A. Letronne (Paris, 1814) and G. Parthey (Berlin, 1870, best as to text). *See* also C. R. Beazley, *Dawn* of *Modern Geography,* vol. i. (1897).

DIDA, a bush population of the French Ivory Coast between the Bandama river and the Rio Fresco. Their language is related to Bete.

See Delafosse, *Vocabulaires comparatifs* (1904).

DIDACHĒ, THE, or *Teaching of the (twelve) Apostles.* This early Christian document is one of the most important discoveries of the second half of the 19th century. There are several references to it in Eusebius and elsewhere, and by applying to these the methods of comparative criticism a rough reconstruction of its contents had been obtained. But in 1875 Bryennios discovered it in the Patriarchal Library at Constantinople, in the ms. which also contains I. and II. Clement.

The Didachē, as we now have it in the Greek, falls into two marked divisions: *(a)* a book of moral precepts, opening with the words, "There are two ways"; (b) a manual of church ordinances, linked on to the foregoing by the words, "Having first said all these things, baptize," etc. Each of these must be considered separately before we approach the question of the locality and date of the whole book in its present form.

The author of the complete work, as we now have it, has modified an earlier document entitled *The Two Ways,* which may have been a Jewish manual carried over into the use of the Christian Church. Near the beginning he has inserted a considerable section containing, among other matter, passages from the Sermon on the Mount, in which the language of St. Matthew's Gospel is blended with that of St. Luke's. He has also added at the close a few sentences, beginning, "If thou canst not bear (the whole yoke of the Lord), bear what thou canst" (vi. 2); and among minor changes he has introduced, in dealing with confession, reference to "the church" (iv. 14).

The second part of the *Teaching* might be called a church directory. It consists of precepts relating to church life, which are couched in the second person plural; whereas *The Two Ways* uses throughout the second person singular. It appears to be a composite work. (1) First (vii. 1–xi. 2) is a short sacramental manual intended for the use of local elders or presbyters, though such are not named, for they were not yet a distinctive order or clergy. This section was probably added to *The Two Ways* before the addition of the remainder. It orders baptism in the threefold name, and adds directions as to the manner of baptism and preparation for it. Then follows the Lord's Prayer, almost exactly as in St. Matthew, with a brief doxology—"for Thine is the power and the glory for ever." This is to be said three times a day. Next come three eucharistic prayers, the language of which is clearly marked off from that of the rest of the book, and shows parallels with the diction of St. John's Gospel. As in Ignatius and other early writers, the eucharist, a real meal (x. 1) of a family character, is regarded as producing immortality *(cf.* "spiritual food and drink and eternal life"). None are to partake of it save those who have been "baptized in the name of the Lord" (an expression which is of interest in a document which prescribes the threefold

formula). The "prophets" are not to be confined to these forms, but may "give thanks as much as they will." This appears to show that a "prophet," if present, would naturally preside over the eucharist. (2) The next section (xi. 3–xiii.) deals with the ministry of spiritual gifts as exercised by "apostles," "prophets" and "teachers." An apostle is to be 'received as the Lord"; but he must follow the Gospel precepts, stay but one or two days, and take no money, but only bread enough for a day's journey. Here we have that wider use of the term "apostle" to which Lightfoot had already drawn attention. A prophet, on the contrary, may settle if he chooses, and in that case he is to receive tithes and first-fruits; "for they are your high priests." If he be once approved as a true prophet, his words and acts are not to be criticized; for this is the sin that shall not be forgiven. (3) Next comes a section (xiv., xv.) reflecting a somewhat later development concerning fixed services and ministry; the desire for a stated service, and the need of regular provision for it, is leading to a new order of things. The eucharist is to be celebrated every Lord's Day, and preceded by confession of sins: "appoint therefore unto yourselves bishops and deacons, worthy of the Lord, men meek and uncovetous, and true and approved; for they also minister unto you the ministration of the prophets and teachers." This is an arrangement recommended by one who has tried it, and he reassures the old-fashioned believer who clings to the less formal régime (and whose protest was voiced in the Montanist movement), that there will be no spiritual loss under the new system. The book closes (chap. xvi.) with exhortations to steadfastness in the last days, at the coming of the "world-deceiver" or Antichrist, which will precede the coming of the Lord. This section is perhaps the actual utterance of a Christian prophet, and may be of earlier origin than the two preceding sections.

It will now be clear that indications of the locality and date of the present *Teaching* must be sought for only in the second part, and in the Christian interpolations in the first part. We have no ground for thinking that the second part ever existed independently as a separate book. The whole work was in the hands of the writer of the seventh book of the *Apostolic Constitutions* (*q.v.*), who embodies almost every sentence of it, interspersing it with passages of Scripture, and modifying the precepts of the second part to suit a later (4th-century) stage of church development; this writer was also the interpolator of the Epistles of Ignatius, and belonged to the Syrian Church. The *Apostolic Church Order* has several passages closely parallel to *The Two Ways;* but the only parallel to the second part of the *Teaching* is in a quotation from one of the eucharistic prayers. The anti-Jewish tone of the second part suggests the neighbourhood of Jews, from whom the Christians were to be sharply distinguished. Either Egypt or Syria would satisfy this condition, and in favour of Syria is the fact that the presbyterate there was to a late date regarded as a rank rather than an office. But all that we can safely say as to locality is that the community here represented seems to have been out of touch with the larger centres of Christian life.

This last consideration helps us in discussing the question of date. For such an isolated community may have preserved primitive customs for some time after they had generally disappeared. Certainly the stage of development is an early one, as is shown, *e.g.,* by the prominence of prophets, and the need that was felt for the vindication of the position of the bishops and deacons (there is no mention at all of presbyters); moreover, there is no reference to a canon of Scripture (though the written Gospel is expressly mentioned) or to a creed. On the other hand the "apostles" of the second part are obviously not "the twelve apostles" of the title; and the prophets seem in some instances to have proved unworthy of their high position. The ministry of enthusiasm which they represent is about to give way to the ministry of office, a transition which is reflected in the New Testament in the 3rd Epistle of John. Three of the Gospels have clearly been for some time in circulation; St. Matthew's is used several times, and there are phrases which occur only in St. Luke's, while St. John's Gospel lies behind the eucharistic prayers which the writer has embodied in his work. There are no indications of any form of doctrinal heresy as needing rebuke; the warnings against false teaching are quite general. While the first part must be dated before the Epistle of Barnabas, *i.e.,* before A.D. 90, it seems wisest not to place the complete work much earlier than A.D. 120, and there are passages which may well be later,.

BIBLIOGRAPHY.—A large literature has sprung up round *The Didachē* since 1884. Harnack's edition in *Texte und Untersuchungen* vol. ii. (1884) is indispensable to the student; and his discussions in *Geschichte der altchristlichen Literatur* give clear summaries of his work. Other editions of the text are those of F. X. Funk, *Patres Apostolici,* vol. i. (Tubingen, 1901); H. Lietzmann (Bonn, 1903; with Latin version). Dr. C. Taylor in 1886 drew attention to some important parallels in Jewish literature; his edition contains an English translation. Dr. Rendel Harris published in 1887 a complete facsimile, and gathered a great store of patristic illustration. Text and translation will also be found in Lightfoot's *Apostolic Fathers* (shorter edition). The fullest critical treatment in English is by Dr. Vernon Bartlet in the extra volume of Hastings's *Dictionary of the Bible;* the most complete commentary on the text is by P. Drems in Hennecke's *Handbuch zu den N.T. Apocryphen* (1904). The most convenient edition with text and translation is that of Kirsopp Lake, *The Apostolic Fathers,* vol. i. (the Loeb Classical Library).

DIDACTIC **POETRY,** that form of verse the aim of which is less to excite the hearer by passion or move him by pathos than to instruct his mind and improve his morals. The Greek word *διδακτικός* signifies apt for teaching, and poetry of the class under discussion approaches us with the arts and graces of a schoolmaster. Modern criticism is inclined to exclude the term "didactic poetry" from our nomenclature, as a phrase absurd in itself and indeed obsolete. But in earlier times, in the absence of all written books, this was the easiest way in which information could be made attractive to the ear and be retained by the memory.

In the prehistoric dawn of Greek civilization there was a great body of verse occupied entirely with increasing the knowledge of citizens in useful branches of art and observation; these were the beginnings of didactic poetry, and we class them together under the dim name of Hesiod. The *Works and Days,* which passes as the direct masterpiece of Hesiod (*q.v.*), may be taken as the type of all the poetry which has had education as its aim. In somewhat later times, as the Greek nation became better supplied with intellectual appliances, the stream of didactic poetry flowed more and more closely in one, and that a theological, channel. The great poem of Parmenides On *Nature* and those of Empedocles exist only in fragments, but enough remains to show that these poets carried on the didactic method in mythology. Cleostratus of Tenedos wrote an astronomical poem in the 6th century. and Periander a medical one in the 4th; but didactic poetry did not flourish again in Greece until the 3rd century, when Aratus. in the Alexandrian age, wrote his famous *Phenomena,* a poem about things seen in the heavens.

By far the greatest didactic Latin poet known to us is Lucretius, who composed, in the 1st century before Christ, his magnificent *De rerum natura.* By universal consent, this is the noblest didactic poem in the literature of the world. It was intended to instruct mankind in the interpretation and in the working of the system of philosophy revealed by Epicurus. What gave the poem of Lucretius its extraordinary interest, and what has prolonged and even increased its vitality, was the imaginative and illustrative insight of the author, piercing and lighting up the recesses of human experience. On a lower intellectual level, but of a still greater technical excellence, was the *Georgics* of Virgil, *a* poem on the processes of agriculture, published about 30 B.C. The brilliant execution of this famous work has justly made it the type and unapproachable standard of all poetry which desires to impart useful information in the guise of exquisite literature. In the rest of surviving Latin didactic poetry the influence and the imitation of Virgil and Lucretius are manifest. Manilius produced a fine *Astronomica* towards the close of the reign of Augustus. Columella, regretting that Virgil had omitted to sing of gardens, composed a smooth poem on horticulture. Natural philosophy inspired Lucilius junior, of whom a didactic poem on Etna survives. Long afterwards, under Diocletian, a poet of Carthage, Nemesianus, wrote in the manner of Virgil the *Cynegetica,* a poem on hunting with dogs, which has had numerous imitations in later European literatures.

In Anglo-Saxon and early English poetic literature, and espe-

cially in the religious part of it, an element of didacticism is not to be overlooked. The first English poem, however, which we can in any reasonable way compare with the classic works of which we have been speaking is the *Hundreth Good Pointes* of *Husbandrie*, published in 1557 by Thomas Tusser; these humble Georgics aimed at a practical description of the whole art of English farming. In the early part of the 17th century one or two writers appeared who were as didactic as the age would permit them to be, Samuel Daniel with his philosophy, Fulke Greville (Lord Brooke) with his "treatises" of war and monarchy. After the Restoration, as the lyrical element rapidly died out of English poetry, there was more and more room left for educational rhetoric in verse. The poems about prosody, founded upon Horace and signed by John Sheffield, 3rd earl of Mulgrave (1648–1721), and Lord Roscommon, were among the earliest purely didactic verse-studies in English. John Philips deserves a certain pre-eminence, as his poem called *Cyder*, in 1706, set the fashion, which lasted all down the 18th century, of writing precisely in verse about definite branches of industry or employment. None of the greater poets of the age of Anne quite succumbed to the practice, but there is a very distinct flavour of the purely didactic about a great deal of the verse of Pope and Gray. In such productions as Gilbert West's (1703–56) *Education*, Dyer's *Fleece*, and Somerville's *Chase*, technical information is put forward as the central aim of the poet. In 1748 Gray began, though he failed to finish, a didactic poem on *The Alliance of Education and Government*. Didactic poems were discredited by the publication of *The Sugar-Cane* (1764), a long verse-treatise about the cultivation of sugar by negroes in the West Indies, by James Grainger (1721–66). Whether so great a writer as Cowper is to be counted among the didactic poets is a question on which readers of *The Task* may be divided; this poem belongs rather to the class of descriptive poetry, but a strong didactic tendency is visible in parts of it. Perhaps the latest frankly educational poem which enjoyed a great popularity was *The Course of Time* by Robert Pollok (1798–1827), in which a system of Calvinistic divinity is laid down in the pomp of blank verse. This kind of literature had already been exposed, and discouraged, by the teaching of Wordsworth, who had insisted on the imperative necessity of charging all poetry with imagination and passion. Oddly enough, *The Excursion* of Wordsworth himself is perhaps the most didactic poem of the 19th century, but it must be acknowledged that his influence, in this direction, was saner than his practice.

The history of didactic poetry in France repeats, in great measure, but in drearier language, that of England. Boileau, like Pope, but with a more definite purpose as a teacher, offered instruction in his *Art poétique* and in his *Epistles*. But his doctrine was always literary, not purely educational. At the beginning of the 18th century the younger Racine (1692–1763) wrote sermons in verse, and at the close of it the Abbé Delille (1738–1813) tried to imitate Virgil in poems about horticulture.

During the century which preceded the Romantic revival of poetry in Germany didactic verse was cultivated in that country on the lines of imitation of the French, but with a greater dryness and on a lower level of utility. Modern German literature began with Martin Opitz (1597–1639) and the Silesian School, who were in their essence rhetorical and educational, and who gave their tone to German verse. Albrecht von Haller (1708–77) brought a very considerable intellectual force to bear on his huge poems, *The Origin of Evil*, which was theological, and *The Alps* (1729), botanical and topographical. Johann Peter Uz (1720–96) wrote a *Theodicée*, which was very popular, and not without dignity. Johann Jacob Dusch (1725–87) undertook to put *The Sciences* into the eight books of a great didactic poem. Tiedge (1752–1840) was the last of the school; in a once-famous *Urania* he sang of God and Immortality and Liberty. These German pieces were the most unswervingly didactic that any modern European literature has produced. There was hardly the pretence of introducing into them descriptions of natural beauty, as the English poets did, or of grace and wit like the French.

DIDEROT, DENIS (1713–1784), French man of letters and encyclopaedist, was born at Langres on Oct. 5, 1713. He was educated by the Jesuits, and then threw himself into the vagabond life of a bookseller's hack in Paris. An imprudent marriage (1743) did not better his position. His wife, Anne Toinette Champion, was a devout Catholic, but her piety did not restrain a narrow and fretful temper, and Diderot's domestic life was irregular and unhappy. He sought consolation, first with a Madame Puisieux, and then with Sophie Voland, to whom he was constant for the rest of her life. His letters to her are among the most graphic of all the pictures that we have of the daily life of the *philosophes* who dined once a week at the baron D'Holbach's, to listen to the wild sallies and the inspiring declamations of Diderot.

Diderot earned a little by doing various translations, among these being one of Shaftesbury's *Inquiry Concerning Virtue and Merit* (1745), with some original notes of his own. He then composed a volume of stories, the *Bijoux indiscrets* (1748), of which he afterwards repented. From tales Diderot went back to the more congenial region of philosophy. Between the morning of Good Friday and the evening of Easter Monday he wrote the *Pensées philosophiques* (1746), and he presently added a short complementary essay on the sufficiency of natural religion. In these he pressed the ordinary rationalistic objections to a supernatural revelation. In 1747 he wrote the *Promenade du sceptique*. Diderot's next piece was his famous *Lettre sur les aveugles* (1749). The immediate object of this short but pithy writing was to show the dependence of men's ideas on their five senses. It considers the case of the intellect deprived of the aid of one of the senses; and in a second piece, published afterwards, Diderot considered the case of a similar deprivation in the deaf and dumb. The *Lettre sur les sourds et muets*, however, is substantially a digressive examination of some points in aesthetics. The philosophic significance of the two essays is in the advance they make towards the principle of relativity. But what interested the militant philosophers of that day was an episodic application of the principle of relativity to the master-conception of God. What makes the *Lettre sur les aveugles* interesting is its presentation, in a distinct though undigested form, of the modern theory of variability, and of survival by superior adaptation. It is worth noticing, too, as an illustration of the comprehensive freedom with which Diderot felt his way round any subject he approached, that in this theoretic essay he suggests the possibility of teaching the blind to read through the sense of touch. The speculation of the *Lettre sur les aveugles* was too hardy for the authorities, and he was thrown into the prison of Vincennes, where he spent three months; on his release he entered on the gigantic undertaking of his life.

A MONUMENTAL WORK

The Encyclopaedia. — The bookseller Lebreton had suggested to him the publication of a translation into French of Ephraim Chambers's *Cyclopaedia*, undertaken in the first instance by an Englishman, John Mills, and a German, Gottfried Sellius (for particulars *see* ENCYCLOPAEDIA). Diderot accepted the proposal, but in his busy and pregnant intelligence the scheme became transformed. He persuaded the bookselier to enter upon a new work, which should collect under one roof all the active writers, all the new ideas, all the new knowledge, that were then moving the cultivated class to its depths, but still were comparatively ineffectual by reason of their dispersion. His enthusiasm infected the publishers; D'Alembert was persuaded to become Diderot's colleague; the requisite permission was procured from the Government; and in 1; 51 the first volume was given to the world. The last of the letterpress was issued in 1765, but it was 1772 before the subscribers received the final volumes of the plates. These 20 years were to Diderot years not merely of incessant drudgery, but of harassing persecution, of sufferings from the cabals of enemies, and of injury from the desertion of friends. The ecclesiastical party detested the *Encyclopaedia*, in which they saw a rising stronghold for their philosophic enemies. By 1757 they could endure the sight no longer. To any one who turns over the pages of these redoubtable volumes now, it seems surprising that their doctrines should have stirred such portentous alarm. There is no atheism, no overt attack on any of the cardinal mysteries of the faith, no direct denunciation even of the notorious abuses of the

church. Yet the atmosphere of the book may well have been displeasing to authorities who had not yet learnt to encounter the modern spirit on equal terms. The *Encyclopaedia* takes for granted the justice of religious tolerance and speculative freedom. It asserts in distinct tones the democratic doctrine that it is the common people in a nation whose lot ought to be the main concern of the nation's Government. From beginning to end it is one unbroken process of exaltation of scientific knowledge on the one hand, and pacific industry on the other. All these things were odious to the old governing classes of France; their spirit was absolutist, ecclesiastical and military. Perhaps the most alarming thought of all was the current belief that the *Encyclopaedia* was the work of an organized band of conspirators against society, and that a pestilent doctrine was now made truly formidable by the confederation of its preachers into an open league. When the seventh volume appeared, it contained an article on "Geneva," written by D'Alembert. The writer contrived a panegyric on the pastors of Geneva, of which every word was a stinging reproach to the abbés and prelates of Versailles. At the same moment Helvétius's book, *L'Esprit,* appeared, and gave a still more profound shock to the ecclesiastical party. In 1759 the *Encyclopaedia* was formally suppressed.

The decree, however, did not arrest the continuance of the work: it went on, but with its difficulties increased by the necessity of being clandestine. D'Alembert, wearied of shifts and indignities, withdrew from the enterprise. Other powerful colleagues, Turgot among them, declined to contribute further. Diderot was left to bring the task to an end as he best could. For seven years he laboured like a slave at the oar. He wrote several hundred articles, some of them very slight, but many of them most laborious, comprehensive and ample. He spent his days in the workshops, mastering the processes of manufactures, and his nights in reproducing on paper what he had learnt during the day. And he was incessantly harrassed all the time by alarms of a descent from the police. At the last moment, when his immense work was just drawing to an end, he discovered that the bookseller had struck out from the proof sheets, after they had left Diderot's hands, all passages that he chose to think too hardy. The monument to which Diderot had given the labour of 20 long and oppressive years was irreparably mutilated and defaced. It is calculated that the average annual salary received by Diderot for his share in the *Encyclopaedia* was about £120 sterling. "And then to think," said Voltaire, "that an army contractor makes £800 in a day!"

Other Works.—Although the *Encyclopaedia* was Diderot's monumental work, he is the author of a shower of dispersed pieces that sowed nearly every field of intellectual interest with new and fruitful ideas. He wrote plays—Le *Fils naturel* (1757), and *Le Pbre de famille* (1758), which he accompanied by essays on dramatic poetry, including especially the *Paradoxe sur le comkdien,* in which he announced the principles of a new drama—the serious, domestic, bourgeois drama of real life, in opposition to the stilted conventions of the classic French stage. Diderot's lessons and example gave a decisive bias to the dramatic taste of Lessing, whose plays and *Hamburgische Dramaturgie* (1768) mark an epoch in dramatic history. Diderot's most intimate friend was Grimm, who wrote news-letters to various high personages in Germany, reporting what was going on in the world of art and literature in Paris. Diderot helped his friend at one time and another between 1759 and 1779, by writing for him an account of the annual exhibitions of paintings. These *Salons* are among the most readable of all pieces of art criticism. They have a freshness, a reality, a life, which take their readers into a different world from the dry and conceited pedantries of the ordinary virtuoso.

DIDEROT'S VERSATILITY

Diderot's interest in human nature expressed itself in didactic and sympathetic form; in two, however, of the most remarkable of all his pieces, it is not sympathetic, but ironical. *Jacques le fataliste* (written in 1773, but not published until 1796) is in manner an imitation of *Tristram Shandy* and *The Sentimental Journey. Le Neveu de Rameau* is a far superior performance. Its intention has been matter of dispute; whether it was designed to be merely a satire on contemporary manners, or a reduction of the theory of self-interest to an absurdity, or the application of an ironical clincher to the ethics of ordinary convention, or a mere setting for a discussion about music, or a vigorous dramatic sketch of a parasite and a human original. There is no dispute as to its curious literary flavour, its mixed qualities of pungency, bitterness, pity and, in places, unflinching shamelessness. Goethe's translation (1805) was the first introduction ,of *Le Neveu de Rameau* to the European public. After executing it, he gave back the original French manuscript to Schiller, from whom he had it. No authentic French copy of it appeared until 1823.

It would take several pages merely to contain the list of Diderot's miscellaneous pieces, from an infinitely graceful trifle like the *Regrets sur ma vieille robe de chambre* up to *Le Rêve de D'Alembert,* where he plunges into the depths of the controversy as to the ultimate constitution of matter and the meaning of life. It is a mistake to set down Diderot for a coherent and systematic materialist. We ought to look upon him "as a philosopher in whom all the contradictions of the time struggle with one another" (Rosenkranz). That is to say, he is critical and not dogmatic. There is no unity in Diderot, as there was in Voltaire or in Rousseau. Yet he drew at last to the conclusions of materialism, and contributed many of its most declamatory pages to the *Systbme de la nature* of his friend D'Holbach,—the very Bible of atheism, as some one styled it. All that he saw, if we reduce his opinions to formulae, was motion in space: "attraction and repulsion, the only truth." If matter produces life by spontaneous generation, and if man has no alternative but to obey the compulsion of nature, what remains for God to do? In proportion as these conclusions deepened in him, the more did Diderot turn for the hope of the race to virtue, in other words, to such a regulation of conduct and motive as shall make us tender, pitiful, simple, contented. Hence his one great literary passion, his enthusiasm for Richardson, the English novelist. Hence, also, his deepening aversion for the political system of France, which makes the realization of a natural and contented domestic life so hard. Diderot had almost as much to say against society as even Rousseau himself. The difference between them was that Rousseau was a fervent theist. The atheism of the Holbachians, as he called Diderot's group, was intolerable to him; and this feeling, aided by certain private perversities of humour, led to a breach of what had once been an intimate friendship between Rousseau and Diderot (1757). Diderot was still alive when Rousseau's *Confessions* appeared, and he was so exasperated by Rousseau's stories about Grimm, then and always Diderot's intimate, that in 1782 he transformed a life of Seneca, that he had written four years earlier, into an *Essai sur les règnes de Claude et de Néron* (1778–82), which is much less an account of Seneca than a vindication of Diderot and Grimm, and is one of the most rambling and inept productions in literature. As for the merits of the old quarrel between Rousseau and Diderot, we may agree with the latter, that too many sensible people would be in the wrong if Jean Jacques was in the right.

Diderot's mental activity was not of a kind to bring him riches. He could not even obtain that bare official recognition of merit which was implied by being chosen a member of the Academy. The time came for him to provide a dower for his daughter, and he saw no other alternative than to sell his library. When the empress Catherine of Russia heard of his straits, she commissioned an agent in Paris to buy the library at a price equal to about £1,000 of English money, and then handsomely requested the philosopher to retain the books in Paris until she required them, and to constitute himself her librarian, with a yearly salary. In 1773 Diderot passed some months at St. Petersburg. The empress received him cordially. The strange pair passed their afternoons in disputes on a thousand points of high philosophy, and they debated with a vivacity and freedom not usual in courts. *"Fi, donc,"* said Catherine one day, when Diderot hinted that he argued with her at a disadvantage, *"is there any difference among men?"* Diderot returned home in 1774. Ten years remained to him, and he spent them in the industrious acquisition of new knowledge. in the composition of a host of fragmentary pieces, and in luminous declamations with his friends. Diderot was seen at his best in conversation. "He who only knows Diderot in his writings," says

Marmontel, "does not know him at all. When he grew animated in talk, and allowed his thoughts to flow in all their abundance, then he became truly ravishing. In his writings he had not the art of ensemble; the first operation which orders and places everything was too slow and too painful to him."

Diderot died on July 30, 1784, six years after Voltaire and Rousseau, one year after his old colleague D'Alembert, and five years before D'Holbach, his host and intimate for a lifetime. An elaborate and exhaustive collection of his writings in 20 stout volumes, edited by MM. Assézat and Tourneux, was completed in 1875–77. (J. Mo.; X.)

BIBLIOGRAPHY.—Studies on Diderot by Scherer (1880); by E. Faguet (1890); by Sainte-Beuve in the *Causeries du lundi;* by F. Brunetière in the *Etudes critiques,* 2nd series, may be consulted. In English Diderot has been the subject of a biography by John Morley (Viscount Morley of Blackburn) (1878). *See* also Karl Rosenkranz, *Diderots Leben und Werke* (1866); *G.* Hirn, *Diderot* (Stockholm, 1917); P. Hermand, *Les Idées morales de Diderot* (1923). For a discussion of the authenticity of the posthumous works of Diderot *see* R. Dominic in the *Revue des deux mondes* (Oct. 15, 1902).

DIDIUS SALVIUS IULIANUS, MARCUS, Roman emperor for two months (March 28–June 2, A.D. 193). He was the grandson of Salvius Iulianus, a famous jurist under Hadrian and the Antonines, and the son of a distinguished general. On the death of Pertinax, the praetorian guards offered the throne to the highest bidder. Didius and Sulpicianus (prefect of the city) bid against each other, and finally the throne was knocked down to Didius. The senate and nobles professed their loyalty; but the people made no attempt to conceal their indignation at this insult to the State, and the armies of Britain, Syria and Illyricum revolted. Septimius Severus, the commander of the Pannonian legions, was declared emperor and hastened to Italy. Didius, abandoned by the praetorians, was condemned and executed by order of the senate, which at once acknowledged Severus.

BIBLIOGRAPHY.—Dio Cassius lxxiii. 11–17, who was actually in Rome at the time; Aelius Spartianus *Didius Iulianus;* Iulius Capitolinus, *Pertinax;* Herodian ii.; Aurelius Victor *De Caesaribus,* 19; Zosimus; i. 7; Gibbon *Decline and Fall,* chap. 5.

DIDO or ELISSA, the reputed founder of Carthage (*q.v.*), daughter of the Tyrian King Mutton, wife of Acerbas. Her husband having been slain by her brother Pygmalion, Dido fled to Cyprus, and thence to the coast of Africa, where she purchased from a local chieftain, Iarbas, a piece of land on which she built Carthage. The city soon began to prosper and Iarbas sought Dido's hand in marriage, threatening her with war in case of refusal. To escape from him, Dido constructed a funeral pile, on which she stabbed herself before the people (Justin xviii. 4–7). Virgil, in defiance of the usually accepted chronology, makes Dido a contemporary of Aeneas, with whom she fell in love after his landing in Africa, and attributes her suicide to her abandonment by him at the command of Jupiter. Dido was identified with the Virgo Caelestis; *i.e.,* Tanit, the tutelary goddess of Carthage. Timaeus is the oldest authority for the story; the meaning of the name Dido is uncertain.

BIBLIOGRAPHY.—*See* Rossbach in Pauly-Wissowa's *Realencyklopädie;* O. Meltzer's *Geschichte der Karthager,* i. (1879), and in Roscher's *Lexikon.*

DIDON, HENRI (1840–1900), French Dominican, was born at Trouvet, Isère, on March 17, 1840. Joining the Dominicans in 1858, he completed his theological studies at the Minerva convent at Rome. His brilliant preaching career began on his return to Paris in 1868. He concentrated on the relations between religion and science, and social problems, especially divorce. His disputes with the secular press led his superiors to interdict him from preaching and send him to the convent of Corbara in Corsica, whence he visited Palestine and also the German universities In 1892 he returned to France, becoming director of the Collège Albert-le-Grand at Arcueil, and founding three auxiliary institutions, École Lacordaire, Ecole Laplace and École St. Dominique He wrote several works on educational questions, an often-translated *Life of Christ* (Paris, 1890), and *Les Allemands* (Eng trans. 1884). *His Spiritual Letters* have been translated by A. G Nash (London, 1906). He died at Toulouse on March 13, 1900.

See the biographies by J. de Romano (1891) and A. de Coulanges (1900); and especially Stanislas Reynaud, *Le Père Didon, sa vie et son oeuvre* (1904).

DIDOT, the name of a family of learned French printers and publishers. FRANÇOIS DIDOT (1689–1757), founder of the greatness of his family, was born at Paris. He began business as a bookseller and printer in 1713, and among his famous productions was a collection of the travels of his friend the Abbé Prévost, in twenty volumes (1747). FRANÇOIS AMBROSE DIDOT (1730–1804), son of François, made important improvements in type-founding, and was the first to attempt printing on vellum paper (1780). Among the works which he published was the famous collection of French classics prepared by order of Louis XVI. for the education of the Dauphin, *in usum Delphini,* and the folio edition of *L'Art de vérifier les dates.* PIERRE FRANÇOIS DIDOT (1732–1795), his brother, devoted much attention to the art of type-founding and to paper-making. Among the works which issued from his press was an edition in folio of the *Imitatio Christi* (1788). HENRI DIDOT (1765–1852), son of Pierre François, is celebrated for his "microscopic" editions of various standard works, for which he engraved the type when nearly seventy years of age. He was also the engraver of the *Assignats* issued by the Constituent and Legislative Assemblies and the Convention. DIDOT SAINT-LÉGER (1767–1829), second son of Pierre François, was the inventor of the paper-making machine known in England as the Didot machine. PIERRE DIDOT (1760–1853), eldest son of François Ambroise, is celebrated as the publisher of the beautiful "Louvre" editions of Virgil, Horace and Racine. The Racine, in three volumes folio, was pronounced in 1801 to be "the most perfect typographical production of all ages." FIRMIN DIDOT (1764–1836), his brother, second son of François Ambroise, invented the process of stereotyping, and coined its name. He was the author of two tragedies—La *Reine de Portugal* (1824) and *La Mort d'Annibal* (1817); and he wrote metrical translations from Virgil, Tyrtaeus and Theocritus. AMBROISE FIRMIN DIDOT (1790–1876) was his eldest son. On the retirement of his father in 1827 he undertook, in conjunction with his brother HYACINTHE FIRMIN DIDOT (1794–1880), the direction of the publishing business. Their greatest undertaking was a new edition of the *Thesaurus Graecae linguae* of Henri Estienne, under the editorial care of the brothers Dindorf and M. Hase (g vols., 1855–1859). Among the numerous important works published by the brothers, the 200 volumes forming the *Bibliothèque des auteurs grecs, Bibliothèque latine,* and *Bibliothèque française* deserve special mention. Ambroise Firmin Didot was the first to propose (1823) a subscription in favour of the Greeks, then in insurrection against Turkish tyranny. The works include a translation of Thucydides. In 187j he published a very learned and elaborate monograph on Aldus Manutius. His collection of mss., the richest in France, was said to have been worth, at the time of his death, not less than 2,000,000 francs.

See P. G. Brunet, *Firmin Didot et sa famille* (1870).

DIDYMI or **DIDYMA,** an ancient sanctuary of Apollo in Asia Minor in the territory of Miletus and on the promontory Poseideion. It was sometimes called *Branchidae* from the name of its priestly caste which claimed descent from Branchus, a youth beloved by Apollo. As the seat of a famous oracle, the original temple attracted offerings from Pharaoh Necho (in whose army there was a contingent of Milesian mercenaries), and the Lydian Croesus, and was plundered by Darius of Persia. Xerxes finally sacked and burnt it (481 B.C.) and exiled the Branchidae to the far north-east of his empire. The celebrated cult-statue of Apollo by Canachus, familiar to us from reproductions on Milesian coins, was also carried to Persia, there to remain till restored by Seleucus I. in 295, and the oracle ceased to speak for a century and a half. The Milesians were not able to undertake the rebuilding till about 332 B.C., when the oracle revived at the bidding of Alexander. The work proved too costly, and despite a special effort made by the Asian province nearly 400 years later, at the bidding of the emperor Caligula, the structure was never quite finished: but even as it was, Strabo ranked the Didymeum the greatest of Greek temples and Pliny placed it among the four

most splendid and second only to the Artemisium at Ephesus. The area covered by the platform measures roughly 360×160 feet.

No excavation was attempted till MM. E. Pontremoli and B. Haussoullier were sent out by the French Schools of Rome and Athens in 1895. They cleared the western facade and the *pro*-domos, and discovered inscriptions giving information about other parts which they left still buried. Finally the site was purchased by, and the French rights were ceded to, Dr. Th. Wiegand, the German explorer of Miletus, who in 1905 began a thorough clearance of what is incomparably the finest temple ruin in Asia Minor.

The temple was a decastyle peripteral structure of the Ionic order, standing on seven steps and possessing double rows of outer columns 60 ft. high, twenty-one in each row on the flanks. It is remarkable not only for its great size, but (*inter alia*) for (1) the rich ornament of its column bases, which show great variety of design; (2) its various developments of the Ionic capital, *e.g.*, heads of gods, probably of Pergamene art, spring from the "eyes" of the volutes with bulls' heads between them; (3) the massive building two storeys high at least, which served below for *prodomos*, and above for a dispensary of oracles χρησμογράφια mentioned in the inscriptions) and a treasury; two flights of stairs called "labyrinths" in the inscriptions, led up to these chambers; (4) the pylon and staircase at the west; (5) the frieze of Medusa heads and foliage. Two outer columns are still erect on the north-east flank, carrying their entablature, and one of the inner order stands on the south-west.

See Dilettanti Society, *Ionian* Antiquities, ii. (1821); C. T. Newton, *Hist.* of Discoveries, etc. (1862) and Travels in the Levant, ii. (1865); O. Rayet and A. Thomas, *Milet* et le Golfe *Latmique* (1877); E. Pontremoli and B. Haussoullier, Didymes (1904).

DIDYMIUM, originally regarded as a chemical element, was found by A. von Welsbach in 1885 to be a mixture of the two elements, praseodymium (*q.v.*) and neodymium (*q.v.*). (See also RARE EARTHS.)

DIDYMUS (309?–394), surnamed "the Blind," ecclesiastical writer of Alexandria, was, in spite of becoming blind at the age of four, one of the most learned men of his day, respected by Jerome and Athanasius. He became head of the catechetical school of Alexandria. He was condemned by the sixth and seventh general councils as a continuator of Origen, but he stoutly opposed Arian and Macedonian teaching. His surviving writings show a remarkable knowledge of Scripture, and have distinct value as theological literature. They include the De Trinitate, De *Spiritu Sancto* (Jerome's Latin trans.), *Adversus Manichaeos*, and expositions of various books, especially the Psalms and the Catholic Epistles.

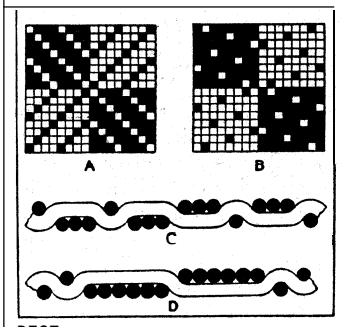
See Migne, Patrol. Graec. xxxix.; J. Leipoldt, "Didymus der Blinde" in Texte u. *Untersuchungen* zur Gesch. der altchrist. Lit., vol. xiv. (Leipzig, 1906); Tixeront, *Hist.* of Dogma, vol. ii. (1914).

DIDYMUS CHALCENTERUS (*c.* 63 B.C.–A.D. 10), Greek scholar and grammarian, flourished in the time of Cicero and Augustus, and taught in Alexandria and Rome. His surname, which means "brass-bowelled," came from his industry; he was said to have written more than 3,500 books. He wrote a treatise on Aristarchus' recension of Homer, of which fragments have been preserved in the Venetian Scholia. He also wrote commentaries on many other Greek poets and prose authors, and the extant scholia to Pindar, Sophocles and Aristophanes are largely due to Didymus. His work, though it showed no great critical acumen, was valuable because it collected the results reached by earlier scholars. (Ammianus Marcellinus, xxii. 16).

See M. W. Schmidt (Dc Didymo Chalcentero (1853) and Didymi Chalcenteri *fragmenta* (1854); also F. Susemihl, Geschichte der griech. Literatur in der Alexandrinerzeit, ii. (1891); J. E. Sandys, History of Classical Scholarship, i. (1906).

DIE, a town of south-eastern France, capital of an arrondissement in the department of Drôme, 43 m. E.S.E. of Valence on the Paris-Lyons railway. Pop. (1936) 2,717. Under the Romans, Die (Dea *Augusta Vocontiorum*) was an important colony. It was formerly the seat of a bishopric, united to that of Valence from 1276 to 1687 and suppressed in 1790. Previous to the revocation of the Edict of Nantes in 1685 it had a Calvinistic university. The town stands in a plain enclosed by mountains on the right bank of the Drôme below its confluence with the Meyrosse, which supplies power to some of the industries. The old cathedral has a porch of the 11th century supported on granite columns from an ancient temple of Cybele; and the Porte St. Marcel is a Roman gateway flanked by massive towers. There are also ruins of Roman aqueducts and altars. Die is the seat of a sub-prefect, and of a tribunal of first instance. The manufactures are silk, cloth, lime and cement, and there are saw mills. Trade is in timber, especially walnut, and in white wine known as *clairette* de **Die.** The mulberry is largely grown for the rearing of silkworms.

DIE, a word used in various senses for a small cube of ivory, etc. (see DICE); for the engraved stamps used in coining money, etc.; and various mechanical appliances in engineering. In architecture a "die" is the term used for the square base of a column, and it is applied also to the vertical face of a pedestal or podium.



DICE PATTERNS. SHOWING WEAVES A is formed from two four-thread twill weaves; B from two double-damask weaves; C shows the arrangement of the warp and weft in A, while D shows the arrangement of B

The fabrics known as "dice" take their name from the rectangular form of the figure. The original figures would probably be perfectly square, but to-day the same principle of weaving is applied, and the name dice is given to all figures of rectangular form. The different effects in the adjacent squares or rectangles are due to precisely the same reasons as those explained in connection with the ground and the figure of damasks (*q.v.*). The same weaves are used in both damasks and dices, but simpler weaves are generally employed for the commoner classes of the latter. The effect is, in every case, obtained by what are technically called warp and weft float weaves. The illustration B shows the two double damask weaves arranged to form a dice pattern, while A shows a similar pattern made from two four-thread twill weaves. C and D represent respectively the disposition of the threads in A and B with the first pick, and the solid marks represent the floats of warp. The four squares, which are almost as pronounced in the cloth as those of a chess-board, may be made of any size by repeating each weave for the amount of surface required. It is only in the finest cloths that the double damask weaves B are used for dice patterns, the single damask weaves and the twill weaves being employed to a greater extent. This class of pattern is largely employed for the production of table-cloths of low and medium qualities. The term damask is often applied to cloths of this character, and especially so when the figure is formed by rectangles of different sizes.

DIEBITSCH, HANS KARL FRIEDRICH ANTON (1785–1831), Count von Diebitsch and Narden, called by the Russians Ivan Ivanovich, Count Diebich-Zabalkansky, Russian field-marshal, was born at Grossleipe, Silesia, on May 13, 1785. He was educated at the Berlin cadet school, but passed into the service of Russia in 1801. He served in the campaign of 1805, and was wounded at Austerlitz, fought at Eylau and Friedland, and after Friedland was promoted captain. He distinguished himself very greatly in Wittgenstein's campaign, and in particular at Polotzk (Oct. 18 and 19, 1812), and was promoted major-general. In the latter part of the campaign he served against the Prussian contingent of Gen. Yorck (von Wartenburg), with whom, through Clausewitz, he negotiated the convention of Tauroggen, serving thereafter with Yorck in the early part of the War of Liberation. After the battle of Lützen he served in Silesia and took part in negotiating the secret treaty of Reichenbach. He fought at Dresden and Leipzig. At the crisis of the campaign of 1814 he urged the march of the allies on Paris. In 1815 he attended the congress of Vienna, and was afterwards made adjutant-general

to the emperor. In 1820 he had become chief of the general staff, and in 1825 he assisted in suppressing the St. Petersburg *émeute*. His greatest exploits were in the Russo-Turkish War of 1828–29, which was decided by Diebitsch's brilliant campaign of Adrianople; this won him the rank of field-marshal and the honorary title of Zabalkanski to commemorate his crossing of the Balkans. In 1830 he was appointed to command the army destined to suppress the insurrection in Poland. He won the terrible battle of Gróchow on Feb. 25, and was again victorious at Ostrolenka on May 26, but soon afterwards he died of cholera (or by his own hand) at Klecksewo near Pultusk, on June 10, 1831.

See Belmont (Schiimberg), *Graf* Diebitsch (Dresden, 1830); Stürmer, Der *Tod* des Grafen Diebitsch (1832); Bantych-Kamenski, *Biographies of* Russian Field-Marshals (in Russian, St. Petersburg, 1841).

DIEDENHOFEN: see THIONVILLE.

DIEKIRCH, a small town of Luxembourg, situated on the banks of the Sûre. Pop. (1930) 3,858. Its name is said to be derived from Dide or Dido, granddaughter of Odin and niece of Thor. Diekirch was an important Roman station, and in the 14th century John of Luxemburg, king of Bohemia, fortified it. In the 19th century during their occupation the French changed the fortifications into boulevards.

DIELECTRIC. The insulating medium separating the conductors in a condenser was called by Faraday the insulating dielectric. The term dielectric is now used to denote any insulator when it is regarded as a medium in which electromagnetic stresses may be set up. The dielectric constant for a substance is the ratio of the capacity of a condenser when that substance fills the space between the plates to the capacity of the same condenser when air is the dielectric. (See CONDENSER [ELECTRICAL] and ELECTRICITY.)

DIELMANN, FREDERICK (1847–1935), U.S. portrait and figure painter, was born at Hanover, Germany, Dec. 25, 1847. He was taken to the United States in early childhood; studied under Diez at the Royal academy at Munich; was first an illustrator, and became a distinguished draughtsman and painter of genre pictures. His mural decorations and mosaic panels for the Congressional library, Washington, are notable. He was president of the National Academy of Design (1899–1909), president of the Fine Arts Federation of New York (1910–15), professor of art at the College of the City of New York (1903–18) and art director of Cooper Union, New York city (1905–31).

DIEMEN, ANTHONY VAN (1593–1645), Dutch admiral, became governor-general of the East Indian settlements in 1636, and captured the Portuguese possessions in Ceylon and Malacca. He developed the prosperity both of the Indies and of Dutch trade with them, ensuring the Dutch monopoly, *e.g.*, of pepper in Sumatra, etc. He greatly extended the commercial relationships of the Dutch, opening up trade with Tong-king, China and Japan. Exploring expeditions were sent to Australia under his auspices in 1636 and 1642, and Abel Tasman named after him (Van Diemen's land) the island now called Tasmania. Van Diemen died at Batavia on April 19, 1645.

DIEPENBECK, ABRAHAM VAN (1599–1675), Flemish painter, was born at Herzogenbusch, in 1599, and died at Antwerp, where he was buried in Dec. 1675. He studied painting at Antwerp as one of Rubens' "Hundred pupils." Most of Diepenbeck's important canvases are in continental galleries. The best are the "Marriage of St. Catherine" at Berlin and "Mary with Angels Wailing over the Dead Body of Christ" at Vienna. But Diepenbeck spent much more of his time on glass painting, though he failed to master the secrets of gorgeous tinting, which were lost in the 16th century. In 1635 he finished 40 scenes from the life of St. Francis of Paula in the church of the Minimes at Antwerp. In 1644, he received payment for four windows in St. Jacques of Antwerp, two of which are still preserved and represent Virgins to whom Christ appears after the Resurrection.

DIEPPE, a seaport of northern France, capital of an arrondissement in the department of Seine-Inférieure, on the English channel, 38 mi. N. of Rouen, and 105 mi. N.W. of Paris by the Western railway. Pop. (1936) 25,304. It is suggested that Dieppe owed its origin to Norman adventurers, who found its "diep" or inlet suitable for their ships. In 1197 it was bestowed by Richard I of England on the archbishop of Rouen in return for territory near the latter city. In 1339 it was plundered by the English, but it soon recovered, and, in spite of opposition from the lords of Hantot, fortified itself. In the same year, the Dieppois plundered Southampton. Its commercial activity was already great, and it is believed that its seamen visited the coast of Guinea in 1339, and founded there a Petit Dieppe in 1365. The town was occupied by the English from 1420 to 1435. A siege undertaken in 1442 by John Talbot, first earl of Shrewsbury, was raised by the dauphin, afterwards Louis XI, and the day of the deliverance continued for centuries to be celebrated. The prosperity of the town in the 15th century was mainly due to its seamen and corsairs. Its inhabitants in great number embraced the reformed religion; and they were among the first to acknowledge Henry IV, who fought one of his great battles at the neighbouring village of Arques. From 1668 to 1670 the population of Dieppe was ravaged by the plague; some 10,000 died.

Few cities suffered more from the revocation of the edict of Nantes in 1685; this blow was followed in 1694 by a terrible bombardment on the part of the English and Dutch. The town was rebuilt after the peace of Ryswick, but its modern prosperity dates only from the 19th century, partly owing to Marie Caroline, duchess of Berry, who brought it into fashion as a watering place; and also because the railway gave an impetus to its trade. The Dieppois played an important part in the colonization, the evangelization and the defense of Canada from the 16th to the 18th centuries. Two monuments were erected in Dieppe to commemorate its everlasting ties with Canada. During the Franco-German War the town was occupied by the Germans from Dec. 1870 till July 1871.

During World War II, on August 19, 1942, a commando raid executed by 7,000 Allied troops, mostly Canadian, was launched on Dieppe, occupied by the Germans in June 1940. Almost half the attacking force was lost, as well as a large number of tanks, ships and planes, but the damage inflicted upon the German occupation forces was extremely heavy. This raid was not an invasion attempt by the Allies, but merely a raid considered as a full-dress rehearsal for the second front in Europe.

Dieppe stands at the mouth of the river Arques in a valley bordered on each side by steep white cliffs. The main part of the town lies to the west, and the fishing suburb of Le Pollet to the east of the river and harbour. The sea front of Dieppe, which in summer attracts large numbers of visitors, consists of a pebbly beach backed by a handsome marine promenade. Dieppe has a modern aspect and two squares side by side form the nucleus of the town. The church of St. Jacques, founded in the 13th century, consists largely of later workmanship and was restored in the 19th century. The castle, overlooking the beach from the summit of the western cliff, was built in 1435. The church of Notre-Dame de Bon Secours on the opposite cliff, and the church of St. Remy, of the 16th and 17th centuries, are noteworthy. A well-equipped casino stands on the sea front. The public institutions include the subprefecture, tribunals of first instance and commerce, a chamber of commerce and a school of navigation.

Dieppe has one of the safest and deepest harbours on the English channel. A curved passage cut in the bed of the Arques and protected by an eastern and a western jetty gives access to the outer harbour, which communicates at the east end by a lock-gate with the Bassin Duquesne and the Bassin Bérigny, and at the west end by the New channel, with an inner tidal harbour and two other basins. Vessels drawing 20 ft. can enter at neap tide. The harbour railway station is on the northwest quay of the outer harbour. The distance of Dieppe from Newhaven, with which there has long been daily communication, is 64 mi. The imports include silk and cotton goods, thread, oil-seeds. timber, coal, iron, patent fuel cement, china-clay, machinery, tobacco and mineral oil; leading exports are wine, silk, woollen and cotton fabrics, vegetables and fruit and flint-pebbles. The industries comprise shipbuilding, oil refining, steam-sawing, the manufacture of machinery, rope, porcelain and briquettes. Lace-making and production of articles in ivory and bone, dating from the 15th century, are carried on. The fishermen of Le Pollet, traditionally of Venetian origin. are among the main providers of the Parisian market. Two miles to the northeast of the town

is the ancient camp known as the Cité de Limes, which perhaps furnished the nucleus of the population of Dieppe.

See L. Vitet, *Histoire de Dieppe* (Paris, 1844); D. Asseline, *Les Antiquités et chroniques de la ville de Dieppe*, a 17th-century account published at Paris in 1874; Quentin Reynolds, *Dress Rehearsal* (1943).

DIERX, LÉON (1838–1912), French poet, was born in the island of Réunion in 1838, and died in Paris on June 11, 1912. He came to Paris to study at the Central School of Arts and Manufactures. A friend and disciple of Leconte de Lisle, Dierx was one of the most distinguished of the Parnassians. On the death of Stéphane Mallarmé in 1898 he was acclaimed "prince of poets" by "les jeunes." The most significant of his volumes of verse is *Lèvres closes* (1867). His *Oeuvres* (2 vol., 1894–96) contain much exquisite verse.

DIES, CHRISTOPH ALBERT (1755–1822), German painter, was born at Hanover, and learned the rudiments of art there. For one year he studied in the academy of Diisseldorf, and then he started, at the age of 20, with 30 ducats in his pocket, for Rome. There he lived till 1796. He published, in partnership with Méchan, Reinhardt and Frauenholz, the series of plates known as the *Collection de vues pittoresques de l'Italie* (1799).

In 1787 he swallowed by mistake three-quarters of an ounce of sugar of lead. His recovery from this poison was slow and incomplete, and he eventually lost the use of one of his hands. He died at Vienna in 1822, after years of suffering.

DIESEL, RUDOLF (1858–1913), German engineer, was born in Paris, March 18, 1858, of German parents. He was educated at the Munich Polytechnic school and spent a short time in Paris as manager of a company which manufactured refrigerating equipment, but returned to Munich, where in 1893 he published *The Theory and Construction* of *a Rational Heat Motor,* the result of his studies on what was to become the Diesel oil engine. In the same year work began at the Krupp and Augsburg machine factories on the construction of the Diesel engine (*q.v.*). Work continued on the motor until 1897, and in 1898 it was publicly displayed for the first time at Munich. In 1899 Diesel founded a factory for the construction of the engines at Augsburg and spent the greater part of the rest of his life perfecting the machine, although he did not live to see its possibilities fully exploited. On the night of Sept. 29–30, 1913, he fell overboard the Antwerp-Harwich mail steamer in the English channel and was drowned. In the last year of his life he wrote *The Genesis* of *Diesel Motors.*

For a discussion of the practical uses of Diesel's invention, *see* AERO ENGINES; MARINE ENGINEERING; LOCOMOTIVE.

DIESEL ENGINE. In 1892 Dr. Rudolf Diesel (*q.v.*) patented the type of internal-combustion engine with which his name is now inseparably associated, though it was not until 1895 that the first real "diesel" was built. Independent tests of an engine were conducted by Prof. Schroter at Augsburg in 1897, and diesel engines were first publicly exhibited at the Munich exhibition of 1898.

In a paper read before the Congress at Paris in 1900 Diesel stated that the cycle of operations finally adopted by him 'after extended experiments was as follows:

(1) A suction stroke during which air alone at atmospheric pressure was drawn into the cylinder.

(2) A compression stroke in which this air was next compressed "adiabatically" to a pressure of 500–600 lb. per sq.in.

(3) From, and for a short period after, the end of the compression stroke, regulated admission of the fuel in the form of a fine spray in such manner as to cause combustion to occur at (approximately) constant pressure.

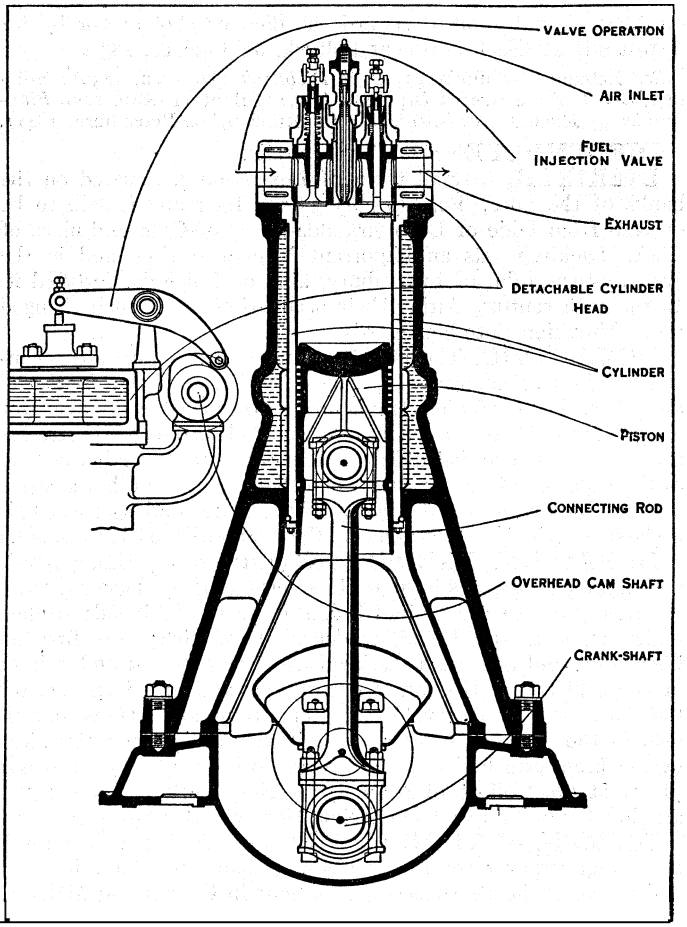
(4) Expansion of the ignited mixture of fuel spray and air during the remainder of the working stroke.

(5) Expulsion of the burnt products during the next stroke.

The cycle thus described was of the ordinary four-stroke type with stroke-sequence of suction, compression, working and exhaust; and the engine contemplated was of the normal single-acting type furnishing one working impulse in each two complete revolutions of the crankshaft.

The special feature of the diesel cycle is the regulated introduction of the fuel spray giving a combustion at approximately constant pressure, so that, in normal conditions of running, the maximum pressure of compression is not exceeded. In other internal-combustion engines the combustion or "explosion" of the working charge at the end of the compression stroke results in an almost instantaneous rise of pressure to a peak value much in excess of that of the compression.

It is stated above that the air is considered to be compressed. and that the burning gases are expanded "adiabatically"; by this



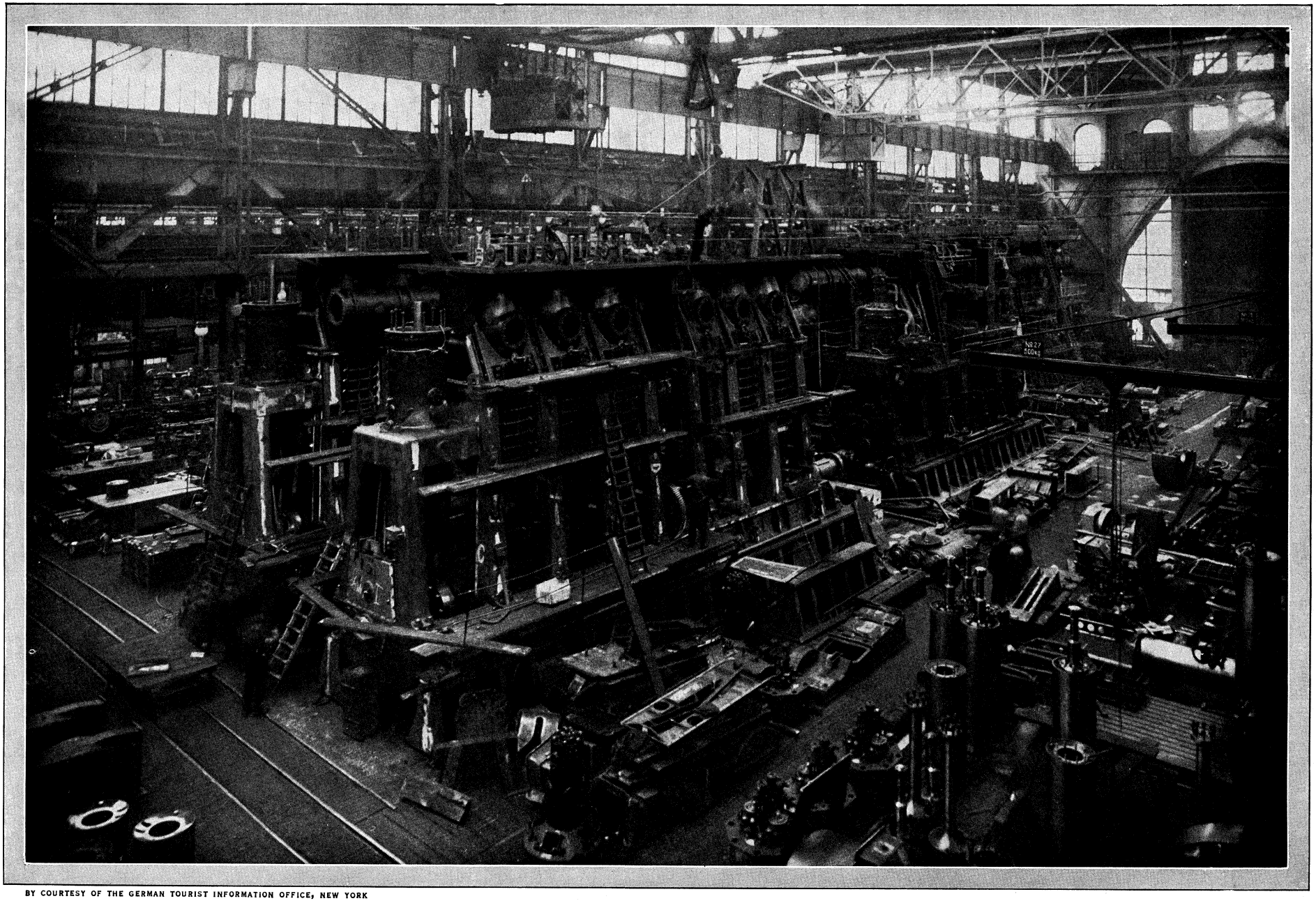
FROM C. A BURLS AND SIR DUGALD CLERK IN "DICT. OF APPLIED PHYSICS" (MACMILLAN)

FIG. 1.— SECTIONAL VIEW OF A TYPICAL 4-STROKE DIESEL ENGINE. SHOWING. ALSO. USUAL MODE OF VALVE ACTUATION

is meant that the air and gases are supposed for the sake of simplicity to be compressed and expanded respectively, without any loss or gain of heat to the containing cylinder. Actually of course some heat is lost to the cylinder during the compression and expansion (working) strokes; nevertheless the rapid squeezing-up of the air during the compression stroke results in increase of its temperature to about 1,000° F, which is sufficient to cause spontaneous ignition of the fuel spray during its injection; thus no igniting apparatus is required with diesel engines.

Neither the suction and subsequent compression of air alone, nor the absence of igniting apparatus in the diesel engine was novel. Akroyd Stuart (1886–90) injected the fuel spray into a hot-bulb prolongation at the combustion chamber end of the cylinder, and atmospheric air, during compression, formed with this heated spray the working charge, which ignited spontaneously and explosively, at the end of the compression stroke. The characteristic feature of the diesel procedure is the regulated admission of the fuel spray by which combustion at constant pressure is realized.

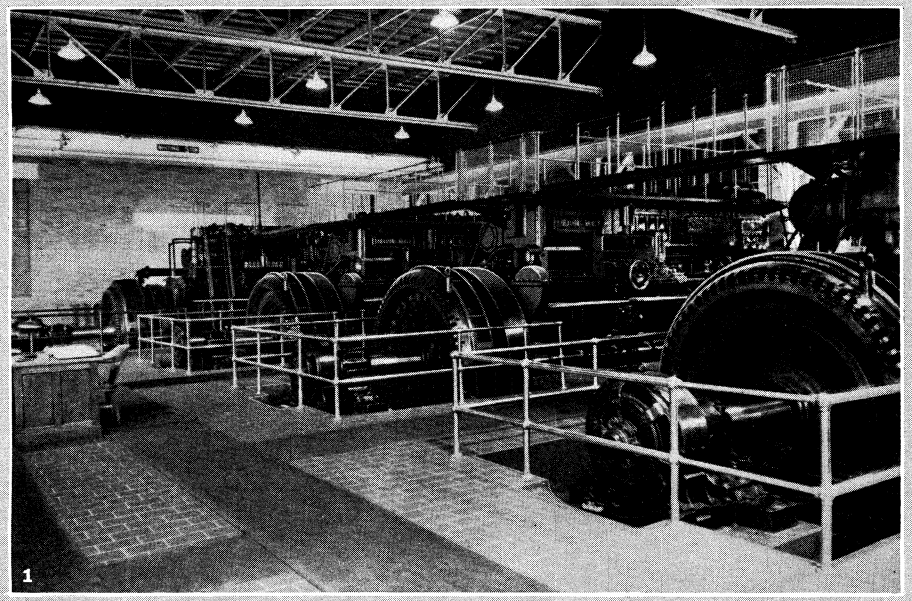
Definition of a Diesel Engine.— The accepted definition of a diesel engine is as follows:—A *diesel engine is a prime mover actuated by the gases resulting from the combustion of a liquid or pulverized fuel injected in a state of fine subdivision into the engine cylinder at or about the end of the compression stroke. The heat generated by the compression of air in the cylinder is*

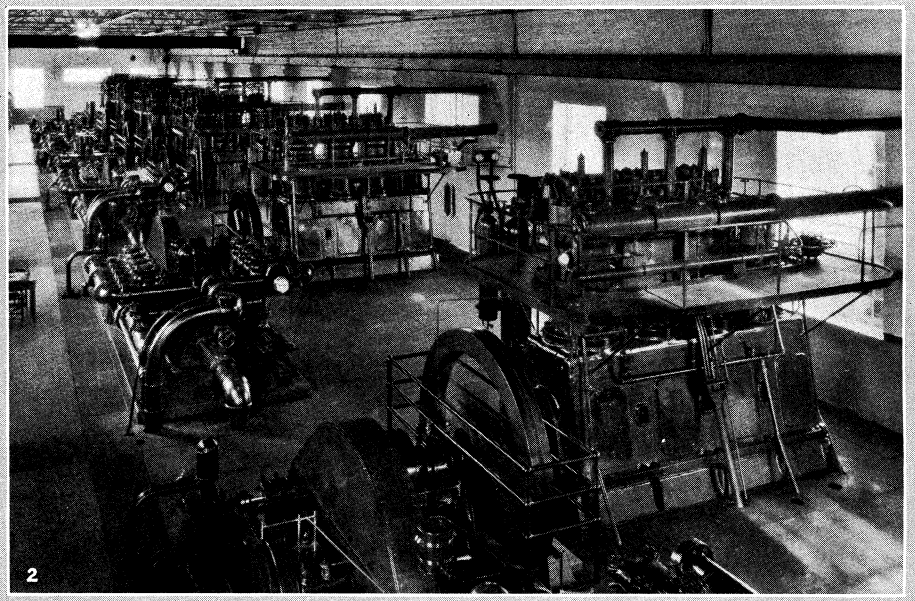


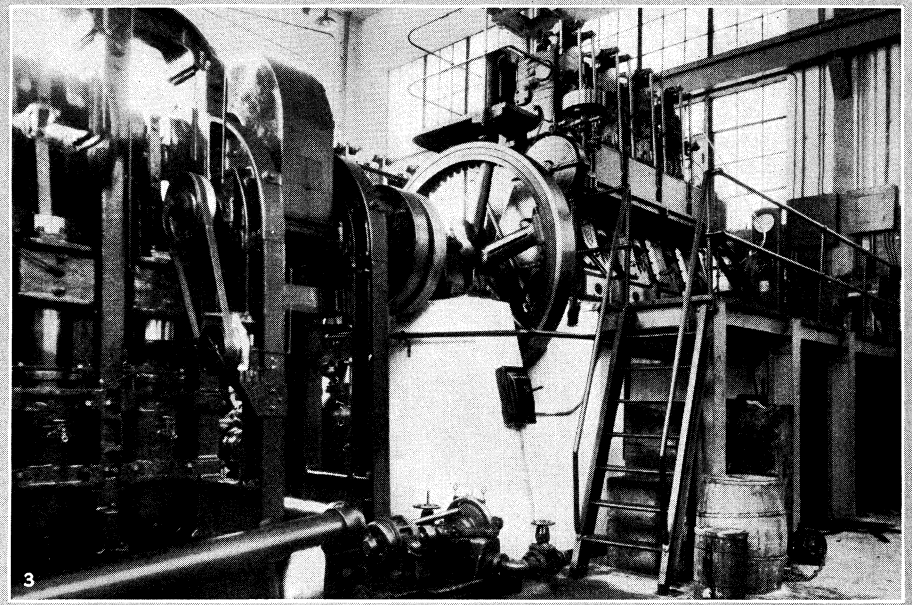
BY COURTESY OF THE GERMAN TOURIST INFORMATION OFFICE, NEW YORK

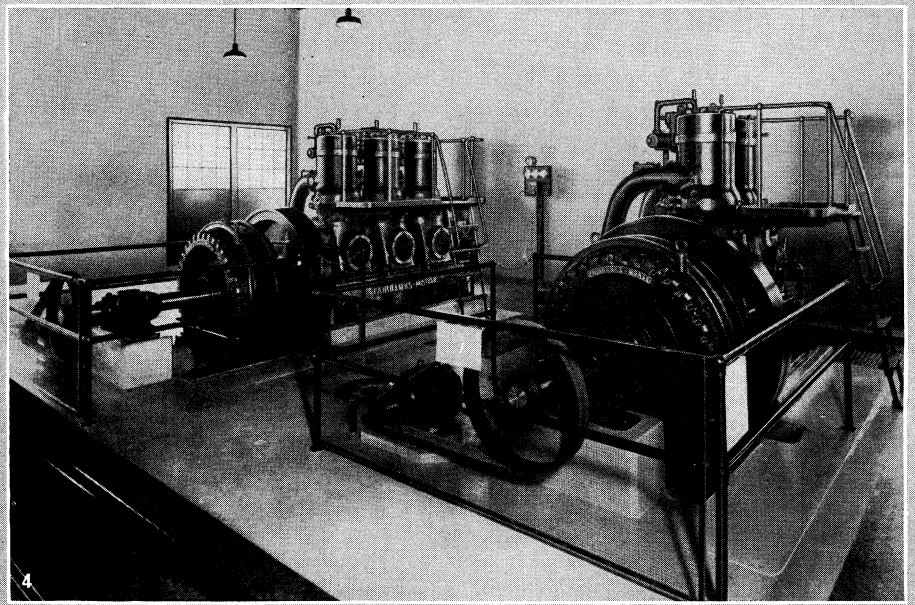
CONSTRUCTION OF A LARGE MARINE DIESEL ENGINE

gine works, Kiel, Germany, showing frame of Diesel engine and component parts, partially assembled for installation









BY COURTESY OF (1, 4) FAIRBANKS, MORSE & COMPANY, (2) THE MCINTOSH AND SEYMOUR CORPORATION, (3) THE DE LA VERGNE MACHINE COMPANY

STATIONARY DIESEL ENGINES. FOUR PLANTS SHOWING USES OF THE MODERN OIL ENGINE

1. Three 900-h.p. and one 1400-h.p. diesels in light and power plant
2. Six 300-h.p. 3-cylinder engines in an oil pipe-line station
3. High-pressure water pump operated by direct-connected diesel engine
4. Small 2-cycle diesels (180 and 120 h.p.) for municipal power plant

the sole means of *igniting the charge*. Combustion of *the* charge proceeds at, or *approximately at,* constant *pressure.*

A sectional view of a simple four-stroke diesel engine appears in fig. 1; the inverted vertical frame design shown is almost universally adopted. The piston reciprocates within the cylinder and drives the crankshaft through connecting rod. On the first down stroke air is drawn through the air inlet and valve into the cylinder; this air is next compressed on the return up stroke of the piston, and the fuel spray is then forcibly injected into this compressed and consequently highly heated mass of air through the fuel valve; spontaneous ignition takes place and the piston is driven down and performs the "working stroke." Near the bottom of this stroke the exhaust valve is opened and the burnt gases are discharged through the exhaust into the atmosphere during the final up stroke of the piston; this completes the cycle.

The inlet and exhaust valves are usually of the "poppet" or "mushroom" type as shown, and all valves are cam-driven from a "half-speed" shaft in the manner indicated in the illustration substantially as in an ordinary motor-car engine. It will be noted that the cylinder is well water-jacketed, and that the engine generally is of massive design.

In normal working the maximum pressure, as already stated, does not exceed that of compression, *i.e.,* 500–600 lb. per sq.in., but the engine has to be built safely to resist occasional excessive pressures that occur if, *e.g.,* a leaky fuel valve permits admission of oil during suction with subsequent vaporization during the compression stroke, and pre-ignition near the end of the compression; in this way momentary pressures of fully 1,000 lb. per sq.in. not uncommonly occur, and have to be provided against. Accordingly, in general, the diesel is a heavy internal-combustion engine in relation to its power development.

Ideal Diesel Indicator Diagram. — An ideal indicator diagram of a four-stroke diesel engine is given in fig. 2. Horizontal measurements represent volumes, and vertical measurements pressures in lb. per sq.in., each to some convenient scale. Thus at the commencement of the cycle, the combustion chamber, of volume V_0 is, in the simplest theory, filled with air at atmosphere pressure p_0. The piston performs the suction stroke, and the line 01 is traced on the diagram; at the end of the suction stroke the cylinder contains a volume V_1 of air at atmospheric pressure. The inlet valve is now closed and the returning piston compresses

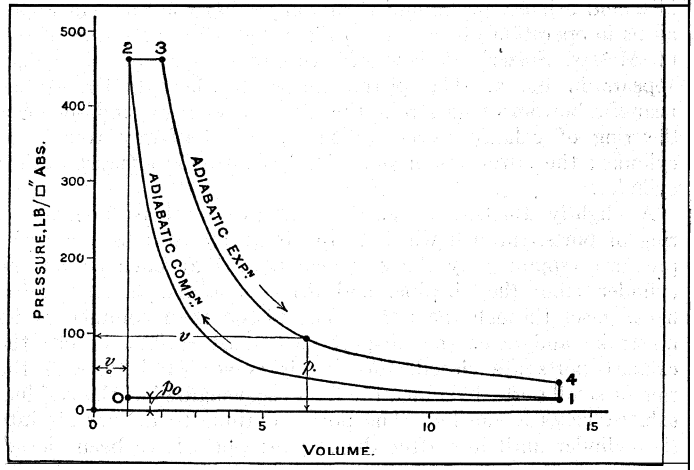


FIG. 2. — IDEAL INDICATOR DIAGRAM OF A 4-STROKE DIESEL ENGINE

the entrapped air adiabatically at constantly increasing pressure as indicated by the curve $\overline{12}$; at the end of this stroke the air, now at high temperature, has a volume $V_2(=V_0)$, and pressure p_2 lb. per square inch. The regulated charge of fuel is next sprayed into this mass of highly heated and compressed air during the first part of the downward movement of the piston on its working stroke; spontaneous ignition takes place, and continues at constant pressure to some point, as 3, indicated by the horizontal line $\overline{23}$; the fuel is then cut oti and the working mixture expands at rapidly falling pressure and temperature, driving the piston downwards, until the point 4, the end of the working stroke, is reached.

The exhaust valve is now suddenly opened and the burnt gases escape into the atmosphere, falling instantly from pressure p_4 to $p_1(=p_0)$. Finally, during the return of the piston from 1 to 0, the remaining exhaust gas is expelled. This cycle is then repeated indefinitely.

Simple Theory. — The working fluid is regarded as a perfect gas, conforming strictly to the relation:

$$PV = c.T \qquad (1)$$

where T denotes absolute temperature (say, in °F) and c is a constant, being equal to the difference $(C_p - C_v)$ between the specific heat of the fluid at constant pressure and that at constant volume. The compression and expansion curves are regarded as truly adiabatic, so that the fluid neither gains nor loses heat, *qua* heat, during these periods. Hence, on these simplifying assumptions, the heat given to the working fluid per cycle is $H = K_p(T_3 - T_2)$ British thermal units. While the heat rejected per cycle (*see* the indicator diagram, at $\overline{41}$) is

$$R = K_v(T_4 - T_1) \text{ British thermal units.}$$

The useful work done, expressed in heat units, is $(H - R)$. Thus an expenditure of H, B.T.U. gives a return of $(H - R)$B.T.U. of useful work; and accordingly the "thermodynamic efficiency" of the cycle is expressed by the fraction $\frac{H-R}{H}$, thus,

$$\text{Thermodynamic efficiency} = \frac{H-R}{H} = 1 - \frac{R}{H}. \qquad (2)$$

That is, denoting as usual the ratio of the specific heats, viz. $\frac{k_p}{K_v}$, by γ:

$$\text{Thermodynamic efficiency} = 1 - \frac{1}{\gamma} \cdot \frac{T_4 - T_1}{T_3 - T_2}. \qquad (3)$$

This expression gives the value of the ideal thermodynamic efficiency of the diesel cycle in terms of the absolute temperatures at the four corners of the indicator diagram; these temperatures are not, however, readily ascertainable; but the efficiency can, fortunately, also be expressed in terms of magnitudes immediately measurable from the indicator diagram, as follows:

The volume ratio of compression, commonly termed the "compression ratio," $\frac{V_1}{V_2}$ (fig. 2), is usually denoted by r; it will be seen that this is the same as $\frac{V_4}{V_3}$; thus $r = \frac{V_1}{V_2} = \frac{V_4}{V_3}$.

Also $\frac{V_3}{V_2}$, the ratio of expansion at constant pressure (*i.e.,* of combustion at constant pressure) is commonly denoted by *p;* thus $\rho = \frac{V_3}{V_2}$.

Note here also that $\frac{V_3}{V_4} = \frac{V_3}{V_2} \cdot \frac{V_2}{V_4} = \frac{\rho}{r}$. Now it may be shown that when any perfect gas is compressed or expanded adiabatically, the product $TV^{\gamma-1}$ remains constant along the curve; hence by aid of Eqs. (1) and (3), and the above results we have from fig. 2:

$$T_2V_2^{\gamma-1} = T_1V_1^{\gamma-1}. \quad \text{Therefore } \frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma-1} = r^{\gamma-1}.$$

Thus $T_2 = r^{\gamma-1}T_1\frac{T_3}{T_2} = \frac{V_3}{V_2} = \rho$. Therefore $T_3 = \rho T_2$;

and thus $T_3 = \rho r^{\gamma-1}T_1$;

and accordingly $T_3 - T_2 = r^{\gamma-1}(\rho - 1)T_1. \qquad (4)$

Again: $T_4V_4^{\gamma-1} = T_3V_3^{\gamma-1} = \rho r^{\gamma-1}V_3^{\gamma-1}T_1.$

Therefore $\frac{T_4}{T_1} = \rho r^{\gamma-1}\left(\frac{V_3}{V_4}\right)^{\gamma-1}$; *i.e.*, $\frac{T_4}{T_1} = \rho r^{\gamma-1}\left(\frac{\rho}{r}\right)^{\gamma-1} = \rho^{\gamma}$;

and thus $T_4 = \rho^{\gamma} T_1$;

so that $T_4 - T_1 = (\rho^{\gamma} - 1)T_1$. (5)

Substituting, now, in (3) from (4) and (5) we get:

$$\text{Thermodynamic efficiency} = 1 - \left(\frac{1}{r}\right)^{\gamma-1} \times \frac{\rho^{\gamma} - 1}{(\rho - 1)\gamma} \quad (6)$$

and thus the diesel cycle efficiency is expressed in terms of the compression and expansion ratios only. Eq. (6) is the exact expression for the efficiency, on the ordinary simple theory, and as Table I. below shows, the efficiency falls as p, *i.e.*, the period of constant-pressure combustion, increases. When the constant-pressure combustion period is extremely short, *i.e.*, when $\rho = 1$, the expression (6) above reduces to $1 - \left(\frac{1}{r}\right)^{\gamma-1}$. Now it is shown in the article on gas engines (*q.v.*) that for the type of four-stroke cycle in general use in gas and petrol engines known as the "constant-volume" cycle, the thermodynamic efficiency, with the usual simplifying assumptions, is expressed by the formula $1 - \left(\frac{1}{r}\right)^{\gamma-1}$, where r is, again, the ratio of adiabatic compression.

A committee of the Institution of Civil Engineers in 1905 after careful consideration recommended the adoption of this formula for estimating the ideal maximum of thermodynamic efficiency of the internal-combustion engines in general use at that date, all such engines being assumed as working with a perfect gas for which the value of γ was taken as 1·4. Thus the

$$1905 \text{ Air Standard} = 1 - \left(\frac{1}{r}\right)^{0.4} \quad (7)$$

and this has been largely used from that date in connection with all internal-cornbustion engines, including diesels. The 1905 Air Standard makes the efficiency increase with the compression ratio, thus:

For r =	3.	4.	5.	6.	7.	8.	10.	12.	14.
The Air Std =	·356	·426	·475	·513	·541	·565	·602	·630	·652

and the diesel engine owes its position as one of the most economical engines in fuel consumption to the high compression ratio (14–15) employed. This high compression ratio is practicable on account of air alone being compressed; in the case of gas engines, and of many oil engines, much lower compression ratios must be used in order to avoid detonation of the working charge, and in such cases the value of r ranges from about 3 to 7.j only. The ideal diesel efficiency is, however, somewhat over-estimated if Eq. (7) be used, as is shown in Table I. below, which exhibits the true efficiency values from Eq. (6) for a compression ratio of 14, and with p ranging from its minimum value 1 to the maximum, in practice, of about 2.

TABLE I.—*Ideal Thermodynamic Efficiency of Diesel Cycle*
From Eq. (6) r=i4. ρ=1 to 2

Volume ratio of constant-pressure expansion, F	1905 air standard value $1-\left(\frac{1}{14}\right)^{0.4}$	True value of diesel cycle effy. from eq. (6)	% error in using air std. instead of (6)
1·0 . . .	·652	·652	0
1·25 . . .	·652	·635	2·7
1·5 . . .	·652	·620	5·2
1·75 . . .	·652	·605	7·8
2·0 . . .	·652	·591	10·3

Two-stroke Cycle Diesel Engines.—All the earliest diesel engines were operated on the four-stroke cycle, but two-stroke cycle engines are now (1928) common and are increasing in favour. The sequence of operations is as follows:—

(1) On the first up-stroke of the piston, air alone is adiabatically compressed into the combustion chamber, becoming in consequence highly heated.

(2) The charge of fuel is then forcibly injected at a regulated rate into this compressed and heated air just as in the four-stroke cycle engine, and spontaneous ignition occurs and continues at approximately constant pressure during the early part of the working down-stroke.

(3) When about 80% of the down-stroke has been completed, the piston over-runs a ring of ports in the lower part of the

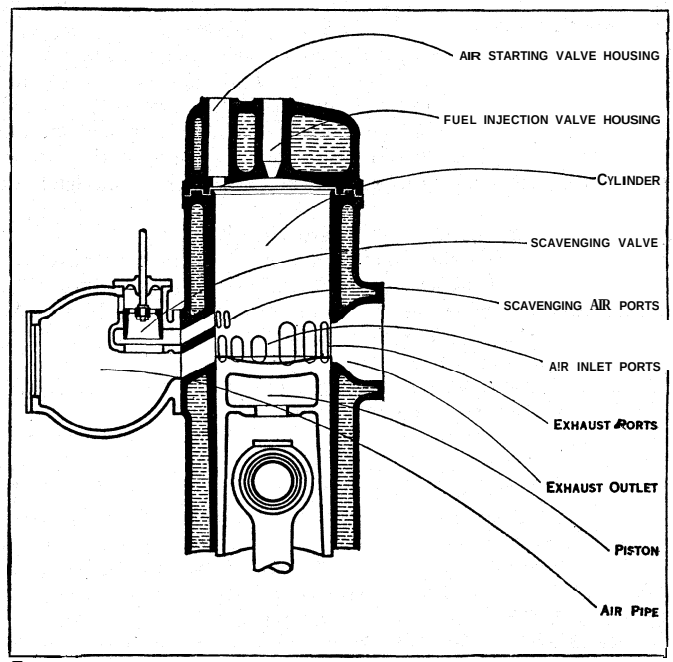


FIG. 3.— DIAGRAM OF A TYPICAL 2-STROKE DIESEL ENGINE. SHOWING INLET. EXHAUST AND SCAVENGING PORTS

cylinder through which the burnt gas discharges itself into the atmosphere. Simultaneously air, supplied by a so-called scavenge pump under a pressure of 1·5 to 3 lb. per sq.in. enters the cylinder through a valve, or ports, and causes the expulsion of any remaining exhaust gas, so that at the end of the working stroke the cylinder is again filled with air alone. This completes the cycle. The piston on the return up-stroke first closes the rings of air inlet and exhaust ports, and then compresses the now entrapped air as in operation (1) above. A diagrammatic illustration of one of Messrs. Sulzér's designs of two-stroke cycle diesel engines appears in fig. 3. The piston works in the cylinder. When near the bottom of its stroke the piston over-runs. and so opens the ring of exhaust ports, which extends half-way round the cylinder; the burnt gas at once escapes into the exhaust outlet; cylinder.

A slightly further descent of the piston then uncovers a ring of ports, through which fresh air at 1·5 to 3 lb. per sq.in. pressure (supplied by the scavenge pump) at once enters the cylinder from the air-pipe, and drives out the remaining exhaust gases through the ports. The piston then commences its up-stroke and after the air-ports are masked, but before the exhaust ports are closed. further air is admitted through the ring of small ports, by which the final "scavenging" of the residual exhaust gases is effected. The ports continue to deliver air into the cylinder until just after the exhaust ports have been closed, so that in this ingenious manner the cylinder is charged with fresh air at slightly above atmospheric pressure.

The supply of air to the ports is regulated by a reciprocating valve operated from the crankshaft. The only valves in the cylinder head in this type of engine are (1) the fuel injection valve and (2) the air-starting valve. The massive strength of the design and the liberal water-jacketing provided should be noticed.

The ideal two-stroke cycle engine would develop twice the power of a four-stroke of equal size; actually, as only about 80% of the stroke can be utilized on account of the presence of the scavenging and exhaust ports, and as some power is absorbed

in driving the scavenging pump, the two-stroke diesel in practice is usually a little less efficient than the four-stroke. Another difficulty with the two-cycle is that it is practically impossible to get complete scavenging, especially at high speeds, where the scavenging pressures and consequent losses are necessarily much higher. It possesses, however, the important advantages (1) that it is lighter for the same power output; (2) that it possesses fewer moving parts, and is thus simpler; and (3) that it is very readily reversed. With reference to (3), it is obvious that a two-stroke cycle engine will work equally well in whichever direction it may be started; it is therefore only necessary to move the crankshaft operating the fuel inlet valve through a small angle in order to change the injection-period to that suitable for reverse running.

Fuel: Fuel Injection: **Fuel** Consumption. — Although many liquid and even some solid (pulverized) fuels, as coal dust, have been tried in diesel engines, practically the only fuels employed are (1) crude and residual petroleum oils and (2) coal-tar oils obtained from the large-scale distillation of coal. Suitable petroleum oils have a specific gravity (water = 1) of ·85–·95 at 60° F, a flash point of 150–250° F (by close test), and a lower heat value of 18,000–19,000 B.T.U. per pound. Oils having an asphalt base are liable to gum-up the valves, and are thus less favoured.

Coal-tar oils often show a flash point of 400° F or more, a sp gr. of 1·0–1·1 and a (lower) heat value of about 16,000 B.T.U. per lb. These oils require in general a very high temperature to produce spontaneous ignition and this proved at first an obstacle to their employment in the diesel engine; the difficulty was completely removed by injecting through the fuel inlet valve into the cylinder a minute quantity of some more readily ignitable oil (as gas oil), immediately before, or simultaneously with, the main charge of tar oil; by aid of this "pilot jet" combustion is initiated, and entirely satisfactory performance obtained.

The injection of the charge of fuel oil into the compressed and heated mass of air in the combustion chamber at and for a short period after the instant when the piston has reached the top of its stroke is effected through a spring-seated needle valve (the fuel inlet valve) located in the cylinder head, in one of two ways:

(1) By a blast of *air* supplied from a special air reservoir at a pressure of up to 1,000 lb. per sq.in. Air blast injection has given, in general, a somewhat better distribution of the sprayed and "pulverized" fuel throughout the combustion chamber, with consequent improvement in fuel economy. It is thought that one of the principal contributions of air-blast injection is the turbulence thus introduced into the combustion space. However, it involves the provision of bulky and costly air-compressing apparatus which absorbs in its operation 6–7% of the whole power output of the engine. Accordingly great attention was devoted to the discovery of a means of dispensing with the air-blast, and recent engines are provided in increasing numbers with: —

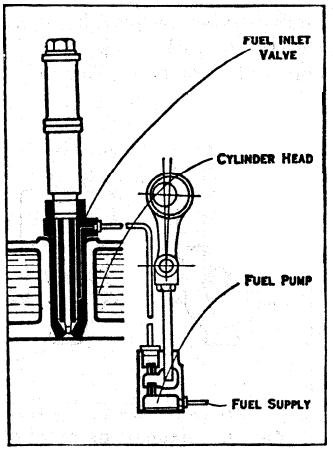


FIG. 4.—DIAGRAM SHOWING "SOLID" FUEL INJECTION

(2) *"Airless" or "Solid" Injection* —In this method the charge of fuel is forced through a cam-operated, or automatic, spring-loaded fuel injection valve into the cylinder by a small quick-acting mechanically-operated pump at a pressure of 4,000–7,000 lb. per sq.in. The fuel consumption per indicated horse-power-hour is usually a little greater than with air-blast injection; on the other hand the elimination of the air-blast apparatus increases the mechanical efficiency of the engine, and in consequence the fuel consumption per brake-horse-power-hour with airless injection compares quite favourably with that when an air blast is used.

A diagrammatic illustration of a fuel injection valve and fuel pump for airless injection appears in fig. 4; the small solid-plunger eccentric-driven fuel pump is shown on the right by which the charge of oil is delivered at high pressure into the space surrounding the needle valve which is simultaneously raised just off its seat, against the pressure of its spring, by a cam-operated lever; the oil immediately enters the combustion chamber in a finely pulverized condition in the form of a hollow cone, and instant ignition occurs; in true diesel engines the inlet is held open during an appreciable portion of the down stroke, and the continued supply of oil then causes the combustion to continue at approximately constant pressure until cut-off. In the important class of so-called "semi-diesel" engines *(see* OIL ENGINES), the fuel inlet valve is not cam-operated, but is forced open, against the pressure of its closing spring, by the pump delivery pressure, and the whole charge of oil is suddenly sprayed into a heated chamber, usually a prolongation or extension of the combustion chamber; in such engines the combustion is practically instantaneous, with resulting rise of pressure considerably above that of compression.

The diesel, of all internal-combustion engines, is the most economical in fuel consumption, and Table II. illustrates in a general way not only the high economy of the type but also the progress that has been made since its introduction; all the figures given relate to single-acting four-stroke cycle inverted-vertical engines at full load, using petroleum oils as fuel:

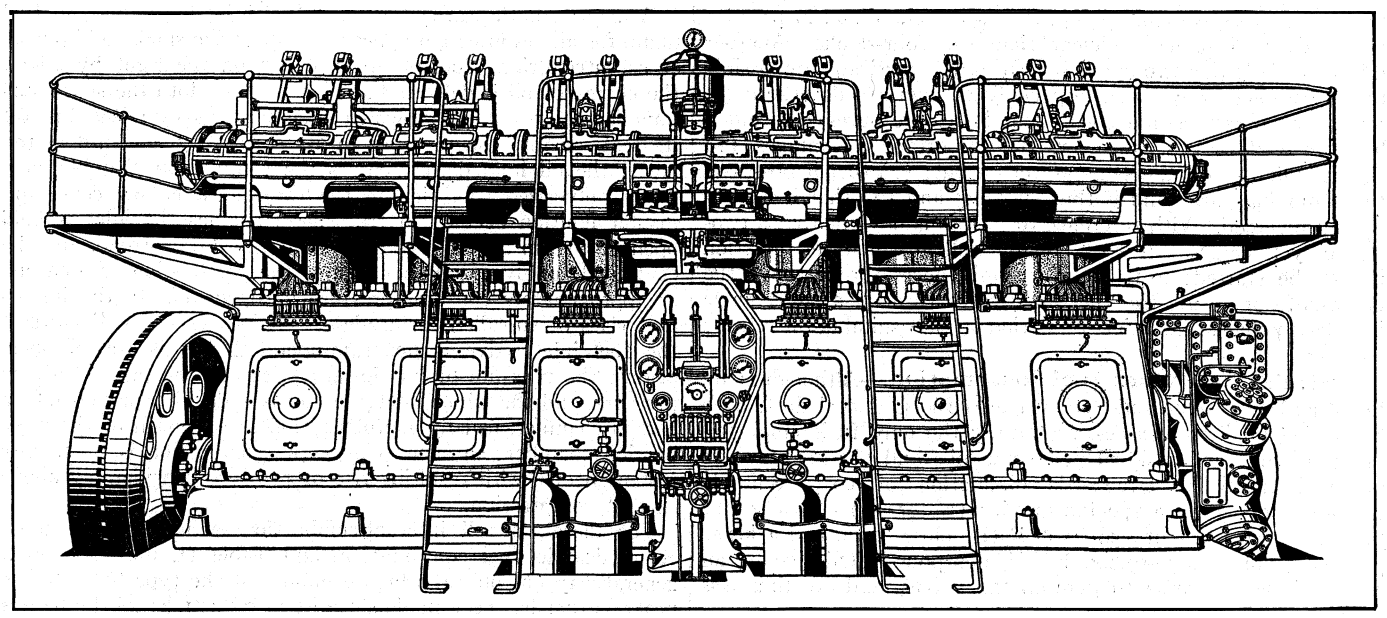
TABLE II.—*Fuel Consumption of Diesel Engines 1897–1927*

Date	Authority	Leading dimensions of engines				Actual brake horse power	Lb. of fuel per b.h.p. hour	Brake thermal efficiency
		Number of cyl.	Cyl. bore in inches	Stroke in inches	Normal speed. rev. per min.			
								%
1897	Schroter	1	9·8	15·7	171·8	19·6	·548	25.2
1900	Meyer	1	11·8	18·1	181·2	29·7	·457	30·0
1903	A. Clark	2	15·75	23.6	154·5	164·8	·406	32.6
1905	Longridge	3	22·05	29·52	152·8	459	·451	31·7
1910	Mirrlees	3	12·0	18·25	200	130	·42j	31·6
..	Eberle	2	16·9	26.8	160·2	197·9	·416	34.8
1927	Charing Cross	6	21·5		300	1750	'39	35'5

These figures show a steady increase in the brake thermal efficiency; the highest value included, viz., 35·5%, is that of a 6-cyl. 1,750 b.h.p. engine installed in 1927 at Charing Cross for the Charing Cross Electricity Supply Co., Ltd.; this was, at that date, the largest stationary oil engine built in Britain. An external view of this engine is given in fig. 5. With special types of diesel even higher values are obtained; for example, tests conducted by the marine oil engine trials committee on a Scott-Still diesel-steam engine of 1,250 b.h.p. showed a consumption of only ·354 lb. of fuel per b.h.p. hour corresponding to a brake thermal efficiency of 36·9%. According to H. R. Ricardo, "almost, if not quite, the highest thermal efficiency ever yet recorded on a diesel engine, namely 38·8% on the net shaft horse-power, was obtained by the Royal Aircraft Establishment on a high-speed diesel engine of 8 in. bore running at 1,000 revolu-

TABLE III.

Type of engine	Best brake thermal eff.
	%
Non-condensing steam engines	8·4
Condensing steam engines, and turbines using superheated steam	15·0
Ditto, using steam pressure of 500 lb. sq.in.	21
Suction gas engines	23
Normal diesel engines	35·5
Scott-Still combined diesel and steam engine	36·9

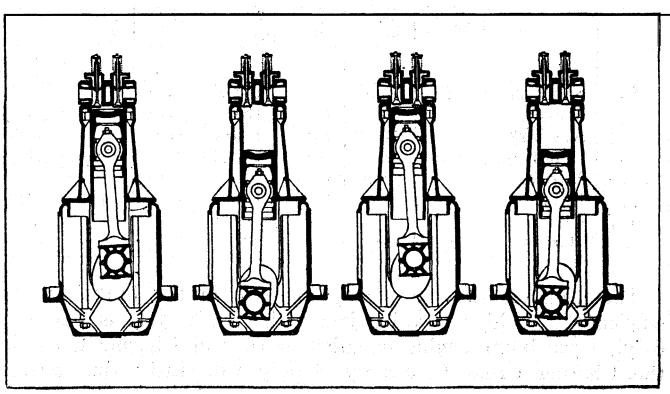


BY COURTESY OF MESSRS. FRASER AND CHALMERS ENGINEERING WORKS

FIG. 5.— EXTERNAL VIEW OF THE 1750 B.H.P. 6-CYLINDER DIESEL ENGINE, WHICH WAS. AT THE TIME OF ITS INSTALLATION AT THE CHARING CROSS ELECTRICITY SUPPLY CO.. IN 1927. THE LARGEST STATIONARY OIL ENGINE BUILT IN BRITAIN

tions per minute." It is of interest to compare these figures with the best attained with other types of prime mover, and the figures on p. 3j1 (Table III.) include some given by *A.* B. Chalkley, *Diesel Engines* (6th ed., 1927).

General.— A fundamental disadvantage of the four-stroke cycle engine, especially when of the predominating single-acting type *(see* fig. 1), is the infrequency of the working impulses, and



BY COURTESY OF THE WORTHINGTON PUMP & MACHINERY CORP.

FIG. 8.— DIAGRAM OF A SINGLE-ACTING FOUR-CYCLE DIESEL ENGINE
Only during one stroke in four does combustion and generation of power occur

a reasonable degree of uniformity of revolution speed can only be obtained in single-cylindered or few-cylindered engines by the provision of heavy fly-wheels. The drawback is minimized in practice by constructing engines having two, three, four, six, eight, and even more, cylinders arranged in line and acting upon a common crankshaft, but the one impulse per cylinder in every two crankshaft revolutions is still an objection, as such engines necessarily remain very bulky and costly in relation to their power output.

The two-stroke engine at once doubles the impulse frequency, but for long the design of completely satisfactory engines of this type proved difficult, largely from the serious piston- and cylinder-cooling troubles encountered; these difficulties were in due course entirely overcome, and the attention of designers was next concentrated upon the problem of the production of double-acting engines, *i.e.*, engines in which working impulses are caused to occur on each side of the piston; this problem was obviously of extreme importance in relation to marine applications on account of the great value of space and weight saved on a ship. The double-acting engine, however, raised again in an acute form the problems of piston- and cylinder-cooling, and many experimental engines were built before success was finally attained. By the end of 1927, however, large double-acting diesel engines both of the four-stroke and two-stroke type were running regularly in commercial service; in all these the pistons are necessarily cooled by the continuous circulation through them of a current of water or oil. The piston rod terminates in an external crosshead—as in the normal type of steam engine—by which the piston is entirely relieved of the side thrust of the connecting-rod, this thrust being taken by a well-lubricated and water-cooled crosshead guide.

British engineers for long favoured the single-acting type of engine with uncooled pistons; with these the cylinder diameter is limited to a maximum of about 26 in. and is usually considerably less than this limit; with water- or oil-cooled pistons the diameter is independent of cooling considerations.

Of land installations in 1926 the largest was a 15,000 b.h.p. double-acting two-stroke diesel engine built for the Hamburg electricity works; this engine had nine cylinders, each 33·86 in. bore and 59·05 in. stroke, and ran normally at 94 revs. per minute.

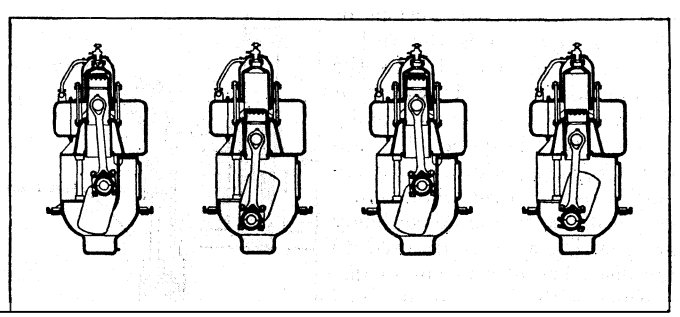


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FIG. 7.— DIAGRAM OF SINGLE-ACTING TWO-CYCLE DIESEL ENGINE
Power stroke occurs once per revolution, and for equal size cylinder the output is double that of the single-acting four-cycle type

An idea of its size may be formed from the statement that it had an over-all length of 77 ft., width of 14 ft. and height of $33\frac{1}{2}$ ft. The fuel consumption (using gas oil of ·875 sp.gr.) on trial was only 0·392 lb. per b.h.p. hour at full load. Among large marine installations may be mentioned:—

(1) The engines of the 23,900 ton, 19-knot, motor ship "Saturnia," launched late in 1927; this vessel is propelled by two 10,000 horse-power eight-cylindered double-acting four-stroke supercharged diesel engines of jj in. bore and 59 in. stroke; and

(2) The engines of the 32,650 ton, 19-knot, motor ship "Augus-

tus," also built in 1927, and fitted with four double-acting two-stroke diesels aggregating 25,000 b.h.p. The report of Lloyd's Register at the end of June 1927 showed that throughout the world at that date there were under construction 268 motor ships aggregating 1,459,595 tons, and 30 steam ships aggregating 1,366,809 tons; and that for the first time the motor tonnage under construction throughout the world exceeded that of steam.

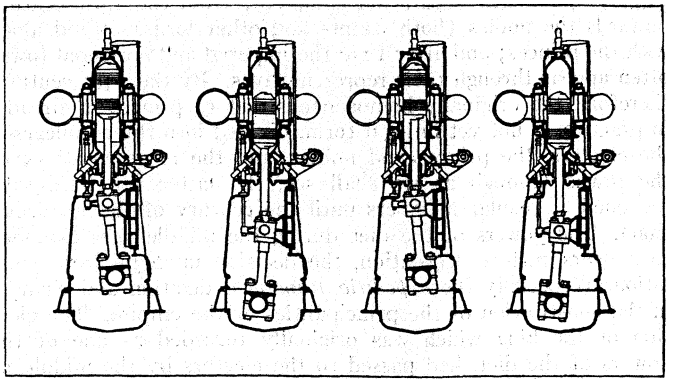

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FIG. 8.— DOUBLE-ACTING TWO-CYCLE DIESEL ENGINE. HAVING THE SAME WORKING SEQUENCE AS IN THE STEAM ENGINE— FOUR POWER STROKES FOR EACH FOUR STROKES OF THE ENGINE

In this necessarily limited article only a general sketch can be presented. The diesel engine forms already a highly specialized branch of engineering calling for great knowledge and skill in designing and extreme accuracy and refinement in construction. An instructive series of articles on earlier developments will be found in the pages of ***The Engineer*** from April to Oct. 1913; development since then has been so phenomenally rapid that reference must mainly be made to the many technical papers dealing with the type: ***Tha Engineer, Engineering, The Motor Ship, The Marine Engineer, Gas and Oil Power,*** etc. Of special treatises wholly devoted to the subject there are but a few, the principal, in Britain, being that of A. B. Chalkley, *Diesel Elcgines for Land and Marine Work* (6th ed., 1927), in which a very clear and complete account is given. (G. A. Bu.)

United States.— American practice in diesels is tending distinctly towards supercharging. The practice at this date is supercharging which is measurable in ounces of super-atmospheric pressure. This has two very beneficial tendencies: (1) it contributes in an engine of a given size a larger combustion space, therefore smaller ratio of chilled walls; (2) more oxygen with its complement of fuel demand per stroke. The difficulty with supercharging is that the exhaust valve or exhaust passages open at somewhat higher temperatures and pressures. It is a logical sequence that, when supercharging rises to really considerable pressures, the corresponding increased pressures at the point of exhaust opening should be utilized by farther expansion in a cylinder provided for this purpose. One group of engineers in America has been pursuing this type of design for some time with results which indicate ultimate success. The increased temperatures and pressures which the exhaust valves are compelled to handle in case of supercharging engines entail difficulties in connection with the heat erosion of the valve seats. A complete remedy for this has been found in compounding, where proper cushioning in the low pressure cylinder does away entirely with high velocity in gases passing through the exhaust port, which opens under conditions of equal pressure on both sides, the velocity being reduced to a value due to piston movement, and erosion is suppressed.

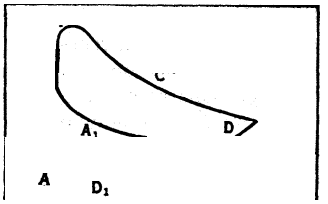


FIG. 9.— INDICATOR CARD FOR SUPERCHARGING ENGINE

Fig. 9 gives a typical card from such an engine, the supercharged induction pressure being indicated at A_1, the compression proper at BC, the fuel injection at C_1, the double expansion curve in the high pressure cylinder being indicated at C'' and that in the low pressure from E to D, the final exhaust passage opening at point D_1 near the atmospheric line.

Sleeve Valve.— Ricardo succeeded in adapting the sleeve valve to diesel operation in England in 1926. Since that time considerable advance has been made in the utilization of this type of valve for high speed engines. The great advantage of its adoption consists in giving sufficient port opening to permit the transference of gases to the low pressure cylinder. Further, the internal shape of the combustion chamber permits the supercharging pressures to be utilized by its tangential inlet direction to secure an extremely high state of turbulence, by a simple solid fuel injection nozzle. This achieves two important functions: (1) almost instantaneous co-mingling of the fuel and oxygen; (2) it allows the solid injection to reach a very much more increased amount of the oxygen present than ever before. The design lends itself, therefore, to high fuel efficiency and high speed operation. (E. A. Sp.)

DIESEL LOCOMOTIVE: see LOCOMOTIVE.

DIE SINKING, art of making tools, called dies, by means of which metals and other materials are pressed or cut into various shapes by a hammer or an arrangement of levers. The die is usually cut from steel by a machine, but where extreme accuracy is required, *e.g.*, when engraving dies for coins, goldsmiths' work and for some parts of machines, hand work predominates. Here an exact copy of the design is traced on a thin coating of wax spread over the prepared smooth surface, and is then engraved on the metal by recessing or *sinking*. The tools used are chisels, gravers and rifflers, which are small files with curved ends for negotiating curves and recessed portions. First the sinker recesses the master die by engraving, in intaglio, the design on a piece of soft steel called the *hub,* which is then hardened to form the *matrix.* By means of the matrix, the design is expressed in relief on a second piece of softened steel called the punch which in turn is hardened and held in the press to strike the softened face of the working die. Several operations are necessary to bring the impressions to a perfect state, the first blow being made on the die while in cone shape (see fig. 1). The blow changes the form to that in the second view. The working die must then be annealed, and its edge turned off a little smaller; a complete, perfectly clean impression is produced, the die appearing as in the third view.

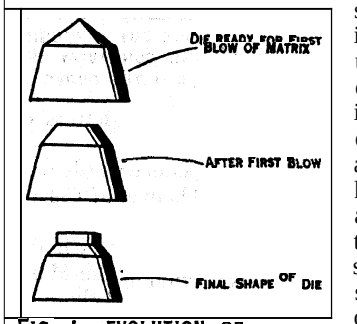
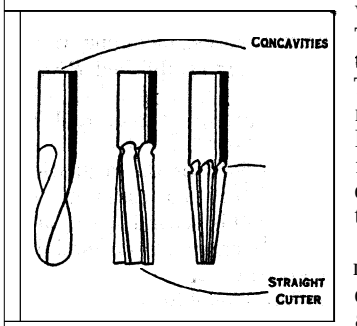


FIG. 1.—EVOLUTION OF COINING

Dies for stamping coins are not actually cut by hand, but are multiplied from a hardened matrix, which has been struck from an engraved die. A number of heavy blows cause the soft working die to impress its pattern upon the



CUTTERS

Milling cutters eliminate hand cutting. The die is moved about under the cutters as required by slides controlled with screws and hand wheels

Considerable quantities of metal must be removed in sinking dies, and machine cutting, as far as possible, is essential to save hand labour. Dies which have the shape cut through from top to bottom, for press work, are roughed out on a metal jig-sawing machine, and finished on a slotting machine or a filing machine. which passes a file up and down while the die is held on a table and moved about as required. Large dies are often cut out by means of the oxy-acetylene blowpipe. A die-sinking machine, which is a milling machine, uses a variety of revolving cutters (see fig. 2). The difficulty with half-dies, pairs of which make cylindrical or spherical shapes, is the cutting of the half-round recesses. A *cherry* cutter is utilized for these; instead of revolving it is made to oscillate by the action of a curved slide on the machine, this motion (not required in other metal-working operations) cutting a half-round recess as sketched. The principle of

the copying lathe applied to the die-sinking machine, enables it to cut any intricate shapes from a pattern in sheet metal, or sunk in iron or brass, the milling cutters being guided by the movement of an arm controlled by the pattern. Pantograph engraving and die-sinking machines also work from a copy, and cut the dies to an enlarged or reduced scale. A celluloid or sheet metal copy can be used also for guidance when cutting lettering, the copy being either in one piece, or made up of the separate letters or figures clamped in a holder.

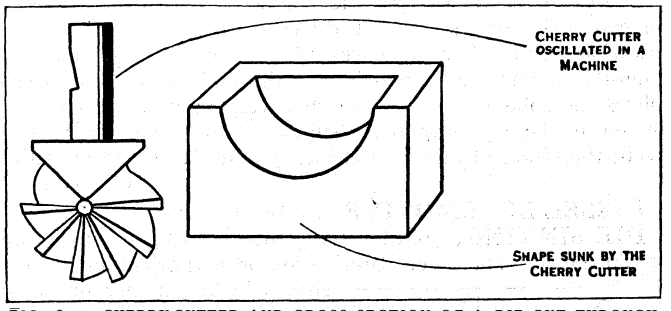


FIG. 3.— CHERRY CUTTER AND CROSS SECTION OF A DIE CUT THROUGH IN THE VERTICAL DIRECTION. AS EACH END OF THE CONCAVITY IS CLOSED. THE CHERRY CUTTER IS NECESSARY TO MILL OUT THE CURVE

DIES IRAE (Lat., "day of wrath"), the opening words of a Latin hymn on the Last Judgment, ascribed to Thomas of Celano (*c.* 1250) and forming part of the Office for the Dead and Requiem Mass; in music, the traditional plain-song melody to which the words are sung and settings in general of this portion of the Mass. Among famous examples of the latter may be mentioned those of Mozart, Cherubini, Berlioz and Verdi.

DIEST, a town in the province of Brabant, Belgium, on the Demer at its junction with the Bever. Pop. (1930) 8,389. The chief industry is brewing.

DIESTERWEG, FRIEDRICH ADOLF WILHELM (1790–1866), German educationist, was born at Siegen on Oct. 29, 1790. Educated at Herborn and Tiibingen universities, he began teaching in 1811. In 1820 he was appointed director of the teachers' seminary at Mörs, where he put in practice the methods of Pestalozzi. In 1832 he became director of the new state-schools seminary in Berlin. In 1846 he established the Pestalozzi institution at Pankow, and the Pestalozzi societies for the support of teachers' widows and orphans. In 1858 he was elected to the chamber of deputies as member for Berlin, and voted with the Liberal opposition. He died in Berlin on July 7, 1866. Diesterweg wrote several text-books and educational works, including *Wegweiser f. deutsche* Lehrer (1834), and in 1827 established *Rheinische Blätter* f. *Erziehung* u. Unterricht.

See W. Kreitz, Diesterweg *u.* die *Lehrerbildung* (1890) and K. Richter, Diesterweg *nach seinem* Leben und Wirken (1890).

DIET, a term used in two senses, (1) food or the regulation of feeding (see DIET AND DIETETICS), (2) an assembly or council. We are only concerned here with this second sense, and in particular with the diet of the Holy Roman empire and its relation to its successors in modern Germany.

The origin of the diet, or deliberative assembly, of the Holy Roman empire must be sought in the *placitum* of the Frankish empire. This represented the tribal assembly of the Franks, meeting partly for a military review on the eve of the summer campaign, partly for deliberation on important matters of politics and justice. By the side of this larger assembly, however, which contained in theory, if not in practice, the whole body of Franks, available for war, there had developed, even before Carolingian times, a smaller body composed of the magnates of the empire, both lay and ecclesiastical. The germ of this smaller body is to be found in the episcopal synods, which, afforced by the attendance of lay magnates, came to be used by the king for the settlement of national affairs. It is from this assembly of magnates that the diet of mediaeval Germany springs. The general assembly became meaningless and unnecesary, as the feudal array gradually superseded the old levy en *masse,* in which each freeman had been liable to service; and after the close of the 10th century it no longer existed.

The imperial diet (*reichstag*) of the middle ages might sometimes contain representatives of Italy; but it was practically always confined to the magnates of Germany. The regular members were the princes (*Fürsten*), both lay and ecclesiastical. In the 13th century the seven electors began to disengage themselves from the princes as a separate element; and the Golden Bull (1356) made their separation complete; from the 14th century onwards the nobles (both counts and other lords) attend along with the princes; and after 1250 the imperial and episcopal towns often appear through their representatives. By the 14th century, therefore, the originally homogeneous diet of princes is already, in practice, if not yet in legal form, divided into three colleges—the electors, the princes and nobles, and the representatives of the towns (though as we shall see, the latter can hardly be reckoned as regular members until the century of the Reformation). The powers of the diet during the middle ages extended to matters such as legislation, the decision upon military expeditions (especially the *expeditio* Romana), taxation and changes in the constitution of the principalities or the empire. The election of the king which was originally regarded as one of the powers of the diet, had passed to the electors by the middle of the 13th century.

A new era in the history of the diet begins with the Reformation. The division of the diet into three colleges was henceforth definite and precise. The representatives of the towns became regular members; but it was not until 1648 that they were recognized as equal to the other estates of the diet. The estate of the princes and counts, which stood midway between the electors and the towns, also attained, in the years that followed the Reformation, its final organization. The vote of the great princes ceased to be personal and began to be territorial: it was not the status of princely rank, but the possession of a principality which was henceforward a title to membership. The position of the counts and other lords, who joined with the princes in forming the middle estate, was also finally fixed by the middle of the 17th century. While each of the princes enjoyed an individual vote, the counts and other lords were arranged in groups, each of which voted as a whole, though the whole of its vote (*Kurialstimme*) only counted as equal to the vote of a single prince (Virilstimme).

There were six of these groups; but as the votes of the whole college of princes and counts (at any rate in the 18th century) numbered 100, they could exercise but little weight.

The last era in the history of the diet may be said to open with the treaty of Westphalia (1648). The treaty acknowledged that Germany was no longer a unitary State, but a loose confederation of sovereign princes; and the diet accordingly ceased to bear the character of a national assembly, and became a mere congress of envoys. The last diet which issued a regular "recess" (*reichsabschied*—the term applied to the *acta* of the diet, as formally compiled and enunciated at its dissolution) was that of Regensburg in 1654. The next diet, which met at Regensburg in 1663, never issued a recess, and was never dissolved; it continued in permanent session, as it were, till the dissolution of the empire in 1806. This result was achieved by the process of turning the diet from an assembly of principals into a congress of envoys. The emperor was represented by two *commissarii;* the electors, princes and towns were similarly represented by their accredited agents. In practice the diet had nothing to do; and its members occupied themselves in "wrangling about chairs"—that is to say, in unending disputes about rights of precedence.

In the Germanic Confederation, which occupies the interval between the death of the Holy Roman empire and the formation of the North German Confederation (1815–66), a diet (*Bundestag*) existed, which was modelled on the old diet of the 18th century. It was a standing congress of envoys at Frankfurt-on-Main. In the North German Confederation (1867–70) a new departure was made, which was followed in the constitution of the German empire after 1870. Two bodies were instituted—a bundesmt, which resembled the old diet in being a congress of envoys sent by the different States of the confederation, and a reichstag, which bore the name of the old diet, but differed en-

tirely in composition. The new *reichstag* was a popular representative assembly, based on wide suffrage and elected by ballot; and, above all, it was an assembly representing, not the several States, but the whole empire, which was divided for this purpose into electoral districts. Both as a popular assembly, and as an assembly which represents the whole of a united Germany, the *reichstag* of modern Germany goes back, one may almost say, beyond the diet even of the middle ages, to the days of the old Teutonic folk-moot.

See R. Schroder, *Lehrbuch der deutschen Rechtsgeschichte* (1902), pp. 149, 508, 820, 880. Schroder gives a bibliography of monographs bearing on the history of the mediaeval diet. (E. B.)

DIET and **DIETETICS,** that part of science which deals with food, its composition and its value to the animal economy in supplying the necessary material for life and work.

Food may be defined as that which when taken into the body may be utilized for the formation and repair of body tissues and for the production of energy. When a living being is increasing in size, materials must obviously be supplied for the purpose, and the food must contain in some form the actual chemical constituents of the new tissues which are being laid down. Even in the adult the various parts of the body undergo wear and tear just as any machine does and this loss of substance must be replaced from the food.

It is not necessary that all the chemical compounds which are found in the body shall be present in the food; but the necessary chemical elements and certain complex groupings must be provided from which the body can build up what it needs. Only a small part of the ingested food is made use of for purposes of growth or replacement; most of it is needed for the liberation of energy to perform muscular and glandular work, and partly for conversion into heat. The law of conservation of energy has been found to apply to man and animals as well as to inanimate nature; the income and expenditure of energy in the body are equal.

The energy value of foodstuffs is universally expressed in terms of heat units or *calories* (referred to in this article as C.). The calorie (C) is the quantity of heat energy required to raise the temperature of one kilogram of water by 1° Centigrade. The total energy that can be obtained from food is determined by burning a known weight of foodstuff in oxygen and measuring the amount of heat produced by the combustion.

Essential Constituents. — The essential constituents of a diet are *proteins, fats, carbohydrates, vitamins, water* and *salts. Proteins* are complex bodies containing the elements C, H, O, N, and sometimes P, S, and Fe. They are the only constituents of the diet which contain nitrogen in a form which may be used for purposes of body building or of repair. The albumen of egg white, vitellin of egg yolk, myosin of meat, casein of milk and glutein of flour are examples. Meat extract, soups and beef tea have practically no energy value though they probably improve the appetite and increase the flow of the digestive juices.

Fats are compounds of glycerin with acids containing a large number of carbon, hydrogen and oxygen atoms and afford much energy when burnt. Butter, lard, suet, olive oil are examples of nearly pure fats, but fat is a constituent of most natural foodstuffs in varying quantity.

Carbohydrates contain carbon, hydrogen and oxygen, the two latter elements being present in the same proportions as they are in water. They are met in a variety of *forms* — *starch,* a prominent constituent of wheat and other cereals and potatoes; *sugar,* of which several kinds are distinguished; e.g., *cane sugar* of sugar cane and beetroot, milk sugar or *lactose* of milk, *glucose* and *fructose* in fruits and honey.

These three kinds of foodstuffs yield energy on being oxidized in the body, so that in a diet they may be replaced one by the other to a considerable extent. But we shall see that certain minimal amounts of the individual foodstuffs are essential if health and growth are to be maintained. The accepted values for the energy liberated by 1gm. of each of the foodstuffs when burnt in the body are as follows: — Protein 4·1 C.; carbohydrate 4·1 C.; fat 9.3 C. If protein is completely combusted outside the body it yields 5·6 C. per 1 gm. The destruction of protein in the body is, however, not so complete, as a certain number of products are excreted in the urine which are capable of still further oxidation and liberation of energy.

ENERGY REQUIREMENTS

Basal Metabolism. — For a first calculation it is desirable to determine the total food requirements in terms of calorie value, for we have to provide sufficient energy to meet individual needs. Living matter is continually undergoing chemical changes and as a result of these activities energy is being liberated. This process is taking place on a considerable scale even when the body is under conditions of complete physical and mental rest. The amount of energy evolved is found to be correlated most closely with the *surface area* and less closely with the body weight.

It is found desirable for comparative purposes to determine the energy output first under so-called *basal* conditions — namely at complete bodily rest after the digestion and absorption of the last meal has been completed. In adult males the energy liberated under such conditions (basal metabolism) is 40 C. per sq. metre of body surface per hour or less accurately 1 C. per kg. body weight per hour. The surface area can be calculated from du Bois' formula $S = \cdot 007184 \times W^{0.425} \times H^{0.725}$, where S is the surface in sq. metre, W the weight in kilograms and H the height in centimetres. In females the metabolic processes are slightly less active and only amount to 37 C. per sq. metre per hour.

Mean Heights, Weights and Surface Area

	Height.	Weight.	Surface area.
Men.			
American and Canadian insured persons 1912 .	5′ 8·5″ (174 cm.)	155 lb. (70·3 kilo)	1·792 sq. metres
British Association (1883) for England (ages 20–50)	5′ 7·4″ (171 cm.)	155 lb. (70·3 kilo)	1·772 sq. metres
Women.			
American and Canadian persons 1912 .	5′ 4·5″ (163·8 cm.)	134 lb. (60·8 kilo)	1·60j sq. metres
British Association (1883) for England (ages 20–50)	5′ 2·7″ (159·3 cm.)	122·8 lb. (55·7 kilo)	1·511 sq. metres

The weights quoted are with the clothes on; 10 lb. has been subtracted from them before compiling the surface area to allow for the weight of the clothes.

The English figures are old, but have recently been confirmed for nearly 5,000 working women. An English adult with a surface area of 1·772 sq. metre would have a basal metabolism of 1·772 × 40 C. per hr. or 1701 C. per 24 hours. The basal metabolism diminishes slightly as age advances, so that the resting energy requirements of the old are less than those of young adults. This large resting energy output is devoted to a small extent to maintain the activity of the vital organs — to enable the heart, the brain, the respiratory muscles and the essential glands to continue their functions; but in the main the energy is converted into heat and used to maintain the normal temperature of the body.

The basal metabolism is altered by changes of external temperature. On exposure to cold, metabolism is stimulated, chiefly by increased muscular activity; on exposure to heat, it is somewhat surprising to find that there is little depression of the metabolism. Immediate compensation is established by sweating and flushing the skin with blood. In the tropics, however, it has been shown by de Almeida that the metabolic rate is about 25% lower than it is in the temperate zone, and food requirements would be correspondingly diminished. A rise of 1° F. in body temperature causes an increase of 7% in the metabolism, so that a patient with a temperature of 105° F. would have a metabolic rate which is 50% above normal.

Prolonged under-nutrition results in a great lowering of the resting metabolism and this may be regarded as a protective reaction on the part of the tissues to the unfavourable environment.

The ingestion of *food* results in an increase in metabolism; this is mainly due to the stimulating action exerted by the products of digestion on the tissue cells. This effect varies with the kind of food consumed, and is more marked with protein than with fats or carbohydrates. This property of protein is referred to as its "specific dynamic action" and is due to the action of the amino-acids of which it is composed, more especially glycine and alanine. It is difficult to see what advantage is conferred on the body by the specific dynamic action of protein; it gives rise to a wasteful expenditure of energy quite independently of the needs of the body. The effect of an ordinary mixed diet is to increase the daily metabolism by about 10%.

Finally energy is needed for the carrying out of physical *work*. It is difficult to compute the energy expended during ordinary body movements and in the various avocations. It must be remembered that the mechanical efficiency of the body is about **25%;** by this is meant that only 25% of the energy freed as a result of the chemical transformation in the muscles is converted into work and the remaining 75% is dissipated as heat. Consequently if the energy value of the work done is expressed in heat units, this figure must be multiplied by four to obtain the amount of energy liberated in the body during the process. An example may help to make this clearer. It is usual to assume that the average amount of work done daily may be represented by eight hours' continuous moderate work. It has been shown by Waller that a young man may perform in eight hours without fatigue about 100,000 kilogram-metres of work in raising his body by going up a staircase. This is equivalent to **240** C. when expressed in heat units. The total energy liberated during the process is $240 \times 4 = 960$ C. An increase of about 20% in the metabolism is produced by moving about a room, carrying out the small activities of daily life and being exposed to fluctuations in the external temperature.

Average Calorie Requirements — We can now calculate the daily calorie requirements of an average man in whom the basal metabolism is 71·1 C. per hour. It is convenient to divide the day into three eight-hour periods:

Eight hours' sleep, eight hours' rest and eight hours' work

	Calories
eight hours asleep at 71·1 (Basal metabolism)	568.8
eight hours awake at 92·4 (basal+30% *i.e.*+ 10% for action of food and 20% for minor activities)	739·2
eight hours' work (basal+960 C.)	1,528·8
Total	2,836·8
Add for locomotion and travelling	300
	3,136·8 (Starling)

In the above-given estimate an allowance had been made for the energy expended in travelling between home and place of occupation. The Food (War) Committee of the Royal Society suggested that the various occupations should be classified as follows as far as the energy requirements for the work are covered: —

Sedentary: less than 400 C. in excess of resting requirements.
Light work: 400 to 700 C. in excess of resting requirements.
Moderate work: 700–1,100 C. in excess of resting requirements.
Heavy work: 1,100–2,000 C. in excess of resting requirements.

Among the sedentary pursuits must be included all classes of brain worker. Even the most intense mental activity causes no appreciable increase in the metabolism. In a country like Great Britain determinations of the total energy expended by different classes of workers have shown that the average is about **3,000** C. per diem. A distinction must be drawn between the energy value of the digested food and of the food as purchased. A small percentage of the food escapes digestion and absorption and is eliminated in the fæces; this is more marked on a vegetable than on an animal diet. It is usual to deduct 10% from the theoretical calorie value of the mixed diet to allow for this loss. Thus if 3,000 C. are needed by the body, the daily ration should contain 3,300 C. and this represents a fair average allowance for each adult male of the population. The energy requirements of working *women* can be similarly calculated and found to be about 2,200 C. A net allowance of 2,400 C. would be ample and leave an adequate surplus for household duties. The calorie value of the food as purchased should be **2,650** C. The food requirements of a purely sedentary worker should not exceed 2,100 C.

Calorie Needs of Children. — The energy needs of *children* are extremely difficult to compute. The basal metabolism in children per square metre of body surface per hour is considerably higher than in adults; *e.g.* age **6,** 57·5 C.; age 12·6, 50·4 C.; age 13·7, **49.4** C.; age **16**·5, 43·0 C.; age 20·25, 40·7 C. (du Bois). Greenwood has calculated from the scanty data available the basal requirements in calories of boys and girls.

Age	5	6	7	8	9
Boys	1026	1100	1159	1197	1262
Girls	1008	1057	1110	1163	1201
Age	**10**	**11**	**12**	**13**	**14**
Boys	1328	1358	1389	1430	1499
Girls	1266	1321	1399	1476	1539

The fact that *growth* is occurring implies that excess of energy must be taken over and above that required to furnish the energy output of the body. Between the ages of 11 and **16** both sexes put on weight at the average rate of about **4** kilos a year. This is equivalent to only **30** C. per day; but the growing body is formed at the expense of many different varieties of food which have to undergo chemical conversions of different kinds before they can take their place as part of the living body, so that probably the amount of energy which must be provided in the food to produce the necessary increase in weight is considerably in excess of 30 C. It is very difficult to compute the energy output due to muscular activity in children. Lusk gives the following table to show the food requirements of children in relation to that of an average man or woman:

Age.	Coefficients.	Utilizable calories.
Averageman	1·0	3,000
Average woman	0·83	2,500
0–6 (both sexes)	0·5	1,500
6–10 (,, ,,)	0·7	1,800
10–14 (,, ,,)	0·83	2,500
14–20 (boys)	1·0	3,000
14–20 (girls)	0·83	2,500

Average and Total "Man Value." — By using these coefficients we can determine the "average and total man value" of a mixed population.

Ages.	Population.	"Man Value" per head.	Total "Man Value."
0–6	5,772,153	0·5	2,886,076
6–10	3,708,513	0·7	2,595,959
10–14	3,548,403	0·83	2,945,174
Males 14 and upward	15,436,633	1·0	15,436,633
Females 14 and upward	16,807,929	0·83	13,950,581
	45,273,631	0·835	37,814,423

The table quoted from Starling shows the calculation made for **1911** population of the United Kingdom. Allowing 3,300 C. per man per day, the total requirements of the whole population would amount to approximately **45.5** billion calories. It is interesting to note that the average annual requirements per head are **1,200,000** C. A computation has been made of the calorie value of the food available for consumption in the United Kingdom during the years 1909–13. It amounted to just over **47** billion calories, which gave a daily ration of 3,410 C. per "average man." In France, according to official statistics, the average consumption per man per day before the war was 3,800 C.; in 1916–17, **3,300** C.; in 1917–18, **2,900** C. Some small addition must be added to these figures for the calorie value of cottage and garden production which cannot be determined accurately. The average energy consumption per head for all countries is **3,400** C.

World's Calorie Requirements. — Holmes has presented data to show the amount of energy contributed annually to the world's requirements by the more important food materials. Expressed in trillion calories the figures are: — Rice 900, wheat 382, sugar 209, rye 164, barley 119, potatoes 99, meat 62. The figures show clearly how dependent mankind is on cereals for the major part of its energy needs. The consumption of meat is concentrated in relatively few countries. No data are available for China, India or Japan where the amount used is known to be small. The highest figures are those of the meat raising countries, Australia, Argentine and the U.S.A. where the number of lb. of meat and meat products consumed per head annually are 262.6, 140 and 171 lb. respectively. In Great Britain the figure is 119 lb. and in Portugal only 44 lb.

If the diet of many nations is surveyed, it is found that meat, including fish, poultry and eggs, supplies 20% of the calories and about the same percentage of the protein; milk and its produces 13–17% of the calories and 14–25% of the protein; cereals 35–40% of both calories and protein. The greatest variation is found in the nature of the cereal used. In Great Britain and France it is almost exclusively wheat; in U.S A. maize is not unimportant; in Germany especially among the rural population, rye is used almost exclusively. The part played by sugar is greatest in Great Britain and the U.S.A. but is considerable in all countries. Potatoes usually furnish 10–12% of the total energy needs and a somewhat smaller part of the protein.

COMPOSITION OF COMMON FOODSTUFFS

The coinposition of the common foodstuffs must now be surveyed.

Table of composition and calorie value of more important foodstuffs adopted by the Inter-Allied Scientific Food Commission. (The carbohydrate content is not quoted but is taken into account in calculating the energy values.)

Commodity.	Protein %.	Fat %.	Calories per kg.
Cereals			
Wheat and barley flour	11·5	1·0	3,640
Oatmeal	16·0	8·0	4,000
Barley meal	10·5	2·2	3,600
Rice	8·0	0·3	3,540
Meat			
Beef, prewar	14·5	22·5	2,690
Beef, wartime	15·0	18·0	2,290
Veal	16·0	6·3	1,230
Mutton	13·5	24–30	2,790–3,340
Bacon	9·5	60·0	6,000
Ham	14·5	34·0	3,750
Poultry and game	15·0	9·5	1,500
Herrings	11·6	4·0	850
Fresh fish	10·0	1·0	500
Dairy produce			
Eggs at 2 oz	12·0	9·5	1,400
Milk	3·3	3·7	700
Butter	1·0	85·0	7,950
Cheese	25·0	30·0	4,000
Margarine	1·2	83·5	7,800
Lard	2·2	94·0	8,800
Fresh fruits	av. 0·7	0·4	500
Nuts	av. 6·5	22·8	2600
Potatoes	1·8	0·1	700
Shelled peas and beans	7·0	0·5	1,000
Dried peas	24·3	1·3	3,600
Refined sugar	..	..	4,100
Cocoa	15·0	34·0	4,800
Olive oil	..	100·0	9,300

The percentage *carbohydrate* content of the different classes of food are: cereals 66–75; meat and poultry, eggs, fish, butter, olive oil, nothing or a trace; milk j; cheese 24; peas and beans 60; potatoes 14–18; fruits 4–14; starch go; sugar 100.

The percentage composition of *bread* is: protein 9·0, fat 1·5, carbohydrate 53, calories 1,200 per 1 lb.

The proportions of protein, carbohydrates and fat in a normal diet have been given somewhat differently by different authorities. (1) Royal Society Food (War) Committee; (2) and (3) from Voit.

Protein. — As has been pointed out previously, protein is an essential constituent of the diet because it is the only class of foodstuff containing Nitrogen (and Sulphur) in a form which can be assimilated by the tissue cells and used for the replacement of the nitrogen lost as a result of the normal cell activities.

Anywhere in the world except among the destitute, the protein consumption does not fall below 1 g. per kilo. per diem, or 70 g. for a man of average weight; in N. Europe and the U S.A the figure is more like 1·3 g. to 1·5 g. per kilo. or about 100 g. per man. 8·5% of the total calories needed are obtained from protein in the Orient and among the poorer classes of mankind; 18 to 19% in Swedish and Finnish diets; 44% among the Esquimaux; the average for normal diets is 12–15% and only exceeds 18% in exceptional circumstances. The amount of protein consumed varies directly with the wealth and social position of the individual; it is not increased in the case of men doing hard work. Thus the lumber men of Maine or Sweden who consume 8,000–9,000 calories daily, obtain only 10·5% of their calories from protein and about 58% from fat.

The *minimum* protein requirements are probably 30 to 40 g. per day, provided that the protein is of the proper constitution. On such a ration, if enough carbohydrate and fat is consumed to provide the full energy requirements of the individual nitrogenous balance may be maintained, the amount of nitrogen lost (chiefly in the urine), being no greater than the amount ingested. But with certain kinds of protein it is impossible to obtain nitrogen balance no matter how much is consumed. Some of the amino-acids present in protein are essential for the proper functioning of the body, presumably because they cannot be synthesized and so must be provided in the food and serve for the formation of essential secretions or enzymes. These amino-acids are tryptophane, tyrosine, lysine, cystine and histidine. Without tryptophane or histidine body weight cannot be maintained; without lysine growth cannot occur. Adequate amounts of cystine are essential if a normal rate of growth is to occur. Proteins which are deficient in any of these amino-acids are of inferior biological value and cannot in themselves produce healthy development. *Gliadin* of wheat contains no lysine; *zein* of maize is deficient in tryptophane and lysine; *gelatin* contains no tryptophane or tyrosine; *casein* is deficient in cystine but together with the lactalbumen of milk forms a satisfactory source of protein. Proteins which contain all the essential amino-acids are ovalbumen (egg), glutein (wheat), glutelin (maize), excelsin (brazil nut), lactalbumen (milk).

Experiments have been carried out by Chittenden, Hindhede and others, in which nitrogenous equilibrium, unimpaired health, and mental and physical vigour have been maintained for months or years on diets which contained no more than 30 to 50 g. protein daily. But the proteins were specially selected and were of high biological value. To provide a margin of safety when consuming a mixed diet. a minimum of 80 g. should be aimed at and this tallies better with the general experience of mankind. Bayliss said "Take care of the calories and the proteins will take care of themselves" because if dietaries are studied it is found that if the calorie value of a mixed diet is adequate it will probably contain 100 g. of protein or even more.

Vegetable proteins as a class are rather less effective as body builders, but there are marked exceptions; the proteins of potato being one of the most efficient. The mixed proteins of wheat or maize as found in flour or meal will maintain nitrogenous equilib-

rium at a fairly low level, particularly if whole grain is used and if it be supplemented by small quantities of other proteins such as those of milk.

Fat.—The amount of fat consumed varies with the country, economic status, occupation and the time. The maximum fat content of the native diets in Japan is about 30 g. per day, which is (except during the war period) the European minimum. The amount of fat eaten increases steadily with the income. The Inter-Allied Food Commission adopted 57 g. daily as the minimum fat ration, during the war. Experiments of short duration have been carried out (Hindhede) in which health and weight were maintained on diets of high total calorie value with as little as 10·9, 13·8 and 13·9 g. of fat daily. Although the body can adapt itself to partial or even complete deprivation of fat for short periods (probably preparing the necessary fat from the carbohydrate of the food) deleterious effects will become apparent after months or years. The significance of fat in the diet depends on several factors. It is highly assimilable and is almost entirely absorbed from the alimentary canal. But its absorption is a gradual process, not reaching its maximum till five or six hours after a meal. Man is unaccustomed to work with the alimentary canal entirely at rest, and when the digestion of the last meal is finished, hunger recurs and affects the efficiency of the work.

The bulk of the food becomes of importance when the total energy requirements of the body are very large. Weight for weight fat has double the calorie value of starch or sugar. Fat, in addition, is taken without admixture in a pure form, whereas the other foods are all mixed with a considerable proportion of water; when starch is cooked it is swollen up with fire to ten times its voiume of water. As has been pointed out, the Swedish and American lumbermen and the Welsh miners obtain a large part of their huge calorie intake from fat. Carbohydrates are more subject to fermentative changes in the intestine with the production of gases and general discomfort. A study of dietaries shows that a normal diet of 3,000 C. should contain 75 g. fat (698 C.); the proportion of fat in the diet may be increased to 35% of the total calories where there is abundance of animal food; the fat ration should always be high if there is a large increase in the energy expenditure of the body, either in the form of work or in consequence of exposure to cold (Starling).

As is shown below, the animal fats are the most important sources of some of the vitamins; *i.e.*, A, D and E. The vegetable fats are an equally effective source of energy, but are deficient in vitamins. It is advisable from the point of view of the health of the community that margarine should not be made exclusively from vegetable oils, but should have added to it animal fats (not lard) or milk fats.

Carbohydrates furnish more than 50% of the energy content of most diets, and are a cheap and readily obtained food. If greatly reduced in amount. the fats are incompletely oxidized and give rise to poisonous bodies such as β-hydroxy-butyric acid and aceto-acetic acid. As both carbohydrate and fat serve chiefly as sources of energy, they can replace one another to a considerable extent, so long as precautions are taken to ensure the minimum amounts of fat specified above.

Vitamins.—The vitamins (*q.v.*) or accessory food factors are a group of substances of unknown chemical composition present in the food which are essential for adequate growth and for the maintenance of health. Five such bodies have been described—vitamins **A,** B, C, D and E.

Vitamin A (fat soluble A) is found associated with certain animal fats; *e.g.*, butter, cream, beef-fat, cod liver oil, eggs and the embryo of seeds; and green vegetables. It is absent from root vegetables and from vegetable fats; *e.g.*, linseed oil, olive oil. It is not found to any extent in lard. It is therefore absent in purely vegetable margarine. It is a fairly stable substance and can resist the ordinary processes of cooking. It is essential for *growth* in young animals and promotes the resistance of the various mucous membranes, as of the intestinal or respiratory tract or the eye, against infection. in its absence disorders like broncho-pneumonia, enteritis and inflammation of the eyes are common

Vitamin B (water soluble B) is found in most natural foodstuifs, especially in seeds and eggs. In the pulses it is found throughout the seed; in the cereals it is only found in the germ and the bran. It is present in yeast. It is absent from white flour and is apparently present in inadequate amounts in white bread, in spite of the yeast which is added previous to baking. Wholemeal bread is an important source of the vitamin. This vitamin probably exerts a specific stimulating action on the functions of the digestive tract, increases the movements of the bowel and aids effective digestion and absorption of the food.

Vitamin C (antiscorbutic vitamin) is found in *fresh* foodstuffs: fruit juices; *e.g.*, lemon, orange; vegetables; *e.g.*, raw cabbage leaves, raw juice of swedes, and to some extent in potato. It is present in small amounts in fresh milk, and it is formed during the process of germination of seeds. This vitamin is rapidly destroyed by heating at 100° C. (especially in an alkaline medium) and by drying. It is absent from dried, canned or preserved foods. The absence of the vitamin results in a condition called scurvy which is characterized by haemorrhages from different parts of the body.

Vitamin D (anti-rachitic vitamin) has a very similar distribution in nature to Vitamin A. It can be synthesized from a complex lipoid, ergosterol, by means of ultra-violet rays. It is present in cod-liver oil, beef suet, lard and to a less extent in vegetable fats. It is believed to promote the absorption of calcium and phosphorus from the bowel and thus ensure sufficient concentrations of these substances in the blood to ensure normal development of the skeleton.

Vitamin E is a recently described accessory factor which is necessary for fertility in both sexes. It is present in whole wheat. wheat germ, lettuce, rolled oats and milk fat.

It is clear from this brief survey of the distribution and properties of the vitamins that *animal fats, eggs, milk, fresh fruit and vegetables* and *whole cereals* should be present in adequate amounts in the dietary to ensure normal growth, health and reproductory vigour.

WATER, SALTS, COOKING, ETC.

Water and Mineral **Salts.**—*Water* does not afford energy since it is already completely "burnt" or oxidized. It may be looked on, however, as a kind of food as it is necessary for the proper working of the animal machine; it can be compared to some extent to the lubricating oil used for the moving parts of the petrol motor. Water is continually being lost in the urine and lungs and sweat and faeces and it must be replaced. The *mineral* constituents of the human body amount to 4·3–4·4%. The only salt commonly consumed as such is table salt or sodium chloride (NaCl). The various salts needed by the body are present in small amounts in food, particularly in milk and in vegetables. 1–2 g. of NaCl are needed daily, and while custom varies considerably, the average intake is probably nearer 8–10 g. Possibly habit has resulted in the use of much more NaCl in the human dietary than is physiologically necessary. 0·9–1 g. of *calcium* is needed daily (Sherman), and the minimum necessary for the maintenance of a calcium balance is 0.63 g. calcium per 70 kg. of body weight. Of the American diets investigated by Sherman 15% were found to be deficient in calcium. A sufficient calcium supply is very important, especially in children because calcium phosphate is the chief constituent of bone and is best obtained by the ingestion of liberal quantities of milk Of *phosphate* 0·88 g. is the minimum needed per 70 kg. body weight, but there is no risk of phosphorus shortage in diets yielding 3,000 C. daily unless large amounts of degerminated patent flour are consumed as the principal cereal.

Iron is an essential constituent of the food since it is its presence in the haemoglobin of the red corpuscles which endows the blood with the power of transporting oxygen from the lungs to the tissues. The daily intake of iron should be not less than 12 mgm daily, a figure which should be increased in pregnancy and in lactation. it must be mentioned that milk is very deficient in iron, and that this substance is principally obtained from animal Food and the chlorophyll of green vegetables. It has been shown in animal experiments that iron deficiency leads to impoverish-

ment of the blood and stunting of growth. A similar anaemia develops in infants at the 6th month if they have been fed exclusively on milk, hut rapid recovery is noted when a mixed diet is commenced. It is now advised thai infants shall be given small amounts of soups prepared from marrow bones and mixed vegetables from the 3rd month onwards, partly to prevent this anaemia.

Iodine in minute traces is essential for the preparation of thyroxin which is the name given to the active principle of the secretion of the thyroid gland. In districts in which the iodine supplies in the drinking water are insufficient simple goitre frequently develops. This may be prevented or the condition may be cured by the use of iodized table salt, or by the deliberate addition of iodine to the water supply *(see* GOITRE).

Vegetarian Diet.—The real objection to the free use of meat *(see* VEGETARIANISM) is that though animals are partly fed on materials not required for human consumption (cow, sheep), they are to some extent grain fed (pig, fowl), or live on products that are grown on land which might otherwise be used for vegetables, grain or fruit. To this extent animals compete with man for utilizable foods. The cow, pig and fowl consume 12–14 lb. dry fodder for each 1 lb. of dry human food produced (as meat, eggs, etc.); the sheep 24 lb. and the ox 64 lb. (Wood). Prime beef is thus the most extravagant of all forms of animal food as regards the quantity of vegetable food required to produce it. Because of these facts, meat is dear, and if too large a proportion of the income is expended on meat there is not enough left for milk and vegetables which are indispensable constituents of the diet.

The great disadvantage of a purely vegetarian diet is its bulk. This objection does not apply to a lacto-vegetarian diet which permits the free use of milk and eggs; in fact such a diet has much to commend it (Greenwald). It need not be bulky. The milk and eggs furnish protein of exceptionally good quality to compensate for possible deficiencies in those supplied by other articles of the diet, and they contain much phosphorus and calcium, the latter of which is apt to be present in inadequate amounts if milk is not included in the diet and they furnish a considerable, if seasonally-varying quantity of some of the vitamins. Moreover the cow and hen return in the form of milk and eggs much more of the energy they receive than they do if kept for their meat (Armsby).

Cooking.—The great value of cooking lies in making dishes attractive to the palate and other senses and thus ensuring an adequate intake of food; it improves the digestibility of certain classes of food partly by splitting the envelopes of the starchy granules and also by destroying certain substances which prevent the action of the digestive enzymes. It kills micro-organisms and other parasites. It has a destructive action, however, on some of the vitamins, but this is of considerable extent only in the case of the antiscorbutic factor, and it can be readily compensated for by taking fresh fruit or vegetables.

When the diet is controlled by authority the essential points to be borne in mind are:—the prbvision of the necessary *calories,* which will almost certainly ensure adequate amounts of protein; the maintenance of a minimum *fat* supply; plentiful supplies of *milk* and milk products especially for children and of *fresh vegetable food.*

Army and Navy Food Scales.—To illustrate how the practical problems of dietetics are treated, a brief reference will be made to the procedure in the navy and army.

In the British navy *(see* Appendix XIX. King's Regulations and Admiralty Instructions) the daily standard ration, service afloat, is 10 oz. bread, ½ lb. fresh meat, 1 lb. fresh vegetables or 4 oz. haricot beans or marrow fat beans when fresh vegetables are not available, ½ pint spirit, 2 oz. sugar, ½ oz. tea, ½ oz. chocolate (or 1 oz. coffee), ¾ oz. condensed milk, 1 oz. jam, marmalade or pickles, 4 oz. corned beef on one day of the week in harbour or on two days at sea, mustard, pepper, vinegar and salt as required. This ration is supplemented by money allowances, out of which the men purchase at their discretion the extra foodstuffs necessary to complete their messing.

In the army *(see* 40/WO/8263 [Management of Soldiers Messing] and 40/WO/9071 [Manual of Military Cooking and Dietary]) the diet provided contains Protein 136 g., Fats 138 g., Carbohydrates 442 g.

The daily scale of rations is:—Meat, fresh or frozen 12 oz. (or preserved meat 9 oz.); bread 16 oz. (or biscuits 12 oz.); bacon 2 oz.; sugar 1½ oz.; tea ⅜ oz.; suet ¼ oz.; cheese 1 oz.; jam or syrup 1½ oz.; margarine 1 oz. Messing cash allowance of 3½ d. per day.

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DIETARY: *see* DIET AND DIETETICS.

DIETERICI, FRIEDRICH (1821–1903), German orientalist, and a pioneer in mediaeval Arabic studies, was born on July 6, 1821, in Berlin, where he died on Aug. 18, 1903. He travelled in Egypt and the Near East from 1847–49 and on his return became professor at Berlin. His writings did much to stimulate an appreciation of the speculations of the mediaeval Arabs; they include *Alfijgah, carmen grammaticum auctore Ibn Mâlik* (1851); *Mutanabbii carmina cum commentario Wâhidii* (1858); *Die Philosophie der Araber im 9 u. 10 Jhr. n. Chr.* (1876–95); *Die sogenannte Theologie des Aristoteles* (trans. from Arabic, 1883); *Der Streit zwischen Mensch u. Thier . . . aus den Schriften der lauteren Brüder übersetzt* (1858); *Alfarabis philosophische Abhandlungen* (Arabic ed. 1892); *Der Musterstaat von Alfarabi* (trans. from Arabic, 1900); *Christomathie Ottomane* (1854) and an oriental novel, *Mirjant* (1886).

DIETHER VON ISENBURG (1412–1463), second son of Count Diether of Isenburg-Biidingen, was rector of the University of Erfurt in 1434 and became archbishop of Mainz in 1450. He led the movement for the reform of the empire, and the opposition to the papal encroachments, supporting the theory of Church government enunciated at the Councils of Basel and Constance and condemned in Pius II.'s bull, *Execrabilis. (See* PAPACY.)

DIETRICH, CHRISTIAN WILHELM ERNST (1712–1774), German painter and engraver, was born at Weimar on Oct. 31, 1712, and died at Dresden on April 24, 1774. He was taught by his father, Johann George, painter of miniatures to the court and was then sent to Dresden to work under Alexander Thiele, the landscape painter. Augustus II., king of Saxony, sent him to Italy and the Netherlands where he learnt to imitate the masters of the previous century with amazing fidelity. At Dresden there are pictures acknowledged to be his, bearing the fictitious dates of 1636 and 1638 and the name of Rembrandt. His "Itinerant Musicians," in the manner of Ostade, is in the National Gallery, London. In 1741 he was appointed court painter to Augustus III. at Dresden, with an annual salary conditional on the production of four pictures a year and there are 52 of his canvases and panels in one room at the Dresden Museum. A collection of his engravings at the British Museum, produced on the lines of earlier men, such as Ostade and Rembrandt, reveal both spirit and skill. Dietrich, after his return from Italy generally signed himself "Dietericij." He was director of painting at the Meissen porcelain factory and professor of the Dresden academy of arts.

DIETRICH OF BERNE, name given in popular story to Theodoric the Great. The legend differs so widely from the true history that even in mediaeval times some doubted the connection, and noted the staring anachronisms. But the identity seems to be proved by the names Dietrich (Theodoric), Dietmar (Theudemir), Berne (Verona), Raben (Ravenna); and there is some resemblance in character between Theodoric and Dietrich. The South-German cycle of Dietrich-songs is partially preserved in the *Heldettbuch* (*q.v.*), *Dietrichs Flucht,* the *Rabenschlacht,* and *Alpharts Tod;* but it was reserved for a 13th century Ice-

lander to compile a consecutive account. This prose redaction *(Vilkina* or *Thidreks Saga)* incorporates much matter from the Nibelungen and Wayland legends; in fact practically the whole South-German epos.

There are traces of a form of the story in which the hero started out from Byzantium for the conquest of Italy. But this was very early superseded by the existing legend, in which, perhaps by epic fusion with his father Theudemir, he was associated first with Attila and then with Ermanaric, by whom he was driven from his kingdom of Berne. After years of exile at Attila's court he returned with a Hunnish army and defeated Ermanaric in the Rabenschlacht (battle of Ravenna). Attila's two sons fell in the fight, and Dietrich returned to Attila to answer for their death: this seems to suggest that originally the Rabenschlacht was a defeat. In *Ermenrichs Tod* he slays Ermanaric, as in fact Theodoric slew Odoacer; and in the *Hildebrandslied* "Otacher" takes the place of Ermanaric. Dietrich's long stay with Attila represents Theodoric's youth spent at the Byzantine court; the period of exile was as usual adorned with marvellous exploits, most of which had no connection with the cycle; the poems of *König Laurin, Sigenot, Eckenlied,* and *Virginal* are based largely on independent traditions. Through Attila Dietrich enters the Nibelung cycle. In the final catastrophe it is he who, to avenge his Amelungs, at last delivers Hagen to Kriemhild. His "flame-breath" seems to be pure myth; but the tales of his demonic origin and of his being carried off by the devil may be ascribed to clerical hostility to Theodoric's Arianism.

Dietrich typifies the wise and just ruler as opposed to Ermanaric the typical tyrant. He is invariably represented as slow to anger; but once roused he overcomes even Siegfried (but probably the fight in the rose garden at Worms is a late accretion). The chief heroes of the Dietrich cycle are his tutor and comrade Hildebrand *(see* HILDEBRAND, LAY *OF),* with his nephews the Wolfings Alphart and Wolfhart; Wittich, who renounced his allegiance and slew Attila's sons; Heime and Biterolf.

The poems of the Dietrich-cycle are summarized by Uhland, *Zur Geschichte der Dichtung und Sage* (Stuttgart, 1873). *Thidrekssaga* (ed. Unger, Christiania, 1853) is translated into German by v. der Hagen, *Altdeutsche Heldensagen* (Breslau, 3rd ed., 1872). A summary of the legend is in Hodgkin, *Theodoric* (1891). Part of *Thidrekssaga* is in Mobius, *Analecta Norroena* (Leipzig, 1877). *See* also W. Grimm, *Deutsche Heldensage* (1867); accounts in Sandbach, *Saga-cycle of Dietrich* (1906); Jiriczek, *Deutsche Heldensage* (trans. Bentinck-Smith, *Northern Legends,* 1902). Original extracts, Jiriczek, *Kudrun und Dietrichepen* (Stuttgart, 189;). For full bibliography *see* Symons, *D. Heldensage,* in Paul's *Grundriss;* also Goedeke, *Geschichte der d. Dichtung* (1857–81).

DIEZ, FRIEDRICH CHRISTIAN (1794–1876), German philologist, the founder of Romance philology, was born at Giessen, Hesse-Darmstadt, on March 1;, 1794. A visit to Goethe in 1818 decided the direction to his studies. Goethe had been reading Raynouard's *Choix de poésies originales des troubadours,* and advised the young scholar to explore the rich mine of Provencal literature which the French savant had opened up. Henceforth Diez devoted himself to Romance literature. He removed in 1822 to Bonn, where he held the position of privat-docent. His *Poesie der Troubadours* (1826) and *Leben und werke der Troubadours* (1829), of both of which there are modern editions edited by Karl Bartsch, were his earliest important studies. In 1830 he became professor of modern literature at Bonn. The rest of his life was mainly occupied with the composition of the two great works on which his fame rests, the *Grammatik der romanischen Sprachen* (3 vols., Bonn. 1836–44; 5th ed. 1882), and the *Etymologisches Wörterbuch der romanischen Sprachen* (2 vols., Bonn, 1853; 5th ed. 1887); in these two works Diez did for the Romance group of languages what Jacob Grimm did for the Teutonic family. He died at Bonn on May 29, 1876. He also wrote works on Spanish and Portuguese language and early literature.

See W. Foerster, *Friedrich Diez* (1894).

DIEZ, town of Hesse-Nassau, Prussia, Germany, in the deep valley of the Lahn, crossed by an old bridge, 30 m. east from Coblenz on the railway to Wetzlar. Population 3,850. It is overlooked by a former castle of the counts of Nassau-Dillenburg, now a prison. Close by, on an eminence above the river, lies the castle of Oranienstein, formerly a Benedictine nunnery. The industries include iron works, machine-making, colour preparation, lime-burning and quarrying. In the vicinity are Fachingen, celebrated for its mineral waters, and the castle of Schaumburg.

DIFFERENTIAL, in a motor car (*q.v.*), the system of gears (usually situated in the back axle) by means of which one driving wheel may revolve with increased speed while the other is checked (in taking corners, etc.). In physics, differential apparatus, *e.g.,* a differential thermometer *(see* THERMOMETRY), is designed in such a manner that errors due to extraneous effects in the experiments are eliminated.

DIFFERENTIAL CALCULUS, ABSOLUTE: *see* TENSOR ANALYSIS.

DIFFERENTIAL EQUATIONS. If we have given the relation $y=\sin x$ and differentiate twice with respect to x, we find that $y''+y=0$. This latter equation is an ordinary differential equation. In general, an equation involving derivatives of y with respect to x, together possibly with x and y, is called an *ordinary differential equation.*

TYPES AND SOLUTIONS

Need For Differential Equations. — These equations are of frequent occurrence in mathematical analysis, geometry, physics, and chemistry. For example, the equation just referred to describes the law of motion of a particle moving in a straight line subject to an attraction, from a point in the line, that is proportional to the distance of the particle from the centre of attraction. Here x represents the time and y the distance. In order to determine where the particle will be at a given moment, we must find a function y of x that is connected with its second derivative in the way described by the equation. That is, we must do what is described as solving the differential equation.

In general, we say that a function y of the independent variable x is a solution of a differential equation if the two sides of the equation are identically equal — that is, equal for all values of x when for y and its various derivatives in the equation there are substituted the given function and its corresponding derivatives. It is not evident that a differential equation selected at random has a solution, but it will be shown later that under certain rather broad conditions solutions do exist. It is however evident independently of this that many of the simpler and more common differential equations, such as we shall discuss in the first part of this article, have solutions, as these solutions either can be seen directly or can be found by more or less ingenious devices.

Many problems might be cited from physics and chemistry to show how the statement of a natural law gives us a differential equation and how the solution of this equation furnishes information concerning natural phenomena.

An ordinary differentia1 equation is said to be of order n if it contains the nth derivative of y with respect to x, but no derivative of higher order.

Common **Types** and Solutions. — We consider now the solution of a few of the simpler and more common types. But first it should be observed that the equation

$$\frac{dy}{dx}=f(x, y) \qquad (1)$$

can be written in the form

$$dy=f(x, y)dx, \qquad (2)$$

where dx and dy represent the differentials of x and y respectively. The reader may refer to a standard text on the calculus (*q.v.*) for the precise significance of differentials.

(1) *Variables Separable.* — *If* (1) can be written in such a way that one member contains only x and its differential, the equation can be solved by two integrations, or quadratures, as they are sometimes called. For example, the equation $\frac{dy}{dx}=\frac{y}{x}$ can be written in the form $\frac{dy}{y}=\frac{dx}{x}$. Here the variables are separated. By in-

tegration we get $\log y = \log x + \log c$, or $y = cx$. Since we can give to c any constant value, we have here a whole family of loci which are all straight lines through the origin. The fact that there is an unlimited number of these loci is in agreement with the theorem to be established in the second part of this article that there is a solution passing through an arbitrary point of the plane.

(2) Exact Equations.—When (1) is written in the form

$$M dx + N dy = 0, \tag{3}$$

where M and N are functions of x and y, it may be that the left member is the exact differential of some function of x and y, as $\phi(x, y)$. When this is the case the equation is said to be exact. The solution is then obviously given by the equation $\phi(x, y) = c$. For example, the left member of the equation

$$y dx + x dy = 0$$

is the differential of xy. Hence the solution is given by the equation $xy = c$. The curves of this family are equilateral hyperbolas (see HYPERBOLA). On the other hand, the left member of the equation

$$y dx - x dy = 0$$

is not an exact differential. But if we divide through by y^2 we get

$$\frac{y dx - x dy}{y^2} = 0,$$

and the left member of this equation is the differential of $\frac{x}{y}$. Hence $\frac{x}{y} = c$ gives the solution. 4 factor, such as $\frac{1}{y^2}$ in this case, which when introduced into equation (3) makes the left member an exact differential is called an integrating factor. Every equation of the form (3) has an unlimited number of integrating factors. The actual determination of such factors is, however, in most cases a difficult matter. In a few simple cases they can be determined by inspection or by the application of simple rules.

(3) Homogeneous *Equations.*—The function $f(x, y)$ is said to be *homogeneous* of degree m if the equation

$$f(u, v) = t^m f(x, y)$$

is identically satisfied when we put $u = tx$ and $v = ty$. If now in equation (1), $f(x, y)$ is homogeneous of degree zero and we take $t = \frac{1}{x}$, we get

$$f\left(1, \frac{y}{x}\right) = f(x, y).$$

This tells us that $f(x, y)$ can be expressed as a function of $\frac{y}{x}$ alone, and suggests that we write (1) in terms of a new dependent variable v connected with x and y by the relation $v = \frac{y}{x}$, or $y = vx$. In order to do this we must know what dy is in terms of v and x and their difierentials. We find by differentiation that $dy = v dx + x dv$. Hence (1) becomes $v dx + x dv = f(1, v) dx$, or $\frac{dv}{f(1, v) - v} = \frac{dx}{x}$, and the variables are separated.

(4) Linear Equations.—Equations of the form

$$\frac{dy}{dx} + P(x) y = Q(x), \tag{4}$$

are linear with respect to y and $\frac{dy}{dx}$. They are therefore called linear equations. They are also of the first order. We shall later discuss linear equations of higher orders.

We could solve (4) if we knew an integrating factor. If v is such a factor $v(x)y' + P(x)v(x)y$ is the derivative with respect to x of some function. Since this expression contains the term vy', we are led to consider whether v can be so determined that $vy' + Pvy$ shall be the derivative of vy. In order for this to be the case we must have

$$vy' + Pvy = vy' + v'y,$$

or $v' = Pv$. This requires that

$$\log v = \int P(x) dx + c,$$

or

$$v = e^{\int P(x) dx + c}.$$

Since any integrating factor will answer our purpose, we can put $c = 0$.

If we apply this factor $e^{\int P(x) dx}$ to (4) we get

$$e^{\int P(x) dx} y' + P e^{\int P(x) dx} y = Q e^{\int P(x) dx}.$$

Hence

$$e^{\int P(x) dx} y = \int Q e^{\int P(x) dx} dx + C,$$

or

$$y = e^{-\int P(x) dx} \int Q e^{\int P(x) dx} dx + C e^{-\int P(x) dx}.$$

(5) Equations of Order Higher Than the First.—We mention first certain equations of the second order whose solution can be made to depend upon the solution of equations of the first order—for example, the equation

$$\frac{d^2 s}{dt^2} = f(s),$$

which occurs in mechanics. If we put $v = \frac{ds}{dt}$, we have $\frac{dv}{dt} = f(s)$, or $v \frac{dv}{ds} = f(s)$. This is of the first order and the variables can be separated. Having determined v, we can find s by a quadrature. As a second example, consider the differential equation of the catenary,

$$\frac{d^2 y}{dx^2} = \frac{1}{c} \sqrt{\left[1 + \left(\frac{dy}{dx}\right)^2\right]}.$$

Its solution can be reduced to the solution of an equation of the first order by putting $\frac{dy}{dx} = p$.

The equations that are linear and homogeneous in y and its derivatives, and have constant coefficients, form another simple class under this head. They are of the form

$$p_0 y^{(n)} + p_1 y^{(n-1)} + \ldots + p_{n-1} y' + p_n y = 0. \tag{5}$$

If the right member is a function of x, instead of 0, we have the non-homogeneous equation with constant coefficients

$$p_0 y^{(n)} + p_1 y^{(n-1)} + \cdots + p_{n-1} y' + p_n y = f(x). \tag{6}$$

Equations of this form are in general much more difficult to solve than those of form (5). We shall therefore consider first those of form (5).

In case $n = 1$, we have $p_0 y' + p_1 y = 0$, and we know from the discussion of equation (4), since P is here a constant and $Q = 0$, that $y = Ce^{rx}$, where r is a constant, is a solution. We are therefore led to inquire whether $y = e^{rx}$ is a solution of (5) for a properly chosen constant value of r. If we substitute this function for y in (5), the left member becomes

$$e^{rx}(p_0 r^n + p_1 r^{n-1} + \cdots + p_{n-1} r + p_n).$$

This equals zero if, and only if, r is a root of the equation

$$p_0 r^n + p_1 r^{n-1} + \ldots + p_{n-1} r + p_n = 0. \tag{7}$$

This equation is called the auxiliary equation of (5). The manner of its formation from (5) is obvious.

If (7) has n distinct roots, $r_1, r_2, \ldots, r_n$, (5) has the linearly independent solutions

$$y_1 = e^{r_1 x}, \; y_2 = e^{r_2 x}, \; \cdots, \; y_n = e^{r_n x}.$$

Now it is a property of linear, homogeneous differential equations that the sum of two solutions is also a solution, and that the product of a solution by any constant is a solution. Hence

$$y = c_1 y_1 + c_2 y_2 + \ldots + c_n y_n, \tag{8}$$

where $c_1, c_2, \ldots, c_n$ are arbitrary constants, is a solution of (5). Moreover any solution of (5) can be obtained from (8) by assigning to the c's proper values, as will appear from the theoretical discussion to be given later. For this reason (8) is called the

general solution of (j). But if equation (7) has multiple roots we cannot get the general solution of (5) in this way, although we can get certain particular solutions. If r is a k-fold root of (7) and we put $y=x^i e^{rx}$, where i is any positive integer less than k, we shall get from the left member of (5)

$$e^{rx}[f^{(i)}(r)+i_1 x f^{(i-1)}(r)+i_2 x^2 f^{(i-2)}(r)+\cdots+x^i f(r)].$$

where $i_j=\dfrac{i(i-1)\cdots(i-j+1)}{j!}$ *Now this is zero since r is a k-fold root of (7) and $i<k$. Hence*

$$y_1=e^{rx},\ y_2=xe^{rx},\ \cdots,\ y_{-k}=x^{k-1}e^{rx}$$

are solutions of (j). Taking into consideration the solutions obtained in this way from each of the distinct roots of (7), we get in all n linearly independent solutions from which we can form the general solution as in (8). The problem of the solution of the non-homogeneous equation (6) is much more difficult. However, if $\phi(x)$ is any solution of it and (8) is the general solution of the corresponding homogeneous equation, the general solution of (6) is

$$y=c_1y_1+c_2y_2+\cdots+c_ny_n+\phi(x).$$

The function

$$c_1y_1+c_2y_2+\cdots+c_ny_n$$

is called the complementary function pertaining to (6).

Since we now know how to solve the homogeneous equation, we need to consider only the problem of finding a particular solution of (6). Various special devices for finding this particular solution are given in the textbooks. They depend upon special forms of the function f(x). A more general method due to Lagrange (q.v.) is based on the idea of taking the complementary function and replacing the n arbitrary constants in it by such functions of x as will give us a solution of (6). It turns out that this can be done in a variety of ways, but the details cannot be given here.

The problem of solution is still more difficult if the coefficients in (6) are functions of x. Many of the equations that are of importance in mathematical physics are of this type. They are however, for the most part of the second order, and we shall accordingly confine our discussion to equations of this order.

Consider the equation

$$p_0y''+p_1y'+p_2y=f(x), \qquad (9)$$

where the coefficients are either constants or functions of x. If we know a solution v of the homogeneous equation

$$p_0y''+p_1y'+p_2y=0, \qquad (10)$$

and if we introduce a new dependent variable z by virtue of the relation $y=vz$, we get

$$p_0vz''+(2p_0v'+p_1v)z'+(p_0v''+p_1v'+p_2v)z=f(x).$$

But v is a solution of (10). Hence

$$p_0vz''+(2p_0v'+p_1v)z'=f(x).$$

Now, although this last equation is of the second order, it contains no term in z. If therefore we put $t=z'$, we get

$$p_0vt'+(2p_0v'+p_1v)t=f(x).$$

By the solution of this linear equation of the first order we get t. Then an integration gives z, and an algebraic operation gives y.

This method reduces the solution of linear equations of order greater than one to the solution of similar equations of order one less. The practical difficulty consists in finding a particular solution of the corresponding homogeneous equation. If the original equation is homogeneous we have a close analogy with the fact that the solution of an algebraic equation of degree n can be reduced to the solution of one of degree $n-1$ when we know one root of the original equation.

(6) Equations of the first order that can be solved for y. These can be written in the form $y=f(x,p)$, where p represents $\dfrac{dy}{dx}$.

By differentiation we get $p=f_x+f_p\dfrac{dp}{dx}$. This is an equation of the first order and first degree in x and p. We can therefore solve it and get a relation between x and p. This relation, together with the original equation between y and p gives a parametric representation of the integral curves, p playing the role of parameter.

If the given equation can be solved for x in terms of y and p, a similar procedure can be followed.

Singular Solutions.— If the family of integral curves of a differential equation of the first order has an envelope, this envelope is a solution of the differential equation, since at any of its points it is tangent to an integral curve. It may be included in the general solution, but in general it is not. In the latter case it is called a singular solution. Consider, for example, the equation $y=px+\dfrac{1}{p}$. This is a special form of what is known as Clairaut's equation, the general form being $y=px+f(p)$. Differentiation with respect to x gives us

$$p=p+x\frac{dp}{dx}-\frac{1}{p^2}\frac{dp}{dx},$$

or

$$\frac{dp}{dx}\left(x-\frac{1}{p^2}\right)=0.$$

Hence either $\dfrac{dp}{dx}=0$ and $p=c$, or $x-\dfrac{1}{p^2}=0$. If $p=c$, we have as the general solution $y=cx+\dfrac{1}{c}$. But if we eliminate p from $x=\dfrac{1}{p^2}$ and the original equation, we get $y^2=4x$. This is the equation of the envelope of the family of straight lines $y=cx+\dfrac{1}{c}$, and is therefore a singular solution of the given equation. It can be shown in a similar way that the general Clairaut equation has a singular solution.

It should be observed that an equation of the first order and the first degree does not have a singular solution.

Solution in Series.—In a large class of cases, which includes all that we have already discussed and many others not readily solvable otherwise, we can obtain solutions in power series. The Bessel equation

$$xy''+y'+xy=0$$

affords a good illustration of this method. If

$$y=a_0+a_1x+a_2x^2+\cdots+a_nx^n+\cdots$$

is a solution, the coefficients $a_0, a_1, a_2, \ldots$ must have definite values (up to an undetermined factor) which can be found by substitution of this value of y in the given equation. The series turns out to be

$$1-\frac{x^2}{2^2}+\frac{x^4}{2^2\cdot4^2}-\frac{x^6}{2^2\cdot4^2\cdot6^2}+\cdots$$

and is commonly represented by the symbol $J_0(x)$. It converges for all finite values of x. All the solutions of the given Bessel equation that are linearly independent of this one are of a more complicated nature. We shall have more to say concerning integration by series in the second part of this article.

This is a method for the approximate solution of differential equations. We refer the reader to the book by Runge cited in the bibliography at the end of this article for the details concerning other methods, for this kind of solution.

The reader will have observed in the preceding discussion a complete lack of any general method of procedure for the solution of ordinary differential equations. A general method of approach to this problem has, however, been given by Sophus Lie (q.v.) in his theory of one-parameter groups. We refer the reader to the work of Lie mentioned in the bibliography.

Partial Differential Equations.— An equation involving certain independent and dependent variables and partial derivatives of the dependent variables with respect to the independent variables is called a partial differential equation. In the discussion of partial differential equations we shall confine our at-

tention to the case of two independent variables and one dependent variable, although we shall have occasion to mention equations that contain more than two independent variables. The linear equation

$$P\frac{\partial z}{\partial x}+Q\frac{\partial z}{\partial y}=R, \tag{11}$$

where P, Q, and R are continuous functions of x, y and z and P and Q do not vanish simultaneously, is the simplest of these equations. Suppose that (11) has a solution

$$z=\phi(x,y)$$

Now the direction cosines of the normal to the surface represented by this equation at the point (x_0, y_0, z_0) are proportional to the values of $\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}$ and -1 at this point. Moreover, the values of P, Q, and R at (x_0, y_0, z_0) are proportional to the direction cosines of a line through this point, and the differential equation says that the normal to the surface at (x_0, y_0, z_0) is perpendicular to this line. That is, at every point of an integral surface the differential equation determines a unique line that is perpendicular to the normal to the surface at this point. These lines are tangent to the curves defined by the system of ordinary equations

$$\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}. \tag{12}$$

These curves are called the characteristic curves of the given differential equation.

As a simple illustration we cite the equation

$$x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}=z. \tag{13}$$

The differential equations of the characteristic curves are

$$\frac{dx}{x}=\frac{dy}{y}=\frac{dz}{z}=dt, \tag{14}$$

where t is a parameter. The equations of the characteristic that passes through the point (x_0, y_0, z_0) are therefore $x=x_0e^t$, $y=y_0e^t$ and $z=z_0e^t$. If we let the point (x_0, y_0, z_0) vary along the curve $y=x+2$, $z=x^2-1$, we get a one-parameter family of characteristic curves whose equations are

$$x=x_0e^t, \quad y=(x_0+2)e^t, \quad z=(x_0^2-1)e^t.$$

If we eliminate x_0 and t from these equations, we get

$$z=\frac{4x^2-(y-x)^2}{2(y-x)}.$$

This represents an integral surface through the given curve.

Since $y-c_1x=0$ and $z-c_2x=0$ are solutions of (14), $\phi\left(\frac{y}{x},\frac{z}{x}=0\right)$ where $\phi(u,v)$ is an arbitrary function containing v, defines an integral surface of (13). But when we obtain an integral surface in this way we do not know whether it passes through a given curve, or not.

Equations of the First Order.—The general partial differential equation of the first order is of the form

$$F(x, y, z, p, q)=0, \tag{15}$$

where $p=\frac{\partial z}{\partial x}$ and $q=\frac{\partial z}{\partial y}$. We shall assume that F, together with its first partial derivatives, is a continuous function of its arguments throughout a certain region U. As a matter of convenience we shall adopt the following notation:

$$X=\frac{\partial F}{\partial x}, \quad Y=\frac{\partial F}{\partial y}, \quad Z=\frac{\partial F}{\partial z}, \quad P=\frac{\partial F}{\partial p}, \quad Q=\frac{\partial F}{\partial q}.$$

Let

$$z=\phi(x, y)$$

be an integral surface S of (15). If (x_0, y_0, z_0) is a point on S, the equation of the tangent plane to S at this point is

$$z-z_0=p_0(x-x_0)+q_0(y-y_0), \tag{16}$$

where p_0, q_0 and -1 are proportional to the direction cosines of the normal to S at this point. The plane is determined by the values of p and q, and any set of values of p and q that satisfy the equation

$$F(x_0, y_0, z_0, P, q)=0$$

determine the tangent plane to some integral surface at this point. This singly infinite set of planes envelopes a cone whose vertex is at the point (x_0, y_0, z_0).

We consider a curve on an integral surface whose tangent at a given point is an element of the cone corresponding to this point. The values of x, y, z, p, and q vary from point to point along this curve. It can be shown that they satisfy the system of ordinary equations

$$\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{pP+qQ}=-\frac{dp}{X+pZ}=-\frac{dq}{Y+qZ}=dt \tag{17}$$

where t is a parameter. These equations determine x, y, z, p and q as functions of t and an initial set of values of the dependent variables. The functions determining x, y and z define a set of curves that are known as the characteristic curves of the equation (15). If the equation is linear, these curves are the same as the characteristic curves already defined for linear equations. The values of p and q determined by the remaining equations serve to orient a plane through the point (x_0, y_0, z_0). This plane is tangent to the integral surface on which the characteristic lies. The set of five values (x, y, z, p, q) are said to form a *surface* element and the set of surface elements along a characteristic curve are said to form a characteristic strip.

We have thus far looked upon the characteristics as determined by the integral surfaces. But the differential equations (17) of the characteristic strips can be written donn directly without any reference to the integral surfaces. We then naturally enquire whether we can make use of the integrals of these equations in the determination of the integral surfaces. It turns out that this can be done, but we cannot go into the details here.

Equations of the Second Order.—From the point of view of mathematical physics the linear partial differential equations of the second order with two or three independent variables and one dependent variable are of great importance. We have space only for a brief reference to the more important types with brief statements of the physical problems that give rise to them.

(a) We mention first Laplace's equation in two and three dimensions,

$$\frac{\partial^2u}{\partial x^2}+\frac{\partial^2u}{\partial y^2}=0 \tag{18}$$

and

$$\frac{\partial^2u}{\partial x^2}+\frac{\partial^2u}{\partial y^2}+\frac{\partial^2u}{\partial z^2}=0. \tag{19}$$

As an illustration of a physical problem that gives rise to an equation of this kind the following may be cited: Let K be a conductor of heat whose bounding surface is maintained at a constant temperature—that is, the temperature at any point of the surface is kept at a constant value U which varies continuously from point to point on the surface. After a time the temperature u at a given point within the conductor will no longer vary with the time, but will vary continuously from point to point in such a way that u will satisfy equation (19).

The potential function due to the attraction of gravitating matter, or to an electric or magnetic field also satisfies (19). For this reason a function of x, y and z that satisfies this equation is called a *Newtonian* potential *function.*

But in order to determine the temperature within the conductor we must find not merely a solution of (19), but a solution that is equal to U on the bounding surface. This gives rise to the important problem of finding a function of x, y and z that satisfies (19) within the region bounded by a given surface and has upon this surface prescribed values. This is known as *Dirichlet's* problem.

A function of x and y that satisfies (18) is called a *logarithmic* potential. The function $\log\sqrt{(x^2+y^2)}$ is such a function. Solutions of (18) and (19) are also called *harmonic functions.*

The problem of the solution of Laplace's equation is closely connected with a problem in the calculus of variations (*q. v.*); namely, the problem of determining a function u of x, y and z that is continuous throughout a region V, together with its partial derivatives of the first two orders, and assumes prescribed values on the boundary, in such a way that it shall make the integral

$$\iiint_V \left[\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 + \left(\frac{\partial u}{\partial z}\right)^2\right] dV$$

a minimum. A necessary condition that u shall have these properties is that it shall satisfy (19).

Neumann's problem is similar to Dirichlet's with the difference that it requires the normal derivative of u to have assignedvalues on the bounding surface. Obviously, a solution of this problem can be determined only up to an additive constant. Moreover, if u is a solution, then all solutions that are subject to certain natural conditions are of the form $u+c$, where c is a constant. Both Laplace's and Neumann's problems can be solved by the methods of integral equations.

(*b*) D'Alembert's equation for the motion of a vibrating string is

$$\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$$

This equation is of interest historically from the fact that it was the first partial differential equation to be studied by mathematicians. It has as a solution $u=f(x-at)+F(x+at)$, where f and F are arbitrary functions.

(c) The equation for the motion of a vibrating membrane is

$$\frac{\partial^2 u}{\partial t^2} = a^2\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right).$$

This involves three independent variables and one dependent variable.

(d) The equation of wave-propagation in three dimensions is

$$\frac{\partial^2 u}{\partial t^2} = a^2\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right).$$

Here we have four independent variables.

(e) The equation for the flow of electricity in wires—the so-called telegraph equation—is

$$\frac{\partial^2 u}{\partial t^2} + b\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}.$$

Total Differential Equations.—An equation of the form

$$P(x, y, z)dx + Q(x, y, z)dy + R(x, y, z)dz = 0 \qquad (20)$$

is called a total *differential* equation. Total differential equations may contain any number of variables. The first question that arises in connection with an equation of this kind concerns the existence of a function $u(x, y, z)$ such that the left member of (20) is its total differential. If there is such a function, $\frac{\partial u}{\partial x}$, $\frac{\partial u}{\partial y}$, and $\frac{\partial u}{\partial z}$ are equal to P, Q and R respectively. Hence if (x_0, y_0, z_0) is any point on the surface $u(x, y, z)=0$ the tangent plane to the surface at this point is

$$P(x_0, y_0, z_0)(x-x_0) + Q(x_0, y_0, z_0)(y-y_0) + R(x_0, y_0, z_0)(z-z_0) = 0. \qquad (21)$$

Any curve in this surface satisfies (20). The necessary and sufficient condition for the existence of such a function $u(x, y, z)$ is

$$P\left(\frac{\partial Q}{\partial z} - \frac{\partial R}{\partial y}\right) + Q\left(\frac{\partial R}{\partial x} - \frac{\partial P}{\partial z}\right) + R\left(\frac{\partial P}{\partial y} - \frac{\partial Q}{\partial x}\right) = 0. \qquad (22)$$

When this condition is not satisfied there is no surface such that every curve in it satisfies (20). But if we take an arbitrary surface $v(x, y, z)=0$, its tangent plane at the point (x_0, y_0, z_0) is

$$\left(\frac{\partial v}{\partial x}\right)_0 (x-x_0) + \left(\frac{\partial v}{\partial y}\right)_0 (y-y_0) + \left(\frac{\partial v}{\partial z}\right)_0 (z-z_0) = 0. \qquad (23)$$

This plane and the plane (21) in general determine a line through (x_0, y_0, z_0), and the family of curves in $v=0$ that have these lines for tangents satisfies equation (20).

EXISTENCE THEOREMS AND GENERAL THEORY

On the theoretical side the first question that presents itself in connection with a given differential equation concerns the existence of solutions. Suppose that we have the equation

$$\frac{dy}{dx} = f(x, y), \qquad (24)$$

where f(x , y) is an analytic function of x and y that is regular in the neighbourhood of the point (x_0, y_0). Then the existence of an analytic solution $y=y(x)$, that is regular in the neighbourhood of the point $x=x_0$ and takes the value y_0 when $x=x_0$ may be established as follows:

From (24) we get by successive differentiations

$$\frac{d^2y}{dx^2} = \frac{\partial f}{\partial x} + \frac{\partial f}{\partial y}\frac{dy}{dx}$$

$$\frac{d^3y}{dx^3} = \frac{\partial^2 f}{\partial x^2} + 2\frac{\partial^2 f}{\partial x \partial y}\frac{dy}{dx} + \frac{\partial^2 f}{\partial y^2}\left(\frac{dy}{dx}\right)^2 + \frac{\partial f}{\partial y}\frac{d^2y}{dx^2}.$$

In the right members of (24) and these successive equations we put x_0 for x and y_0 for y, and use the resulting values of the successive derivatives of v to form the series

$$\phi(x) = y_0 + \left(\frac{dy}{dx}\right)_0 (x-x_0) + \left(\frac{d^2y}{dx^2}\right)_0 \frac{(x-x_0)^2}{2!} + \cdots + \left(\frac{d^ny}{dx^n}\right)_0 \frac{(x-x_0)^n}{n!} + \cdots. \qquad (25)$$

If this power series converges within a certain interval for x, we know from the theory of power series that it can be differentiated term-by-term within this interval. Hence

$$\frac{d\phi}{dx} = \left(\frac{dy}{dx}\right)_0 + \left(\frac{d^2y}{dx^2}\right)_0 (x-x_0) + \cdots + \left(\frac{d^ny}{dx^n}\right)_0 \frac{(x-x_0)^{n-1}}{(n-1)!} + \cdots. \qquad (26)$$

But the series in the right member of this equation is the expansion of the analytic function in the right member of (24) after y has been replaced by the analytic function $\phi(x)$. Moreover, $\phi(x_0)=y_0$. We have therefore in (25) a solution of (24) that satisfies the given conditions, provided that the series in the right member of (24) converges within some interval. The establishment of this convergence is the crux of this proof of the existence of an integral. It is accomplished by recourse to what Cauchy (*q.v.*), to whom we are indebted for this proof, called the "Calculus of Limits." The essential feature of this method consists in setting up, a so-called *majorant function* of whose convergence we are assured. This majorant function is represented by a power series each of whose coefficients is positive and not less than the absolute value of the corresponding coefficient in (25). We cannot give the details here. The solution obtained in this way is obviously unique.

Picard established the existence of these solutions by making use of a method of successive approximations. In his proof it is not necessary that $f(x, y)$ be analytic. It is sufficient to assume that for $|x-x_0|<a$ and $|y-y_0|<b$ the function $f(x, y)$ be continuous and satisfy Lipschitz's condition; namely,

$$|f(x, y_1) - f(x, y_2)| < M|y_1 - y_2|, \qquad (27)$$

where the points (x, y_1) and (x, y_2) are in the given neighbourhood and M is a constant.

The successive approximations y_i are obtained from the following equations

$$\frac{dy_i}{dx} = f(x, y_{i-1}) \quad (i>1),$$

subject to the condition that $y_i(x_0)=y_0$. By integration we get

$$y_1 = \int_{x_0}^{x} f(x, y_0)dx + y_0,$$

$$y_i = \int_{x_0}^{x} f(x, y_{i-1})dx + y_0. \quad (i>1)$$

Now the proof consists in showing that for a sufficiently small a all the functions y_i satisfy the inequality $|y_i - y_0| < b$, and that the series $\sum_{i}^{\infty} (y_{-i} - y_{i-1})$ converges to a definite function, $y(x)$, which satisfies the differential equation and the given initial conditions. This solution is unique.

Each of these existence proofs suggests a method for obtaining an approximate solution of the equation,

Only slight modifications need to be made in these proofs to have them applicable to systems of n equations of the first order in one independent and n dependent variables. And since an ordinary equation of order n is equivalent to a system of n equations of the first order of the kind described, it follows that these theorems also apply to ordinary equations of order n. For such an equation there is, therefore, a unique solution y such that y and its first $n-1$ derivatives have assigned values for $x = x_0$, provided that the conditions set forth in the existence theorem are satisfied.

In the preceding discussion we have confined our attention to the domain of real variables. There is, however, at times an advantage in including the domain of complex numbers (*q.v.*). In this more extended domain the proofs of the existence theorems given above are valid, provided that in the second one we restrict the functions to being analytic.

We add a brief sketch of two points in the general theory. These concern equations of the second order of the form

$$y'' + [\sigma(x) + \lambda\rho(x)]y = 0, \qquad (28)$$

where $\sigma(x)$ and $\rho(x)$ are continuous and $\rho(x) > 0$ in the interval (x_0, x_1). We wish to know whether there are solutions y of (28) that satisfy the two conditions

$$y(x_0) = 0 \quad \text{and} \quad y(x_1) = 0. \qquad (29)$$

Heretofore we have imposed on the solution the condition that it and its first derivative shall have definite values at the initial point, whereas here the conditions prescribe the values of the solution at the two ends of an interval. It is for this reason that the problem is described as a "boundary-value problem." There are, of course, more general boundary-value problems.

Now it turns out that (28) has a unique solution that satisfies conditions (29) if, and only if, λ is one of an infinite set of values $\lambda_1, \lambda_2, \ldots, \lambda_n, \ldots$. These are called the *characteristic values*, and the unique solutions $y_1(x), y_2(x), \ldots, y_n(x), \ldots$ corresponding to these are called the *characteristic functions*, of the problem.

If in (28) $\sigma(x) \equiv 0$, $\rho(x) \equiv 1$, $x_0 = 0$, and $x_1 = \pi$, it can readily be seen that $\lambda_n = n^2$ and $y_n = \sin nx$, where n is a positive integer. Now it is well known that functions satisfying certain conditions can be represented in the interval $(0, \pi)$ by the series

$$\sum_{n=1}^{\infty} a_n \sin nz.$$

This is merely a special case of Fourier's series (*q.v.*), which, in its turn, is a special case of an important and general theorem concerning the characteristic functions of equation (28) with the boundary conditions (29). This theorem is as follows:

Any function $f(x)$ that is continuous in the interval (x_0, x_1), together with its first two derivatives, and vanishes at the ends of the interval can be represented in this interval by the uniformly convergent series

$$\sum_{n=1}^{\infty} a_n y_n(x),$$

where $a_n = \int_{x_0}^{x_1} f(x) y_n(x) \rho(x) dx$, and each $y_n(x)$ has been multiplied by a properly chosen constant factor.

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DIFFERENTIAL FORMS. The theory of differential forms is a branch of mathematics which presupposes several other branches, including differential calculus, algebra, and theory of functions. In essence, it is a theory of transformations of co-ordinates, such as

$$\begin{aligned} x &= f(x', y', z') \\ y &= g(x', y', z') \\ z &= h(x', y', z') \end{aligned} \qquad (1)$$

which are analytic and have single-valued inverses. This transformation carries any set of values of the variables x, y, z into a definite set of values of x', y', z'. It also *induces* the transformation of *differentials*

$$\begin{aligned} dx &= \frac{\partial f}{\partial x'}dx' + \frac{\partial f}{\partial y'}dy' + \frac{\partial f}{\partial z'}dz', \\ dy &= \frac{\partial g}{\partial x'}dx' + \frac{\partial g}{\partial y'}dy' + \frac{\partial g}{\partial z'}dz', \\ dz &= \frac{\partial h}{\partial x'}dx' + \frac{\partial g}{\partial y'}dy' + \frac{\partial h}{\partial z'}dz' \end{aligned} \qquad (2)$$

The differentials, it should be understood, are merely a second set of independent variables associated with the first set x, y, z.

Now consider a function of these two sets of variables, for example,

$$P(x, y, z)dx + Q(x, y, z)dy + R(x, y, z)dz, \qquad (3)$$

in which P, Q, and R represent analytic functions of any sort of x, y, and z. This function has a definite numerical value whenever definite values are assigned to the variables x, y, z, dx, dy, dz. If we substitute for these variables according to the equations (1) and (2) we obtain a function

$$P'(x', y', z')dx' + Q'(x', y', z')dy' + R'(x', y', z')dz', \qquad (4)$$

which has the same value as (3) whenever x', y', z', dx', dy', dz' and x, y, z, dx, dy, dz are assigned values which are related by the equations (1) and (2). The two functions (3) and (4) are representations or *components* in different co-ordinate systems of the same *differential form*. In this case, since the expressions (3) and (4) are both linear functions, the differential form is said to be *linear*.

The components of a differential form can also be quadratic in the differentials, for example,

$$Edu^2 + 2Fdudv + Gdv^2, \qquad (5)$$

in which E, F, and G are functions of two variables u and v. In general, the components of a differential form are required to be functions which are analytic in the variables x, y, etc., and analytic and homogeneous in the differentials dx, dy, etc. In the cases usually considered they are homogeneous polynomials in the differentials. They may also be functions of several sets of

differentials. For example, the quadratic form (5) is intimately related to the bilinear form,

$$E\,du\,\delta u+F(du\,\delta v+dv\,\delta u)+G\,dv\,\delta v.$$

It is obviously a fundamental problem to determine whether two differential expressions, such as (3) and (4) for example, are or are not components of the same differential form. This is known as the *equivalence* problem. The study of this problem, as well as of related problems, has led to the discovery of differential invariants of various kinds. The simplest of these are functions formed from the given form which are unchanged in value by transformations of coordinates. For example, an invariant of (3) is the bilinear form,

$$\left(\frac{\partial P}{\partial y}-\frac{\partial Q}{\partial x}\right)(dx\,\delta y-dy\,\delta x)+\left(\frac{\partial Q}{\partial z}-\frac{\partial R}{\partial y}\right)(dy\,\delta z-dz\,\delta y)$$
$$+\left(\frac{\partial R}{\partial x}-\frac{\partial P}{\partial z}\right)(dz\,\delta x-dx\,\delta z).$$

This example illustrates one of the uses to which differential invariants are put. For the vanishing of this bilinear form is a necessary and sufficient condition that (3) be a "complete differential." In other words, there exists a function $F(x, y, z)$ such that

$$dF(x, y, z)=Pdx+Qdy+Rdz,$$

if and only if this bilinear form vanishes. Other properties of the differential form (3) are expressed by the vanishing of other invariants. Indeed, the typical way of saying anything about a differential form is to assert that such and such an invariant vanishes—and a very large proportion of the theorems of geometry and physics reduce to such statements.

Returning to the example of a linear differentia1 form which has the components (3) and (4) in two coordinate systems we find, on carrying out the substitution of (1) and (2) in (3), that

$$\begin{aligned}P'(x', y', z')&=P\frac{\partial f}{\partial x'}+Q\frac{\partial g}{\partial x'}+R\frac{\partial h}{\partial x'},\\ Q'(x', y', z')&=P\frac{\partial f}{\partial y'}+Q\frac{\partial g}{\partial y'}+R\frac{\partial h}{\partial y'},\\ R'(x', y', z')&=P\frac{\partial f}{\partial z'}+Q\frac{\partial g}{\partial z'}+R\frac{\partial h}{\partial z'},\end{aligned}\qquad(6)$$

In these equations P stands for the function of x', y', z', obtained by substituting (1) in $P(x, y, z)$; similarly Q and R. In the language of Tenson Analysis (*q.v.*) the equations (6) state that the coefficients of a linear differential form are the components of a covariant vector. In like manner we can work out the equations of transformation, analogous to (6), of the coefficients of a differential form of any degree. It comes out that whenever the differential form is a polynomial in the differentials, the coefficients are the components of a covariant tensor. The theory of these differential forms is therefore co-extensive with that of covariant tensors.

The theory even of linear differential forms is very extensive and has applications in a wide variety of fields of mathematics and physics. We need only mention line integrals, vector analysis (*q.v.*), and electricity and magnetism (*qq.v.*). The higher theory of linear differential forms and systems of linear differential forms is to be found in mathematical books usually under the heading "The problem of Pfaff," so called because the first investigations of the subject were made by Pfaff in 1814 and 1815. The further development of the subject is associated with the names of Gauss, Jacobi, Natani, Clebsch, Grassmann, Frobenius, Darboux and Cartan.

The theory of quadratic differential forms was initiated in 1827 by Gauss, who showed that the metric properties of surfaces depend on forms of the type (5). This work of Gauss is also the foundation of modern differential geometry (*q.v.*). From the point of view of differential forms his chief contribution was the discovery of an invariant, called the *curvature*, which is a function of E, *F*, and *G*, and their first and second derivatives, which is unaltered by all analytic transformations of the variables u, v. The next important step was taken by Riemann, who in 1854 outlined the theory in its full generality and used it as the basis of what has come to be known as Riemannian geometry. He also showed that the curvature of Gauss must be replaced in the general case by what is now called the curvature tensor. The work of Riemann was followed immediately by that of Christoffel and Lipschitz. The former introduced the functions often called Christoffel symbols or the components of affine connection, and gave a solution of the equivalence problem. Lipschitz developed the calculus of variations (*q.v.*) side of the subject and also the system of normal coordinates which had been sketched by Riemann. This work was followed by a long series of researches by such mathematicians as Ricci, Voss, Lie, Levi-Civita, Zorawski, Wright and Haskins. Differential forms of degree higher than the second have been studied by Lipschitz, E. Noether, E. Pascal, and others.

The theory of quadratic differential forms has found many applications in geometry and physics, notably in dynamics. In recent years it has received a great deal of attention and been generalized in various directions because it is the foundation of Einstein's theory of relativity. In the researches of Einstein, as extended by Weyl and others, the phenomena of gravitation and electricity are described by means of a quadratic and a linear differential form restricted by the vanishing of certain invariants.

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DIFFERENTIAL GEOMETRY embodies the theorems concerning curves, surfaces and other manifolds which involve applications of the calculus. Straight lines, circles, planes and spheres are geometrical entities possessing the common property that any part of one of them has the same shape as any other part. Other curves and surfaces do not possess this property, as for example, conics, ellipsoids and paraboloids. The geometrical character of these entities varies in general continuously from point to point, and consequently the calculus is needed in order to study many of their geometrical properties.

Most of the older differential geometry, and much of the recent, in so far as magnitudes are concerned, rests upon the assumption that the curves and surfaces under consideration lie in ordinary, or Euclidean, space of three dimensions, and that the measurement of magnitudes, such as lengths of curves, angles and areas of surfaces, is based upon Euclidean measure. Thus, when the three-dimensional space is referred to rectangular cartesian coordinates, the quadratic differential form

$$ds^2=(dx)^2+(dy)^2+(dz)^2,\qquad(1)$$

which defines the square of the distance between points (x, y, z) and $(x+dx, y+dy, z+dz)$, leads by the processes of the integral calculus to the determination of the length of a curve between two points of it. In fact, a curve is defined by two equations of the form

$$f(x, y, z)=0,\quad g(x, Y, z)=0.\qquad(2)$$

For differentials dx, dy, dz in the direction of this curve and by means of (2), equation (1) is reducible to the form $ds=F(x)dx$, and then the length of arc is given by an integration. Or any curve may be defined, in many ways, in the form

$$x=f_1(t),\quad y=f_2(t),\quad z=f_3(t),$$

where t is a parameter, and then the length of arc is given by an integral in t.

When all the points of a curve lie in one plane, it is called a

plane curve, otherwise a skew curve. If P is any point on a skew curve C, l the tangent line to C at P, and Q is any other point of the curve, the plane determined by 1 and Q assumes a limiting position as Q approaches P along the curve; it is called the osculating plane to C at P; of all the planes through 1 it lies nearest to the curve in the sense that the distance of a point of C near P from the osculating plane is of the second order and from the other planes it is of the first order. The normal to C at P in the osculating plane is called the *principal* normal, and the normal to the osculating plane at P the binormal. The manner in which the configuration consisting of the tangent, principal normal, and binormal varies in direction, as the point describes the curve, characterizes the curve. The rate of change of direction of the tangent with the arc is the curvature, and of the binormal the torsion. These are the fundamental elements in the differential geometry of curves and in any of the many treatises the reader will find extensive developments of the theory.

A surface is a locus of two dimensions. A surface in Euclidean space, or a portion of it, is defined by one relation between the coordinates as

$$f(x, y, z) = 0. \tag{3}$$

If P is an ordinary point of the surface, not a singular point such as the vertex of a cone, the tangents at P to all curves on the surface through P lie in a plane, called the tangent plane at P; its eauation is

$$\frac{\partial f}{\partial x}(X-x)+\frac{\partial f}{\partial y}(Y-y)+\frac{\partial f}{\partial z}(Z-z)=0. \tag{4}$$

When one of the three variables x, y, z is eliminated from (4) by means of (3), ordinarily the other two enter in the equation, that is, the tangent plane depends upon two parameters. When the tangent plane involves a single parameter, the surface is called developable, otherwise *non-developable;* a developable surface can be rolled out, or developed, upon a plane.

When the tangent plane at an ordinary point P of a non-developable surface is taken for the plane $z=0$, and any two orthogonal lines in this plane are taken for the x and y axes, the equation of the surface, at least in the neighbourhood of the point, can be written in the form

$$z = ax^2+2bxy+cy^2+\phi(x, y),$$

where ϕ (x, y) is a power-series in x and y of the third and higher orders, and a, b and c are constants. The ellipse or hyperbola whose equations are

$$ax^2+2bxy+cy^2=1, \quad z=0$$
$$ax^2+2bxy+cy^2=1, \quad z=0,$$

is called the *Dupin* indicatrix of the surface at P. The principal axes of the conic are called the *principal* directions at P; conjugate diameters determine conjugate directions, and the asymptotes asymptotic directions. Two one-parameter families of curves on the surface whose directions at a point of meeting are conjugate are said to form a conjugate system; a curve whose direction at every point is asymptotic is any asymptotic line; a curve whose direction at every point is principal is a line of curvature. These various curves may be defined also by properties involving the tangent plane. The tangent planes to a surface along any curve form a developable surface, and the directions of the generators are conjugate to the given curve; the tangent planes to a surface along an asymptotic line are the osculating planes of the latter; the normals to a surface along a line of curvature are tangent to a curve in space, and this is true only of a line of curvature.

If in equation (3) we put x and y each equal to a function of two parameters, u and v, and solve for z, the surface is defined by three equations

$$x=f_1(u, v), \quad y=f_2(u, v), \quad z=f_3(u, v). \tag{5}$$

Conversely, any three equations of this type define a surface. This method of definition is due to Gauss. Owing to the great arbitrariness in the choice of the parameters u and v, it is a very powerful method and has simplified the solution of many problems. When the expressions (5) are substituted in (1), we get the differential form

$$ds^2 = Edu^2+2Fdudv+Gdv^2, \tag{6}$$

where E, F and G involve the first derivatives of f_1, f_2, f_3. Any curve on the surface is defined by a relation between u and v; when this is used in connection with (6), the latter defines the length of the curve. The right-hand member of (6) is called the first *fundamental* quadratic form of *the* surface. There is another quadratic differential form of importance, called the second fundamental form and usually written

$$Ddu^2+2D'dudv+D''dv^2; \tag{7}$$

to within terms of third and higher orders it is equal to twice the distance from the point $(u+du, v+dv)$ on the surface to the tangent plane at the point (u, v). Measurement of angles between directions at a point on the surface depends only upon the first form, and conjugacy only upon the second. Since lines of curvature form an orthogonal system and also a conjugate system, their differential equation involves the coefficients of both forms.

Through each point of a surface, and in each direction, there is a curve of the surface whose principal normal at each point is normal to the surface. Although this definition involves a property of the curve as viewed from the Euclidean space in which the surface is contained, the differential equations of these curves involve only the coefficients of the first form and their first derivatives, that is, they are characterized by a property of distance alone. In fact, they are the curves for which the first variation of the integral $\int ds$ is zero; that is, they are the extremals of -this integral, to use the terminology of the calculus of variations. These curves are called the geodesics of the surface.

Let P be any point of a surface, Σ a small portion of the surface including P and C its contour. If lines be drawn through a point O parallel to the normals to the surface at points of C, these lines will meet the sphere of unit radius and centre O in a closed curve. The limit of the ratio of the area enclosed by the latter to the area of Σ as Σ approaches P in the limit is the curvature of the surface at P. It is equal to $(DD'-D'^2)/(EG-F^2)$, but it is equal also to a function of E, F, G and their first and second derivatives. Hence, when the formula for distance (6) of a surface is known, the Gaussian curvature of the surface at any point can be found without reference to the enveloping Euclidean space. In this sense properties involving geodesics and Gaussian curvature are *intrinsic.*

The foregoing are the fundamental elements which enter into the vast body of theorems concerning surfaces in a Euclidean space, which are to be found in any of the many treatises. Much of the theory involves metric properties. Since conjugate systems and asymptotic lines are invariant under projective transformations of the enveloping Euclidean space, there is a considerable theory which is projective in this sense. It is a geometrical interpretation of linear partial differential equations of the second order. This has been developed by Darboux, Guichard, Tzitzeica. Demoulin and Wilczynski. Recently Fubini and Bompiani have made further developments.

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DIFFERENTIAL PARALLELISM: see TENSOR ANALYSIS.

DIFFERENTIAL PSYCHOLOGY is that branch of psychology which deals with the differences found among individuals and groups in mental traits and performances. Individual differences are attributable broadly to the two opposed, but closely interwoven, forces of nature and nurture, or heredity and environment. In the first category are the intrinsic factors such as race, sex, age, immediate ancestry, etc.; under the latter

head are the extrinsic factors, viz.—the social, educational. cultural, physical (*e.g.,* disease) and other agencies which shape and mould the developing individual from birth until death.

In a general sense, the complex and more recently acquired traits tend to be more variable than the simple, biologically more fundamental ones. The feeble-minded, for example, differ least from the normal in physical and motor abilities and most in the ability to use language, deal with "ideas," and employ abstract thought. Even among groups relatively homogeneous as to general ability, we find greater variability in those tests requiring the education of intricate verbal relations, in learning and association, than in those tests designed to measure the speed of voluntary movement, rote memory, or recognition. Individuals do not fall into sharply separated groups or "types" in mental, any more than in physical, traits. People differ widely, for example, in the vividness and kind of mental imagery which they possess. In other traits the same condition obtains; mediocrity is the status most commonly encountered, marked superiority or inferiority being relatively and equally infrequent.

The results of many careful studies of primitive peoples point to the conclusion that these races do not differ markedly from modern Europeans in general sensory equipment, such as keenness of vision and hearing, sensitivity to pain and pressure, and delicacy of the skin senses. Simple "intelligence" tests of the "form board" variety (a form board is a board containing cut out depressions into which blocks of different shapes and sizes are to be fitted) show no large differences between the whites and many primitive folk (*e.g.,* Eskimos, American Indians, etc.), although a few races, the Igorot, the Negrito and the Pygmies, do no better than low-grade and even imbecile whites. The inferiority of the negro to the white in mental capacity has often been asserted as the result of comparative studies, but it is difficult to say how much of difference found is due to native as against cultural factors. Negro high school children in New York city remain in school longer, are older on the average, and are inferior in scholastic work to whites of approximately the same social status (Mayo). The greater the admixture of white blood, the closer does the negro approach the white in performance (Ferguson). Intelligence tests given to large groups of whites and negroes in the American army place the negro below the white both in tests of the language and non-language variety. Several investigations have shown the negro to be more overtly emotional and less inhibited in his reactions than the white (Crane). The American Indian ranks consistently below the white man on tests of mental capacity; the greater the admixture of white blood, the smaller the deviation from the performance of the white. There is some recent evidence to indicate that the Indian, while slower in motor performances than the white, is more accurate and painstaking.

In comparative studies of general intelligence made in America, Chinese children have ranked slightly lower than whites in language tests (English) but better in rote memory. Japanese children do not differ significantly in intelligence from comparable groups of whites, due allowance being made for social and cultural status. The most extensive comparative data on the intellectual differences as among national groups is that obtained from the tests given in the American army during the World War. These tests indicated a superiority of those foreign-born men from northern countries of Europe (the "Nordics") over those from central and southern Europe (the "Alpines" and "Mediterranean~").Selection plus differences in language, schooling, age and culture probably account for much if not all of the difference found.

Comparative studies of men and women have indicated few differences which might be attributed to the factor of sex, apart from social and cultural influences. The differences within either sex are far greater than the differences between the two sexes. Women have been reported to have a finer sense of touch, better colour discrimination, and to be faster in verbal association; men to be superior, on the average, in the discrimination of differences in weight and visual magnitudes, and in the speed of motor response (reaction time). In general, females are superior in tests of memory and in foreign languages; males in tests of logical construction and in problems involving abstract and space relations (Thompson). Women are somewhat less stable emotionally than men. They have been asserted also to be more interested in people, more religious, more patient and more sympathetic, while men are more interested in athletic activity, have a superior sense of humour and are more independent (Pearson. Heymans and Wiersma). Girls are definitely better in school work than boys. This result has been explained as due to the slower physical development of boys, to the greater docility of girls and to native differences in ability.

The fact that men have excelled women in practically every field of endeavour is probably to be attributed to social, cultural and traditional factors, and to the greater physical strength and endurance of men, rather than to native differences in endowment One explanation is based upon the reputed greater variability within the male sex. Greater variability, *i.e.,* greater range of ability, would tend to produce more gifted men than women, even though the average man and woman ranked about the same in ability. The fact of greater variability in the male sex has been disputed, however, by competent investigators, and the question is still an open one.

Investigators are fairly well agreed that there is a regular and progressive increase in ability as measured by mental tests from infancy up to and through adolescence (14–18 years). This mental growth parallels roughly the steady increase in physical size and strength. After adolescence growth in most mental traits increases slowly, if at all, while in many cases it ceases altogether. Processes which are based upon experience, such as judgment, "reasoning ability" in practical situations, rational learning, etc., probably improve up through middle life and show no very definite losses until old age (Thorndike). There is a general loss in the speed and flexibility of mental operations in old age Sensory acuity in general — auditory, visual and tactual — is considerably reduced and there is some loss in learning ability, speed of reaction and memory. Curiosity and enthusiasm are lost as physical and mental vigour wane. A part, at least, of the fall in general intelligence score with increasing age may be attributed to the loss in speed of response, and also to the removal, by a relatively long-time interval, from school practice with the kind of operations called for by the tests. Suggestibility, or the ability to resist suggestion, is another complex trait which has been iound to differ with age and sex. Tests applied to children indicate that ability to "resist" suggestions increases progressively with age from 6 or 7 through adolescence (M. Otis). Girls are slightly more resistant than boys but the differences are not reliable.

The influence of immediate ancestry is best studied by comparing those of like ancestry and ***vice versa.*** Careful studies of twins have shown that they are more alike both mentally and physically than ordinary brothers and sisters. The fact that older twins are no more alike than younger twins argues for the greater potency of heredity in shaping mental traits. Brothers, and brothers and fathers. are more nearly alike, as measured by correlation of traits (both mental and physical) than are unrelated individuals. Brother and sister, brother and brother, and sister and sister, are also more alike in such traits as vivacity, temper, assertiveness and other character traits than unrelated persons (Pearson). No doubt a considerable part of the mental resemblance noted among those of the same family or closely related families, such as habits of speech and thought, common opinions, ideas and attitudes, is due to a common fund of environmental influences and associations. But over and above all of this, there is, in the opinion of most competent workers in the field, a large share attributable to native factors.

See W. Stern, *Differentielle Psychologie* (Leipzig, 1921); E. L. Thorndike, *Educational Psychology,* vol. iii. (New York, 1914); G. M. Whipple, *Manual of Mental and Physical Tests,* Parts I. and II. (Baltimore, 1921). (H. E. G.)

DIFFERENTIATION, a term used in biology signifying the evolutionary process, by which certain modifications of the body both structural and functional take place in plants and animals. In the vegetable kingdom the evolution of growth is usually from the simple to the complex form, the organs developing into more specialized parts of the body. (See PLANTS; EXPERI-

MENTAL EMBRYOLOGY; DEDIFFERENTIATION.) For differentiation in mathematics *see* CALCULUS.

DIFFRACTION: *see* LIGHT.

DIFFRACTION GRATING, a series of parallel straight lines spaced at equal intervals in one plane or on a concave surface. A beam of radiation after falling on such a grating, is resolved into a spectrum *(see* SPECTROSCOPY and LIGHT).

DIFFUSION, in general, a spreading out, scattering or circulation; in physics the term is applied to a special phenomenon, treated below. The word is from the Lat. *diffundere; dis-,* asunder, and *fundere,* to pour out.

1. **General** Description. — When two different substances are placed in contact with each other they sometimes remain separate, but in many cases a gradual mixing takes place. This occurs whenever there is a difference of concentration or (in the case of gases) of partial pressure between the constituents of neighbouring portions. This phenomenon is known as diffusion.

Simple cases of diffusion are easily observed qualitatively. If a solution of a coloured salt is carefully introduced by a funnel into the bottom of a jar containing water, the two portions will at first be fairly well defined, but if the mixture can exist in all proportions, the surface of separation will gradually disappear; and the rise of the colour into the upper part and its gradual weakening in the lower part, may be watched for days, weeks or even longer intervals. The diffusion of a strong aniline colouring matter into the interior of gelatine is easily observed, and is commonly seen in copying apparatus. Diffusion of gases may be shown to exist by taking glass jars containing vapours of hydrochloric acid and ammonia, and placing them in communication with the heavier gas downmost. The precipitation of ammonium chloride shows that diffusion exists, though the chemical action prevents this example from forming a typical case of diffusion. Again, when a film of Canada balsam is enclosed between glass plates, the disappearance during a few weeks of small air bubbles enclosed in the balsam can be watched under the microscope.

In fluid media, whether liquids or gases, the process of mixing is greatly accelerated by stirring or agitating the fluids, and liquids which might take years to mix if left to themselves can thus be mixed in a few seconds. It is necessary carefully to distinguish the effects of agitation from those of diffusion proper. Agitation brings together portions of the fluid between which considerable differences of concentration may exist. The interchange between such portions then proceeds much more rapidly. In many cases, especially in gases, the intermixing goes on until the concentration is uniform throughout. Thus a strong solution of $CuSO_4$ will ultimately form a uniform weaker solution if brought into contact with water. In other cases, the material remains divided into two or more regions (or phases) in each of which the relative concentration of the components is uniform, but changes in passing from one phase to the next. The passing of one or more components across the boundary between two phases is known as solution or evaporation or condensation; but the process by which the uniform distribution in each phase is set up is diffusion.

Diffusion may take place in solids, that is, in regions occupied by matter which continues to exhibit the properties of the solid state. Thus, gold and lead brought into contact begin to diffuse into one another. An interesting series of examples is afforded by the passage of gases through partitions of metal, notably the passage of hydrogen through platinum and palladium and of helium through silica ("fused" quartz) at high temperatures. When the process is considered with reference to a membrane or partition taken as a whole, the passage of a substance from one side to the other is commonly known as "osmosis" or "transpiration" *(see* SOLUTIONS) but what occurs in the material of the membrane itself is correctly described as diffusion. Agitation brings together portions of the fluid between which considerable differences of concentration may exist. The interchange between such portions then proceeds much more rapidly.

To sum up, the ultimate process by which the individual molecules of two different substances become mixed, producing finally a homogeneous mixture, is in every case diffusion.

In order to make accurate observations of diffusion in fluids it is necessary to guard against any cause which may set up currents; and in some cases this is exceedingly difficult. Thus, if gas is absorbed at the upper surface of a liquid, and if the gaseous solution is heavier than the pure liquid, currents may be set up, and a steady state of diffusion may cease to exist. This has been tested experimentally by C. G. von Hufner and W. E. Adney. The same thing may happen when a gas is evolved into a liquid at the surface of a solid even if no bubbles are formed; thus if pieces of aluminium are placed in caustic soda, the currents set up by the evolution of hydrogen are sufficient to set the aluminium pieces in motion, and it is probable that the motions of the Diatomaceae are similarly caused by the evolution of oxygen. In some pairs of substances diffusion may take place more rapidly than in others. Of course the progress of events in any experiment necessarily depends on various causes, such as the size oi the containing vessels, but it is easy to see that when experiments with different substances are carried out under similar conditions, however these "similar conditions" be defined, the rates of diffusion must be capable of numerical comparison, and the results must be expressible in terms of at least one physical quantity, which for any two substances can be called their coefficient of diffusion. How to select this quantity we shall see later.

2. Quantitative Methods of **Observing Diffusion.**—The simplest plan of determining the progress of diffusion between two liquids would be to draw off and examine portions from different strata at some stage in the process; the disturbance produced would, however, interfere with the subsequent process of diffusion, and the observations could not be continued. By placing in the liquid column hollow glass beads of different average densities, and observing at what height they remain suspended, it is possible to trace the variations of density of the liquid column at different depths, and different times. In this method, which was originally introduced by Lord Kelvin, difficulties were caused by the adherence of small air bubbles to the beads.

In general, optical methods are the most capable of giving exact results, and the following may be distinguished. (a) By *refraction in a horizontal plane.* If the containing vessel is in the form of a prism, the deviation of a horizontal ray of light in passing through the prism determines the index of refraction, and consequently the density of the stratum through which the ray passes. (b) By *refraction in a vertical plane.* Owing to the density varying with the depth, a horizontal ray entering the liquid also undergoes a small vertical deviation, being bent downwards towards the layers of greater density. The observation of this vertical deviation determines not the actual density, but its rate of variation with the depth, ie., the "density gradient" at any point. A parallel-faced vessel is employed and the incident beam falls normally upon it. (c) By *the saccharimeter.* In the cases of solutions of sugar, which cause rotation of the plane of polarized light, the density of the sugar at any depth may be determined by observing the corresponding angle of rotation; this was done originally by W. Voigt.

3. Elementary Definitions of Coefficient **of Diffusion.**— The simplest case of diffusion is that of a substance, say a gas, diffusing in the interior of a homogeneous solid medium which remains at rest, when no external forces act on the system. We may regard it as the result of experience that: (1) if the density of the diffusing substance (*i.e.,* the mass of that substance per unit volume) is everywhere the same, no diffusion takes place, and (2) if the density of the diffusing substance is differentat different points, diffusion will take place from places of greater to those of lesser density, and will not cease until the density is everywhere the same. It follows that the rate of flow of the diffusing substance at any point in any direction must depend on the density gradient at that point in that direction, *i.e.,* on the rate at which the density of the diffusing substance decreases as we move in that direction. We may define the *coefficient of diffusion* as the ratio of the total mass which flows per unit area across any small section, to the rate of decrease of the density with distance in a direction perpendicular to that section.

In the case of steady diffusion parallel to the axis of x, if p be

the density of the diffusing substance, and q the mass which flows across a unit of area in a plane perpendicular to the axis of x in unit time, then the density gradient is $-d\rho/dx$ and the ratio of q to this is called the "coefficient of diffusion." By what has been said this ratio remains finite, however small the actual gradient and flow may be; and it is natural to assume, at any rate as a first approximation, that it is constant as far as the quantities in question are concerned. Thus if the coefficient of diffusion be denoted by K we have $q=-K(d\rho/dx)$.

Further, the rate at which the quantity of substance is increasing in an element between the distances x and $x+dx$ is equal to the difference of the rates of flow in and out of the two faces, whence as in hydrodynamics, we have $d\rho/dt=-dq/dx$.

It follows that the equation of diffusion in this case assumes the form:

$$\frac{\partial\rho}{\partial t}=\frac{\partial}{\partial x}\left(K\frac{\partial\rho}{\partial x}\right),$$

which is identical with the equations representing conduction of heat, flow of electricity and other physical phenomena. For diffusion in three dimensions we have in like manner:

$$\frac{\partial\rho}{\partial t}=\frac{\partial}{\partial x}\left(K\frac{\partial\rho}{\partial x}\right)+\frac{\partial}{\partial y}\left(K\frac{\partial\rho}{\partial y}\right)+\left(\frac{\partial}{\partial z}K\frac{\partial\rho}{\partial z}\right);$$

and the corresponding equations in electricity and heat for anisotropic substances would be available to account for any parallel phenomena, which may arise, or might be conceived, to exist in connection with diffusion through a crystalline solid. The solution of such an equation can usually be expressed in terms of an expansion in an infinite series (see FOURIER'S SERIES, SPHERICAL HARMONICS, etc.).

In the case of a very dilute solution, the coefficient of diffusion of the dissolved substance can be defined in the same way as when the diffusion takes place in a solid, because the effects of diffusion will not have any perceptible influence on the solvent, and the latter may therefore be regarded as remaining practically at rest. But in most cases of diffusion between two fluids, both of the fluids are in motion, and hence there is far greater difficulty in determining the motion, and even in defining the coefficient of diffusion. It is important to notice in the first instance that it is only the relative motion of the two substances which constitutes diffusion. Thus when a current of air is blowing, under ordinary circumstances the changes which take place are purely mechanical, and do not depend on the separate diffusions of the oxygen and nitrogen of which the air is mainly composed. It is only when two gases are flowing with unequal velocity, that is, when they have a relative motion, that these changes of relative distribution, which are called diffusion, take place. The best way out of the difficulty is to investigate the separate motions of the two fluids, taking account of the mechanical actions exerted on them, and supposing that the mutual action of the fluids causes each fluid to resist the relative motion of the other.

4. The Coefficient of Resistance. — Let us call the two diffusing fluids A and B. If B were absent, the motion of the fluid A would be determined entirely by the variations of pressure of the fluid A, and by the external forces, such as that due to gravity acting on A. Similarly if A were absent, the motion of B would be determined entirely by the variations of pressure due to the fluid B, and by the external forces acting on B. When both fluids are mixed together, each fluid tends to resist the relative motion of the other, and by the law of equality of action and reaction, the resistance which A experiences from B is everywhere equal and opposite to the resistance which B experiences from A. If the amount of this resistance per unit volume be divided by the relative velocity of the two fluids, and also by the product of their densities, the quotient is called the "coefficient of resistance." If then ρ_1,ρ_2 are the densities of the two fluids, u_1, u_2 their velocities, C the coefficient of resistance. then the portion of the fluid A contained in a small element of volume v will experience from the fluid B a resistance $C\rho_1\rho_2 v(u_1-u_2)$, and the fluid B contained in the same volume element will experience from the fluid A an equal and opposite resistance, $C\rho_2\rho_1 v(u_2-u_1)$.

This definition implies the following laws of resistance to diffusion, which must be regarded as based on experience, and not as self-evident truths: (1) each fluid tends to assume, so far as diffusion is concerned, the same equilibrium distribution that it would assume if its motion were unresisted by the presence of the other fluid. (Of course, the mutual attraction of gravitation of the two fluids might affect the final distribution, but this is practically negligible. Leaving such actions as this out of account the following statement is correct.) In a state of equilibrium, the density of each fluid at any point thus depends only on the partial pressure of that fluid alone, and it is the same as if the other fluids were absent. It does not depend on the partial pressures of the other fluids. If this were not the case, the resistance to diffusion would be analogous to the friction of solids, and would contain terms which were independent of the relative velocity u_2-u_1. (2) For slow motions the resistance to diffusion is (approximately at any rate) proportional to the relative velocity. (3) The coefficient of resistance C is not necessarily always constant: it may, for example, and, in general, does, depend on the temperature.

If we form the equations of hydrodynamics for the different fluids occurring in any mixture, taking account of diffusion, but neglecting viscosity, and using suffixes 1, 2 to denote the separate fluids, these assume the form given by James Clerk hlaxwell ("Diffusion," in *Ency. Brit.*, 9th ed.):

$$\rho_1\frac{Du_1}{Dt}+\frac{\partial p_1}{\partial x}-X_1\rho_1+C_{12}\rho_1\rho_2(u_1-u_2)+\cdots=0,$$

where $$\frac{Du_1}{Dt}=\frac{\partial u_1}{\partial t}+u_1\frac{\partial u_1}{\partial x}+v_1\frac{\partial u_1}{\partial y}+w_1\frac{\partial u_1}{\partial z},$$

and these equations imply that when diffusion and other motions cease, the fluids satisfy the separate conditions of equilibrium $\partial p_1/\partial x-X_1\rho_1=0$. The assumption made in the following account is that terms such as Du_1/Dt may be neglected in the cases considered.

A further property based on experience is that the motions set up in a mixture by diffusion are very slow compared with those set up by mechanical actions, such as differences of pressure. Thus, if twc gases at equal temperature and pressure be allowed to mix by diffusion, the heavier gas being below the lighter, the process will take a long time; on the other hand, if two gases, or parts of the same gas, at different pressures be connected, equalization of *pressure* will take place almost immediately. It follows from this property that the forces required to overcome the "inertia" of the fluids in the motions due to diffusion are minute in comparison. At any stage of the process, therefore, any one of the diffusing fluids may be regarded as in equilibrium under the action of its own partial pressure, the external forces to which it is subjected and the resistance to diffusion of the other fluids.

5. Slow Diffusion of Two Gases, Relation Between the Coefficients of Resistance and of Diffusion. — llie now suppose the diffusing substances to be two gases which obey Boyle's law, and that diffusion takes place in a closed cylinder or tube of unit sectional area at constant temperature, the surfaces of equal density being perpendicular to the axis of the cylinder, so that the direction of diffusion is along the length of the cylinder, and we suppose no external forces, such as gravity, to act on the system.

The densities of the gases are denoted by ρ_1, ρ_2, their velocities of diffusion by u_1, u_2, and if their partial pressures are p_1, p_2, we have by Boyle's law $p_1=k_1\rho_1$, $p_2=k_2\rho_2$, where k_1, k_2 are constants for the two gases, the temperature being constant. The axis of the cylinder is taken as the axis of x.

From the considerations of the preceding section, the effects of inertia of the diffusing gases may be neglected, and at any instant of the process either of the gases is to be treated as kept in equilibrium by its partial pressure and the resistance to diffusion produced by the other gas. Calling this resistance per unit volume R, and putting $R=C\rho_1\rho_2(u_1-u_2)$, where C is the coefficient of resistance, the equations of equilibrium give

$$\frac{dp_1}{dx}+C\rho_1\rho_2(u_1-u_2)=0, \text{ and } \frac{dp_2}{dx}+C\rho_2\rho_1(u_2-u_1)=0. \quad (1)$$

These involve

$$\frac{dp_1}{d} + \frac{dp_2}{dr} = 0 \quad \text{or} \quad p_1 + p_2 = P, \qquad (2)$$

where P is the total pressure of the mixture, and is everywhere constant, consistently with the conditions of mechanical equilibrium.

Now dp_1/dx is the pressure-gradient of the first gas, and is, by Boyle's law, equal to k_1 times the corresponding density-gradient. Again $\rho_1 u_1$ is the mass of gas flowing across any section per unit time, and $k_1\rho_1 u_1$ or $p_1 u_1$ can be regarded as representing the flux of partial pressure produced by the motion of the gas. Since the total pressure is everywhere constant, and the ends of the cylinder are supposed fixed, the fluxes of partial pressure due to the two gases are equal and opposite, so that

$$p_1 u_1 + p_2 u_2 = 0 \quad \text{or} \quad k_1\rho_1 u_1 + k_2\rho_2 u_2 = 0. \qquad (3)$$

From (2) *(3)* we find by elementary algebra

$$u_1/p_2 = -u_2/p_1 = (u_1 - u_2)/(p_1 + p_2) = (u_1 - u_2)/P,$$

and therefore

$$p_2 u_1 = -p_2 u_2 = p_1 p_2 (u_1 - u_2)/P = k_1 k_2 \rho_1 \rho_2 (u_1 - u_2)/P.$$

Hence equations (1) *(2)* gives

$$\frac{\partial p_1}{\partial x} + \frac{CP}{k_1 k_2}(p_1 u_1) = 0, \text{ and } \frac{\partial p_2}{\partial x} + \frac{CP}{k_1 k_2}(p_2 u_2) = 0;$$

whence also substituting $p_1 = k_1\rho_1$, $p_2 = k_2\rho_2$, and by transposing

$$\rho_1 u_1 = -\frac{k_1 k_2}{CP}\frac{\partial \rho_1}{\partial x}, \text{ and } \rho_2 u_2 = -\frac{k_1 k_2}{CP}\frac{\partial \rho_2}{\partial x}.$$

We may now define the "coefficient of diffusion" of either gas as the ratio of the rate of flow of that gas to its density-gradient. With this definition, the coefficients of diffusion of both the gases in a mixture are equal, each being equal to $k_1 k_2/CP$. The ratios of the fluxes of partial pressure to the corresponding pressure-gradients are also equal to the same coefficient. Calling this coefficient K, we also observe that the equations of continuity for the two gases are

$$\frac{\partial \rho_1}{\partial t} + \frac{\partial(\rho_1 u_1)}{\partial x} = 0, \text{ and } \frac{\partial \rho_2}{\partial t} + \frac{\partial(\rho_2 u_2)}{\partial x} = 0,$$

leading to the equations of diffusion

$$\frac{\partial \rho_1}{\partial t} = \frac{\partial}{\partial x}\left(K\frac{\partial \rho_1}{\partial x}\right), \text{ and } \frac{\partial \rho_2}{\partial t} = \frac{\partial}{\partial x}\left(K\frac{\partial \rho_2}{\partial x}\right),$$

exactly as in the case of diffusion through a solid.

If we attempt to treat diffusion in liquids by a similar method, it is, in the first place, necessary to define the "partial pressure" of the components occurring in a liquid mixture. This leads to the conception of "osmotic pressure," which is dealt with in the article SOLUTIONS. For dilute solutions at constant temperature, the assumption that the osmotic pressure is proportional to the density, leads to results agreeing fairly closely with experience, and this fact may be represented by the statement that a substance occurring in a dilute solution behaves like a perfect gas. (It is to be borne in mind that the partial pressures are no longer additive. For a solution containing 1 gm. molecule of sugar per litre the osmotic pressure is about 30 atmospheres even though the total pressure is only 1 Atm.)

6. Relation of the Coefficient of Diffusion to the Units of Length and Time.—We may write the equation defining K in the form

$$u = -K \times \frac{1}{\rho}\frac{d\rho}{dx}.$$

Here $-d\rho/\rho dx$ represents the proportional rate at which the density decreases with the distance x; and we thus see that the coefficient of diffusion represents the ratio of the velocity of flow to the proportional rate at which the density decreases with the distance measured in the direction of flow. This proportional rate being of the nature of a number divided by a length, and the velocity being of the nature of a lcngtli divided by a time, we may state that K is of two dimensions in length and -1 in time, *i.e.*, of dimensions L^2/T.

Example 1. Taking K = 0·1423 for carbon dioxide and air (at temperature 0° C and pressure 76 cm. of mercury) referred to a centimetre and a second as units, we may interpret the result as follows:—Supposing in a mixture of carbon dioxide and air, the density of the carbon dioxide decreases by, say, 1, 2, or 3% of itself in a distance of 1 cm, then the corresponding velocities of the diffusing carbon dioxide will be respectively 0·01, 0·02 and 0·03 times 0·1423, that is, 0·001423, 0·002846 and 0·004269 cm. per second in the three cases.

Example 2. If we wished to take a foot and a second as our units, we should have to divide the value of the coefficient of diffusionin Example 1 by the square of the number of centimetres in 1 ft., that is, roughly speaking, by *goo*, giving the new value of K = 0·00016 roughly.

7. Numerical Values of the Coefficient of Diffusion.—The table with this article gives the values of the coefficient of diffusion of several principal pairs of gases at a pressure of 76 am. of mercury, and also of a number of other substances. In the values for gases the centimetre and second are taken as fundamental units, in other cases the centimetre and day. The numbers given must be taken as indicating the order of magnitude only since considerably different values are obtained by different observers. Thus Obermayer obtained the value 0·67 for hydrogen-oxygen.

8. Diffusion Through a Membrane or Partition. Theory of the Semi-permeable Membrane.—It has been pointed out that diffusion of gases frequently takes place in the interior of solids; moreover, different gases behave differently with respect to the same solid at the same temperature. A membrane or partition formed of such a solid can therefore be used to effect a more or less complete separation of gases from a mixture. This method is employed commercially for extracting oxygen from the atmosphere, in particular for use in projection lanterns where a high degree of purity is not required. A similar method is often applied to liquids and solutions and is known as "dialysis."

In such cases as can be tested experimentally it has been found that a gas always tends to pass through a membrane from the side where its density, and therefore its partial pressure, is greater to the side where it is less; so that for equilibrium the partial pressures on the two sides must be equal. This result is unaffected by the presence of other gases on one or both sides of the membrane. For example, if different gases at the same pressure are separated by a partition through which one gas can pass more rapidly than the other, the diffusion will give rise to a difference of pressure on the two sides, which is capable of doing mechanical work in moving the partition. In evidence of this conclusion Max Planck quotes a test experiment made by him in the Physical Institute of the University of Munich in 1883, depending on the fact that platinum foil at white heat is permeable to hydrogen but impermeable to air, so that if a platinum tube filled with hydrogen be heated the hydrogen will diffuse out, leaving a vacuum.

The details of the experiment may be quoted here:—"A glass tube of about 5 mm. internal diameter, blown out to a bulb at the middle, was provided with a stop-cock at one end. To the other a platinum tube 10 cm. long was fastened, and closed at the end. The whole tube was exhausted by a mercury pump, filled with hydrogen at ordinary atmospheric pressure. and then closed. The closed end of the platinum portion was then heated in a horizontal position by a Bunsen burner. The connection between the glass and platinum tubes, having been made by means of sealing-wax, had to be kept cool by a continuous current of water to prevent the softening of the wax. After four hours the tube was taken from the flame, cooled to the temperature of the room, and the stop-cock opened under mercury. The mercury rose rapidly, almost completely filling the tube, proving that the tube had been very nearly exhausted"

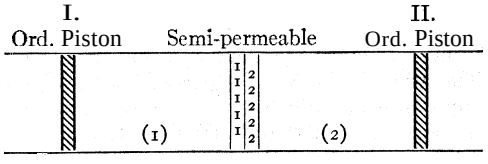
In order that diffusion through a membrane may be reversible so far as a particular gas is concerned, the process must take place so slowly that equilibrium is set up at every stage. In order to separate one gas from another consistently with this condition it is necessary that no diffusion of the latter gas should accom-

Substances	Temp.	K.	Author
Carbon dioxide and air	0° C	0·1423 cm²–sec.	J. Loschmidt
,, ,, ,, hydrogen	0° C	0·5558 ,,	,,
,, ,, ,, oxygen	0° C	0·1409 ,,	,,
,, ,, ,, carbon monoxide	0° C	0·1406 ,,	,,
,, ,, ,, marsh gas (methane)	0° C	0·1586 ,,	,,
,, ,, ,, nitrous oxide	0° C	0·0983 ,,	,,
Hydrogen and oxygen	0° C	0·7214 ,,	,,
,, ,, carbon monoxide	0° C	0·6422 ,,	,,
,, ,, sulphur dioxide	0° C	0·4800 ,,	,,
Oxygen and carbon monoxide	0° C	0·1802 ,,	,,
Water and ammonia	20° C	1·250 ,,	G. Hüfner
,, ,, ,,	5° C	0·822 ,,	,,
,, ,, common salt (density 1.0269)		0·355 cm²/hour	J. Graham
,, ,, ,, ,, ,, ,,	14·33° C	1·020, 0·996, 0·972, 0·932 cm²/day	F. Heimbrodt
,, ,, zinc sulphate (0·312 gm/cm³)		0·1162 ,,	W. Seitz
,, ,, zinc sulphate (normal)		0·2355 ,,	,,
,, ,, zinc acetate (double normal)		0·1195 ,,	,,
,, ,, zinc formate (half normal)		0·4654 ,,	,,
,, ,, cadmium sulphate (double normal)	..	0·2456 ,,	,,
,, ,, glycerin ($\frac{1}{8}$n, $\frac{1}{2}$n, $\frac{7}{8}$n, 1·5n)	10·14° C	0·356, 0·350, 0·342, 0·315 cm²/day	F. Heimbrodt
,, ,, urea ($\frac{1}{8}$n, $\frac{1}{2}$n, n^4, 1·5n)	14·83° C	0·973, 0·946, 0·926, 0·883 cm²/day	
,, ,, hydrochloric acid	14·30° C	2·208, 2·331, 2·480 cm²/day	,,
Gelatin 20% and ammonia	17° C	127·1 ,,	A. Hagenbach
,, ,, ,, carbon dioxide	..	0·845 ,,	,,
,, ,, ,, nitrous oxide	..	0·509 ,,	,,
,, ,, ,, oxygen	..	0·230 ,,	,,
,, ,, ,, hydrogen	..	0·0565 ,,	,,

pany the process. The name "semi-permeable" is applied to an *ideal* membrane or partition through which one gas can pass, and which offers an insuperable barrier to any diffusion whatever of a second gas. By means of two semi-permeable partitions acting oppositely with respect to two different gases *A* and B these gases could be mixed or separated by reversible methods.

Most physicists admit, as Planck does, that it is impossible to obtain an ideal semi-permeable substance; indeed such a substance would necessarily have to possess an infinitely great resistance to diffusion for such gases as could not penetrate it. But in an experiment performed under actual conditions the losses of available energy arising from this cause would be attributable to the imperfect efficiency of the partitions and not to the gases themselves; moreover, these losses are, in every case, found to be completely in accordance with the laws of irreversible thermodynamics. The reasoning in this article being somewhat condensed, the reader must necessarily be referred to treatises on thermodynamics for further information on points of detail connected with the argument.

9. Work That Can Be Gained on Mixing Perfect Gases Reversibly. — In the case of perfect gases the partial pressures of the respective gases are independent of the presence of other gases. Take two separate gases, each at the same pressure, p_1+p_2, and at the same temperature; their volumes being V_1 and V_2. These can be mixed in a reversible way by means of suitable cylinders and pistons.



Place the gases in cylinders 1 and 2. The central pistons *initially in contact* must be semi-permeable, No. 1 to gas No. 1 and No. 2 to gas No. 2. By adjusting the ordinary pistons the gases may be brought to pressures p_1 and p_2 respectively. The isothermal work done by the system is

$$R_1T\log\frac{p_1+p_2}{p_1}+R_2T\log\frac{p_1+p_2}{p_2}$$

and the volumes become V'_1 and V'_2.

By suitably moving all four pistons the gases can be transferred reversibly to the space between the two inner pistons the pressure remaining at the values p_1 and p_2 while the intervening region remains throughout at constant pressure, p_1+p_2. The work done in this stage is

$$-V'_1p_1-V'_2p_2+(p_1+p_2)(V_1+V_2)$$

which, on inserting the values of V'_1 and V'_2 is seen to be zero. Hence the total work obtained is that done in the first stage and on putting $(p_1+p_2)V_1=R_1T$ and $(p_1+p_2)V_2=R2T$ it becomes

$$(p_1+p_2)V_1\log\frac{p_1+p_2}{p_1}+(p_1+p_2)V_2\log\frac{p_1+p_2}{p_2}.$$

When the two gases are mixed by diffusion in an enclosed space, the total pressure remaining constant at p_1+p_2 throughout, all this work is lost for good since the gases can only be separated again by having work performed on them at *least* equal to that which might have been gained.

10. Kinetic Models of Diffusion. — Imagine in the first instance that a very large number of red balls are distributed over one half of a billiard table, and an equal number of white balls over the other half. If the balls are set in motion with different velocities in various directions, diffusion will take place, the red balls finding their way among the white ones, and vice versa; and the process will be retarded by collisions between the balls. The simplest model of a perfect gas studied in the kinetic theory of gases (*see* KINETIC THEORY OF MATTER) differs from the above illustration in that the bodies representing the molecules move in space instead of in a plane, and, unlike billiard balls, their motion is unresisted, and they are perfectly elastic, so that no kinetic energy is lost either during their free motions, or at a collision.

The mathematical analysis connected with the application of the kinetic theory to diffusion is very long and cumbersome. We shall therefore confine our attention to regarding a medium formed of elastic spheres as a mechanical model, by which the most important features of diffusion can be illustrated. We shall assume the results of the kinetic theory, according to which: — (1) In a dynamical model of a perfect gas the mean kinetic energy of translation of the molecules represents the absolute temperature of the gas. (2) The pressure at any point is proportional to the product of the number of molecules in unit volume about that point into the mean square of the velocity. (The mean square of velocity is different from but proportional to the square of the mean velocity, and in the subsequent arguments either of these two quantities can generally be taken.) (3) In a gas mixture represented by a mixture of molecules of unequal masses. the mean

kinetic energies of the different kinds are equal.

Consider now the problem of diffusion in a region containing two kinds of molecules A and B of unequal mass. The molecules of A in the neighbourhood of any point will, by their motion, spread out in every direction until they come into collision with other molecules of either kind, and this spreading out from every point of the medium will give rise to diffusion. If we imagine the velocities of the A molecules to be equally distributed in all directions, as they would be in a homogeneous mixture, it is obvious that the process of diffusion will be greater, *ceteris paribus*, the greater the velocity of the molecules, and the greater the length of the free path before a collision takes place. If we assume consistently with this, that the coefficient of diffusion of the gas A is proportional to the mean value of $w_a l_a$, where w_a is the velocity and l_a is the length of the path of a molecule of A, this expression for the coefficient of diffusion is of the right dimensions in length and time. If, moreover, we observe that when diifusion takes place in a fixed direction, say that of the axis of x, it depends only on the resolved part of the velocity and length of path in that direction: this hypothesis readily leads to our taking the mean value of $\frac{1}{3}w_a l_a$ as the coefficient of diffusion for the gas A. This value was obtained by O. E. Meyer and others.

Unfortunately, however, it makes the coefficients of diffusion unequal for the two gases, a result inconsistent with that obtained above from considerations of the coefficient of resistance, and leading to the consequence that differences of pressure would be set up in different parts of the gas. To equalize these differences of pressure, Mever assumed that a counter current is set up, this current being, of course, very slow in practice; and J. Stefan assumed that the diffusion of one gas was not affected bv collisions between molecules of the *same gas*. When the molecules are mixed in equal proportions both hypotheses lead to the value $\frac{1}{6}([w_a l_a]+[w_b l_b])$, (square brackets denoting mean values). When one gas preponderates largely over the other, the phenomena of diffusion are too difficult of observation to allow of accurate experimental tests being made. Moreover, in this case no difference exists unless the molecules are different in size or mass.

Instead of supposing a velocity of translation added after the mathematical calculations have been performed, a better plan is to assume from the outset that the molecules of the two gases have small velocities of translation in opposite directions, superposed on the distribution of velocity, which would occur in a medium representing a gas at rest. When a collision occurs between molecules of different gases a transference of momentum takes place between them, and the quantity of momentum so transferred in one second in a unit of volume gives a dynamical measure of the resistance to diffusion. It is to be observed that, however small the relative velocity of the gases A and B, it plays an all-important part in determining the coefficient of resistance; for without such relative motion, and with the velocities evenly distributed in all directions, no transference of momentum could take place. The coefficient of resistance being found, the motion of each of the two gases may be discussed separately.

One of the most important consequences of the kinetic theory is that if the volume be kept constant the coefficient of diffusion varies as the square root of the absolute temperature. To prove this, we merely have to imagine the velocity of each molecule to be suddenly increased n fold; the subsequent processes, including diffusion, will then go on n times as fast; and the temperature T, being proportional to the kinetic energy, and therefore to the square of the velocity, will be increased n^2 fold. Thus K, the coefficient of diffusion, varies as $\sqrt{T}$.

The relation of K to the density when the temperature remains constant is more difficult to discuss, but it may be sufficient to notice that if the number of molecules is increaskd n fold, the chances of a collision are n times as great, and the distance traversed between collisions is (not *therefore* but as the result of more detailed reasoning) on the average $1/n$ of what it was before. Thus the free path, and therefore the coefficient of diffusion, varies inversely as the density, or directly as the volume. If the pressure p and temperature T be taken as variables, K varies inversely as p and directly as $\sqrt{T^3}$.

Now according to the experiments first made by J. C. Maxwell and J. Loschmidt, it appeared that with constant density K was proportional to T more nearly than to $\sqrt{T}$. The inference is that in this respect a medium formed of colliding spheres fails to give a correct mechanical model of gases. It has been found by L. Boltzmann, Maxwell and others that a system of particles whose mutual actions vary according to the inverse fifth power of the distance between them represents more correctly the relation between the coefficient of diffusion and temperature in actual gases. Other recent theories of diffusion have been advanced by M. Thiesen, P. Langevin and W. Sutherland. On the other hand, J. Thovert finds experimental evidence that the coefficient of diffusion is proportional to molecular velocity in the cases examined of non-electrolytes dissolved in water at 18° at 2·5 grams per litre.

11. Applications of Diffusion to Separating Gases.—Lord Rayleigh has applied the different *rates* at which diffusion takes place through porous partitions to the partial separation of mixed gases. Let x and y denote the quantities of the respective gases remaining at any moment in the chamber, so that $-dx$ and $-dy$ can stand for the quantities diffusing out in time dt. The values of dx/dt and dy/dt will depend upon the character of the porous partition and upon the actual pressure. Calling the relative rates of diffusionp, and v, we have

$$dy/dx=(\nu y)/\mu x. \qquad (1)$$

The integral of (1) is

$$\log \frac{y}{x} = x^{-\frac{\mu-\nu}{\mu}} + \text{constant}.$$

If the values, at any moment which we take as the initial time, are Y and X the constant can be eliminated. If we write $\frac{y}{x}\frac{X}{Y}=r$, the value of r represents the enrichment of the residue in regard to the second constituent (y) and we can write

$$\frac{x+y}{X+Y}=\frac{X}{X+Y}r^{\frac{\mu}{(\nu-\mu)}}+\frac{Y}{X+Y}r^{\frac{\nu}{(\nu-\mu)}}.$$

These equations show that the residue becomes purer *without limit*, and this is so whatever may be the original proportions. This is an outline of the theory that might be expected to apply to Graham's atmolyser in which the gaseous mixture is caused to travel along a tobacco pipe on the outside of which a vacuum is maintained. The third Lord Rayleigh applied this method to the separation of argon from air from which the oxygen had previously been removed. If an enrichment in the ratio 2 to 1 is desired the diffusion must continue until the total quantity of gas is reduced to less than 2%. In his experiments even more than this reduction was required (Rayleigh, *Phil.* Mag., xlii. 493, 1896).

BIBLIOGRAPHY.—The best introduction to the study of theories of diffusion is afforded by O. E. Meyer's *Kinetic Theory of Gases*, translated by Robert E. Baynes (London, 1899). The mathematical portion, though sufficient for ordinary purposes, is mostly of the simplest possible character. Another useful treatise is R. Ruhlmann's *Handbuch der mechanischen Wärmetheorie* (Brunswick, 1880). For a shorter sketch the reader may refer to J. C. Maxwell's *Theory of Heat*, chaps. xix. and xxii., or numerous other treatises on physics. The theory of the semi-permeable membrane is discussed by M. Planck in his *Treatise on Thermo dynamics*, Engiish translation by A. Ogg (1903), also in treatises on thermodynamics by W. Voigt and other writers. For a more detailed study of diffusion in general the following papers may be consulted:—L. Boltzmann, "Zur Integration der Diffusionsgleichung," *Sitzung. der k. bayer. A kad math.-phys. Klasse* (May 1894); T. des Coudres, "Diffusionsvorgange in einem Zylinder," *Wied. Ann.* lv. (1895), p. 213; J. Loschmidt, "Experimentaluntersuchungen iiber Diffusion," *Wien. Sitz.* lxi., lxii (1870); J. Stefan, "Gleichgewicht und . . . Diffusion von Gasmengen," *Wien. Sitz.* lxiii., "Dynamische Theorie der Diffusion, *Wien. Sitz.* lxv. (April 1872); M. Toepler, "Gas-diffusion," *Wied. Ann.* lviii. (1896), p. 599; A. Wretschko, "Experimentaluntersuchungen iiber die Diffusion von Gasmengen," *Wien. Sitz.* lxii. The mathematical theory of diffusion, according to the kinetic theory of gases, has been treated by a number of different methods, and for the study of these the reader may consult L. Boltzmann, *Vorlesungen iiber Gastheorie* (Leipzig, 1896–98); S. H. Burbury, *Kinetic Theory of Gases* (Cambridge, 1899), and papers by L. Boltzmann in *Wien. Sitz.* lxxxvi. (1882), lxxxvii. (1883); P. G. Tait, "Foundations of the Kinetic Theory of Gases," *Trans. R.S.E.* xxxiii., xxxv., xxvi., or *Scientific Papers*, ii. (Cambridge, 1900). Some of the difficulties in the

theory are discussed in a recent paper by S. Chapman, Phil. Mag. 5,630 (1928). For other work reference should be made to the current issues of *Science Abstracts* (London), and entries under the heading "Diffusion" will be found in the general index at the end of each volume. (G. H. BR.; **A.** W. Po.)

DIFFUSIVITY, the rate of propagation of *temperature,* as distinct from *heat* (*q.v.*), along a body. It depends on the thermal conductivity K, density ρ and specific heat S of the material, according to the equation: diffusity $= \frac{K}{\rho S}$.

DIGBY, GEORGE, 2nd Earl of Bristol: *see* BRISTOL, EARLS AND MARQUESSES OF.

DIGBY, SIR EVERARD (1578–1606), English conspirator, son of Everard Digby of Stoke Dry, Rutland, was born on May 16, 1578. In 1605 he joined the conspirators in the Gunpowder Plot (*q.v.*). His share in the plan was to organize a rising in the Midlands; and on the pretence of a hunting party he assembled at Danchurch, Warwickshire, on Nov. 5, a party of gentlemen who, on receiving news of the destruction of the king and the House of Lords, were to seize the person of the princess Elizabeth, who was residing in the neighbourhood. The conspirators arrived late on the evening of the 6th to tell their story of failure, and Digby was persuaded by Catesby, with a false tale that the king and Salisbury were dead, to join the small band of conspirators in their hopeless endeavour to raise the country. He went with them to Huddington, Worcs., and on the 7th to Holbeche, Staffs. On the 8th, he abandoned his companions, and, with two servants, hid in a pit, where he was discovered and captured. He was tried in Westminster Hall, on Jan. 27, 1606, and alone among the conspirators he pleaded guilty, declaring that the motives of his crime had been his friendship for Catesby and his devotion to his religion. He was condemned to death, and executed on the 31st, in St. Paul's Churchyard, with the customary brutalities.

See narrative of Father Gerard, in *Condition of the Catholics under James I.,* by J. Morris (1872), etc. A life of Digby under the title of *A Life of a Conspirator,* by a Romish recusant (Thomas Longueville) was published in 1895.

DIGBY, SIR KENELM (1603–1665), English author, diplomatist and sailor, son of Sir Everard Digby (*q.v.*), was brought up as a Roman Catholic at his mother's house at Gayhurst. On leaving Oxford in 1620 he travelled in France and Italy, and in March 1623 joined his uncle, Sir John Digby, ambassador to the court of Spain. There he met Prince Charles and the duke of Buckingham, and, joining the prince's household, returned with him to England, and was knighted by James in October. Digby was a handsome man and cut a great figure in society, but was kept out of public employment by Buckingham's jealousy of his cousin, Lord Bristol. In 162; he decided, on the latter's advice, to attempt an adventure on his own. With two ships-he set sail on a privateering expedition, captured some Spanish and Flemish ships off Gibraltar (Jan. 18, 1628), seized a Dutch ship off Majorca, and defeated the French and Venetian ships in the harbour of Scanderoon. He returned to England in Feb. 1629, and next year was made a commissioner of the navy, but his doings in the Mediterranean had to be disavowed on account of the complaints of the Venetian ambassador.

Digby had married secretly in 1625 the beautiful Venetia Hanley. She died in 1633, and was celebrated by Ben Jonson in *Eupheme.* Her husband went into retirement for two years to mourn for his wife, and changed his religion, only to return to the Roman Catholic faith immediately He wrote from France pamphlets in defence of his faith, and on his return to England appealed (1640) to Roman Catholics for money in support of the King's Scottish expedition (1641) to secure help against the parliament. He was summoned to the bar of the House of Commons (Jan. 27, 1641) to answer for his conduct. He left England, returned and was imprisoned, and was finally released and allowed to go to France (July 30, 1643), on condition that he engaged in no plots against the Government.

He became chancellor to the queen Henrietta Maria, in Paris, and was sent by her on a mission to Rome in 1646, where he promised in her name (he had no warrant from Charles) religious freedom for Roman Catholics in England and Ireland, an independent parliament for Ireland, etc. In Feb. 1649 he was asked to return to England, was again banished, and remained in exile until 1654. At that time he was engaged by Cromwell, to the scandal of both parties, in diplomatic business. At the Restoration he returned to England. He died on June 11, 1665.

While he was in Paris he had written two works famous in their day, *Of Bodies* and *Of the Immortality of Man's Soul* (1644). He dabbled in medicine, and some of his preparations are described in *Tlze Closet of the Eminently Learned Sir Kenelm Digby Knt. Opened* (1677). His *Memoirs* are composed in the high-flown fantastic manner then usual when recounting incidents of love and adventure, but the style of his more sober works is excellent.

Digby translated *A Treatise of bdhering to God written by Albert the Great, Bishop of Ratisbon* (1653); and he was the author of *Private Memoirs,* published by Sir N. H. Nicholas from *Harleiun Ms. 6758* with introduction (1827); *Journal of the Scanderoon Voyage in 1628,* printed by J. Bruce with preface (Camden Society, 1868); *Poems from Sir Kenelm Digby's Papers . . .* with preface and notes (Roxburghe Club, 1877); in the *Add. Mss.* 34,362 f. 66 is a poem *Of the Miserys of Man,* probably by Digby; *Choice of Experimental Receipts in Physick and Chirurgery . . . collected by Sir K. Digby* (1668), and *Chymical Secrets and Rare Experiments* (1683), were published by G. Hartman, who describes himself as Digby's steward and laboratory assistant.

See the *Life of Sir Kenelm Digby by one of his Descendants* (T. Longueville), 1896.

DIGBY, KENELM HENRY (1800–ISSO), English writer, youngest son of William Digby, dean of Clonfert, was born at Clonfert, Ireland. His reputation rests chiefly on his earliest publication, *The Broadstone of Honour, or Rules for the Gentlemen of England* (1822), which contains an exhaustive survey of mediaeval customs, full of quotations from varied sources. The work was subsequently enlarged and issued (1826–27) in four volumes entitled: *Godefridus, Tancredus, Morus* and *Orlandus* (numerous re-impressions, the best of which is the edition brought out by B. Quaritch in five volumes, 1876–77).

See J. Gillow's *Bibliographical Dictionary of English Catholics,* ii. 81–83, and Bernard Holland, *Memoir of Kenelm Henry Digby* (1919).

DIGENES ACRITAS, BASILIUS, Byzantine national hero, probably lived in the 10th century. He is named Digenes (of double birth) as the son of a Muslim father and a Christian mother; Acritas (ἄκρα, frontier, boundary), as one of the frontier guards of the empire. The original Digenes epic is lost, but four poems are extant, in which the different incidents of the legend have been worked up by different hands. The first of these was discovered in the latter part of the 19th century, in a 16th-century ms., at Trebizond; the other three mss. were found at Grotta Ferrata, Andros and Oxford. The poem undoubtedly contains a kernel of fact, although it cannot be regarded as in any sense an historical record. The scene of action is laid in Cappadocia and the district of the Euphrates.

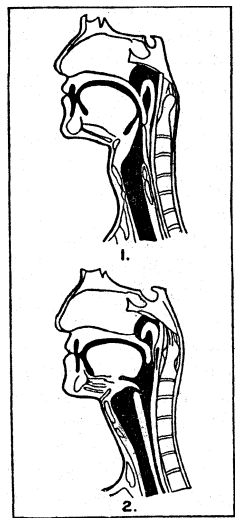
Editions of the Trebizond ms. by C. Sathas and E. Legrand in the *Collection des monuments pour servir à l'etude de la langue néo-hellénique,* new series, vi. (1875), and by S. Joannides (Constantinople, 1887). *See* monographs by A. Luber (Salzburg, 1885) and G. Wartenberg (Berlin, 1897). Full information will be found in C. Krumbacher, *Geschichte der byzantinischen Litteratur* (2nd ed., 1897); *see* also G. Schlumberger, *L'Epopée Byzantine à la fin du dixième siècle* (1897).

DIGEST, a term used generally of any digested or carefully arranged collection or compendium of written matter, but more particularly in law of a compilation in condensed form of a body of law digested in a systematic method; *e.g.,* the Digest *(Digesta)* or Pandects (Πάνδεκται) of Justinian, a collection of extracts from the opinions of earlier jurists compiled by order of the emperor Justinian. The word is also given to the compilations of the main points (marginal or head-notes) of decided cases.

DIGESTION. Most of the food substances taken by animals for nourishment require some alteration before they can be absorbed into the blood and in this way carried to all parts of the body. The conversion of foodstuffs into diffusible or assimilable substances is known as digestion and is carried out in the alimentary canal, mainly by the enzymes secreted by the various glands. The food introduced into the mouth begins its long jour-

ney 'through the alimentary canal, where it comes into contact with the digestive juices and thus undergoes chemical disintegration, the products being finally absorbed. The three chief functions of the digestive tract are (1) propulsion of food along the tract; (2) secretion of digestive juices by glands which are connected with the tract by means of ducts or situated in the walls of the tract; (3) absorption of the final products of digestion.

Salivary Secretion.—The food undergoes its first change while in the mouth; it is broken up into small pieces during the process of mastication, and is well mixed with the first digestive juice, the saliva. The normal secretion of saliva can best be studied in animals in which the natural opening of one of the salivary glands has been surgically transplanted from the inside skin of the mouth to the outside, so that the saliva flows from the gland through the diverted duct to the chin or cheek of the animal. As a result of this harmless operation, the saliva can easily be collected, measured and analyzed. This operation is known as the establishment of a salivary fistula. The results have been compared with observations on man obtained in cases where a fistula became established as the result of accidental injury. The salivary glands must be divided into two groups according to their structure and the composition of the secretion. The first group consists of the mucous glands (submaxillary and sublingual glands) which secrete viscid saliva, rich in the gluco-protein mucin. The second group comprise the serous glands (parotid gland), the juice of which contains no mucin and is therefore watery; it contains, however, some other proteins mainly of the globulin type. In man and certain other animals, both sets of glands secrete the enzyme ptyalin. Before and after the periods of intake of food, the glands are at rest, for the moisture of the mouth depends chiefly on the continuous secretion of small glands covering the mucous membrane, and not on the secretion of the salivary glands.



FROM STARLING, "PRINCIPLES OF HUMAN PHYSIOLOGY"

FIG. 1.—DIAGRAM SHOWING POSITION OF SOFT PALATE (TIGERSTEDT) 1. During rest; 2. during the act of swallowing

Function and *Composition of* Saliva.—On the administration of food, all the salivary glands begin to secrete, the amount of secretion being proportional to the length of time the food remains in the mouth. It is, however, not only food substances which evoke secretion. This power is also possessed by certain chemical substances which often are not swallowed but ejected from the mouth, as for instance acids, alkalies, salts and various irritants such as pepper, mustard, etc.; secretion is even evoked by some substances whose irritant nature is due to purely mechanical properties, as is the case with fine sand and certain powders. It is obvious that many of these irritants play a considerable rôle in our daily menu, though they cannot be regarded as nutritive substances. The main function of saliva is to soften and lubricate, in order to make the food able to pass through the comparatively narrow oesophagus tube to the stomach. In the case of irritants, the purpose of saliva is to dilute them, and to protect the mucous membrane of the mouth by covering it with a layer of viscid mucin. The primary function of the saliva is therefore physical, but in man and those animals whose saliva contains ptyalin, there is the further function of assisting in the chemical decomposition of the higher carbohydrates.

The composition of saliva secreted on administration of the two classes of stimuli (food and irritants) is very different. When food is given, the mucous glands secrete a viscid saliva, rich in mucin, but when irritants are administered, the secretion contains hardly any mucin. This differencein viscosity can be demonstrated by observing the length of time taken by different samples of saliva to flow through a capillary tube, and comparing the rates with that of water. For instance, in one experiment, 1cc. of water took 6 seconds to pass through the viscosimeter, 1cc. of saliva obtained on introduction into the mouth of 0·5% HCl took 8 seconds, of an emulsion of mustard 9 seconds, of 2·5% NaCl g seconds, while 1cc. of saliva obtained on administration of bread took 95 seconds, of meat 175 seconds, of milk 231 seconds and of dried powdered meat 255 seconds. On determining the organic and inorganic constituents of the saliva, it was found that the "alimentary" saliva from the submaxillary gland contained about 0·99% of organic matter, and about 0·4% of inorganic, while that secreted after administration of irritants contained only about 0·1–0·2% of organic matter, and about the same percentage of inorganic matter, namely from 0·35–0·45%. These peculiar differences in the composition of saliva are exhibited only by the mucous glands. The parotid saliva varies little, and with both types of substance has approximately the same composition (0·9–1·0% of organic and 0·35–0·48% of inorganic matter). The organic substances are proteins and ptyalin, and the inorganic are chiefly potassium chloride, which appears in considerably larger quantities than in the blood, sodium chloride, sodium bicarbonate and potassium sulphocyanide.

Mechanism *of* Salivary Secretion.—The amount of saliva secreted depends on the length of time any particular substance remains in the mouth, and also on the extent to which the substance can mechanically or chemically stimulate the mucous membrane of the mouth. Dry substances always evoke a far more copious secretion than liquids. The results of an actual set of observations will serve as an illustration. The following substances were administered for one minute each. Dry bread and the same soaked in water; the resulting secretion measured 3·9cc. and 1·4cc. respectively; with dry meat powder and the same soaked in water, the secretions were 4·5cc. and 1·9cc. respectively; and with dry sand and the same soaked in water, 2·8cc. and 0·4cc. It is obvious that the purely mechanical stimulation caused by the various substances is enough to bring about secretion. Pure water at body temperature evokes no secretion, but saliva is secreted on administration of both hot and cold water, and in each case the composition is the same as that obtained on administration of irritants. The concentration of the chemical stimuli is also of considerable importance. For instance, on administering HCl in concentrations of 0·1, 0.2, 0·3, 0·4 and 0·5% for one minute the total secretion was in one experiment 5.2, 7.4, 8·1, 9.2 and 9·5cc. respectively.

The movements of mastication do not evoke salivary secretion in the absence of the higher parts of the central nervous system; the well-known effect of smell and sight of food is in this case also absent. The secretory effect of these stimuli is the result of association, and will be discussed in the section on conditioned reflexes. The mechanism of salivary secretion is based on a reflex act. Foodstuffs or irritants, in virtue of their chemical or mechanical nature, stimulate the peripheral nerve endings of the sensory nerves of the mouth and tongue, namely the lingual and the glossopharyngeal nerves. The nervous impulse passes along these nerves to the salivary centre in the medulla, and is there transmitted by the efferent (secretory) nerves to the corresponding salivary glands. The higher centres are not necessary for the normal reflex salivary secretion. In dogs in which the brain has been destroyed above the medulla, all the characteristics of the salivary secretion are preserved; moreover, the composition and amount of the secretion depend on the nature of the stimulus in the usual way. After injury to the medulla or after section of both sensory nerves of the mouth, secretion cannot be evoked either by the act of eating, or by irritants.

Nerve *Connections*.—The chief secretory fibres of the two mucous glands were discovered by Ludwig in 1851. They run in the chorda tympani, which is a branch of the facial nerve. The secretory fibres of the parotid gland pass along the glossopharyngeal nerve. Electrical stimulation of these nerves evokes an immediate and copious secretion from the corresponding glands, the rate of secretion being proportional to the strength of the stimulation. All the salivary glands also receive a nerve supply from the sympathetic system, via the cervical sympathetic nerve. The saliva obtained from the mucous glands after stimulation of the cerebral nerves of the dog is more copious and less viscid than

that obtained after stimulation of the sympathetic nerve

Stimulation of the cerebral nerves produces a very considerable vasodilation and therefore increases the blood supply to the gland, while stimulation of the sympathetic nerves produces vasoconstriction to the point of almost arresting the circulation. The correlation formerly drawn was that the extent of secretion and the composition of the saliva were dependent on changes in the blood supply accompanying the stimulation of the corresponding nerves. But it is now generally accepted that the composition of the secretion depends little if at all on the blood flow. At any rate, the saliva does not become more concentrated if on stimulating the cerebral nerve the blood flow is reduced to its original level nor does it become more dilute if the blood flow is artificially increased. The differences in the composition of the saliva and the amount secreted in the normal animal during administration of various substances is certainly not dependent on changes in blood flow (as proved by direct measurements); neither is it dependent on the presence of the sympathetic fibres. After section of all the sympathetic connections, the secretion remains viscid in the case of food, and fluid in the case of irritants.

The part played by the sympathetic nerves in normal secretion is not definitely known. After section of the latter, the secretion hardly changes, while after section of the cerebral nerve it ceases. Artificial stimulation of the sympathetic nerve, however, produces a slight flow of saliva, and causes definite histological changes in the gland. Besides the secretory and vasomotor fibres, the sympathetic nerve contains fibres which stimulate some contractile elements around the secretory cells, and thus help to empty the gland of the viscid juice. The cerebral nerves have no such fibres. The secretory nerve endings of the cerebral salivary nerves are completely paralysed by atropine while the vasodilator nerves are left intact—a further proof that secretion is not due to vasodilation.

The Metabolism **of** the Gland. — The activity of the glands is accompanied by increased metabolism, and the consumption of oxygen and blood sugar may be increased during secretion tenfold. The organic substances and ptyalin which are secreted by the gland are derived from the stores laid down by the gland during the period of rest, and the inorganic substances are derived, together with the water, from the blood. In protracted secretion, as the stores are depleted, the saliva becomes progressively poorer in organic substances, and finally contains only inorganic substances and some urea. **A** gland can however excrete as much as one third of its total nitrogen, showing that the store of organic substances is considerable. As regards water, a gland may be able to secrete over 100 times its own weight in the course of a few hours. The daily secretion from all the salivary glands in man may be roughly estimated at about one litre.

Secretion is not filtration of water from the blood through the gland with a certain washing out of stored substances, but is an active process, the energy for which is derived from oxidations within the gland itself. This is most conclusively proved by the fact that during secretion the gland may develop a hydrostatic pressure in its ducts that is much greater than the blood pressure. The exact nature of the secretory process is not known, and none of the physico-chemical processes that are known to take place in the organism supplies an adequate explanation.

Deglutition.—After mastication, the food is carried to the stomach by a series of co-ordinated voluntary and involuntary movements of the muscles of the tongue, pharynx and oesophagus. The whole act of deglutition may be divided into 3 stages. During the first stage, the food, which has been collected on the surface of the tongue, is carried past the anterior pillars of the fauces; during the second stage it passes through the pharynx, past the openings of the nasal cavities and of the larynx; and during the third stage, it goes through the oesophagus into the stomach. The 3 stages actually compose one single act, and no perceptible pause can be observed between them. Just before deglutition begins, a pause takes place in mastication while the diaphragm gives a short contraction (known as the respiration of deglutition). The bolus of food is then thrown back by a sudden and vigorous contraction of the tongue, assisted by the surrounding muscles (chiefly mylohyoid, also styloglossus, palatoglossus). The contraction of the palatoglossus closes the isthmus faucium, thus preventing the return of food towards the mouth.

In the pharynx, the food passes, a region common to the respiratory and digestive system, but the respiratory passages are temporarily closed. The act of deglutition is impossible unless the larynx is free to move. The bolus is now shot rapidly into the region of the medium and lower constrictors of the pharynx, and then into the oesophagus. Liquids and semi-solids quickly pass down the oesophagus to its cardiac end. Here the passage becomes less rapid, the fluid escaping slowly in a narrow stream into the stomach. The average time for a complete act of deglutition is about 6 seconds for liquids and semi-solids, but dry food substances may take as long as 15 minutes to reach the stomach. The propulsion of liquids is mainly due to the movement of the back of the tongue, but that of solids is due to the contraction of the constrictors of the pharynx and the oesophagal muscles, which slowly push the food towards the stomach.

The passage of food along the oesophagus is assisted by a reflex inhibition of the wall, which is succeeded by a contraction. In every complete act of deglutition there are thus two waves which pass along the oesophagus, one of relaxation and the other of contraction. If however several deglutitions follow one another at short intervals, the wave of contraction has no time to develop, and the succeeding waves of relaxation fuse with one another, thus causing a relaxation of the oesophagus along its whole length. The tube therefore becomes an open passage through which large amounts of liquid can pass into the stomach by mere force of gravity. When swallowing stops, a strong wave of contraction develops. These waves of relaxation and contraction are due to a reflex. and they are not arrested by complete transverse section of the oesophagus, but are stopped by section of its nerves.

There is an important interdependence between respiration and deglutition, for every act of deglutition inhibits a respiratory movement. In the absence of this correlation, food might easily slip through the open respiratory passages into the trachea, which may actually happen in cases of paralysis of the laryngeal muscles. The arrest of respiration may last as long as 6 seconds. That deglutition is impossible in the absence of a bolus is shown by the fact that a man with an empty mouth can perform only four or five swallowings in rapid succession, after which swallowing becomes impossible for a time. The first acts of deglutition were possible because of the presence of saliva in the mouth; after rinsing the mouth with a weak solution of atropine even a single deglutition is impossible without taking some liquid.

Gastric Secretion. — Anatomically, the stomach is divided into the fundal or cardiac portion and the pylorus. Physiologically, the pylorus of the carnivorous animal resembles the intestinal tract proper rather than the rest of the stomach. As the result of an accidental wound in the stomach of a Canadian hunter, a permanent gastric fistula was established, and Beaumont was able, in 1834, to observe directly the movements and secretion of the stomach, and the effects of administering food. In 1843, Bassov, a Russian surgeon, established artificial gastric fistulae in dogs, and since that time various operations on the stomach have become a routine in physiological experimentation.

Except during the period of digestion, the gastric glands are at rest, a little mucus being secreted by the superficial epithelial layer. Within about 5 minutes of the intake of food, the gastric gland begins to secrete. The secretion gradually increases in rate, and considerably outlasts the actual period of eating.

The Reflex *Phase*.—In order to determine whether it is the act of eating or the entry of food into the stomach that brings about gastric secretion, Pavlov performed the following operation. In a dog in which a gastric fistula had been established, he made a transverse section of the oesophagus in the neck, and sutured the two ends to the skin, so that anything that was swallowed dropped out from the open end of the oesophagus and could be eaten again. The animal had of course to be fed either through the lower end of the oesophagus or through the gastric fistula. Animals operated on in this manner live as long as they would normally, and

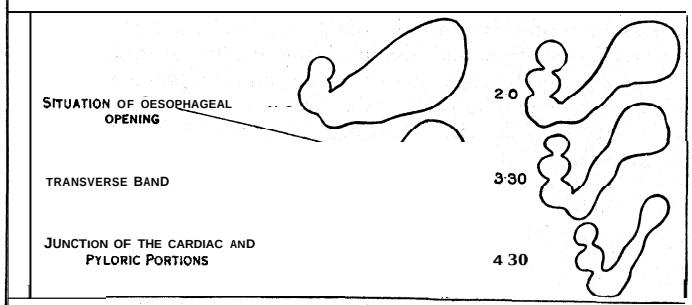
experience no discomfort whatever. When these animals are fed through the mouth (sham feeding), the gastric glands begin to secrete, exactly in the same manner and after the same latent period as in the normal act of eating. The secretion lasts for hours so long as sham feeding is continued, and after its termination the secretion gradually declines, and finally ceases within 10–20 minutes. The conclusion from these experiments is that the onset and the maintenance of the secretion is a reflex which, like that of the salivary secretion, originates in the mouth. The afferent nerves for this reflex are the same as for the salivary secretion, while the secretory fibres run along the vagus nerve. The centre for gastric secretion lies in the medulla. This reflex secretion does not involve the co-operation of the higher nervous centres, and is readily obtained in dogs whose entire fore-brain has been removed. After section of both vagi, the reflex cannot be evoked, just as happens in the case of the salivary glands after section of their respective secretory nerves.

The rate of gastric secretion, the amount of juice secreted, and the composition of the juice (see the section on Nutrition) vary little with different food substances. The juice obtained after administration of fats is deficient in pepsin. The experiments with sham feeding were repeated and confirmed in the case of a man in whom a gastric fistula had to be established on account of stricture of the oesophagus. The amount of juice secreted by an average sized dog may be as much as zoocc. after half an hour of sham feeding, but the secretion may vary considerably.

Part Played by the Higher Centres.—Like the amount of saliva, the amount of gastric juice secreted is largely dependent on appetite. A hungry animal may give, in the same period of time, 5 times more juice than an animal which recently has been fed. It is not only contact with the mucous membrane of the mouth that evokes the reflex, but also the sight and smell of food, and in fact all those' stimuli which the animal associates with food. These effects are entirely dependent on conditioned reflexes (*i.e.* on the higher centres), which in ordinary life play an extremely important part in regulating the activities of all the systems of animals and man; amongst these activities are those of the alimentary glands, which stand in close relation to the central nervous system. Administration of tasteless food, monotony in food, and gross irregularity in the time of feeding will all affect gastric secretion. If the intake of food is too rapid, the secretion will not have time to develop to its maximum, and the food will remain undigested for a considerable time. It is known that the amount of juice secreted, and therefore the digestive and nutritive properties of the food, depend in the long run not so much on the weight or calorific value of the food as on how we eat it, how it is prepared and served, and how we prepare ourselves and concentrate on its intake. However, if man's nutrition depended entirely on his wisdom, only a few would survive, and the organism has, in the case of gastric secretion, a mechanism which is controlled independently not only of the higher centres, but also of the medullary reflex mechanism.

The *Chemical* Mechanism.—This mechanism was also discovered by Pavlov. If certain food substances are introduced through a fistula directly into the stomach, secretion of the gastric juice ensues. This secretion is independent of the nervous system, and can be obtained in a stomach after section of all its nerves. The secretion is best observed in animals in which a portion of the stomach has been separated from the rest and transplanted to the outside (gastric pouch). The pouch may be made so as to preserve its innervation intact, or after section of all the nerves. In the first case, sham feeding will of course produce its usual effect, since this secretion depends on the integrity of the nerves; but in the latter case sham feeding mill have no effect. Introduction of certain food substances into the main part of the stomach will, after a latent period of 10–15 minutes, evoke secretion from the main stomach as well as from the isolated portion, regardless as to whether the nerves are cut or left intact. It is obvious that, in these experiments, since the food substance is never in contact with the transplanted part of the stomach, the secretion cannot be due to a local chemical or mechanical stimulation.

As regards the nature of the substances producing secretion on entry into the stomach, it is known that unchanged food substances, whether carbohydrates, fats or proteins, are unable to produce this secretion. The secretion is however evoked by the presence of the products of the digestion of proteins (peptones, albuminoses) and of fats (fatty acids, soaps). Substances which may be extracted from meat and vegetables on boiling (probably the albumoses) also evoke the secretion if they are introduced directly into the stomach. A most illustrative example is provided



FROM STARLING. "PRINCIPLES OF HUMAN PHYSIOLOGY" (W. B CANNON)

FIG. 2.— SHADOW SKETCHES OF THE OUTLINES OF A CAT'S STOMACH, OBTAINED BY MEANS OF X-RAY ILLUMINATION, IMMEDIATELY AFTER A MEAL CONTAINING BISMUTH SALTS FED AT 11.0, 12.0, 2.0, 3.30 AND 4.30

by the following experiment. Direct introduction of raw meat into the main part of the stomach, after a latent period of about 15 minutes, brought about a considerable secretion from the isolated pouch; a similar introduction of an equal quantity of meat which had been boiled for several hours produced no secretion at all, but the water in which the meat had been boiled caused the same secretion as raw meat. Boiled meat which had been subjected to gastric digestion in vitro produced a very large secretion. The experiment is practically duplicated with vegetables, but on a smaller scale, except that the peptic digestion of the thoroughly boiled vegetables makes no appreciable difference.

There are however proteins which do not yield any extractive substances which are capable of stimulating gastric secretion (for instance egg-white), though on digesting them with gastric juice they acquire strong stimulating properties. In general, we can say that extractive substances from proteins, the products of the digestion of proteins but not proteins themselves, and the products of the digestion of fats but not fats themselves bring about gastric secretion when introduced into the stomach, and this secretion is not under the control of the nervous system.

Two Phases.—The whole gastric secretion may thus be divided into two phases, the first reflex phase (through the vagus nerve), and the second or chemical phase. The first phase is by far the most important—it starts the digestion of proteins, and thus leads to the production of those chemical substances which will further stimulate the secretion of gastric juice. But how much more than mere custom there is in the taking of soup before a meal; in this way we administer to the stomach extractive substances derived from meat or vegetables, and thus ensure that, even in the absence of appetite, our food will meet with some gastric juice in the stomach.

The mechanism underlying the chemical phase of secretion is not yet clear. It is, however, known that the products of digestion of proteins, etc., need not come into contact with the fundal part of the stomach at all; they must, however, come into contact with the mucous membrane of the pylorus, and this is the way in which they produce their effect. There is much evidence for the view that, under the action of these stimulations, a substance (generally called gastrin [Edkins]) is liberated by the pylorus into the blood; the blood then brings this substance to the fundal glands and stimulates them to secrete the juice. That the stimulus is carried by the blood stream can be regarded as proved, at least in cases of transplantation of parts of the stomach to the thigh and chest of the animal, for extractive substances on introduction to the main stomach evoke secretion in the transplanted part.

Besides the two phases of gastric secretion, there are no other methods of evoking secretion, and in any given case the amount of gastric juice secreted, in a complete act of eating, is equal to the

sum of the effects of the nervous phase and the chemical phase. Atropine, which paralyses all secretory nerves, does not affect the second phase of secretion.

The Effect of Fats.—Neutral fats have a peculiar effect on gastric secretion. On administration of fats, the amount and strength of the gastric juice are diminished. This effect is supposed to be due to a reflex originating in the duodenum. It is certainly not due to clogging of the orifices of the gastric glands, for substances with the same viscosity have no effect. Fats when administered to the mouth quickly enter the duodenum, and there augment the pancreatic secretion and diminish the gastric secretion. Fats become digested by the pancreatic juice, and the products of their digestion are regurgitated into the stomach, where they stimulate the gastric secretion by liberating the gastrin bodies from the pylorus. The effect of fats on the gastric secretion passes through three phases, the reflex, the inhibitory and the chemical.

It is obvious that in the case of complete feeding, the production of the gastric juice, depending on the two phases of secretion and on the inhibitory effect of fats, will be typical for each of the three main food substances. In the case of carbohydrate food, the secretion is very much like that in sham feeding—rapidly rising, then falling off within an hour or so; the nervous phase predominates, the chemical phase being negligible since the carbohydrates and their products have hardly any stimulating effect on gastric secretion. In the case of proteins, the chemical phase is well pronounced and superimposes itself on the nervous phase, and the secretion is prolonged at its maximum for over two hours. Then as the food leaves the stomach the secretion gradually diminishes. In the case of fats, the nervous phase is cut short as soon as food enters the duodenum, but the secretion is again favoured by the chemical phase setting in, the net result being a considerable prolongation of the period of gastric secretion. With mixed food, secretion will be the result of a summation of all these individual factors.

Gastric secretion is not evoked by the mechanical stimulation of the gastric mucous membrane, as was supposed before the true mechanism of gastric secretion was known. Water and alcohol both cause a slight secretion. The products of the digestion of carbohydrates do not seem to have any effect on gastric secretion, but carbohydrates themselves increase the strength of the gastric juice, and if they are present in the food in sufficient amount the concentration of pepsin may be actually doubled. The mechanism of this effect is not known.

The Pyloric Secretion.—The secretion of the pylorus is strikingly different from that of the main part of the stomach. The pyloric secretion is never copious but is continuous, and is not increased by sham feeding. The pyloric juice does not contain HCl, and is very poor in pepsin. It is viscid on account of the presence of mucin. The secretion is not affected by section of all the nerves going to that part of the stomach, but it is greatly increased by local mechanical stimulation. It is immaterial whether the stimulation is caused by a food substance or something indigestible; provided that the texture is coarse, it will increase the production of the juice. Local stimulation with a glass rod may increase the secretion four- or five-fold. Local application of chemical irritants, such as 0·5% HCl, a weak solution of carbonate, a suspension of pepper, or an emulsion of mustard also causes an increased secretion. But liquid and semi-liquid food substances, being devoid of mechanical stimulus, have no effect, either on local application or on introduction to the rest of the stomach. Even the extractive substances and the products of the digestion of fat, which serve as stimuli for the fundal secretion, have no effect on the pyloric secretion. The function of the pyloric juice is to lubricate the narrow passage connecting the stomach with the intestine, and to provide a small additional amount of pepsin which helps in the gastric digestion as a whole.

The Movements of the Stomach.—The gastric movements can best be studied by Cannon's method of direct observation by means of Rontgen rays. Bismuth subnitrate or oxychloride is mixed with the food, and the animal or man is then X-rayed at different intervals. The obtained shadow of the stomach gives a good idea of the movements. This method can be checked by other experiments, such as the determination of the rate at which the food or various liquids pass from the stomach into the duodenum. which can be done in an animal with a gastric fistula. An alternative method is to introduce a small rubber balloon through the gastric fistula; the balloon is connected to some kind of registration apparatus, and in this way pressure changes occurring in the stomach at each contraction can be observed. The relaxation of the cardiac orifice, which accompanies swallowing. extends also over the whole fundus of the stomach. This relaxation lowers the pressure within the stomach and makes room for the incoming food. As soon as the gastric contents become acid, the cardiac orifice closes.

When food is taken, it accumulates in the fundus and is separated from the pylorus by a strong contraction (the transverse band or the prepyloric sphyncter). After a few minutes, waves of contraction begin to appear slightly on the fundal side of the transverse band, and travel slowly towards the pylorus. These waves gradually increase in strength so that the pylorus may present a series of constrictions. The semi-digested food is thus brought into close contact with the pylorus mucous membrane. The pylorus, however, remains closed, and the food is therefore squeezed back, and forms a reflux stream towards the fundus. The food thus becomes thoroughly mixed with the gastric juice. The fundus of the stomach is now exercising a steady pressure by the contraction of its muscular walls, so that the digested food is forced to enter the pylorus. At varying intervals, the time depending on the nature of the food, the pylorus opens, and a little of the digested food enters the duodenum. As digestion proceeds, the fundus increases its pressure on the gastric contents while the pylorus opens at more frequent intervals. The stomach thus gradually empties itself, and the whole organ acquires the shape of a curved tube. At the end of digestion, the pylorus may even open to allow the passage of undigested material.

The contractions of the stomach, and its method of emptying, are very similar in man and the carnivorous animals. The foregoing description applies to the events which succeed the taking of a considerable mixed meal. If water alone is taken, the pylorus opens within a very short time, and the fluid reaches the duodenum within a few minutes. The importance of this becomes obvious when it is remembered that practically no absorption of water takes place in the stomach, but only in the intestine.

Pylorus and *Duodenum.*—The movements of the two portions of the stomach can be observed also on anaesthetised animals, and even on a stomach which has been excised and placed in warm salt solution. They must therefore have their origin in the walls of the stomach itself. The vagus nerve supplies the muscles with fibres, the stimulation of which increases the contractions. The opening of the pylorus is more dependent on the nervous mechanism. If both vagi are cut, the emptying of the stomach becomes difficult on account of the diminution in the strength of the contractions, and also because the opening of the pylorus is not easily brought about. The iood thus remains in a semi-digested form (since the secretion of the juice is also diminished) for a long time in the stomach; it undergoes putrefaction and the animal may die of autointoxication. The opening of the pylorus does not only depend on the intragastric events but also, as shown by Pavlov, on the condition of the duodenum. The pylorus remains firmly closed so long as the contents of the duodenum remain acid. If alkaline fluid or water is introduced into the stomach, and at the same time some weak acid is injected into the duodenum by means of a duodenal fistula, no fluid passes out of the stomach until the acid is neutralised by the secretion of the pancreatic juice.

When the pylorus is open, not only do the contents of the stomach enter the duodenum, but also the contents of the duodenum regurgitate into the pyloric cavity. Such regurgitation is a normal occurrence, and takes place in the digestion of any food, but is especially conspicuous in the digestion of fats. Fats are not digested in the stomach; they pass on to the duodenum where they are converted into glycerol and fatty acids which, in the alkaline medium, form soaps. While in the duodenum, fats cause (a) an inhibitory effect on gastric secretion, and (b) a contraction

of the pylorus. As soon as the fats are digested, the pyloric sphyncter opens, and large amounts of the products of the digestion together with bile and pancreatic juice regurgitate into the pylorus, where they increase gastric secretion by chemical stimulation. We must consider the action of the sphyncter as dependent on the central nervous system and on the "acid control." Cannon's experiments have shown that "hunger pangs" are associated with and probably due to the rhythmic contractions of the stomach which occur about meal-times, especially if they are delayed.

Vomiting. — Vomiting may occur as a result of overdistension of the stomach, or the presence of irritating material, or from abnormal conditions of the brain. The first indication of vomiting is the feeling of nausea, accompanied by a profuse secretion of saliva. After a deep inspiration, the glottis is closed, and this is followed by a strong contraction of the diaphragm and of the abdominal muscles. At the same time the cardiac orifice is relaxed, and the gastric contents are passed out. The part played by the stomach itself is negligible. Vomiting is a reflex which can be excited by stimulation of the base of the pharynx, irritation of the stomach and from almost every abdominal organ. It is also evoked reflexly through the labyrinth or the eye, as in sea-sickness, and is a conspicuous symptom of various diseases of the cerebrum and cerebellum. The nerve centre of vomiting is located in the medulla, and can be excited directly by various drugs such as tartar emetic, apomorphine, etc.

Pancreatic Secretion. — The pancreas is the main digestive gland. It is the only gland which secretes a juice that contains enzymes capable of digesting all the three classes of foodstuffs. The carbohydrate-splitting enzyme (amylase or diastase) is secreted in a fully active form. The fat-splitting enzyme (lipase) is partially active when secreted, and is rendered fully active by the action of the bile salts. But when the protein-splitting enzyme (Trypsinogen) is secreted, it is completely inactive; it is converted into the active form (trypsin) by the co-enzyme enterokinase of the intestinal juice.

The secretion of pancreatic juice has been studied in animals in which a fistula of the pancreatic duct has been established (the operation is similar to that of establishing a salivary fistula). Like the salivary glands and the glands of the stomach, the pancreatic gland is at rest except during the periods of digestion. The secretion begins soon after administration of food but it lags Behind the gastric secretion, the maximum of which precedes the maximum of the pancreatic secretion by about an hour. The rate of pancreatic secretion, after a meal of proteins or carbohydrates, is on the whole very similar to that of the gastric secretion, but in the case of fats it is somewhat different. The similarity in the histological structure of the pancreas and the salivary glands has led physiologists to believe that the mechanism of secretion of these glands is the same, that is to say that the pancreatic secretion is controlled by a secretory nerve.

The Secretory *Innervation* of the *Pancreas*.—The secretory fibres were discovered by Pavlov to run in the vagus nerve. However, stimulation of the vagus never produces anything like the normal quantity of the juice, and the whole secretion is rather peculiar. The vagus nerve has to be stimulated for a very long time before the secretion will appear. The vagus produces a strong contraction of the larger ducts of the gland, and thus prevents the juice from leaving the gland. But even independently of this contraction of the ducts, the amount of juice secreted is very small (about 10cc. during a period of stimulation of 5–6 hours, as against a normal secretion of over 150cc. after entry of $\frac{1}{4}$ pound of meat).

Furthermore, the composition of the juice so obtained is not like that which is secreted under normal conditions. It is over 10 times more concentrated, both in its protein and enzyme content. When boiled. it coagulates in a lump like egg-white, while the normal juice becomes only slightly flocculent; it is also less alkaline than the normal juice, and therefore the trypsinogen of the "vagus juice" is apt to undergo spontaneous activation, and is more easily activated by enterokinase than the normal juice (the rate of activation is slower the more alkaline the juice). Nevertheless, the vagus nerve is a true secretory nerve; on stimulation, it produces very considerable histological changes in the gland, far greater changes than in the case of normal secretion, and the nerves are completely paralysed by atropine. It may be concluded that, so far as causing the output of solids and enzymes is concerned, the vagus stimulation does the same or more than the taking of food, but as regards the passage of water from the blood into the ducts it is much less effective.

We also owe to Pavlov the discovery that introduction of acid into the duodenum of animals or anaesthetised animals is followed by a profuse pancreatic secretion, which lasts as long as the acid is being absorbed. The similarity between this effect and the secretion of saliva (on administration of acid into the mouth) led Pavlov to believe that the pancreatic secretion is also based on a reflex mechanism, the efferent path from which follows the vagi. He soon found, however, that section of the vagi, or in fact destruction of the entire nervous system, does not prevent the secretion of the pancreatic juice on administration of acid into the small intestine. Administration of acid into the stomach, into the large intestine or anywhere else has no effect whatever.

Gastric *Juice*.—The discovery of the effect of acids is far more important than could be imagined at first sight. Pure gastric juice contains about 0·5% HCl but usually, on account of dilution with saliva and food, the acidity of the gastric contents is reduced to about 0·2–0·3%. The acid enters the duodenum and causes the pancreatic gland to begin to secrete. The first phase of gastric secretion becomes of outstanding importance, for it not only causes a further stimulation of gastric secretion, by giving rise to the products of digestion, but it also indirectly causes the continuation of digestion, for the acidity of the whole gastric contents leads to the secretion of the pancreatic juice.

Appetite, in that it augments the nervous phase of gastric digestion, is the trigger that sets the whole digestive tract into activity. This fact so much impressed Pavlov that he organized, next to his laboratory, a special department where the gastric juice of dogs was (and still is) obtained by sham feeding in large quantities. This material was sterilized and sold at a low price to the general public at the rate of several thousands of bottles a year. The improvement of digestion and nutrition in cases of dyspepsia, cancer, achlorhydria, loss of appetite and chronic gastritis was immense.

The *Chemical Phase* of Pancreatic *Secretion*.—The mechanism of the secretory effect of acid was discovered by Bayliss and Starling in 1902. They found that, on pounding up some scrapings of the intestinal mucous membrane with dilute acid and filtering. they obtained a filtrate that produced a copious flow of pancreatic juice when it was injected into the blood. This discovery was not only of great value. in elucidating the mechanism of pancreatic secretion, but it was also of general importance in physiology, for it was the first time it could be shown that a chemical substance, manufactured under definite conditions by one organ, could be liberated into the blood stream and conveyed to another organ, which it would excite to activity. Since this discovery, a number of other substances of the same nature have become known. Bayliss and Starling described them as chemical messengers, and gave them the name of *hormones* (*q.v.*). The hormone of the small intestine was called secretin, or pancreatic secretin, to distinguish it from other members of the same class.

Secretin can be extracted from the small intestine by various solvents, *e* g., water, alcohol, salt solutions. etc. It is not an enzyme, and is not destroyed by boiling. That secretin is normally transported by the blood stream is most convincingly shown by experiments with crossed circulation, and perfusion of the isolated pancreatic gland If two arteries of two dogs are connected in such a manner that the blood of one animal freely mixes with that of the other, and if acid is injected into the duodenum of one of the animals, the pancreatic glands of both dogs begin to secrete. Also, if a pancreas is cut out of the body and perfused with blood under pressure so as to keep it alive, and if a solution of secretin is injected into the blood, the isolated pancreas immediately responds by secretion of the juice. In this secretory mechanism, we have a very striking example of a correlation between the activities of two different parts of the body, effected

by chemical means. When the acid chyme enters the intestine, a certain amount of secretin is liberated into the blood stream. The resulting secretion of the alkaline pancreatic juice neutralizes the acid chyme, and the liberation of secretin (and therefore of pancreatic juice) comes to an end. So long as the duodenal contents are acid, the pylorus remains closed, but as soon as they are neutralised, the pylorus opens to allow another portion of the acid gastric contents to pass. In this way, the pancreatic secretion is maintained throughout the whole period of digestion.

Secretin.—The chemical composition of secretin is not known, and secretin has not yet been obtained in a pure form. The usual extracts of the mucous membrane of the small intestine contain, besides secretin, a large number of impurities, especially a substance named histamine, which has a considerable vasodilator effect on the capillaries of all organs. Thus after the injection of crude preparations of secretin, the blood pressure falls, sometimes very considerably. It has been proved that the induced pancreatic secretion is not caused by the fall of blood pressure itself. The proof rests on the following observations. The vasodilatory substances can be extracted from almost every organ, but secretin is only present in the small intestine. With certain solvents, it is possible to extract a depressor-free secretin. In slightly alkaline medium, secretin is destroyed while the vasodilatory substances remain intact. The action of secretin is not paralysed by atropine, showing that secretin acts directly on the pancreatic cells, and not on the nerve-endings of the secretory nerves. The composition of the secretion and the chemical mechanism of pancreatic secretion are apparently the same in all animals; at least, secretin extracted from the intestine of any animal will cause pancreatic secretion in any other animal. In the foetus, secretin is found in a very early stage of development.

The question now arises as to the correlation between the nervous and the chemical mechanisms of pancreatic secretion. The correlation is not yet clear, but we know of one instance in which the secretion, or rather the composition of the juice, is determined by the cooperation of the vagus nerve—that is in the case of injection of fats. Injection of neutral fats or of soaps into the duodenum evokes a secretion of very concentrated juice that is rich in enzymes. After section of the vagi, or after injection of atropine, the quantity of the secreted juice is unaltered, but it is now poor in enzymes. In many cases also sham feeding, when the entry of the gastric juice into the duodenum is prevented, will evoke a small secretion of very concentrated juice, some time before the appearance of gastric secretion; this secretion is absent after section of the vagi.

Stimulation of the vagi, superimposed upon the pancreatic secretion which has been evoked by injection sf secretin, does not modify the rate of secretion but greatly enriches the juice in enzymes. It seems that the nervous mechanism is chiefly concerned with the removal from the cells of the pre-stored enzymes, while the chemical mechanism regulates the passage of water and alkali from the blood through the gland into its system of ducts. Histological observations support this point of view since, after the considerable secretion of pancreatic juice evoked by chemical means, the pancreas looks only slightly exhausted, while after the small secretion evoked by stimulation of the vagus the gland becomes a picture of maximal exhaustion.

The Secretion of Bile.—The liver is the largest gland in the body, but its digestive function is only of secondary importance, as compared with the rôle it plays in the chemical alteration of substances after they have been absorbed into the blood, and its function as an excretory organ of various substances, amongst which the products of the decomposition of haemoglobin are the chief. The production of bile by the liver cells is continuous, but the entry of the bile into the digestive tract is intermittent, and is only to some extent related to the periods of digestion. The secreted bile accumulates in the gall bladder and in the large bile duct, the entry into the intestine being prevented by a small sphyncter at the end of the common bile duct. While the bile remains in the gall bladder, it undergoes concentration on account of absorption of water and secretion of mucin by the walls of the bladder.

From the point of view of digestion, the only important constituents of bile are the bile salts (sodium taurocholate and glycocholate). The digestive functions of bile are:—

(1) Activating the lipase of the pancreatic juice.
(2) Increasing the emulsification of fats by lowering the surface tension.
(3) Dissolving fatty acids and soaps.
(4) Increasing the peristaltic movements of the intestinal tract.
(5) Increasing the bile production on reabsorption of bile salts into the blood.

During the periods of digestion, the flow of bile is increased. This is due to two factors:—(a) the emptying of the gall bladder, and (b) an increased formation of bile.

The muscular wall of the gall bladder is under a nervous control, the vagus conveying motor, and the sympathetic inhibitory fibres. The entry of the products of gastric digestion and of the acid chyme into the duodenum sets the reflex in operation. The actual secretion of bile, however, is independent of the nervous system, and continues even after all the nerve connections of the liver have been severed. It is mainly dependent on the blood supply to the liver and, if other conditions are the same, the bile flow increases with increase of blood flow. Absorption of food substances, of acid, and especially of fats increases the production of bile. This is ascribed by some to the liberation of the pancreatic secretin.

The bile salts are reabsorbed in the intestine and conveyed via the portal vein back to the liver, which removes them from the blood, thus preventing their entry into the general circulation where they would be intensely poisonous (see JAUNDICE). The bile salts increase the production of bile, and thus a comparatively small amount of bile salts undergoes repeated resecretion during a comparatively short time. The entry of bile into the digestive tract, and therefore the stimulating effect of bile salts upon bile production, is stopped at the end of digestion by the closure of the sphyncter of the common bile duct.

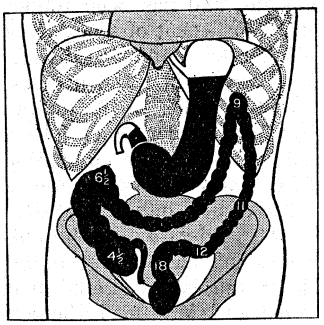
The Intestinal Juice (**Succus Entericus**).—The secretion of the intestinal juice, like that of the pyloric juice, is continuous. The secretion is studied in animals in which one or another part of the intestinal tract is transplanted so as to open to the outside of the abdominal cavity. Since the intestine hangs on the loose mesentery, the blood vessels and nerves of the transplanted part remain intact. The continuity of the rest of the tract is re-established. Animals operated on in this manner live as long as normal animals, and do not suffer in their digestion or general condition.

The intestinal juice on standing divides itself into 2 fractions, a sediment which is chiefly composed of the mucus secreted by the goblet cells of the digestive tract and desquamated epithelium, and a liquid part containing enzymes (see section on nutrition; the enzymes are enterokinase. erepsin, nuclease, amylase, invertase, lactase and lipase maltase; the Brunner's glands of the duodenum secrete an enzyme similar to pepsin). The lower down the tract, the larger is the sedimentation, until the secretion in the large intestine is composed of mucus and is devoid of enzymes.

There are no definite indications of any nervous control of intestinal secretion. Section of the nerves produces a great increase in the flow, but this is usually attributed to the hyperaemia ensuing after section of the nerves, which contain a large amount of vasoconstrictor fibres. Some physiologists regard this secretion as due to section of special inhibitory nerves.

Intravenous injections of secretin increase the secretion of intestinal juice, and Starling regarded the mechanism of intestinal secretion as identical with that of pancreatic secretion, namely that in both cases the stimulus is due to the liberation of the same agent, viz. secretin. However, experiments on animals with a transplanted loop of the intestinal tract (kept under normal conditions) make this view untenable. On feeding such an animal, the secretion of the transplanted part is not increased as it would have been if the hormone mechanism were the operative factor. Pavlov's experiments show that the stimulus for intestinal secretion is, like that of pyloric secretion, local mechanical stimulation of the mucous membrane.

Some *Experiments.*—The following experiments may serve to illustrate this point The secretion of the intestinal juice from the small isolated portion was measured before and after feeding the animal with various food substances. The juice was collected by means of a small tube inserted in the isolated loop. Before feeding, the spontaneous secretion varied between 2·0 and 2·8cc; after intake of meat, it was 2 5cc., after bread 3·0cc., after milk 1·7cc., and after mixed food 1·6cc Only in the case of feeding with fats did the secretion of the isolated portion slightly but definitely increase (from 3·0 to 5·0cc.). With these results should be compared the experiments with local mechanical and chemical stimulation of the transplanted part. The spontaneous secretion was 0·0–0·5cc. per hour; when a rubber tube was introduced into the intestinal loop, the secretion increased to 4cc.; when glass beads were placed in the intestines, it increased to 8·7cc; when 0·5% HCl was injected into the intestine and then removed, thehourly secretion increased to 20cc. The stimulation by either of the above methods of some part of the intestine has no effect on the rest of the tract, showing that the effect is mainly if not entirely local These local stimuli have hardly any effect on the secretion of the sediment; they only increase the production of the enzyme-containing liquid part of the juice.



FROM STARLING, "PRINCIPLES OF HUMAN PHY SIOLOGY"

FIG. 3.—DIAGRAM OF NORMAL POSITION OF COLON OR LARGE **INTESTINE IN MAN, SHOWING THE TIME AT** IN HOURS OF ARRIVAL OF FOOD AT VARIOUS LEVELS

Some observers have found that stimulation of the vagus nerve increases the secretion of the juice after a very long latent period. It is possible, however, that the increased flow is due to a more vigorous contraction of the intestines, for the vagus is the motor nerve of the intestinal muscles.

A very interesting correlation has been discovered as regards the concentration of enterokinase in the intestinal juice and the pancreatic juice The transplanted loop of the intestine secretes a juice which becomes progressively poorer in enterokinase, so that a few months after the operation it almost entirely loses the power to activate trypsinogen (see section on Enzymes). If however the mucous membrane is brought for a short time (2–3 minutes) into contact with the pancreatic juice (the juice may be diluted to as much as one in 1000), the concentration of enterokinase increases Alkali and boiled pancreatic juice have no such effect. The concentration of other enzymes of the intestinal juice is not affected by such treatment of the intestine with pancreatic juice.

The Movements **of** the Small Intestine.— It is known that the intestinal tract is in a state of constant movement, the analysis of which presents great difficulties because several types of contraction may occur simultaneously or in rapid succession, either at the same point or at neighbouring positions. Different authors have given different descriptions of these movements, and have used different nomenclatures but in spite of this confusion it may be said that the small intestine exhibits three kinds of contractions. These are as follows:—(a) the rhythmic segmentation (also known as pendular movements or swaying movements); (b) the peristaltic contraction (also known as the mysenteric reflex); and (c) the tonic contractions.

Rhythmic *Contractions.*—Direct observations of an exposed part of the intestine show that slight waves of contraction pass over its surface. Records by means of instruments show that both the circular and the longitudinal muscular coats take part in these contractions, which recur at the rate of 10–15 a minute. These contractions involve only short stretches of the intestine. They easily can be produced artificially by stimulating the gut either electrically or mechanically. On application of such a stimulus, the part immediately stimulated quickly contracts, the contraction spreading one or two centimetres along the intestine These rhythmic contractions may originate spontaneously in any part of the intestinal tract, especially at those parts which are subjected to some tension. The propagation of this contraction goes from muscle fibre to muscle fibre at an average rate of about 5cm. per second.

These rhythmic contractions are unaffected by section of all the nerves of the intestine, in fact they are entirely myogenic in origin. They are even independent of the local nervous network of the intestinal wall, for strips removed from the longitudinal coat of the small intestine entirely free from any remains of the nerve plexus continue their rhythmic contraction. (The nervous network of the intestine is made up of Auerbach's plexus and Meissner's plexus.)

In order to observe the rhythmical contractions, isolated portions of the intestine can be removed from an animal after its death; these portions should be kept at body temperature, surrounded with a solution containing salts in the same proportion as those in blood (Ringer's fluid), and richly supplied with oxygen In the normal animal, the rhythmic contractions cause a thorough mixing of the contents of the gut with the secretions of the various glands, but they do not help to pass the food along the intestinal tract, for each contraction squeezes the food in both directions. A column of food may thus remain at the same level in the gut for a considerable time.

Peristaltic Contractions.—The onward progress of the food is caused by true peristaltic contractions which involve contraction of the intestine above the food mass, and relaxation below This contraction and relaxation travels down the intestinal tract in the form of two waves, and in this way the food is slowly propelled towards the large intestine. The peristaltic contractions involve the co-operation of the local nervous system of the intestine, and they are absolutely abolished by painting the intestine with drugs which paralyse nerves (*e.g.,* nicotine, cocaine), but still continue after severing the nervous connection between the intestine and the brain and spinal cord. The direct irritating effect of food, or the application of an experimental stimulus, evokes an immediate contraction above and relaxation below (sometimes described as "the law of the intestines") Anti-peristalsis is not observed in the small intestine.

Tonic Contractions.—The third type of movement, which is known as the tonic contraction, is common to all plain muscles, and is determined by a state of sustained partial contraction of the muscle. Neither during the wave of relaxation observed as the forerunner of the wave of contraction in peristalsis, nor during the periods in between the rhythmic segmentation, is the intestine completely relaxed; it always maintains a certain tone, which may be greater or less Thus the two forms of contraction (already described) are superimposed upon the tonically contracted state of muscles. In some cases, the intestinal tone may be intense. It is claimed that colic pains are due to this form of contraction.

Although the mechanism of all these three forms of contraction is entirely peripheral, they can be increased or decreased by impulses from the central nervous system. The vagus nerve carries nerve fibres to the intestine which stimulate its movements, while the splanchnic nerves diminish or even abolish them The lowest ncms. of the small intestine exhibits a thickening of the circular muscular coat, the ileocolic sphincter (valve), which relaxes in front of a peristaltic wave and contracts if there is any regurgitation from the large intestine. This sphincter presents a marked contrast to the rest of the small intestine in that its innervation is reversed, the vagus being the inhibitory and the splanchnic the excitatory nerve.

The Movements **of** the **Large** Intestine.— The contents of the small intestine are gradually transferred into the large intestine. In carnivora, the digestion and absorption are both nearly completed at the ileocolic valve, but in herbivora a large part of the processes of digestion and absorption occur in the large intestine and in the caecum As regards his large intestine, man takes an intermediate position between these two groups of animals.

The movements of the large intestine can best be observed by means of the X-ray method, after feeding a meal containing some bismuth The food first fills the proximal part of the large intestine The distension brings about a wave of contraction which starts at the end portion of the ascending colon, and slowly travels

in a backward direction, passing the food towards the caecum; the ileocolic valve prevents its escape into the small intestine. These contractions are not preceded by a wave of relaxation, and therefore should not be regarded as anti-peristaltic waves. As the whole contents cannot escape into the caecum, certain portions slip back. These movements thus have the same effect as those of the pylorus; they bring the food into closer contact with the walls of the alimentary canal. In this way the intestinal movements favour the absorption of substances that escaped absorption in the small intestine.

The distension of the caecum occasionally excites a true peristaltic wave which travels in a forward direction and drives the semi-solid residue of the food towards the distal part of the colon. The intensity of the peristaltic waves and of the backward contraction vary greatly in different kinds of animals, and even in different individuals of the same species. In man they are not well pronounced, and the caecum and the ascending colon seem to be more or less passive. About 400 grammes of semi-liquid material passes the ileocolic valve daily; of this, about 250 grammes is water with some nutrient material, which is absorbed in the large intestine; the remaining 150 grammes form the faeces.

The large intestine, like the small, has a nervous system of its own in the form of a network of nerve cells and fibres lying in between the muscular layers. The movements of the large intestine are primarily dependent on this network, but they can be increased under the influence of the pelvic visceral nerve, or diminished by the inferior mesenteric nerves which belong to the sympathetic nervous system. **A** distinguishing feature of the distal colon is its complete subordination to the spinal centres. It remains inactive until, on account of distension, it is reflexly excited through the pelvic visceral nerve; it is then completely emptied. In man, the emptying of the rectum is largely assisted by contractions of voluntary muscles of the pelvis and of the abdominal wall.

In herbivora, the large intestine plays an important part in the digestion of cellulose, not because of the secretion of some special enzyme which could effect this digestion, but because of the rich bacterial flora of the large intestine. The splitting of celiulose is due to the action of bacteria, and it results in the formation of simpler carbohydrates, viz., sugars. Thus the cellulose which forms vegetable cell-walls can be utilized by the animal.

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DIGESTIVE ORGANS. The digestive system comprises greater range of structure and diversity of function than any other system in the animal body. The pathological changes met with, therefore, differ widely at first glance. Essentially they are identical in all situations, the apparent differences depending on variation in prominence of the individual components. The mouth of an infant with "thrush" and the small intestine of an adult with typhoid fever show congestion, accumulations of leucocytes, death and desquamation of superficial cells, oedema of subjacent tissues because both are the seats of inflammation caused by a micro-organism, however widely different they may appear to the eye. *(See* ALIMENTARY CANAL, DISEASES OF THE, and allied articles.)

DIGGES, WEST (1720–1786), English actor, made his first stage appearance in Dublin in 1749 as Jaffier in *Venice Preserved,* and both there and in Edinburgh until 1764 he acted in many tragic rôles with success. He was the original "young Norval" in Home's *Douglas* (1756). His first London appearance was as Cato in the Haymarket in 1777, and he afterwards played Lear, Macbeth, Shylock and Wolsey. In 1781 he returned to Dublin and retired in 1784. He died in Cork on Nov. 10, 1786.

DIGIT, literally a finger or toe (Lat. *digitus,* finger), and so from counting on the fingers a single numeral, or, from measuring, a finger's breadth. In astronomy a digit is the 12th part of the diameter of the sun or moon; it is used to express the magnitude of an eclipse.

DIGITALIS. In pharmacy, the leaves of the foxglove (*q.v.*) gathered from wild plants when about two-thirds of their flowers are expanded.

Digitalis contains four important glucosides, of which three are cardiac stimulants. The most powerful is *digitoxin* $C_{34}H_{54}O_{11}$, an extremely poisonous and cumulative drug, insoluble in water. *Digitalin,* $C_{35}H_{56}O_{14}$, is crystalline and is also insoluble in water. *Digifalein* is amorphous but readily soluble in water. It can therefore be administered subcutaneously, in doses of about one-hundredth of a grain. *Digitonin,* on the other hand, is a cardiac depressant, and has been found to be identical with saponin, the chief constituent of senega root.

Taken by the mouth digitalis is apt to cause digestive disturbance, varying in different cases and sometimes severe. This action is probably due to the digitonin, which is thus a constituent in every way undesirable. The all-important property of the drug is its action on the circulation. Its first action is upon the unstriped muscle of the arteries and arterioles.

The clinical influence of digitalis upon the heart is well defined. After a moderate dose the pulse is slowed. This is due to a very definite influence upon the different portions of the cardiac cycle. The systole is not altered in length, but the diastole is very prolonged, and since this is the period not only of cardiac rest but also of cardiac "feeding"—the coronary vessels being compressed and occluded during systole—the result is greatly to benefit the nutrition of the cardiac muscle. So definite is this that, despite a great increase in the force of the contractions and despite experimental proof that the heart does more work in a given time pnder the influence of digitalis, the organ subsequently displays all the signs of having rested, its improved vigour being really due to its obtaining a larger supply of the nutrient blood. Almost equally striking is the fact that digitalis causes an irregular pulse to become regular. Added to the greater force of cardiac contraction is a permanent tonic contraction of the organ, so that its internal capacity is reduced. The bearing of this fact on cases of cardiac dilatation is evident. In larger doses a remarkable sequel to these actions may be observed. The cardiac contractions become irregular. the ventricle assumes curious shapes—"hour-glass," etc.—becomes pale and bloodless, and finally the heart stops in a state of contraction and passes into rigor-mortis. Before this final change the heart may be started again by the application of a soluble potassium salt, or by raising the fluid pressure within it. Clinically the drug is cumulative, being very slowly excreted, so that after it has been taken for some time the pulse may become irregular, the blood-pressure low, and the cardiac pulsations rapid and feeble. These symptoms with gastro-intestinal irritation and decrease in the quantity of urine passed indicate digitalis poisoning. It is by way of stimulation of the cardiac terminals of the vagus nerves that the heart's action is slowed. Thereafter follows the most important effect of the drug, which is a direct stimulation of the cardiac muscle. This can be proved to occur in a heart so embryonic that no nerves can be recognized in it, and in portions of cardiac muscle that contain neither nerve-cells nor nerve-fibres.

The action of this drug on the kidney is of importance only second to its action on the circulation. In small or moderate doses it is a powerful diuretic. It seems probable that this is due to a rise in the general blood-pressure associated with a relatively dilated condition of the renal vessels. In large doses, the renal vessels also are constricted and the amount of urine falls. In large doses it causes cerebral symptoms, such as seeing all objects blue, and various other disturbances of the special senses. It also lowers the reflex excitability of the spinal cord.

Digitalis is indicated when the heart shows itself unequal to the work it has to perform. This formula includes the vast majority of cardiac cases.

DIGNE, a small thermal spa and chief town of the department of the Basses Alpes, in S.E. France, 14 mi. by a branch line from the main railway line between Grenoble and Avignon. Pop. (1936) town, 5,689; commune, 7.623. The *Dinia* of the Romans, it was the capital of the Bodiontii. From the early 6th century at least it has been an episcopal see, which till 1790 was in the ecclesiastical province of Embrun, but since 1802 in that of Aix en Provence. It suffered much during the reliqious wars of the

16th and 17th centuries. The Ville Haute is built on a mountain spur on the left bank of the Bléone river, and above its narrow, winding streets towers the present cathedral church (late 15th cent.), largely reconstructed in modern times, and the former bishop's palace (now the prison). The fine Boulevard Gassendi separates the Ville Haute from the Ville Basse, which is of modern date. The old cathedral (Notre Dame du Bourg) (13th cent.) is now disused except for funerals. The neighbourhood of Digne is rich in orchards, which have long made the town famous in France for its preserved fruits and confections, honey and yellow wax.

DIGOIN, a town of east-central France, in the department of Saône-et-Loire, on the right bank of the Loire, 55 mi. W.N.W. of Mâcon on the Paris-Lyon railway. Pop. (1936) 5,668. It is situated at the meeting places of the Loire, the Lateral canal of the Loire and the Canal du Centre, which here crosses the Loire by a fine aqueduct. The town carries on considerable manufactures of faïence, pottery and porcelain. The port on the Canal du Centre trades in timber, sand, iron, coal and stone.

DIJON, a town of eastern France, capital of the department of CBte d'Or and formerly capital of Burgundy, 195 mi. S E. of Paris on the Paris-Lyon railway. Pop. (1936) 93,929.

Under the Romans Dijon (*Divonense castrum*) was a *vicus* in the *civitas* of Langres. In the 2nd century it was the scene of the martyrdom of St. Benignus (Bénigne, *vulg.* Berlin, Berain), the apostle of Burgundy. About 274 the emperor Aurelian surrounded it with ramparts. Gregory of Tours, in the 6th century, comments on the strength and pleasant situation of the place, expressing surprise that it does not rank as a *civitas.* The dukes of Burgundy acquired Dijon early in the 11th century. The communal privileges, conferred on the town in 1182 by Hugh III., duke of Burgundy, were confirmed by Philip Augustus in 1183, and in the 13th century the dukes took up their residence there. For the decoration of the palace and other monuments built by them, eminent artists were gathered from northern France and Flanders, and during this period the town became one of the great intellectual centres of France. The union of the duchy with the crown in 1477 deprived Dijon of the splendour of the ducal court; but to counterbalance this loss it was made the capital of the province and seat of a *parlement.* Its fidelity to the monarchy was tested in 1513, when the citizens were besieged by 50,000 Swiss and Germans. and forced to agree to a treaty so disadvantageous that Louis XII. refused to ratify it. In the wars of religion Dijon sided with the League, and opened its gates to Henry IV. only in 1595. The 18th century was a brilliant period for the city; it became the seat of a bishopric, its streets were improved, its commerce developed, and an academy of science and letters founded; while its literary salons were hardly less celebrated than those of Paris. The neighbourhood was the scene of considerable fighting during the Franco-Prussian War, which was, however, indirectly of some advantage to the city owing to the impetus given to its industries by the immigrants from Alsace.

Dijon stands on the western border of the fertile plain of Burgundy, at the foot of Mont Afrique, the north-eastern summit of the CBte d'Or range, and at the confluence of the Ouche and the Suzon; it also has a port on the canal of Burgundy. The great strategic importance of Dijon as a centre of railways and roads, and its position with reference to an invasion of France from the Rhine, led to the creation of a fortress forming part of the Langres group. There is no *enceinte,* but on the east side detached forts, 3 to 4 m. distant from the centre, command all the great roads, while the hilly ground to the west is protected by Fort Hauteville to the N.W. and the "groups" of Motte Giron and Mont Afrique to the S.W. Including a fort near Saussy (about 8 m. to the N.W.) protecting the water-supplv of Dijon, there are eight forts, besides the groups above mentioned. The old churches and historic buildings of Dijon are to be found in the irregular streets of the old town, but industrial and commercial activity has been transferred to the new quarters beyond its limits.

The cathedral of St. Bénigne, originally an abbey church, was buiit in the latter half of the 13th century on the site of a Romanesque basilica, of which the crypt remains. The west front is flanked by two towers and the crossing is surmounted by a slender timber spire. The plan consists of three naves, short transepts and a small choir, without ambulatory, terminating in three apses. In the interior there is a fine organ and a quantity of statuary, and the vaults contain the remains of Philip the Bold, duke of Burgundy, and Anne of Burgundy, daughter of John the Fearless. The site of the abbey buildings is occupied by the bishop's palace and an ecclesiastical seminary, The church of Notre-Dame, typical Burgundian Gothic (1252–1334) is distinguished for the grace of its interior and the beauty of the western façade. The portal consists of three arched openings, above which are two stages of arcades, open to the light and supported on slender columns. A row of gargoyles surmounts each storey of the facade, which is also ornamented by sculptured friezes. A turret to the right of the portal carries a clock called the Jaquemart, on which the hours are struck by two figures. The church of St. hfichel belongs to the 15th century. The west facade, the most remarkable feature of the church, is, however, Renaissance. The vaulting of the three portals is of exceptional depth owing to the projection of the lower storey of the facade. Above this storey rise two towers of five stages, the fifth stage being formed by an octagonal cupola. The columns decorating the facade represent all the four orders. The design of this facade is wrongly attributed to Hugues Sambin (*fl. c.* 1540), a native of Dijon, and pupil of Leonardo da Vinci, but the sculpture of the portals, including "The Last Judgment" on the tympanum of the main portal, is probably his work. St. Jean (11th century) and St. Étienne (11th, 16th and 17th centuries), now used as the exchange, are the other chief churches. Of the ancient palace of the dukes of Burgundy there remain two towers, the Tour de la Terrasse and the Tour de Bar, the guard-room and the kitchens; these now form part of the *hôtel de ville,* the rest of which belongs to the 17th and 18th centuries. This building contains an archaeological museum, the archives of the town, and the principal museum, which, besides paintings and other works of art, contains the magnificent tombs of Philip the Bold and John the Fearless, dukes of Burgundy. These were transferred from the Chartreuse of Dijon (or of Champmol), built by Philip the Bold as a mausoleum, now replaced by a lunatic asylum. Relics of it survive in the old Gothic entrance, the portal of the church, a tower and the well of Moses, which is adorned with statues of Moses and the prophets by Claus Sluter (*fl.* end of 14th century), the Dutch sculptor. who also designed the tomb of Philip the Bold. The Palais de Justice, which belongs to the reign of Louis XII., is of interest as the former seat of the *parlement* of Burgundy. Dijon possesses several houses of the 15th, 16th and 17th centuries, notably the Maison Richard in the Gothic, and the Hôtel Vogüé in the Renaissance style.

The town is important as the seat of a prefecture, a bishopric, a court of appeal and a court of assizes, and as centre of an académie (educational district). There are tribunals of first instance and of commerce, a board of trade-arbitrators, a chamber of commerce, an exchange and an important branch of the Bank of France. Its educational establishments include faculties of law, of science and of letters, a preparatory school of medicine and pharmacy, a higher school of commerce, a school of fine art and a conservatoire of music.

Dijon is well known for its mustard, and for the black-currant liqueur called *cassis de Dijon;* its industries include the manufacture of machinery, automobiles, bicycles, soap, biscuits, brandy, leather, boots and shoes and hosiery. There are also flour mills, important printing works, vinegar works and, in the vicinity, nursery gardens. The state has a large tobacco manufactory in the town. Dijon has considerable trade in cereals and wool, and is the second market for the wines of Burgundy.

DIKE or DYKE, a trench dug out of the earth for defensive and other purposes (cf. Dutch *dijk,* Ger. *Teiclz).* Water naturally collects in such trenches, and hence the word is applied to natural and artificial channels filled with water, as appears in the names of many narrow waterways in East Anglia. "Dike"

is also used of the bank of earth thrown up out of the ditch, and so of any embankment, dam or causeway, particularly the defensive works in Holland, the Fen district of England, and other low-lying districts which are liable to flooding by the sea or rivers. (See HOLLAND and FENS.) In Scotland any wall, fence or even hedge, used as a boundary, is called a dyke. In geology the term is applied to wall-like masses of rock (sometimes projecting beyond the surrounding surface) which fill up vertical or highly inclined fissures in the strata.

DIKKA, in architecture, a raised tribune or platform in a hlohammedan mosque, from which the service is directed and the Koran read.

DILAPIDATION, a term meaning in general a falling into decay, but more particularly used in the plural in English law for (1) the waste committed by the incumbent of an ecclesiastical living; (2) the disrepair for which a tenant is usually liable when he has agreed to give up his premises in good repair (see EASEMENT; FLAT; LANDLORD AND TENANT; as to limited owners, *see* WASTE).

In the eye of the law an incumbent of a living is a tenant for life of his benefice, and any waste, voluntary or permissive, on his part must be made good. Under the old law, proceedings might be taken against the dilapidating incumbent in the ecclesiastical court; or an action in the courts of common law could be brought by the successor upon the custom of England against the previous incumbent or his personal representatives if he were dead. And if such a thing should happen, this law might still have to be applied in the case of bishops or cathedral dignitaries or officers. But for parochial incumbents provision was made in 1873 by the Ecclesiastical Dilapidations Act of that year, which Act however has now been superseded by the Ecclesiastical Diiapidations Measure 1923 which covers the whole ground.

By this measure, diocesan dilapidation boards are appointed who are to cause first inspections to be made of the buildings of every benefice. These first inspections are to be made within seven years of the passing of the Measure or earlier if the benefice becomes vacant or is put under sequestration. The surveyor is to report whether any and if so what repairs are needed, and to divide them into ordinary repairs and structural repairs, and to sub-divide the latter into those which do not or do admit of delay; and if there has been any mischief due to deliberate action or gross neglect, he is to state the cost of these separately and call them "wilful dilapidations." For these latter the incumbent is to be liable at once. Opportunity is given to any party interested to object to the report of the surveyor on any point, and the board is finally to determine.

If the inspection is on a vacancy, and the late incumbent is not protected by a certificate under the old Act, he or his personal representatives must pay to Queen Anne's Bounty the cost of ordinary and immediate structural repairs, as determined by the Board. If the first inspection is not on a vacancy and the incumbent or the sequestrator is not protected by a certificate under the old Act he is similarly liable, but in case of personal poverty or the benefice being less than £250 a year, there are provisions for his relief.

As to the future, Queen Anne's Bounty is to make an assessment first for a "repair rate" to cover the execution of repairs required by an order of the dilapidation board, except those already provided for and those for which the cost is spread over more than five years; secondly for an "insurance rate" to provide for reinstating the buildings in case of fire; and thirdly for an "administration rate" to cover office expenses and surveyor's fees. For repairs, the cost of which is to be spread over a longer period than five years, there is to be a "long assessment" in lieu of an ordinary assessment.

There are numerous provisions directing the application of the moneys raised and the execution of repairs and giving power to Queen Anne's Bounty to advance loans and to make grants in the case of poor livings, and concerning timber growing on the glebe. The broad effect of the Measure is to substitute annual payments in the nature of premiums of insurance in lieu of a capital liability

In the United States, the term means the neglect of necessary repairs of a building, the suffering of it to fall into a state of decay or the unauthorized pulling down of the building or any part of it. (See LANDLORD AND TENANT.)

DILATATION, a widening or enlarging; a term used in physiology, etc. In pathology the process is of great importance as it may be compatible with health or the cause of changes so severe that they menace life. In the case of blood vessels dilatation of arteries occurs in blushing and in every inflammation at some stage in its course; dilatation of the abdominal blood vessels is the cause of syncope and shock in many instances and dilatation of veins accompanies every case of passive congestion. In the case of lymphatics dilatation is the cause of elephantiasis. In the case of hollow organs like the heart, bladder, stomach or intestines dilatation, if great and of rapid onset is accompanied by severe pain (*e.g.* angina pectoris) and if continued is followed by temporary paralysis of the organ's musculature. In the case of the brain, dilatation of the lateral ventricles causes hydrocephalus (*q.v.*) dilatation of the central canal of the spinal cord causes the special symptoms depending on syringomyelia. If the dilatation of hollow muscular organs is gradual there may be time for hypertrophy to occur and compensate for the dilatation. This is typically the case with the left ventricle of the heart in cardiac disease but ultimately dilatation gains the upper hand and initiates the terminal stages of the illness. (W. S. L.–B.)

DILATORY, delaying, or slow; in law a "dilatory plea" is one made merely to delay the suit.

DILEMMA is the name of a special type of reasoning. In its commonest form its conclusion presents one with two alternatives. When employed in debate the usual aim is to present alternatives both of which are unpalatable to the opponent. Thus, *e.g.* in answer to the contention of a protectionist that protective import duties *both* increase revenue and stimulate home industry, it has been argued: "If protective duties increase revenue, they cannot also stimulate home industry; and if they stimulate home industry, they cannot also increase revenue.

"But they do either the one or the other.

"Therefore they either cannot stimulate home industry, or they cannot increase revenue." (That is they cannot do both at once) The unpalatable alternatives are called the "horns" of the dilemma. This familiar use of the dilemma has led to an extension of its meaning, and the term is applied popularly to any kind of situation in which one is confronted with unsatisfactory alternatives, as, *e.g.,* when a country, exhausted by war, finds itself in the dilemma of either impoverishing its people or repudiating its debts

Valid arguments in the form of the dilemma are not very common, hence few situations can be adequately summed up in two alternatives. The dilemma is consequently used frequently in a rather loose manner by plausible orators. Hence there is an impression abroad that dilemmas are merely sophistical tricks. But this is a mistake. Dilemmas can be, and sometimes are, quite sound. Their association with political discussions or merely captious argumentations is accidental; and the alternatives which their conclusions present need not be unpalatable. (*See* LOGIC.)

DILETTANTE, an Italian word for one who delights in the fine arts, especially in music and painting. Properly the word refers to an "amateur" as opposed to a "professional" cultivation of the arts, but is often used in a depreciatory sense of one who is only a dabbler. The Dilettanti Society, founded in 1733–34, still exists in England. A history of the society, by Lionel Cust, was published in 1898.

DILIGENCE, in common law, a term which is substantially equivalent to "care." In Scots law it is a general term for the process by which persons. lands or effects are attached on execution, or in security for debt. (See NEGLIGENCE.)

DILKE, CHARLES WENTWORTH (1789–1864), an English critic and antiquarian, was born on Dec. 8, 1789. After studying at Cambridge, he entered the navy pay office. From 1814 to 1816 he edited *Old* English Plays (6 vols.), from 1830 to 1846 the Athenaeum, and from 1846 to 1849 was manager of the *Daily* News. He then became a regular contributor to the

Athenaeum, his valuable essays for it on Elizabethan drama, on the literary history of the 17th and 18th centuries, and especially on Pope, being collected as *Papers of a Critic* (2 vols., 1875). Dilke died in Hampshire on Aug. 10, 1864.

DILKE, SIR CHARLES WENTWORTH, BART. (1810–1869), English politician, son of Charles Wentworth Dilke, proprietor and editor of *The Athenaeum*, was born in London on Feb. 18, 1810, and was educated at Westminster school and Trinity Hall, Cambridge. He studied law, and in 1834 took his degree of LL.B., but did not practise. He assisted his father in his literary work, and was for some years chairman of the council of the Society of Arts. He took a prominent part in the affairs of the Royal Horticultural Society and other bodies, including the executive committee of the Great exhibition. In 1853 Dilke was one of the English commissioners at the New York Industrial Exhibition, and in 1862 one of the five royal commissioners for the second Great Exhibition. Soon after the death of the prince consort he was created a baronet. In 1865 he entered parliament as member for Wallingford. In 1869 he was sent to Russia as representative of England at the horticultural exhibition held at St. Petersburg (Leningrad). His health, however, had been for some time failing, and he died suddenly in that city on May 10, 1869.

DILKE, SIR CHARLES WENTWORTH, BART. (1843–1911), son of the preceding, was born in London in 1843, and educated at Trinity Hall, Cambridge, where he achieved the triple distinction of being senior legalist in the law tripos, president of the Union and stroke of the boat which was head of the river. In 1866 he made a voyage round the world, beginning with the United States, and visiting New Zealand, Australia, Ceylon, India and Egypt. The impressions gained on these travels left him, he said, "with a conception, however imperfect, of the grandeur of our race, already girdling the world, which it is destined, perhaps, to overspread." The book in which he described his travels, *Greater Britain* (1868), gave a great impulse to a sane and reformed imperialism. All his life Dilke was a true imperialist. For him there was no incompatibility between imperialism and extreme radicalism. He became a prominent Liberal politician, as M P. for Chelsea (1868–86), under-secretary for foreign affairs (1880–82), and president of the local government board (1882–85). In 1871–72 Dilke represented the extreme radical party in England. There was no great love for the Crown, for the Queen's retirement of ten years was a cause of discontent, and he attacked the expense of royalty, in particular the dowries voted for the Queen's children. He was a theoretical republican, and on various occasions in public speeches put the case for republicanism. His own attitude was the reverse of revolutionary. As he said himself, "To think and even to say that monarchy in western Europe is a somewhat cumbersome fiction is not to declare oneself ready to fight against it on a barricade." During these years he says himself he was nearly subjected to physical and really subjected to moral martyrdom, and it is a fact that on one occasion at least nothing but his own imperturbable courage saved his life. Nevertheless, within a few years Disraeli could express the opinion that Sir Charles Dilke was the most powerful and influential member among quite young men that he had ever known.

During his first years in the House of Commons he maintained an independent position. Between 1876 and 1880 he became a close ally of Joseph Chamberlain. Gradually, however, he became a force within the Liberal party, and during the Beaconsfield government with Lord Hartington as leader, the task of presenting the case for the opposition fell more and more into his hands. As a result of the Liberal victory of 1880 he and Chamberlain became members of the Gladstone ministry. In 1885 Dilke was chairman at a conference on industrial remuneration attended by all the prominent trade unionists of the day and women representatives of the Protective and Provident League, afterwards to become the Women's Trade Union League. This was symptomatic of his whole attitude towards labour problems. Throughout his life he was an ardent supporter of better conditions for the workers. While he was at the Local Government Board he called attention to the problem of housing, with the result that a Royal Commission sat in 1884 to study the housing of the working classes. He was associated with the acts legalizing the position of the Trades Unions and limiting the hours of work. He was in favour of legislation to secure a minimum wage and he wished for the representation of labour in the House of Commons. When the Independent Labour Party emerged in 1894 he was asked to be its leader, but refused on the ground that he differed on certain radical points with its views. He therefore remained its candid friend and critic to the end of his life. He was largely instrumental in 1884 in bringing about the party truce enabling the Franchise Bill to become law. It was at first rejected by the Lords unless accompanied by a redistribution of seats, a principle for which Dilke had long contended. It was eventually passed at the end of 1884 and the Redistribution Bill early in 188;.

"I never knew a man of his age, hardly ever a man of any age, more powerful and admired than was Dilke during his management of the Redistribution Bill in 1885." Such was Sir George Trevelyan's verdict of a man who combined radical principles with an extraordinary authority on foreign affairs and a capacity for working with men of the most varied views when great questions were at stake. Nevertheless, when Dilke left the Local Government Board on June 24, 1885, on the defeat of the Gladstone ministry, he left official life for ever. At this point he was cited as co-respondent in a divorce suit brought by Donald Crawford, Liberal M.P. for Lanark. Mrs. Crawford was the sister-in-law of Dilke's brother Ashton and the proceedings caused great scandal. The case against Dilke was dismissed, but he determined to retire from public life. In 1884 he had become privately engaged to Emilia Frances Pattison (née Strong), the widow of Mark Pattison, herself an accomplished art critic and collector. She was in India when the blow fell. Her reply to the accusation was the publication of her engagement to Sir Charles Dilke in the *Times*, and she married him on October 3, 1885; she died in 1904. Later, Chamberlain overruled his determination to retire from politics, and he was returned for the Forest oi Dean in 1892 and for Chelsea once more in 1905. Although his knowledge of foreign affairs and his powers as a critic and writer on military and naval questions were admittedly of the highest order, his official position in public life could not again be recovered. We was marked out in 1885 as the future leader of the Liberal Party in the House of Commons, and there is little doubt that he might have become one of the great foreign ministers of Europe. He possessed a knowledge of the needs and aspirations of foreign countries rare among his contemporaries, and a definite policy to be pursued irrespective of party politics and the rise and fall of ministries. His military writings are *The British Army* (1888); *Army Reform* (1898) and, with Spenser Wilkinson, *Imperial Defence* (1892). On colonial questions he wrote with equal authority. His *Greater Britain* (2 vols., 1866–67) reached a fourth edition in 1868, and was followed by *The Present Position of European Politics* (1887), *Problems of Greater Britain* (2 vols., 1890) and *The British Empire* (1899).

Emilia Frances, Lady Dilke, his second wife, was the author of a number of books, the most important being the studies on *French Painters of the Eighteenth Century* (1899) and three subsequent volumes on the architects and sculptors, furniture and decoration, engravers and draughtsmen of the same period, the last of which appeared in 1902. A posthumous volume, *The Book of the Spiritual Life* (1905), contains a memoir of her by Sir Charles Dilke.

(E. F. M. S.)

S. Gwynn and G. M. Tuckwell, *Life of Sir Charles Dilke* (2 vols., 1917). Also published in abridged form by G. M. Tuckwell (1925).

DILL (*Anethum graveolens*), an annual or biennial herb of the family Umbelliferae, native to the south of Europe, Egypt and the Cape of Good Hope. It resembles fennel in appearance. The leaves are used in soups and sauces and, as well as the umbels, for flavouring pickles. The fruits are employed for the preparation of dill-water and oil of dill; they are largely consumed in the manufacture of gin and when ground are eaten in the East as a condiment. Aqua Anethi or dill-water (dose 1–2 oz.) and the Oleum Anethi, almost identical in composition with caraway oil, and given in doses of ½–3 minims, are sometimes used as a carminative and as a vehicle

for the exhibition of nauseous drugs.

DILLEN (DILLENIUS), **JOHANN JAKOB** (1684–1747), English botanist, was born at Darmstadt and educated at the university of Giessen, where he printed in 1719 his *Catalogus plantarum sponte circa Gissam nascentium.* In 1721 he came to England, and in **1724** published a new edition of Ray's *Synopsis stirpium Britannicarum.* In **1732** appeared *Hortus Elthamensis,* a catalogue of the rare plants growing at Eltham, Kent, for which Dillen himself executed 417 plates, and it was described by Linnaeus as *opus botanicum quo absolutius mundus non vidit.* In **1734** he became professor of botany at Oxford. Dillen, who wrote *Historia muscorum* (1741), died at Oxford on April 2, 1747.

For an account of his collections preserved at Oxford, see *The Dillenian Herbaria, by G.* Claridge Druce (Oxford, 1907).

DILL (ANETHUM GRAVEOLENS) AN AROMATIC PLANT VALUED FOR FLAVOURING AND FOR ITS MEDICINAL PROPERTIES
At left is an enlarged drawing of fruit

DILLENBURG, a town of Hesse-Nassau, Prussia, Germany, in wooded country, on the Dill, 25 m. N.W. from Giessen on the railway to Troisdorf. Population **6,470.** On an eminence above it lie the ruins of the castle of Dillenburg, founded by Count Henry the Rich of Nassau, about the year 1255, and the birthplace of Prince William of Orange (1533). It has a chamber of commerce. Its industries embrace iron-works, bronze works, colour-works, tanneries and the manufacture of cigars. Owing to its beautiful surroundings Dillenburg has become a favourite summer resort.

DILLENS, JULIEN (1849–1904), Belgian sculptor, was born at Antwerp June **8, 1849,** son of a painter, and died at St. Gilles, near Brussels, Dec. **24,** 1904. He studied under Eugène Simonis at the Brussels Academy of Fine Arts. In **1877** he received the *prix de Rome* for "A Gaulish Chief taken Prisoner by the Romans," and from that time onward executed a number of important sculptures for the principal towns of Belgium and for the Belgian Government. Perhaps the most famous of these is the group "La justice entre la clémence et le droit," in the Palais de Justice at Brussels.

DILLINGEN, a town of Germany, in the *Land* of Bavaria, on the left bank of the Danube, **25** mi. N.E. from Ulm by rail. Population **6,220.** Dillingen became the residence of the bishops of Augsburg; was taken by the Swedes in **1632** and **1648,** by the Austrians in 1702, and on June **17,** 1800 by the French. In 1803 it passed to Bavaria. Its principal buildings are an old palace of the bishops of Augsburg, now Government offices, a royal gymnasium, a Capuchin monastery and a Franciscan convent. The university, founded in 1549, was abolished in **1804.** The inhabitants are engaged chiefly in cattle-rearing and the cultivation of corn, hops and fruit. In the vicinity is the Karolinen canal, which cuts off a bend in the Danube between Lauingen and Dillingen.

DILLMANN, CHRISTIAN FRIEDRICH AUGUST (1823–1894), German orientalist and biblical scholar, was born at Illingen on April **25, 1823.** In **1853** he became professor extraordinarius (at Tiibingen), and subsequently professor of philosophy at Riel (1854), of theology at Giessen **(1864)** and Berlin **(1869).** He died on July **4,** 1894. Dillmann's chief works are the *Book of Enoch* in Ethiopian **(1851;** German, **1853);** the first part of the Ethiopic bible, *Octateuchus Aethiopicus* (1853–55); *Grammatik der äthiopischen Sprache* (1857; Eng. trans., 1907); the *Book of Jubilee* (1859); another part of the Ethiopic bible, *Libri Regum* **(1861** and 1871); *Lexicon linguae aethiopicae* **(1865);** *Chrestomathia aethiopica* **(1866).** His *Commentar zum Hiob* **(1869)** stamped him as one of the foremost Old Testament exegetes. His renown as a theologian was mainly founded by the series of commentaries on other Old Testament books including *Genesis; Exodus und Leviticus; Numeri, Deuteronomium und Josua,* and *Jesaja.* In **1877** he published the *Ascension of Isaiah* in Ethiopian and Latin, and in **1895** *Vorlesungen iiber Theologie des Alten Testamentes* appeared.

See W. Baudissin, *A. Dillmann* (Leipzig, 1895).

DILLON, ARTHUR RICHARD (1721–1807), French archbishop, was the son of Arthur Dillon (1670–1733), an Irish general in the French service. He was born at St. Germain, held many important preferments and in 1763 became archbishop of Narbonne, and in that capacity, president of the estates of Languedoc. He carried out many works of public utility, bridges, canals, roads, harbours, etc., had chairs of chemistry and of physics created at Montpellier and at Toulouse, and tried to reduce poverty. In 1787 and **1788** he was a member of the Assembly of Notables called by Louis XVI., and in 1788 presided over the assembly of the clergy. Refusing to accept the civil constitution of the clergy, Dillon emigrated to Coblenz in 1791. He lived in London until his death in 1807, never accepting the Concordat.

See L. Audibret, *Le Dernier Prtsident des États du Languedoc, Mgr. Arthur Richard Dillon, archevêque de Narbonne* (Bordeaux, *1868);* L. de Lavergne, *Les Assemblées provinciales sous Louis XVI.* (Paris, *1864).*

DILLON, JOHN (1851–1927), Irish nationalist politician, was the son of John Blake Dillon (1816–1866), who sat in parliament for Tipperary, and was one of the leaders of "Young Ireland." John Dillon was educated at University college, Dublin, and afterwards qualified as a surgeon. He entered parliament in 1880 as member for Tipperary, and was at first an ardent supporter of C. S. Parnell, whom he accompanied in his tour of the United States in that year. In August he delivered a bitter speech on the Land League at Kildare; he advocated boycotting, and was arrested in May **1881** under the Coercion Act, and again after two months of freedom in October. In **1883** he resigned his seat for reasons of health, but was returned unopposed in 1885 for East Mayo, which he continued to represent. He was one of the prime movers in the famous agrarian "plan of campaign" *(see* IRELASD, *History).* Dillon was compelled by the court of queen's bench on Dec. **14, 1886,** to find securities for good behaviour; and in June **1888** under the provisions of the new Criminal Law Procedure Bill he was condemned to six months' imprisonment. He was released in September, and in the spring of **1889** sailed for Australia and New Zealand, where he collected funds for the Nationalist Party. On his return he was again arrested, but, being allowed bail, sailed for France in a fishing-boat with W. O'Brien, and thence to America. He returned to Ireland by way of Boulogne, where he and W. O'Brien held long and indecisive conferences with Parnell. They surrendered to the police in February, and on their release from Galway gaol in July declared their opposition to Parnell. After the expulsion of T. M. Healy and others from the Irish National Federation, Dillon became the chairman (Feb. **1896).** His early friendship with O'Brien gave place to disagreement, but the various sections of the party were ostensibly reconciled in 1900 under Redmond's leadership. In the autumn of **1896** he arranged a convention of the Irish race, which included **2,000** delegates from various parts of the world. In **1897** Dillon opposed in the House the diamond jubilee address to Queen Victoria on the ground that her reign had not been a blessing to Ireland. He was suspended on March 20 for violent language addressed to Joseph Chamberlain.

In 1905 he advised Irishmen in England to vote Liberal at the general election, and now began to support the Liberal government in its Irish measures, notably the Land bill, although in his earlier days he had opposed ameliorative measures as likely to defer Home Rule. In the crisis of **1912** over the Better Government of Ireland bill Dillon urged that Nationalists should concentrate on the attack against the House of Lords. In July 1914 he was invited by King George V. to accompany Redmond to the Buckingham Palace conference which attempted to settle the Irish controversy, when his attitude is said to have been stiffer than Redmond's.

When war broke out, he immediately placed his whole influence behind the British Government, speaking in this sense at the meet-

ing in the Dublin Mansion House on Sept. 25, 1914. He took an active part in recruiting but steadily opposed the extension of conscription to Ireland which would, he was convinced, merely strengthen the Sinn Fein movement. He succeeded Redmond as leader of the Nationalist Party, and at the General Election of Dec. 1918 he shared the general obliteration which overwhelmed the Party. He died in London on Aug. 4, 1927, and was buried in Glasnevin cemetery, Dublin, by the side of his wife (d. 1907), a daughter of Justice Mathew.

DILLON, a city of south-western Montana, U.S.A., on the Beaverhead river, the Oregon Short Line railroad and Federal highway 91; the county-seat of Beaverhead county. The population in 1940 was 3,014. It has a very beautiful location on a plateau 5,200 ft. above sea level, surrounded by mountain peaks. It is the hub of an extensive livestock, seed potato, seed pea and mining (gold and silver) region. Beaverhead county leads the state in area and per capita wealth. Dillon was settled about 1880 and incorporated in 1885, and is the seat of the state normal college, which was established in 1893.

DILTHEY, WILHELM (1833–1911), German philosopher, was born on Nov. 19, 1833, at Biebrich and died on Oct. 1, 1911, at Seis, near Bolzano. He was successively professor in Basle (1866), in Kiel (1868), in Breslau (1871), and in 1882 succeeded Lotze in Berlin. As a supporter of positive Idealism, Dilthey regards the external world as a representation arising out of pure experience, will as well as thought being a factor of knowing and of self-consciousness. His empirical tendency also appears in his historical approach to philosophy. His chief writings are: *Leben Schleiermachers* (1870); *Einleitung in die Geisteswissenschaften* (1883); *Das Erlebnis und die Dichtung* (1905); *Die Jugendgeschichte Hegels* (1905); *Systematische Philosophie* (1907); *Der Aufbau der geschichtlichen Methode in den Geisteswissenschaften* (1910); *Weltansclzauung u. Analyse des Menschen seit Renaissance und Reformation,* 2 vols. (1921).

See E. Spranger; *Wilhelm* Dilthey (1912).

DILUVIUM, a term in geology for superficial deposits formed by flood-like operations of water, and so contrasted with alluvium (*q.v.*) or alluvial deposits formed by slow and steady aqueous agencies. The term (Lat. for "deluge," from *diluere,* to wash away) was formerly given to the "boulder clay" deposits, supposed to have been caused by the Noachian deluge. In this sense it still lingers on the continent of Europe, but it has disappeared from British geological literature.

DIME, the tenth part, the tithe paid as church dues, or as tribute to a temporal power. In this sense it is obsolete, but is found in Wyclif's translation of the Bible—"He gave him dymes of alle thingis" (Gen. xiv. 20). A dime is a silver coin of the United States, in value 10 cents (English equivalent about 5d.), or one-tenth of a dollar; hence "dime-novel," a cheap sensational novel, a "penny dreadful"; also "dime-museum."

DIMENSION, a term used in geometry to denote a magnitude measured in a specified direction, as, for instance, along a diameter or a principal axis or an edge. **A** point is said to be without dimension; a line has the one dimension of length, a surface has the two dimensions of length and breadth, while a solid has the three dimensions of length, breadth and thickness. Since the lengths of lines, the areas of surfaces and the volumes of solids are represented respectively by linear, quadratic and cubic algebraic expressions, the term dimension has been carried over into algebra. Thus quadratic, cubic, biquadratic algebraic expressions or equations are said to be respectively of two, three, four dimensions. Similarly, the term dimensions is used in mechanics with reference to the units of time, length and mass and various derived units *(see* UNITS, DIMENSIONS OF), and it occurs likewise in many other parts of physics, notably in the theory of electricity and magnetism *(see* PHYSICAL **UNITS).**

The fundamental descriptive proposition concerning space, as we are accustomed to it in experience, is that space is a continuum (a continuous or unbroken distribution of points) having three dimensions. The intuitive basis of this proposition may be elucidated as follows. If on a curve (or line) we mark certain points (elements without dimension) we separate the curve into parts bounded by the points in such a way that we cannot pass along the curve from one part to another without encountering and passing over one of these marked points. Since the curve may be separated into parts by elements without dimensions it is itself said to be a figure having one dimension. But a surface cannot be thus separated into parts by marking isolated points on it; for, in going from one place to another on the surface, we can always avoid passing over these marked points by going around them. If we draw in the surface a suitable closed curve (a figure of one dimension) then the surface is separated into parts in such a way that we cannot move over the surface from one part to another without encountering and passing over a point on the curve. Since a surface can not be separated into parts by points (figures without dimension) but can be separated into parts by a suitable figure of one dimension, we say that a surface itself has two dimensions. Similarly space cannot be separated into parts by isolated points or curves or both taken together, while it can be so separated into parts by means of a closed surface (a figure of two dimensions). For this reason we say that space has three dimensions. This, according to Henri Poincaré (*Dernières Pensées, Flammarion,* Paris, 1917, pp. 61ff.), is the fundamental qualitative ground for ascribing three dimensions to the usual space of experience.

The mathematician introduces three co-ordinates to represent the points of ordinary space and much of his analysis of its properties is carried out algebraically. Now the algebraic analysis is competent to deal with sets of any number n of co-ordinates. Thus algebraic geometry leads readily to the conception of spaces of any number n of dimensions; and these have been extensively treated, though no one has a lively mental picture of spaces having more than three dimensions. Popular interest in these higher spaces (as opposed to the interest of mathematicians in them) has been centered principally around the concept of the "fourth dimension." But the number of dimensions of these higher spaces is unlimited; and, in fact, several kinds of space with an infinite number of dimensions have been investigated.

That the higher spaces may be given a concrete representation in terms of experience is shown by the fact that the totality of straight lines in our usual space of three dimensions constitutes a veritable space of four dimensions *(see* PROJECTIVE GEOMETRY). This arises from the fact that four independent co-ordinates are necessary to define completely the position in space of a line of unlimited extent. Therefore a geometry in which the elements are the lines of ordinary space is a geometry of four dimensions.

(R. D. CA.)

DIMINISHING RETURNS, in economics, represents the special application to land of the more generalized "law of diminishing productivity." This latter law may be stated as follows: "The size of the product obtained in a given productive process varies greatly according to the way in which the various agents of production are combined. If the supply of all other agents is kept constant, while the supply of one specific agent is increased, the average product per unit of this specific agent may increase to a maximum point, but, thereafter will, as a rule, diminish continuously, though often irregularly." This law is applicable to all types of production. Economists early noted the application of this law to land and called it "the law of diminishing returns." They observed that, beyond a certain point, as a greater value of labour and other agents of production are applied to a given area of land, the physical product obtained per additional unit of value invested on the land tends to diminish continually. Experience everywhere confirms the existence of this principle.

Any farmer knows that it is unprofitable to increase the intensity of use or cultivation of land beyond a certain point. It is a generally accepted fact that, when population density in a nation increases beyond an optimum point, average productivity per capita diminishes, and hence poverty increases.

(See ECONOMICS). (W. I. K.)

DIMINUENDO (It.), diminishing, *i.e.,* as used in music (abbr, *dim.*), in loudness, otherwise getting softer. *Decrescendo* and the sign have the same meaning.

DIMINUTION, a term in music applying when a given theme or passage is played in a "diminished" form, *i.e.*, in notes of shorter duration; "augmentation" signifying the converse procedure.

DIMITRIEVIĆ, DRAGUTIN (1876–1917) COLONEL, Serbian soldier and conspirator, was born on Aug. 17, 1876, and was the principal organiser of the conspiracy which ended in the murder (1903) of King Alexander Obrenovich of Serbia (*q.v.*) and his wife Draga. He was at first treated with great consideration by King Peter Karageorgević, and advanced rapidly in his profession. He became lecturer in tactics at the Military Academy of Belgrade, and contributed largely to the reorganisation of the Serbian army. In time, however, he became estranged from the dynasty, and as the semi-official "Narodna Obrana" was too lukewarm, in his opinion, he founded (May 1911) the secret society "Ujedinjenje ili Smrt" (Union or Death), a league composed mainly of officers, and known generally as "the Black Hand," which aimed at uniting all Southern Slav districts, by no matter what means. This league, and Dimitriević himself, took an active part in the comitadji warfare in Macedonia, and also in the anti-Austrian propaganda in Bosnia. In June 1913 Dimitriević was appointed chief of intelligence of the Serbian general staff. He was the prime author and organiser of the murder of Sarajevo. The "Black Hand" had quarrelled with the civilian administration and Radical party over the latter's administration in Macedonia. On Dec. 15, 1916, Dimitrievid and his principal partisans were arrested at Salonica on a charge of conspiring to deliver the Serb front to the enemy; he was condemned to death for inciting to mutiny and conspiring to assassinate the crown prince (later king) Alexander of Serbia, and shot June 1917.

Dimitrievid (commonly known as "Apis") was a man of great courage, intelligence, patriotism and energy, but ruthless and utterly unscrupulous in his methods. Personal details are given most fully in Boghichevich, *Le Procès* de *Salonique* (1927), while the evidence regarding the Sarajevo crime is best given in R. W. Seton-Watson, Sarajevo (1927).

DIMITY, derived from the Gr. δίμιτος "double thread," through the Ital. dimito, "a kind of course linzie-wolzie" (Florio, 1611); a cloth commonly employed for bed upholstery and curtains, and usually white, though sometimes a pattern is printed on it in colours. It is stout in texture, and woven in raised patterns.

DIMORPHISM, the property of assuming two forms. In crystallography (*q.v.*), two substances which are identical in chemical composition but different in crystalline form, and consequently in others of their physical properties, are *dimorphous.*

In biology the word is used when there are two distinct varieties of an organism which freely interbreed; thus, in plants, the pin-eyed and thrum-eyed varieties of primrose (Primula) are examples of dimorphism; among animals, some female mimetic butterflies show dimorphism, changing their appearance to resemble a different model (see MIMICRY); some birds, *e.g.*, certain owls, also exhibit dimorphism. In addition, many animals exhibit sexual dimorphism (see SEX) in which the two sexes are sharply differentiated from one another, *e.g.*, deer, birds of paradise, many butterflies, etc.

DINAJPUR, a town and district of British India, in the Rajshah division of Bengal. The population of the town in 1931 was 19,156. The district has an area of 3,946 sq.m. and a population of 1,755,432. It is a flat alluvial plain broken in the south by a slightly elevated tract known as the Barind, and in the north-west by low hills, along the banks of the Kulik river. The principal rivers are the Atrai and Jamuna and the Karatoya, which forms the eastern boundary for 50 m. Rice is the staple agricultural product. The district is partly traversed by the main line of the Eastern Bengal State railway and by the line to Behar. which takes off at Parbatipur. Pillars and copper-plate inscriptions have yielded numerous records of the Pala kings of Bengal. Interesting ruins exist at Devikot and Ghoraghat which were military stations under the early Mohammedan rulers of Bengal.

DINAN, a town of north-western France, capital of an arrocdisscment in the department of Côtes-du-Nord, 37 mi. E. of St. Brieuc on the Ouest-État railway. Pop. (1936) 11,711

Dinan, a stronghold of the dukes of Brittany, was besieged by the English under the duke of Lancaster in 1359, during which siege Du Guesclin and an English knight called Thomas of Canterbury engaged in single combat.

Dinan stands on a height on the left bank of the Rance (here canalized), some 17 m. above St. Malo, with which it communicates by means of small steamers. It is united to the village of Lanvallay on the right bank of the river by a granite viaduct 130 ft. in height. The town is almost entirely encircled by the mediaeval ramparts, strengthened with towers and, on the south, a castle of the late 14th century, now a prison. Three old gateways also remain. The church of St. Malo is late Gothic, that of St. Sauveur, Romanesque and Gothic intermingled. In the latter church a granite monument contains the heart of Bertrand Du Guesclin. The quaint winding streets of Dinan are often bordered by mediaeval houses. It is a tourist centre. Near the town are the ruins of the château and the Benedictine abbey at Léhon; and not far off is the now dismantled chbteau of La Garaye. Dinan is the seat of a sub-prefect. There is trade in grain, cider, wax, honey, butter and other agricultural products. Leather is manufactured.

DINANT, an ancient town in the province of Namur, Belgium, on the Meuse, with the station and the suburb of St. Medard. Pop. (1930) 7,003. As early as the 7th century it was a dependency of the bishopric of Tongres. From the 10th century to the French revolution it was a fief of the prince-bishopric of Liége. In 1040 a castle was built on a rock dominating the town In the 15th century, with a population of 60,000, and 8.000 workers in copper, Dinant was one of the most flourishing cities in Walloon Belgium until it incurred the wrath of Charles the Bold. In 1466 Charles, in his father's name, laid siege to Dinant, and carried the place by storm, killing most of the combatants. In 167j Dinant was taken by Louis XIV., and remained in French hands for nearly 30 years. The citadel on the cliff, 300 ft. or 408 steps above the town, was fortified by the Dutch in 1818, but was dismantled later. Half way up the cliff is the grotto of Montfat, 13th century.

The church of Notre Dame (13th century) stood immediately under the citadel, flanking the bridge, and was a remarkably complete illustration of Gothic architecture with a curious slate-covered spire shaped like a long pumpkin.

Dinant was practically destroyed in August 1914 during the German invasion, and 670 of its inhabitants were shot, but after 1918 it was largely restored. It again suffered heavily in the May 1940 campaign.

Dinant is a summer resort and also a convenient central point for excursions into the Ardennes.

DINAPORE, a subdivisional town and cantonment of British India, in the Patna district of Behar and Orissa, on the right bank of the Ganges. Pop. (1931) 81 367. In 1857 the sepoy regiments here who had been allowed to retain their arms broke into open mutiny when an attempt was made to disarm them. The majority crossed over the Son into Shahabad where they joined the rebels under Kuar Singh and laid siege to Arrah.

DINAR. The monetary unit of Serbia, and since the war of Yugoslavia, divided into 100 paras. At par, the dinar is equivalent to 2.982 cents in the currency of the United States.

Gold coins are of 20 and 10 dinars in denomination, and silver is coined into pieces of 5, 2, 1 and ½ dinars, respectively. Nickel coins circulate, in the form of 20, 10 and 5 paras, while bronze is struck into coins of 2 paras. With the dinar equivalent to 1.76 cents or about three-farthings, 2 paras would be only 1/100th of a penny.

National bank notes circulate in Yugoslavia. In 1920, 3,344 million dinars were outstanding, and by 1924 the volume had risen to 6,000 millions. Concurrently, the dollar exchange fell from 2 95 to 1.49 cents.

The world depression of the 1930s and the outbreak of World War II in 1939 caused further violent fluctuations in the exchange value of this and other currencies.

(See also CURRENCY.)

DENARD, a seaside town of north-western France. in the department of Ille-et-Vilaine. Pop. (1936) 6,541. The town, the chief watering place of Brittany, stands on a rocky promontory at the mouth of the Rance opposite St. Malo, which is about 1 mi distant. It is a favourite resort of English and Americans, as well as of the French, its attractions being the beauty of its situation, a famous grotto, the mildness of the climate and the good bathing. It has two casinos and numerous luxurious hotels and elegant villas. The adjoining watering places of St. Enogat, St. Lunaire and St. Briac are increasing in importance.

DINDIGUL, a town of British India, in the Madura district of Madras, 880 ft. above the sea, 40 m. from Madura by rail. Pop. (1931) 43,617. Dindigul is a trade centre, and has a considerable manufacture of tobacco, a large cotton ginning and pressing factory, and tanneries. The town has manufactures of cloth and safe-locks and an export trade in cotton, coffee, grain and cardamoms. Approximately one-ninth of the population is Christian. There is an industrial school. The ancient fort, well preserved, stands 350 ft. above the town; this was formerly a position of great strategic importance, commanding passes into Madura from Coimbatore, and figured prominently in the military operations of the Mahrattas in the 17th and 18th centuries, and of Hyder Ali in 1755 and the years which followed. After being thrice captured by the British it was eventually ceded to the East India Company.

DINDORF, KARL WILHELM (1802–1883), German classical scholar, was born at Leipzig. After completing F. Invernizi's edition of Aristophanes (1826), and editing several grammarians and rhetoricians, he was, in 1828, appointed extraordinary professor at Leipzig, a post which he resigned in 1883. He edited Athenaeus (1827) and the Greek dramatists, both separately and combined in his *Poetae scenici Graeci* (1830 and later editions). He also wrote a work on the metres of the Greek dramatic poets, and compiled special lexicons to Aeschylus and Sophocles. He edited Procopius for Niebuhr's *Corpus* of the Byzantine writers, and between 1846 and 1851 brought out at Oxford an important edition of Demosthenes; he also edited Lucian and Josephus for the Didot classics. His last important editorial labour was his *Eusebius of Caesarea* (1867–71). Much of his attention was occupied by the republication of Stephanus's *Thesaurus* (Paris, 1831–65), chiefly executed by him and his brother Ludwig, a work of prodigious labour and utility.

His brother LUDWIG (1805–1871) led so secluded a life that many doubted his existence, and declared that he was a mere pseudonym. The important share which he took in the edition of the *Thesaurus* is nevertheless authenticated by his own signature to his contributions. He also published valuable editions of Polybius, Dio Cassius and other Greek historians.

D'INDY, PAUL MARIE THÉODORE VINCENT (1851–1931), French musical composer, was born in Paris on March 27, 1851. He studied composition and the organ at the Paris Conservatoire under César Franck, and obtained the grand prize offered by the city of Paris in 1887 with *Le Chant de la Cloche,* a dramatic legend after Schiller. His principal works include the symphonic trilogy *Wallenstein,* the symphonic works entitled *Saugefleurie, La Forêt enchantke, Istar, Symphonie sur un air montagnard français;* overture to *Anthony and Cleopatra; Ste. Marie Magdeleine,* a cantata; *Attendez-moi sous l'orme,* a one-act opera; *Fervaal,* a music drama in three acts; and *La Légende de Saint-Christophe,* a hybrid work, part oratorio, part opera, part symphony, containing some of his finest music. Vincent d'Indy was perhaps the most prominent among the disciples of César Franck. He was guided by the loftiest ideals and few musicians laboured more strenuously or disinterestedly in the service of art. His opera *Fervaal,* which is styled "action musicale," is constructed upon the leading motive system. Its legendary subject recalls both *Parsifal* and *Tristan,* and the music is also suggestive of Wagnerian influences. As founder and director of the Schola Cantorum d'Indy did magnificent work as a teacher. and the briefest record of his activities would be incomplete which omitted reference to his indefatigable propagandist labours on behalf of his master, César Franck.

DINEIR, also DINAR or GEYIKLER, a kaza in the vilayet of Afiun Qarahisar in Turkey, built amidst the ruins of Celaenae-Apamea, near the sources of the Maeander. Population, 36,117. It lies on the Smyrna-Egerdir railway *(see* APAMEA).

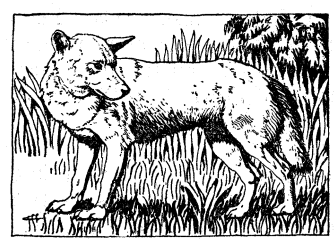
DINGAAN: *see* ZULULAND.

DINGELSTEDT, FRANZ VON (1814–1881), German poet and dramatist, was born at Halsdorf, in Hesse Cassel, on June 30, 1814. He studied at Marburg, became schoolmaster at Cassel (1836) and at Fulda (1838). In 1839 he produced a novel, *Unter der Erde,* and in 1841 the book by which he is best remembered, the *Lieder eines kosmopolitischen Nachtwächters* These poems, which expressed the liberal aspirations of his time, determined his career, and in 1841 he joined the staff of the *Augsburger allgemeine Zeitung.* In 1843 the satirist of German princes accepted, to the general surprise, the appointment of private librarian to the king of Wiirttemberg, and in the same year he married the Bohemian opera singer, Jenny Lutzer. After the production of his tragedy, *Das Haus der Barneveldt* (1850), he became intendant at the court theatre at Munich, but in 1856 was suddenly dismissed on the most frivolous charges, the real authors of his disgrace being the ultramontane clique at court., Through the influence of Liszt he became intendant of the court theatre at Weimar, where he remained until 1867; under his management there all Shakespeare's historical plays were presented in an unbroken cycle. In 1867 he became director of the court opera house in Vienna, and in 1872 of the Hofburg theatre, a position he held until his death on May 1;, 1881. Among his other works may be noticed an autobiographical sketch of his Munich career, entitled *Münchener Bilderbogen* (1879), *Die Amazone,* a society novel (1869), translations of several of Shakespeare's comedies, and several writings dealing with questions of practical dramaturgy. He was ennobled in 1867 by the king of Bavaria, and in 1876 was created *Freiherr* by the emperor of Austria. Dingelstedt was one of the founders of the German Shakespeare Society.

Dingelstedt's *Sämtliche Werke* (12 vols., 1877–78), is incomplete. On his life *see,* besides the autobiography mentioned above, J. Rodenberg, *Heimaterinnerungen an* F. *Dingelstedt* (1882), and *F. Dingelstedt, Blatter aus seinem Nachlass* (2 vols., 1891).

DINGHY, a boat of greatly varying size and shape, used on the rivers of India; the term is applied also, in certain districts, to a larger boat used for coasting purposes. The name was adopted by the merchantmen trading with India, and is now generally used to designate the small extra boat kept for, general purposes on a man-of-war or merchant vessel, and also, on the Thames, for small pleasure boats built for one or two pairs of sculls.

DINGLE, a seaport and market town of Co. Kerry, Eire, on the fine natural harbour of Dingle bay. Pop. (1936) 1,800. The town, a mackerel-fishing centre, was important in the 16th century as a seaport, and had also a noted manufacture of linen. It was incorporated by Queen Elizabeth and returned two members to the Irish parliament until the Union.



BY COURTESY OF THE NEW YORK ZOOLOGICAL SOCIETY

DINGO, THE NATIVE AUSTRALIAN DOG, IS THE ONLY LARGE PLACENTAL MAMMAL WHICH INHABITED AUSTRALIA PREVIOUS TO EUROPEAN COLONIZATION

DINGO (*Canis dingo),* the native Australian dog, a stoutly-built, short-legged animal, intermediate in size between a jackal and a wolf. It is very similar in appearance to the pariah dogs of India and Egypt, from which it is probably derived. The dingo occurs both wild and tame, and is the only large placental mammal which inhabited Australia previous to European colonization. There is strong evidence, however, that the dingo is not indigenous to the continent, but was brought from Asia by the aborigines. In colour it is sandy-brown often marked on the back with black.

Owing to the introduction of the rabbit, which affords it a staple food-supply, the dingo has recently increased in numbers to such an extent as to become a serious menace to the sheep-

farmers in many parts of Australia. It hunts singly or in pairs, more rarely in small packs of five or six.

Fossil remains of the dingo are found in the Australian Pleistocene mixed with bones of giant marsupials.

DINGWALL, royal burgh, county town and parish, shire of Ross and Cromarty, Scotland. Pop (1938) 2,828. It is near the head of Cromarty Firth where the valley of the Peffery unites with the alluvial lands at the mouth of the Conon, 18½ m. N.W. of Inverness by the L.M.S.R. Its name, derived from the Scandinavian *Thingvöllr,* "field or meeting-place of the *thing,"* or local assembly, preserves the Norse origin of the town; its Gaelic designation is Inverpefferon, "the mouth of the Peffery." The 18th-century town house (largely rebuilt in 1905) and some remains of the ancient mansion of the once powerful earls of Ross still exist. A tower has been built on Mitchell hill to the south of the town in memory of Brig. General Sir Hector Macdonald, who was born near Dingwall. The town has an important corn market and auction marts, and a distillery. Some shipping is carried on at the harbour at the mouth of the Peffery, about a mile below the burgh. Branch railways run to Strathpeffer and to Strome Ferry and Kyle of Lochalsh (for Skye). Alexander II. created Dingwall a royal burgh in 1226, and its charter was renewed by James IV. On the top of Knockfarrel, a hill about 3 m. to the west, is a large and very complete vitrified fort with ramparts.

DINIZ DA CRUZ E SILVA: *see* CRUZ E SILVA, ANTONIO DINIZ DA.

DINIZULU: *see* CETYWAYO and *s.v.* ZULULAND.

DINKA: *see* NILOTES.

DINKELSBÜHL, a town of Germany, in the *Land* of Bavaria, on the Wörnitz, 16 mi. N. from Nordlingen by rail. Population 5,180. Fortified by the emperor Henry I., Dinkelsbuhl received in 1305 the same municipal rights as Ulm, and obtained in 1351 the position of a free imperial city, which it retained till 1802, when it passed to Bavaria. Its municipal code, the *Dinkelsbühler Recht,* published in 1536, and revised in 1738, contained a very extensive collection of public and private laws. It is still surrounded by old walls and towers. The *Deutsches Haus,* the ancestral home of the counts of Drechsel-Deufstetten, is of the German renaissance style of wooden architecture. Brushes, gloves, stockings and gingerbread are the chief manufactures.

DINNER, the chief meal of the day, eaten either in the middle of the day or in the evening. The word "dine" comes through Fr. from Med. Lat. *disnare,* for *disjejunare,* to break one's fast (*jejunium*); it is, therefore, the same word as Fr. *déjeuner,* to breakfast, in modern France, to take the midday meal, *diner* being used for the later repast.

DINOFLAGELLATA, single-celled organisms (class Flagellata), with plant-like metabolism, which are present as part of the floating fauna (plankton) of pools, lakes and the sea. They form a certain part of the food-supply of other animals (*e.g.,* of fish larvae). (*See* PROTOZOA.)

DINORNPTHIDAE: *see* MOA.

DINOSAURIA, a sub-class or order of Mesozoic reptiles. The term dinosaur is in current use for the members of two groups of extinct reptiles, most members of which are characterized by their gigantic size.

The first group, the Saurischia, first appears in the Trias, the earliest known remains being found in the Middle Trias, although the evidence of foot-prints suggests that they already existed in the Lower Trias. These Triassic forms are very variable in size, ranging from animals no bigger than a hen to creatures some 15ft. or more in length. All of them are bipedal, walking on the clongated hind legs and scarcely ever if at all touching the ground with their small hands during ordinary progress. In the main these animals were carnivorous, and some of their descendants continued to feed on flesh until their disappearance at the top of the Cretaceous. One other group, however, of very heavily built, more quadri-pedal animals, apparently adopted herbivorous habits and developed into the great group of Sauropoda. The truly carnivorous Jurassic and Cretaceous forms fall into many families differing very considerably from one another. The most important end-forms, *i.e.,* those which represent the climax of the evolution of a line, are *Struthiomimus* and *Tyrannosaurus.*

Struthiomimus is a bipedal animal probably capable of running at a great speed, its legs and particularly its feet, strongly recalling those of such struthious birds as the emu and rhea There are three toes, the middle much the longest, the others forming a symmetrical pair; and they correspond to the second, third and fourth of the full pentadactyl foot. The fore-limb is also three toed, but is peculiar in structure. Its bones and the muscles which move them are slender, whilst the digits are of nearly the same length, each of the three ending in a large curved and sharp-pointed claw. These fingers could not be opposed to one another, the hand could merely be shut and opened like that of a sloth: it can have served only as an organ for grasping boughs. The neck is long, slender and freely movable, whilst the head is relatively very small and the jaws are covered with a horny beak like that of an ostrich. The eye is large. It seems most probable that the animal used its slender arms for pulling down the boughs of trees, in order that their leaves might be plucked by the beak, but it is possible that the animal was capable of digging up shrubs with its hands. It is about 12ft. in length and stands about 4ft. high at the pelvis.

Tyrannosaurus, which is of slightly more recent date, presents a remarkable contrast to *Struthiomimus.* The animal stands about 18ft. high and has a length of some 38ft.; the skull alone is more than 4ft. in length. The animal walked entirely on its hind legs, only the toes resting on the ground; the fore limbs are absurdly small and feeble, and can scarcely have been of much use to the animal in feeding. The body is narrow from side to side, but very deep and must have been immensely heavy; in order to balance its weight the thick tail is nearly twice as long as the anterior part of the body. *Tyrannosaurus* has teeth nearly 1ft. in length and is by far the largest land-living carnivorous animal known. It is a descendant of the somewhat smaller *Gorgonosaurus* from the Middle Cretaceous of Alberta, Canada, in which the fore-legs are somewhat larger and the tail shorter; not dissimilar are *Megalosaurus* from the Lower Jurassic of England and *Allosaurus* from somewhat later rocks in North America. In these forms, however, the neck is relatively longer and the fore limbs are still more so.

A great contrast to *Tyrannosaurus* is afforded by *Compsognathus.* This animal was no bigger than a pigeon, and had a foot with a grasping big toe very like that of a bird. Its very delicate skull was provided with small very sharp teeth. The only known specimen, which comes from the Solenhofen slate of Bavaria, contains within its ribs the remains of a skeleton; this has sometimes been interpreted as that of an unborn individual of the same form, but it is more probably the remains of a small lizard-like reptile which was its last meal.

The other great group of Saurischia, the Sauropoda, is composed of large reptiles, many of which attained gigantic dimensions. The smallest and one of the most recent, *Titanosazrrus,* is little more than 5ft. high at the shoulder and about 25ft. in length, more than half of it being tail. The largest form, *Brachiosaurus,* has a humerus about 6ft. in length. These animals walked on all four legs and the fore-leg was not disproportionately shorter than the hind one. The fore-foot usually bears a single large claw on the thumb, the second and third fingers retain some phalanges, and the fourth and fifth are usually reduced to mere stumps. The hind-foot is similar, but usually the first three digits have claws. The animal walks on the ends of its metacarpals and tarsals, that is, the palm of the hand and the sole of the foot were not placed on the ground; the limbs were rather elephant-like. The trunk is short and the neck long and flexible. The tail is extraordinarily long, and often ends in a whip-like extremity. The head is very small with the nostrils opening on its upper surface; the teeth are never large, and form a uniform series which may be restricted to the front of the mouth. In *Diplodocus* (which has *a* total length of 65ft.), the dentition is reduced to some 20 teeth in each jaw, each tooth about as big as the stump of a thin pencil. It is clear that these animals were not carnivorous, and it is exceedingly

difficult to discover any food soft enough to be eaten with such a dentition, and sufficiently abundant to maintain an animal weighing some 35 tons. As the remains of these animals are not uncommonly found in shallow water marine deposits, it is probable that they were mainly aquatic in their habits, walking on the bottom of shallow estuaries, reaching the air by raising their long necks, and feeding on water plants. The skin, in the only case in which it is known, was covered with small horny scales about half an inch in diameter. The oldest known Sauropod is *Cetiosaurus* from the Great Oolite of Oxford, England, but the best known forms are *Diplodocus* and *Apatosaurus* from the top of the Jurassic of Colorado. The most widely distributed was *Titanosaurus* found in the Cretaceous rocks of England, Hungary, India, Madagascar and Patagonia.

The other great division of the dinosaurs, the Ornithischia, contains only herbivorous animals. The oldest member of the group comes from the Upper Trias of South Africa and the group becomes extinct at the extreme top of the Cretaceous. The most familiar forms are animals with the shape of a gigantic kangaroo, the hind legs being very long and the animal balanced about them by the great tail. The fore-limbs are shorter than the hind ones and may perhaps have been used for grasping food. *Iguanodon* (about 28ft. long and 14ft. high) is the most familiar European form, whilst the Cretaceous of North America and of central Asia yields the remains of many animals similar in appearance, but in many cases diversified by the presence of a crest rising from the top of the head. These animals, the Trachodonts, are sometimes so perfectly preserved that the impression of the skin still covers the entire skeleton, and shows that during life the animals were covered with small horny scales often arranged in little groups forming a pattern. These animals appear to have been predominantly aquatic.

Another very different group, is represented by the armoured dinosaurs: they are the oldest known forms, and are characterized by the possession of at least two rows of bony scutes set in the skin of the back. These scutes may be relatively small, but in larger forms such as *Stegosaurus* from the Jurassic of North America and England, they are enlarged so as to stand up as a wall of bony plates 3ft. high by 3ft. wide, on each side of the mid-line of the back of the animal, the plates in the two rows alternating with one another. The largest plates are over the base of the tail, whose extremity bears two pairs of sharp pointed spines, each one sometimes 3ft. in length, projecting laterally. *Stegosaurus* is flat from side to side and its legs are straight and rather elephant-like.

A widely different form is *Palaeoscincus* and its allies, from the Middle Cretaceous of Alberta, Canada. This animal, with a total length of some 15ft. was only 4ft. high, but had a width across the middle of its back of some 6 feet. The head is short and rounded, the neck is also short and is covered with pairs of bony plates lying in the skin; in the region of the shoulder these plates are tall, very sharp-pointed spines, and a similar group of them lies on the elbow. In the middle of the back the spines disappear and are replaced by flat but keeled small bony plates, forming four rows along the animal's back; these extend over the hip region and swell out on the tail so as to form nearly complete rings. Finally, in some cases at any rate, there is an unarmoured but quite stiff region terminating at the end of the tail in an enormous mass of bone composed of numerous bony scutes.

The last group, the Ceratopsia, begins with *Protoceratops*, an animal whose remains are abundant on a certain horizon in the Middle Cretaceous of Mongolia. This animal was quite small; the head of the adult, although developed backwards into a great frill overhanging the neck, was little more than 1ft. in length, whilst the whole animal was only some 5ft. long. This creature had long hind and short fore legs and was probably capable of running on the former like an *Iguanodon*, but it is clear that it was habitually quadripedal. In later rocks in North America there occur a whole series of animals which become progressively larger until they end in such forms as *Triceratops*, with a head 6ft. long. In these later animals the frill becomes more and more extensive and massive and three horns appear, one over each eye and one on the end of the nose. The fore and hind legs become nearly equal in size and the animal walked entirely on all fours.

Protoceratops is the animal which laid the dinosaur eggs discovered by the American Museum of Natural History expedition in Mongolia. On the whole these recall the eggs of birds; they are large, about 7in. long and 5in. in diameter, covered with a calcareous shell, differing in the detail of its structure from that of a bird, although superficially recalling an ostrich egg-shell. These eggs were laid in clutches of 13 or more, and were neatly arranged in a nest, a mere hollow scooped out of the sand on which the animal was walking. The arrangement is a systematic one, the eggs being so arranged that they radiate from the centre and are in two rings overlying one another. The whole appearance of this nest suggests that the animal actually sat on the eggs as does a bird, and that they were not left untended to hatch by the heat of the sun. Fragments of eggs presumed to have been laid by a Dinosaur had been found much earlier in the south of France.

The brain of a dinosaur was always small and in some species it was extremely tiny. For example that of *Diplodocus* is only 4in. in length, 2in. high, and a little more than 1in. in width, whereas the animal as a whole is some 65ft. in length. The most massive part of the whole central nervous system lay in a swelling in the sacrum. It has to be remembered that an impulse takes an appreciable amount of time to travel down a nerve, and that in *Diplodocus* it might take nearly a second to transmit an impulse from the end of the tail to the brain and back again. (*See* REPTILES.) (*D.* M. S. W.)

DINOSAUR NATIONAL MONUMENT, a reservation (80 ac. in area) in Uintah county, Utah, U.S.A., about 12 m. east by north of Vernal. The reservation, created Oct. 4, 1915, contains deposits of fossil remains of prehistoric animal life of great scientific interest.

DINOTHERIUM, an extinct mammal, fossil remains of which occur in the Miocene beds of France, Germany, Greece and northern India. An entire skull, obtained from the Lower Pliocene beds of Eppelsheim, Hesse-Darmstadt, measured 4½ft. in length and 3ft. in breadth, and indicates an animal exceeding the elephant in size. The upper jaw is destitute of incisor and canine teeth, but possesses five molars on each side, with a corresponding number in the jaw beneath. The most remarkable feature, however, consists in the front part of the lower jaw being bent downwards and bearing two tusk-like incisors also directed downwards and backwards. *Dinotherium* is a member of the group Proboscidea (*q.v.*).

DINTER, GUSTAV FRIEDRICH (1760–1831), German divine and educator, was born on Feb. 29, 1760, at Borna, Saxony. He was educated at Leipzig university, and while pastor of a village near Borna, became interested in the training of teachers. From 1797 to 1807 he was principal of the Dresden normal school, and after founding a progymnasium at Gornitz, in 1816 was appointed inspector of schools of the province of Prussia and shortly afterwards professor of theology at Konigsberg university In education, Dinter introduced the methods of Pestalozzi and in his famous *Schullehrer-bibel* (1826–30) advocated the use of the Bible as an authority in religion only, not in science. He died at Konigsberg on May 29, 1831.

See *Sämtliche Schriften*, 42 Bde. (Neustadt, 1840–51), and his autobiography (Neustadt, 1829).

DINWIDDIE, ROBERT (1693–1770), British colonial governor of Virginia, was born near Glasgow, Scotland, in 1693 From the position of customs clerk in Bermuda, which he held in 1727–38, he was promoted to be surveyor-general of the customs "of the southern ports of the continent of America," as a reward for having exposed the corruption in the West Indian customs service. In 1751–58 he was lieutenant-governor of Virginia. He was energetic in the discharge of his duties, but aroused much animosity among the colonists by exacting heavy fees. It was his chief concern to prevent the French from building in the Ohio valley a chain of forts connecting their settlements in the north with those on the Gulf of Mexico; and in the autumn of 1753 he sent George Washington to Ft. Le Boeuf, a newly established French post at what is now Waterford, P a with a message

demanding the withdrawal of the French from English territory. As the French refused to comply, Dinwiddie in the spring of 1754 sent Washington with an armed force toward the forks of the Ohio river "to prevent the intentions of the French in settling those lands." In May Washington encountered a French force at Great Meadows, in what is now southwestern Pennsylvania, and a skirmish followed which precipitated the French and Indian War. Dinwiddie's appeals to the home government, however, resulted in the sending of General Edward Braddock to Virginia with two regiments of regular troops; and at Braddock's call Dinwiddia and other colonial governors met at Alexandria, Va., in April 1755, and planned the initial operations of the war. Dinwiddie's administration was marked by a constant wrangle with the assembly over money matters; and its obstinate resistance to military appropriations caused him in 1754 and 1755 to urge the home government to secure an act of parliament compelling the colonies to raise money for their protection. In Jan. 1758 he left Virginia and lived in England until his death at Clifton, Bristol, July 27, 1770.

The Official Records of Robert Dinwiddie, Lieutenant-Governor of Virginia (1751–58), published in two volumes, at Richmond, Va., in 1883–84, by the Virginia Historical Society, and edit. by R. A. Brock, are of great value for the political history of the colonies in this period.

DIO CASSIUS (more correctly CASSIUS DIO) **COCCEIANUS** (c. A.D. 150–23j), Roman historian, born at Nicaea in Bithynia. His father was Cassius Apronianus, governor of Dalmatia and Cilicia under Marcus Aurelius, and on his mother's side he was the grandson of Dio Chrysostom. After his father's death Dio Cassius went to Rome (180) and became a member of the senate. During the reign of Commodus, Dio practised as an advocate and held the offices of aedile and quaester. He was raised to the praetorship by Pertinax (193) but did not assume office till the reign of Septimius Severus, with whom he was for a long time on intimate terms. By Macrinus he was entrusted with the administration of Pergamum and Smyrna, and on his return to Rome he was made consul (c. 220). After this he obtained the proconsulship of Africa, and again on his return was sent as legate successively to Dalmatia and Pannonia. He was granted a second consulship by Alexander Severus, in 229, but soon afterwards retired to Nicaea, where he died. Before writing his history of Rome (*Romaika*), Dio Cassius had dedicated to Severus an account of various prodigies which had presaged his elevation to the throne (perhaps the Ἐνόδια attributed to Dio by Suidas), and had also written a biography of his fellow-countryman Arrian. The history of Rome, which is written in Greek, consisted of 80 books, beginning with the landing of Aeneas in Italy and ending with the reign of Alexander Severus (222–23j). We possess books 36–60 (68 B.C.—A.D. 47); books 36 and 55–60 are imperfect. We also have part of 35 and 36–80 in the epitome of John Xiphilinus, an 11th-century Byzantine monk. For the earlier period the loss of Dio's work is partly supplied by the history of Zonaras, who followed him closely. Numerous fragments are also contained in the excerpts of Constantine Porphyrogenitus. Dio's work is a most important authority for the history of the last years of the republic and the early empire. His industry was great and the various offices he held gave him opportunities for historical investigation. His narrative shows the hand of the practised soldier and politician; the language is correct and free from affectation. But his work, although far more than a mere compilation, is not remarkable for impartiality, vigour of judgment, or critical historical faculty.

The best edition with notes is that of H. S. Reimar (1750–52), new ed. by F. G. Sturz (1824–36); text by I. Melber (1890 foll.), with account of previous editions, and U. P. Boissevain (1895–1926); translations by H. B. Foster (Troy, New York, 1905 foll.), with full bibliography, and E. Cary (Loeb series, 1912); *see* also *W.* Christ, *Geschichte der Griechischen Literatur* (1898), p. 675; E. Schwartz in Pauly-Wissowa's *Realencyklopadie,* iii. pt. 2 (1899); C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895).

DIOCESE, the sphere of a bishop's jurisdiction (from Gr. *διοίκησις,* "house-keeping," "administration"). In this, its sole modern sense, the word diocese (dioecesis) has only been regularly used since the 9th century. The Greek word *διοίκησις,* from meaning "administration," came to be applied to the territorial circumscription in which administration was exercised. The word is equivalent to "assize-districts." But in the reorganization of the empire, begun by Diocletian and completed by Constantine, the word "diocese" acquired a more important meaning, the empire being divided into twelve dioceses, of which the largest—Oriens—embraced sixteen provinces, and the smallest—Britain—four (see ROME: Ancient History; and W. T. Arnold, *Roman Provincial* Administration, pp. 187, 194–196, which gives a list of the dioceses and their subdivisions). The organization of the Christian church in the Roman empire following very closely the lines of the civil administration (see CHURCH HISTORY), the word diocese, in its ecclesiastical sense, was at first applied to the sphere of jurisdiction, not of a bishop, but of a metropolitan. For exceptions see Hinschius ii. p. 39, note 1. The word, however, survived in its general sense of "office" or "administration," and it was even used during the middle ages for "parish" *(see* Du Cange, Glossarium, s. "Dioecesis" 2).

The practice, under the Roman empire, of making the areas of ecclesiastical administration very exactly coincide with those of the civil administration, was continued in the organization of the church beyond the borders of the empire, and many dioceses to this day preserve the limits of long vanished political divisions. The process is well illustrated in the case of English bishoprics. But this practice was based on convenience, not principle; and the limits of the dioceses, once fixed, did not usually change with the changing political boundaries. Thus Hincmar, archbishop of Reims, complains that not only his metropolitanate (dioecesis) but his bishopric (*parochia*) is divided between two realms under two kings; and this inconvenient overlapping of jurisdictions remained, in fact, very common in Europe until the readjustments of national boundaries by the territorial settlements of the 19th century. In principle, however, the subdivision of a diocese, in the event of the work becoming too heavy for one bishop, was very early admitted, *e.g.,* by the first council at Lugo in Spain (569), which erected Lugo into a metropolitanate, the consequent division of diocese being confirmed by the king of the second council, held in 572. Another reason for dividing a diocese, and establishing a new see, has been recognized by the church as duly existing "if the sovereign should think fit to endow some principal village or town with the rank and privileges of a city" (Bingham, lib. xvii. c. 5). But there are canons for the punishment of such as might induce the sovereign so to erect any town into a city, solely with the view of becoming bishop thereof. Nor could any diocese be divided without the consent of the primate.

In England an act of parliament is necessary for the creation of new dioceses. In the reign of Henry VIII. six new dioceses were thus created (under an act of 1539); but from that time onward until the 19th century they remained practically unchanged.

By the ancient custom of the church the bishop takes his title, not from his diocese, but from his see, *i.e.,* the place where his cathedral is established. Thus the old episcopal titles are all derived from cities.

See Hinschius, *Kirchenrecht,* ii. 38, etc.; Joseph Bingham, *Origines ecclesiasticae,* 9 vols. (1840); Du Cange, *Glossarium,* s. "Dioecesis"; *New English Dictionary* (Oxford, 1897), s. "Diocese."

DIO CHRYSOSTOM (the "golden-mouthed"), (c. A.D. 40–115), Greek sophist and rhetorician, was born at Prusa (mod. Brusa), a town at the foot of Mount Olympus in Bithynia. Although he did much to promote the welfare of his native place, he became so unpopular there that he migrated to Rome, but, having incurred the suspicion of Domitian, he was banished from Italy. He wandered about in Thrace, Mysia, Scythia and the land of the Getae. He returned to Rome on the accession of Nerva, with whom and his successor Trajan he was on intimate terms. During this period he paid a visit to Prusa, but, disgusted at his reception, he went back to Rome. The place and date of his death are unknown; it is certain, however, that he was alive in 112, when the younger Pliny was governor of Bithynia.

Eighty orations have come down to us under his name; the *Corinthiaca,* however, is generally regarded as spurious, and is probably the work of Favorinus of Arelate. Of the extant ora-

tions the following are the most important: *Borysthenitica* (xxxvi.), on the advantages of monarchy, addressed to the people of Olbia, and containing information about the Greek colonies on the Black sea; *Olympica* (xii.), in which Pheidias is represented as setting forth the principles which he had followed in his statue of Zeus. one passage being supposed by some to have suggested Lessing's *Laocoon; Rhodiaca* (xxxi.), an attack on the Rhodians for altering the names on their statues to those of famous men of the day; *De regno* (i.-iv.) addressed to Trajan and describing the stoic ideal kingship; *De Aeschylo et Sophocle et Euripide* (lii.), a comparison of the treatment of the story of Philoctetes by the three tragedians; and *Philoctetes* (lix.), a summary of the prologue to the lost play by Euripides. In his later life, Dio, who had originally attacked the philosophers, himself became a convert to Stoicism. To this period belong the essays on moral subjects, such as the denunciation of various cities (Tarsus, Alexandria) for their immorality. Most pleasing of all is the *Euboica* (vii.), a description of the simple life of the herdsmen and huntsmen of Euboea. Amongst his lost works were attacks on philosophers and Domitian, and *Getica,* an account of the manners and customs of the Getae.

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DIOCLETIAN (GAIUS AURELIUS VALERIUS DIOCLETIANUS) (A.D. 245–313), Roman emperor 284–305, is said to have been born at Dioclea, near Salona, in Dalmatia. His original name was Diocles. Of humble origin, he held important military commands under the emperors Probus and Aurelian, and accompanied Carus to the Persian War. After the death of Numerianus he was chosen emperor by the troops at Chalcedon, on Sept. 17, 284, and slew with his own hands Arrius Aper, the praefect of the praetorians. Having been installed at Nicomedia, he received general acknowledgment after the murder of Carinus. In consequence of the rising of the Bagaudae in Gaul, and the threatening attitude of the German peoples on the Rhine, he appointed Maximian Augustus in 286; and, in view of further dangers and disturbances in the empire, proclaimed Constantius Chlorus and Galerius Caesars in 293. Each of the four rulers was placed at a separate capital — Nicomedia, Mediolanum (Milan), Augusta Trevirorum (Trier), Sirmium. This amounted to an entirely new organization of the empire, on a plan commensurate with the work of government which it now had to carry on. Diocletian abdicated his sovereignty on May 1, 305, and retired to Salona, where he died eight years afterwards (others give 316 as the year of his death). The end of his reign was memorable for the persecution of the Christians. He hoped to strengthen the empire by reviving the old religion, and the church as an independent State appeared to be a standing menace to his authority.

Under Diocletian the senate became a political nonentity, the last traces of republican institutions disappeared, and were replaced by an absolute monarchy. He wore the royal diadem, assumed the title of lord, and introduced the whole ceremonial of Eastern monarchy. His first work was the reform of the administration of the empire; this is partly dealt with under ROME: *History,* and a brief summary is all that can be attempted here. The titular supremacy of Italy disappears, and a uniform system of administration comes into play throughout the empire. Beginning with Diocletian, local autonomy gradually disappears, and the empire is administered by a huge bureaucracy, entirely dependent on the emperor. The empire was sick of civil war and continual insecurity. and Diocletian and his successors saved it at the price of practically destroying its economic and political life. The old, regular, intricate system of taxation was abolished, and a simplified, but oppressive and inelastic system substituted, which was really a systematization of the practice of exacting forced contributions of produce and labour, based on acreage, which resulted in the country people becoming compulsorily tied to their land The responsibility for the city taxes was put on the members of the municipal councils. In the military sphere Diocletian only laid the foundations of the new system, which was the work of Constantine, but he took the first steps by largely increasing the numbers of the army. His attempted stabilization of prices *(see* DIOCLETIAN, EDICT OF) was a failure. In addition, he adorned the city with numerous buildings, such as the thermae, of which extensive remains are still standing *(see* AURELIUS VICTOR, *de Caesaribus* 39; Eutropius ix. 13; Zonaras xii., 31). The problem before Diocletian was much the same as that before Augustus but the conditions were much more unfavourable. "By his genius Augustus succeeded in restoring not only the State but also the prosperity of the people. Diocletian and Constantine sacrificed the interests of the people to the preservation of the State."

See M. Rostovtzev, *Social and Economic History of the Roman Empire* (1926); and ROME, *History.*

DIOCLETIAN, EDICT OF, an imperial edict (A.D. 301) fixing a maximum price for provisions and other articles, and a maximum rate of wages. Incomplete copies of it have been discovered, the first (in Greek and Latin) in 1709, at Stratonicea in Caria, containing the preamble and the beginning of the tables down to No. 403. A second fragment (now in the museum at Aix, in Provence) was brought from Egypt in 1809; it adds the titles of the emperors and Caesars, and the number of times they had held them, whereby the date can be determined. Other fragments have been found, *e.g.,* at Elatea, Plataea, and Megalopolis. Latin being the oflicial language all over the empire, there was no official Greek translation. All the fragments come from the provinces which were under the jurisdiction of Diocletian, *i.e.,* the eastern portion of the empire. No traces have been found in the western empire. The articles mentioned in the edict, giving their relative values at the time, include cereals, wine, oil, meat, vegetables, fruits, skins, leather, furs, foot-gear, timber, carpets, and articles of dress, and the wages range from those of the ordinary labourer to those of the professional advocate. The unit of money was a copper coin introduced by Diocletian, of which the value has been fixed at one-fifth of a penny. The punishment for exceeding the prices fixed was death or deportation. The edict was a well-intended but abortive attempt to meet the distress caused by several bad harvests and commercial speculation. The actual effect was disastrous, and the edict soon fell into abeyance.

See *Corpus Inscriptionum Latinarum;* Lactantius, *De mortibus persecutorum,* a contemporary who, as a Christian, writes with natural bias against Diocletian; J. E. Sandys, *Companion to Latin Studies* (1921), with useful bibliography. There is an edition of the whole edict by Mommsen, with notes by H. Blümner (1893).

DIODATI, GIOVANNI (1576–1649), Swiss Calvinist, was born in Geneva on June 6, 1576, of a refugee Protestant family from Lucca. In 1606 he became professor of theology, in 1608 pastor at Geneva, and in 1609 succeeded Beza as professor of theology. Diodati is chiefly famous for his Italian translation of the Bible (1603, edited with notes, 1607). He died at Geneva on Oct. 3, 1649.

Among his other works are his *Annotationes in Biblia* (1607, Eng. trans., 1648) and polemical treatises, such as *De fictitio Pontificiorum Purgatorio* (1619); *De iusta secessione Reformatorum ab Ecclesia Romana* (1628); *De Antichristo,* etc. He also published a French translation of his friend Sarpi's *History of the Council of Trent.*

DIODE, in radio, a type of vacuum tube containing two electrodes, which passes current wholly or predominantly in one direction, and which, therefore, may be used as a rectifier.

DIODORUS CRONUS (4th century B.C.), Greek philosopher'of the Megarian school. Practically nothing is known of his life. Diogenes Laertius (ii. 111) tells a story that, while staying at the court of Ptolemy Soter, Diodorus was asked to solve a dialectical subtlety by Stilpo. Not being able to answer on the spur of the moment, he was nicknamed ὁ Κρόνος (Father Time) by Ptolemy. The story goes that he died of shame at his failure. Strabo, however, says (xiv. 658; xvii. 838) that he took the name

from Apollonius, his master. He belonged to the Megarian school. His was the famous sophism known as the Κυριεύων. The impossible cannot result from the possible; a past event cannot become other than it is; but if an event, at a given moment, had been possible, from this possible would result something impossible; therefore the original event was impossible. From his great dialectical skill he earned the title ὁ διαλεκτικός or διαλεκτικώτατος.

See Cicero *De Fato*, 6, 7, 9; Aristotle *Metaphysica*, § 3; Sext. Empiric. *adv. Math.* x. 85; Ritter and Preller *Hist. philos. Gr. et Rom.* chap. v. §§ 234–236 (ed. 1869).

DIODORUS SICULUS, Greek historian, born at Agyrium in Sicily, lived in the times of Julius Caesar and Augustus. From his own statements we learn that he travelled in Egypt between 60–57 B.C. and that he spent several years in Rome. The latest event mentioned by him belongs to the year 21 B.C. His history, *Bibliotheca historica*, "Historical Library" consisted of forty books, and was divided into three parts. The first treats of the mythic history of the non-Hellenic, and afterwards of the Hellenic tribes, to the destruction of Troy; the second section ends with Alexander's death; and the third continues the history as far as the beginning of Caesar's Gallic War. Of this extensive work there are still extant only the first five books, treating of the mythic history of the Egyptians, Assyrians, Ethiopians and Greeks; and also the 11th to the 20th books inclusive, beginning with the second Persian War, and ending with the history of the successors of Alexander, previous to the partition of the Macedonian empire (302). The rest exists only in fragments preserved in Photius and the excerpts of Constantine Porphyrogenitus. The faults of Diodorus arise partly from the nature of the undertaking, and the annalistic form which he adopts. He lacks the critical faculty; he repeats and contradicts himself, and his simple diction, intermediate between pure Attic and the colloquial Greek of his time, enables us to detect the undigested fragments of the materials which he employed. Yet the *Bibliotlzeca* is of considerable value as supplying to some extent the loss of the works of older authors, from which it is compiled. Unfortunately, Diodorus does not always quote his authorities, but his general sources of information were in history and chronology, Castor, Ephorus and Apollodorus; in geography, Agatharchides and Artemidorus. In special sections he followed special authorities, *e.g.*, in the history of Sicily, Philistus and Timaeus.

Editio princeps, by *H.* Stephanus (1559); of other editions the best are: P. Wesseling (1746) not yet superseded; L. Dindorf (1828–31); (test) L. Dindorf (1866–68) (revised by F. Vogel, 1888–93 and C. T. Fischer, 1903–06). The standard works on the sources of Diodorus are C. G. Heyne, *De fontibus et auctoribus historiarum Diodori*, printed in Dindorf's edition, and C. A. Volquardsen, *Die Quellen der griechischen und sicilischen Geschichten bei Diodor* (1868); A. von Mess, *Rkeinisches Museum* (1906); see also L. O. Brocker, *Untersuchungen über Diodor* (1879), short, but containing much information; O. Maass, *Kleitarch und Diodor* (1894 etc.); G. J. Schneider, *De Diodori fontibus*, i.–iv. (1880); C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895); **GREECE:** *Ancient History*, "Authorities."

DIODOTUS, Seleucid satrap of Bactria, who rebelled against Antiochus II. (about 255) and became the founder of the Graeco-Bactrian kingdom (Trogus *Prol.* 41; Justin xli. 4, 5, where he is wrongly called Theodotus; Strabo xi. 515). His power seems to have extended over the neighbouring provinces. Arsaces, the chieftain of the nomadic (Dahan) tribe of the Parni, fled before him into Parthia and here became the founder of the Parthian kingdom (Strabo *l.c.*). When Seleucus II. in 239 attempted to subjugate the rebels in the east he seems to have united with him against the Parthians (Justin xli. 4, 9). Soon afterwards he died and was succeeded by his son Diodotus II., who concluded a peace with the Parthians (Justin *l.c.*). Diodotus II. was killed by another usurper, Euthydemus (Polyb. xi. 34, 2). Of Diodotus I. we possess gold and silver coins, which imitate the coins of Antiochus II.; on these he sometimes calls himself Soter, "the saviour." As the power of the Seleucids was weak and continually attacked by Ptolemy II., the eastern provinces and their Greek cities were exposed to the invasion of the nomadic barbarians and threatened with destruction (Polyb. xi. 34, 5); thus the erection of an independent kingdom may have been a necessity and indeed an advantage to the Greeks, and this epithet well deserved. Diodotus Soter appears also on coins struck in his memory by the later Graeco-Bactrian kings Agathocles and Antimachus. *Cf.* A. v. Sallet *Die Nachfolger Alexanders d. Gr. in Baktrien und Indien;* Percy Gardner *Catal. of the Coins of the Greek and Scythian Kings of Bactria and India* (Brit. Mus.); *see* also BACTRIA. (ED. M.)

DIOGENES, "the Cynic," Greek philosopher, was born at Sinope about 412 B.C., and died in 323 at Corinth, according to Diogenes Laertius, on the day on which Alexander the Great died at Babylon. When his father was exiled Diogenes was included in the charge and went to Athens. Attracted by the zscetic teaching of Antisthenes, he became his pupil, and rapidly excelled his master both in reputation and in the austerity of his life. The stories which are told of him are probably true; in my case, they serve to illustrate the logical consistency of his character. He inured himself to the vicissitudes of weather by living in a tub belonging to the temple of Cybele. The single wooden bowl he possessed he destroyed on seeing a peasant boy drink from the hollow of his hands. On a voyage to Aegina he was captured by pirates and sold as a slave in Crete to a Corinthian named Xeniades. Being asked his trade, he replied that he knew no trade but that of governing men, and that he wished to be sold to a man who needed a master. As tutor to the two sons of Xeniades, he lived in Corinth for the rest of his life, which he devoted entirely to preaching the doctrines of self-control. It was, probably, at the Isthmian games, during which he used to lecture, that he craved from Alexander the single boon that he would not stand between him and the sun, to which Alexander replied "If I were not Alexander, I would be Diogenes." On his death the Corinthians erected to his memory a pillar on which there rested a dog of Parian marble. His ethical teaching will be found in the article CYNICS (*q.v.*). It may suffice to say here that virtue, for him, consisted in the avoidance of all physical pleasure; that pain and hunger were positively helpful in the pursuit of goodness; that morality implies a return to nature and simplicity. Both in ancient and in modern times, his personality has appealed strongly to sculptors and to painters. Ancient busts exist in the museums of the Vatican, the Louvre and the Capitol. The interview between Diogenes and Alexander is represented in an ancient marble bas-relief found in the Villa Albani.

The chief ancient authority for his life is Diogenes Laertius vi. 20; *see* also Mayor's notes on Juvenal, *Satires*, xiv. 308–314; *Quellen-Untersuchungen z. Leben u. Philosophie des Diogenes von Sinope* (*Philolojus*, Supplementband 18, 1926).

DIOGENES APOLLONIATES (c. 460 B.C.), Greek natural philosopher, was a native of Apollonia in Crete. Although of Dorian stock, he wrote in the Ionic dialect, like all the *physiologi* (physical philosophers). He moved to Athens, where his opinions once endangered his life. It is his theories that are ridiculed as those of Socrates in the Clouds (264 ff.). An eclectic in doctrine, he drew his views from many sources but his main position is a reconciliation of the theories of Anaximenes and Anaxagoras, which he achieved by taking Anaximenes' theory that air is the one source of being and attributing intelligence to it as well. His most important work was Περὶ φύσεως (*De natura*), of which considerable fragments are extant (chiefly in Simplicius); it is possible that he wrote also *Against the Sophists* and *On the Nature of Man,* to which the well-known fragment about the veins would belong; possibly these discussions were subdivisions of his great work.

Fragments in F. Mullach, *Fragmenta philosophorum Graecorum*, i. (1860); F. Panzerbieter, *Diogenes Apolloniates* (1830), with philosophical dissertation; J. Burnet, *Early Greek Philosophy* (1892); *H.* Ritter and L. Preller, *Historia Phitosophiae* (4th ed., 1869), §§ 59–68; E. Krause, *Diogenes von Apollonia* (1909).

DIOGENES LAËRTIUS (or LAËRTIUS DIOGENES), the biographer of the Greek philosophers, is supposed by some to have received his surname from the town of Laertc in Cilicia, and by others from the Roman family of the Laertii. Of the circum-

stances of his life we know nothing. It is probable that he flourished during the reign of Alexander Severus (A.D. 222–235) and his successors. His own opinions are equally uncertain. By some he was regarded as a Christian; but it seems more probable that he was an Epicurean. The work by which he is known deals with the lives and sayings of the Greek philosophers. Of no philosophical value itself, its interest lies in the glimpses given of the private life of the philosophers. He treats his subject in two divisions which he describes as the Ionian and the Italian schools. The biographies of the former begin with Anaximander, and end with Cleitomachus, Theophrastus and Chrysippus; the latter begins with Pythagoras, and ends with Epicurus. The Socratic school, with its various branches, is classed with the Ionic; while the Eleatics and sceptics are treated under the Italic. The whole of the last book is devoted to Epicurus, and contains three most interesting letters addressed to Herodotus, Pythocles and Menoeceus. The text seems once to have been much fuller than that now in existence. In addition to the *Lives*, Diogenes was the author of a work in verse on famous men, in various metres.

BIBLIOGRAPHY.—*Editio princeps* (1533); H. Hübner and C. Jacobitz with commentary (1828–33); C. G. Cobet (1850), text only. *See* F. Nietzsche, "De Diogenis Laertii fontibus" in Rheinisches *Museum*, xxiii., xxiv. (1868–69); J. Freudenthal, "Zu Quellenkunde Diog. Laert.," in *Hellenistische Studien*, iii. (1879); O. Maass, De biographis Graecis (1880); V. Egger De fontibus Diog. Laet. (1881). There is an English trans. by C. D. Yonge in Bohn's Class. Lib.

DIOGENIANUS, of Heraclea on the Pontus (or in Caria), Greek grammarian, flourished during the reign of Hadrian. He was the author of a lexicon (sometimes known as περιεργοπένητες for "industrious poor students") which was perhaps abridged from the great lexicon of Pamphilus of Alexandria (*fl.* A.D. 50) and other similar works. It formed the basis of the lexicon of Hesychius of Alexandria, described in the preface as a new edition of the works of Diogenianus. We still possess a collection of proverbs under his name (ed. by E. Leutsch and F. W. Schneidewin in *Paroemiographi Graeci*, i. 1830). Diogenianus was also the author of an anthology of epigrams; of geographical treatises; and of a list (with map) of all the towns in the world.

See H. Weber, *Philol. Suppl.* III., 454 f. (1878); Bursian's Jahresb. xvii., 125 (1881).

DIOGNETUS, EPISTLE TO, one of the early Christian apologies. Diognetus, of whom nothing is known, has expressed a desire to know what Christianity really means—"What is this new race" of men who are neither pagans nor Jews? "What is this new interest which has entered into men's lives now and not before?" The anonymous writer, after attacking idolatry and the ceremonials of Judaism in the usual way, proceeds in a passage of great eloquence to show that Christians have no obvious peculiarities that mark them off as a separate race. In spite of blameless lives they are hated. Their home is in heaven, while they live on earth. "In a word, what the soul is in a body, this the Christians are in the world. . . . The soul is enclosed in the body, and yet itself holdeth the body together: so Christians are kept in the world as in a prison-house, and yet they themselves hold the world together." This strange life is inspired in them by the almighty and invisible God, who sent no angel or subordinate messenger to teach them, but His own Son by whom He created the universe. No man could have known God, had He not thus declared Himself. "If thou too wouldst have this faith, learn first the knowledge of the Father. For God loved men, for whose sake He made the world. . . . Knowing Him, thou wilt love Him and imitate His goodness; and marvel not if a man can imitate God: he can, if God will." By kindness to the needy, by giving them what God has given to him, a man can become "a god of them that receive, an imitator of God." No early Christian writing outside the New Testament appeals so much to modern readers. The best edition is that of Otto, *Corpus Apologeticum*, vol. iii. (3rd ed. 1879), based on accurate collations of the one ms. which contained this letter and which perished by fire at Strasbourg in 1870

See also Lightfoot, Apostolic Fathers (shorter edition), and (very conveniently) Kirsopp Lake, Apostolic Fathers, vol. ii. (in Loeb Classical Library).

DIOMEDEIDAE: *see* ALBATROSS.

DIOMEDE ISLANDS, two small adjacent islands in the Bering strait. The larger, Big Diomede, belongs to the U.S.S.R.; the other, Little Diomede, is a part of Alaska. They were sighted by Vitus Bering Aug. 16, 1728.

DIOMEDES, Latin grammarian, flourished at the end of the 4th century A.D., author of an extant *Ars grammatica* in three books. The third book is the most important, as containing extracts from Suetonius' *De poetis*. Diomedes wrote about the same time as Charisius (*q.v.*) and used the same sources independently.

The best edition is in H. Keil's *Grammatici* Latini, i.; see also C. von Paucker, Kleinere *Studien*, i. (1883), on the Latinity of Diomedes.

DIOMEDES, in Greek legend, son of Tydeus (*q.v.*); in Homer one of the bravest of the heroes of the Trojan War. In the post-Homeric story, he and Odysseus steal the Palladium, the presence of which within the walls secured Troy against capture (Virgil, *Aeneid*, ii. 164). On his return to Argos, finding that his wife had been unfaithful, he removed to Aetolia, and thence to Daunia (Apulia), where he married the daughter of King Daunus. He was buried or mysteriously disappeared on one of the islands in the Adriatic called after him Diomedeae, where his companions were turned into birds (Ovid, *Metam.* xiv. 457 ff.). He was worshipped as a hero in Greece, and on the coast of the Adriatic.

DION (408–353 B.C.), tyrant of Syracuse, the son of Hipparinus, and brother-in-law of Dionysius the Elder. He was a friend of Plato, who had visited the court of the elder Dionysius, and whom Dion now summoned to teach the theory of government to Dionysius' son. But the historian Philistus set Dion at variance with the tyrant, and procured his banishment on a charge of intriguing with the Carthaginians. Dion remained awhile at Athens, but in 357, assembling a small force at Zacynthus, he sailed to Sicily and was received with demonstrations of joy. Dionysius, who was in Italy, returned to Sicily, but was defeated and obliged to flee. Dion himself was soon after banished through the intrigues of Heracleides (356). But the incompetence of the new leader soon led to Dion's recall; Heracleides submitted, and soon afterwards the supporters of Dionysius surrendered. Dion retained the tyranny, but in 353 he was assassinated by Callippus, an Athenian who had accompanied him in his expedition.

See *Lives* by Plutarch and Cornelius Nepos (cf. Diod. Sic. xvi. 6–20) and in modern times by T. Lau (1860); Freeman, History of Sicily (vol. iv.) (1894); and *Camb. Anc. Hist.*, vol. vi., ch. x. with bibliography; see also SYRACUSE and SICILY: History.

DIONAEA: *see* VENUS'S FLY-TRAP.

DIONE, cult-partner of Zeus of Dodona (Strabo vii, 329). As the partner and wife of Zeus is normally Hera, Dione was variously described: in the *Iliad* (v. 370) as mother by Zeus of Aphrodite; in Hesiod (Theog. 353) as a daughter of Oceanus

DIONNE, NARCISSE EUTROPE (1848–1917), Canadian author and librarian, was born at Saint-Denis de la Bouteillerie. He studied at St. Anne's college, at the Quebec grand seminary and at Laval university, where he graduated in medicine. He became editor of *Le Courrier du Canada* and then of *Le Journal de Québec*, and in 1892 chief librarian of the Quebec legislature. He has published *Jacques Cartier* (1889); *La Vie de C. F. Painchaud* (1894); *Les ecclésiastiques et les royalistes français réfugiés au Canada à l'époque de la révolution, 1791–1802* (1905); *Champlain* (1905); *Québec et Nouvelle France. Bibliographie* (4 tom., 1905–12); and in the *Galerie Historique* series of 1910 his chief studies are *Chouart et Radisson; J. Richard, Sulpicien; Mgr. de Forbin-Jamon; Sainte-Anne de la Pocatière* and *Pierre Bédard*.

DIONNE QUINTUPLETS, five phenomenal daughters of Oliva and Elzire Dionne, born near Callander, Ontario, May 28th, 1934. The attending physician was Dr. Allan Dafoe. These children, weighing collectively but 11½ pounds six days after their premature birth, were rescued from the hazards and handicaps of freak exploitation by the Government of Ontario, which made them King's wards. Against all precedent, the five continued to thrive through childhood. *See* plate, TWINS AND TWINNING

DIONYSIA, festivals of Dionysus (*q.v.*). These were numerous and widespread, the most famous being those of Attica, which were (1) the Little or Rustic Dionysia, a festival held in various country places in the month Poseideon (December), characterized by simple, old-fashioned rites; (2) the Lenaea ("festival of Maenads"), in the following month, Gamelion, held at Athens; the chief rites were a festal procession and dramatic performances at the theatre of Dionysus; (3) the Anthesteria (*q.v.*), in the next month, Anthesterion; (4) The Great or City Dionysia, in Elaphebolion (about the end of March), also accompanied by dramatic performances (see DRAMA), and the most famous of all; (5) the Oschophoria ("Carrying of Grape-clusters"), in Pyanepsion (about the end of October). The times and what we know of the ritual of these festivals show them to have been originally rites of a kind common in the worship of gods of fertility.

See A. Mommsen, Feste d. Stadt *Athen* (1898); L. R. Farnell, Cults of *the* Greek States (1896–1919) v., ch. vi.

DIONYSIUS, pope from 259 to 268. To Dionysius fell the task of reorganizing the Church after the persecution of Valerian. At the protest of some of the faithful at Alexandria, he demanded from their bishop (also called Dionysius) explanations touching his doctrine. He died on Dec. 26, 268.

DIONYSIUS (c. 432–367 B.C.), tyrant of Syracuse, began life as a clerk in a public office, but took advantage of war with Carthage to seize the tyranny (405). The next eight years were spent in strengthening his power. He fortified Epipolae (402), defeated his political opponents, and removed the Greek citizens of Naxos, Catana, and Leontini, handing the cities over to foreign mercenaries and Sikels. His first Punic War (397–396), during which the Greeks besieged Motya, and the Carthaginians Syracuse, ended with a notable victory, and Carthage's power in Sicily was confined to the north-west. His second war in 392 was ended by a treaty greatly in his favour. In 391 he led an expedition against Rhegium and its allied cities in Magna Graecia. In one campaign in which he was joined by the Lucanians, he devastated the territories of Thurii, Croton, and Locri. After a protracted siege he took Rhegium (386), thus making himself the chief power in Greek Italy. At the next Olympic festival (384), whither he sent a splendid embassy, the Athenian Lysias attacked him in a speech (Or. 33) and the crowd pillaged the tents of his envoys.

His third Punic War (383–378) proved disastrous; he suffered a crushing defeat and was obliged to pay an indemnity of 1,000 talents and cede to Carthage the territory west of the River Halykas. He was engaged in another war against Carthage when he died. He had friendly relations with the Spartans, whom he assisted more than once with mercenaries, and two inscriptions record his alliance with Athens (369–367). The success of his tragedy at the Lenaea (367) is probably to be connected with this friendship; though he had frequently competed at Athens he had never till now won a first prize. Dionysius reigned 38 years, and was succeeded by his son. Freeman says of him: "He had destroyed the freedom of his native city, but he had made it both the greatest city and the greatest power in Europe." (See SICILY and SYRACUSE.)

See Diod. Sic. xiii, xiv., xv. (the earlier part based on Philistos, Dionysius' friend and contemporary); Freeman *Hist.* of Sicily (Vols. iii. and iv.) (Oxford, 1894); Camb. *Anc. Hist.* Vol. vi. ch. v., with bibliography; J. Bass Dionysius *I.* von *Syrakus* (Vienna, 1881), with full refs. to authorities.

His son DIONYSIUS, known as "the Younger," succeeded in 367 B.C. He mas driven from the kingdom by Dion (356) and fled to Locri; but during the commotions which followed Dion's assassination, he managed to make himself master of Syracuse. On the arrival of Timoleon he was compelled to surrender and retire to Corinth (343). (Diodorus Siculus. xvi.; Plutarch, Timoleon.)

See SYRACUSE and TIMOLEON; and, on both the Dionysii, arts. by B. Niese in Pauly-Wissowa's *Realencyklopädie,* v. pt. I. (1905).

DIONYSIUS AREBPAGITICUS (or "The Areopagite"), named in Acts xvii 34 as one of those Athenians who believed when they had heard Paul preach on Mars Hill. Beyond this mention our only knowledge of him is the statement of Dionysius, bishop of Corinth (*fl.* 171), recorded by Eusebius (Church *Hist.* iii. 4; iv. 23), that this same Dionysius the Areopagite was the first "bishop" of Athens. Some hundreds of years afterwards his name was attached to a number of anonymous theological writings of unknown origin. These were destined to exert enormous influence on mediaeval thought, and their form led to a great development of the personal legend of the original Dionysius (see for example, "The Life and Passion of the Most Holy Dionysius," by Hildwin, abbot of St. Denys, printed in Migne, *Patrologia* Latina, vol. 106).

The author, date and place of composition of these writings are alike unknown. External evidence precludes a date later than 500; the internal evidence from the writings themselves precludes any date prior to 4th-century phases of Neo-platonism, while the first certain dated reference to them is at the Council of Constantinople in 533. The extant writings of the Pseudo-Areopagite are: (a) Περὶ τῆς οὐρανίας ἱεραρχίας, *Concerning* the Celestial Hierarchy, in 15 chapters; (b) Περὶ τῆς ἐκκλησιαστικῆς ἱεραρχίας, Concerning the Ecclesiastical Hierarchy, in 7 chapters; (c) Περὶ θείων ὀνομάτων, Concerning Divine Names, in 13 chapters; (d) Περὶ Μυστικῆς θεολογίας, Concerning Mystic Theology, in five chapters; (e) ten letters addressed to various worthies of the apostolic period. They are all of great interest, first as a striking presentation of the heterogeneous elements that might unite in the mind of a gifted man in the 5th century, and secondly, because of their enormous influence upon subsequent Christian theology and art. Their ingredients—Christian, Greek, Oriental and Jewish—are united into an organic system, not crudely mingled. Perhaps theological philosophic fantasy has never constructed anything more remarkable. The system of Dionysius was a proper product of its time—lofty, and apparently complete.

His constructive principles the writer owed to Hellenism in its last great philosophical creation, Neo-platonism, since the general principle of the transmission of life from the ultimate Source downward through orders of mediating beings unto men might readily be adapted to the Christian God and his ministering angels. Pseudo-Dionysius had lofty thoughts of the sublime transcendence of the ultimate divine Source. That Source was not remote or inert; but a veritable Source from which life streamed to all lower orders of existence,—in part directly, and in part indirectly as power and guidance through the higher orders to the lower. Life, creation, every good gift, is from God directly; but his flaming ministers also intervene to guide and aid the life of man; and the life which through love floods forth from God has its counterflow whereby it draws its own creations to itself. God is at once absolutely transcendent and universally immanent. To live is to be united with God; evil is the non-existent, that is, severance from God.

The transcendent Source, as well as the universal immanence, is the Triune God. Between that and men are ranged the three triads of the celestial hierarchy: Seraphim, Cherubim and Thrones; Dominations, Virtues, Powers; Principalities, Archangels, Angels. Collectively their general office is to raise mankind to God through purification, illumination and perfection; and to all may be applied the term angel. The highest triad, which is nearest God, contemplates the divine effulgence, and reflects it onward to the second; the third, and more specifically angelic triad, immediately ministers to men. The sources of these names are evident: seraphim and cherubim are from the Old Testament; later Jewish writings gave names to archangels and angels, who also fill important functions in the New Testament. The other names are from Paul (Eph. i. 21; Col. i. 16).

Such is the system of Pseudo-Dionysius, as presented mainly in The Celestial Hierarchy. That work is followed by *The* Ecclesiastical Hierarchy, its counterpart on earth. What the primal Triune Godhead is to the former, Jesus is to the latter. The ecclesiastical hierarchy likewise is composed of triads. The first includes the symbolic sacraments: Baptism, Communion, Consecration of the Holy Chrism. Baptism signifies purification; Communion signifies enlightening; the Holy Chrism signifies perfecting. The second is made up of the three orders of Bishops, Presbyters and

Deacons, or rather, as the Areopagite names them: Hierarchs, Light-bearers, Servitors. The third triad consists of monks, who are in a state of perfection, the initiated laity, who are in a state of illumination, and the catechumens, in a state of purification. All worship, in this treatise, is a celebration of mysteries, and the pagan mysteries are continually suggested.

Concerning the Divine Names is a noble discussion of the qualities which may be predicated of God, according to the warrant of the terms applied to him in Scripture. *Concerning Mystic Theology* explains the function of symbols, and shows that he who would know God truly must rise above them.

The works of Pseudo-Dionysius began to influence theological thought in the West from the time of their translation into Latin by Erigena (*q.v.*). Their use may be followed through the writings of scholastic philosophers, *e.g.*, Peter Lombard, Albertus Magnus, Thomas Aquinas and many others. The fifteenth chapter of *The Celestial Hierarchy* constituted the canon of symbolical angelic lore for the literature and art of the middle ages.

BIBLIOGRAPHY.—There is an enormous literature on Pseudo-Dionysius. The reader may be first referred to the articles in Smith's *Dictionary of Christian Biography* and Herzog-Hauck *Realencyklopädie fiür protestantische Theologie.* The bibliography in the latter is very full. Some other references, especially upon the later influence of these works, are given in H. O. Taylor's *Classical Heritage of the Middle Ages* (1903). The works themselves are in Migne's *Patrologia Graeca,* tomes 3 and 4, with a Latin version. Erigena's version is in Migne, *Patrol. Lat.* t. 122.

DIONYSIUS EXIGUUS, a scholar of the 6th century, was, according to the statement of his friend Cassiodorus, a Scythian by birth. He was living at Rome in the first half of the 6th century, and is usually spoken of as abbot of a Roman monastery though Cassiodorus calls him simply "monk." He was in high repute as a theologian, was profoundly versed in the Holy Scriptures and in canon law, and was also an accomplished mathematician and astronomer. We owe to him a collection of 401 ecclesiastical canons, including the apostolical canons and the decrees of the Councils of Nicaea, Constantinople, Chalcedon and Sardis, and also a collection of the decretals of the popes from Siricius (385) to Anastasius II. (498) These collections, which had great authority in the West *(see* CANON LAW), were published by Justel in 1628. Dionysius translated many Greek works now lost, including *Life of St. Pachomius,* and the *Instruction of St. Proclus of Constantinople.* He introduced the method of reckoning the Christian era which we now use *(see* CHRONOLOGY). He died at Rome, some time before A.D. 550.

His works have been published in Migne, *Patrol. Lat.* v. 67; *see* A. Tardif, *Histoire des sources du droit canonique* (1887); D. Pitra, *Analecta novissima, Spicilegii Solesmesis continuatio,* vol. i. p. 36 (1885); Bardenhewer; *Gesch. der Altkirch. Lit.* (Freiburg, 1902).

DIONYSIUS HALICARNASSENSIS ("of Halicarnassus"), Greek historian and teacher of rhetoric, flourished during the reign of Augustus. He went to Rome after the end of the civil wars and spent 22 years in studying Latin and preparing materials for his history. The date of his death is unknown. His great work, entitled Ῥωμαϊκὴ ἀρχαιολογία (Roman Antiquities), embraced the history of Rome from the mythical period to the beginning of the first Punic War. It was divided into 20 books, of which the first nine remain entire, the tenth and eleventh are nearly complete, and the remainder exist in fragments in the excerpts of Constantine Porphyrogenitus and an epitome discovered by Angelo Mai in a Milan ms. The first three books of Appian and Plutarch's *Life of Camillus* also embody much of Dionysius. His chief object was to reconcile the Greeks to the rule of Rome by dilating upon the good qualities of their conquerors. He has carefully consulted the best authorities, and his work and that of Livy are the only connected and detailed extant accounts of early Roman history.

Dionysius was also the author of several critical treatises: *The Arrangement of Words; On Imitation,* on the best models in the different kinds of literature—a fragmentary work; *Commentaries on the Attic Orators,* dealing with Lysias, Isaeus, Isocrates and (by way of supplement), Deinarchus; *On the admirable Style of Demosthenes; On Thucydides,* a detailed but rather unfair criticism of his treatment of subject matter and his style and two *letters to Ammaeus* dealing with Demosthenes and Thucydides, and the *Letter to Cn. Pompeius,* dealing with Plato.

BIBLIOGRAPHY.—Complete edition by J. J. Reiske (1774–77); of the *Archaeologia* by A. Kiessling and V. Prou (1886) and C. Jacoby (1885–91); Opuscula by Usener and Radermacher (1899); Eng. translation by E. Spelman (1758). A full bibliography of the rhetorical works is given in W. Rhys Roberts's edition of the Three Literary Letters (1901); the same author published an edition of the *De compositione verborum* (1910, with trans.); *see* also M. Egger, *Denys d'Halicarnasse* (1902), a very useful treatise. On the sources of Dionysius *see* 0. Bocksch, "De fontibus Dion. Halicarnassensis" in *Leipziger Studien,* xvii. (1895). Cf. also J. E. Sandys, *Hist. of Class. Schol.* i. (1906).

DIONYSIUS OF ALEXANDRIA (*c.* 190–265), bishop of Alexandria, called "Dionysius the Great," became a Christian when young and studied under Origen. In 231 he was made head of the Catechetical school of Alexandria, and in 247 bishop of that city. During the Decian persecution in 251 he fled to the Libyan desert, while under Valerian he was banished to Cephro in 257, returning when toleration was decreed by Gallienus in 260. He was engaged in controversy over the restoration of Christians who had lapsed during the persecution, and over the iteration of baptism by heretics. In opposing the bishops of Upper Libya who supported Sabellianism, Dionysius overemphasized the unity of the Godhead. He had to express his orthodoxy in *Refutation and Defence.* Eusebius in *Hist. Eccl.* often cites him, and in *Praep. Evang.* xiv. quotes some fragments of the On *Nature.* The fragments were edited by Simon De Magistris, S. *Diony. Alex. Opera Omnia* (Rome, 1796), by Migne, *Pat. Graeca,* x., and C. L. Feltoe, *Letters and other Remains of Dionysius* of *Alexandria* (Cambridge, 1904; Eng trans. 1918). *See* also Dittrich, *Dionysius der Grosse* (Frieburg i. B., 1867) and J. Burel, *Denys d'Alexandrie* (1910).

DIONYSIUS PERIEGETES, author of a Περιήγησις τῆς οἰκουμένης, a description of the habitable world in Greek hexameters. There is some reason for believing that the author was an Alexandrian, who wrote in the time of Hadrian (some put him as late as the end of the 3rd century). The work was popular in ancient times as a school-book; it was translated into Latin by Rufus Festus Avienus, and by the grammarian Priscian. The commentary of Eustathius is valuable.

The best editions are by G. Bernhardy (1828) and C. Muller (1861) in their *Geographici Graeci minores; see* also E. *H.* Bunbury, *Ancient Geography* (ii. p. 480), who regards the author as flourishing from the reign of Nero to that of Trajan, and U. Bernays, *Studien zu Dion. Perieg.* (1905). There are two old English translations: T. Twine (1572, black letter), J. Free (1789, blank verse).

DIONYSIUS TELMAHARENSIS ("of Tell-Maḥrē") d. 848, patriarch or supreme head of the Syrian Jacobite Church during 818–848, was born at Tell-Maḥrē near Rakka (ar-Rakkah) on the Balikh. He was the author of an important historical work, which has perished except for some passages quoted by Barhebraeus and an extract found by Assemani in Cod. *Vat.* 144 and published by him in the *Bibliotheca orientalis* (ii. 72–77). He spent his earlier years as a monk at the convent of Ken-neshrē on the upper Euphrates, and later moved to that of Kaisūm in the district of Samosāta. At the death of the Jacobite patriarch Cyriacus in 817, the Church was disputing the phrase "heavenly bread" in connection with the Eucharist. An anti-patriarch had been appointed in the person of Abraham Kartamin, who insisted on the use of the phrase in opposition to the recognized authorities of the Church. The council of bishops at Raḳḳa in 818 elected Dionysius to the patriarchal chair, but the ecclesiastical schism continued unhealed during the 30 years of his patriarchate. The details of this contest, of his relations with the caliph Ma'mūn, and of his many travels—including a journey to Egypt—are to be found in the *Ecclesiastical Chronicle* of Barhebraeus. He died in 848, his last days having been especially embittered by Mohammedan oppression.

In addition to the lost *Annals,* covering the years from the accession of the emperor Maurice (582–583) lo the death of Theophilus (842–843), Dionysius was credited with the authorship

of a *Chronicle* narrating the history of the world from the creation to the year A.D. 774–775, but on the completion of its publication by M. Chabot in 1895, Noldeke (Vienna *Oriental Journal*, x. 160–170), and Nau (*Bulletin critique*, xvii. 321–327), clearly proved that the chronicle was the work not of Dionysius but of an earlier writer, a monk of the convent of Zuknin near Amid (Diarbekr) on the upper Tigris. Though the author had limited intelligence and little historical skill, the last part of his work has considerable value as a contemporary account of events during the middle of the 8th century.

See W. Wright, *Hist.* of Syriac Literature (1894), and Chabot's introduction to his translation of pt. iv. of the Chronicle.

DIONYSIUS THRAX (so called because his father was a Thracian), the author of the first Greek grammar, flourished about 100 B.C. He was a native of Alexandria, where he attended the lectures of Aristarchus, and afterwards taught rhetoric in Rhodes and Rome. His grammar, which we possess (though probably not in its original form), begins with the definition of grammar and its functions. Dealing next with accent, punctuation marks, sounds and syllables, it goes on to the eight parts of speech and their inflections. No rules of syntax are given, and nothing is said about style. The authorship of Dionysius was doubted in the middle ages, and in modern times its origin has been attributed to the oecumenical college founded by Constantine the Great, which existed till 730. But there seems no reason for doubt; the great grammarians of imperial times (Apollonius Dyscolus and Herodian) knew the work in its present form, although additions and alterations may have been made later. Dionysius also wrote commentaries on Homer and Hesiod and various other works, including an account of Rhodes, and a collection of Μελέται (literary studies), to which the considerable fragment in the *Stromata* (v. 8) of Clement of-Alexandria probably belongs. The grammar, first edited by J. A. Fabricius from a Hamburg ms., was published in his *Bibliotheca* Graeca, vi. (ed. Harles). An Armenian translation, belonging to the 4th or 5th century, containing five additional chapters, was published with the Greek text and a French version, by M. Cirbied (1530).

Editions, with scholia, by I. Bekker in *Anecdota Graeca*, ii. and G. Uhlig (1884), reviewed exhaustively by P. Egenolff in Bursian's *Jahresbericht*, vol. xlvi. (1888); Scholia, ed. A. Hilgard (1901); Eng. trans. J. Davidson, 1874; see also W. Horschelmann, De Dionysii *Thracis interpretibus veteribus* (1874); J. E. Sandys, *Hist.* of Classical Scholarship, i. (1906).

DIONYSUS, in Greek mythology originally a nature god of fruitfulness and vegetation, especially of the vine; hence, distinctively, the god of wine. [Gr. Διόνυσος, Διώνυσος; Thracian, Zōnnyxos; Phrygian, Diounsis: etymology doubtful; *?dio-*, name of Thraco-Phrygian sky-god resembling Zeus; *nys-*, possibly akin to Lat. *nurus*, Gr. νυός, and may mean "child" or "son"; hence perhaps "son of God." The names Bacchus (Βάκχος, in use among the Greeks from the 5th century), Sabazius, and Bassareus, are also Thracian names of the god. All are of doubtful significance; for various interpretations of these and other cult-titles *see* O. Gruppe, Griechische *Mythologie*, ii. pp. 1408, 1532, especially the notes.]

There seems little doubt that he is a Thraco-Phrygian deity, introduced into Greece from Thrace or possibly from both Thrace and Phrygia, and, blending with native gods of similar character, *e.g.*, Iacchus at Eleusis. In Homer, notwithstanding the frequent mention of the use of wine, Dionysus is never mentioned as its inventor or introducer, nor does he appear in Olympus; Hesiod is the first who calls wine the gift of Dionysus. On the other hand, he is spoken of in the Iliad (vi. 130 foll.), as "raging," an epithet that indicates that already the orgiastic character of his worship was recognized. In his native country his worshippers sought to become possessed by or assimilated to him by wild dancing and perhaps the use of intoxicants; in Greece this was much toned down. According to the usual tradition, he was born at Thebes and was the son of Zeus and Semele, the daughter of Cadmus. Before the child was mature, Zeus appeared to Semele, whose name is simply the Phrygian for "earth" (*Zemelo*), at her request in his majesty as god of lightning, by which she was killed, but the infant was saved from the flames by Zeus (or Hermes). Zeus took him up, enclosed him within his own thigh till he came to maturity, and then brought him to the light, so that he was twice born; an allusion to this was found in the word dithyrambos, a name of the god and of a hymn in his honour, which perhaps is really to be connected with Phrygian *dithrera*, a tomb. (See Calder in Class. Rev., xxxvi., p. 11. ff. xli. p. 161 ff.) Dionysus was then conveyed by Hermes to be brought up by the nymphs of Nysa, a purely imaginary spot. As soon as Dionysus was grown up, he started on a journey through the world, to teach the cultivation of the vine and spread his worship among men. While so engaged he met with opposition, even in his own country, as in the case of Pentheus, king of Thebes, who opposed the orgiastic rites introduced by Dionysus among the women of Thebes, and, having been discovered watching one of these ceremonies, was mistaken for some animal of the chase, and slain by his own mother. A similar instance is that of Lycurgus, a Thracian king, from whose attack Dionysus saved himself by leaping into the sea, where he was kindly received by Thetis. Lycurgus was blinded by Zeus and soon died, or became frantic and hewed down his own son, mistaking him for a vine. At Orchomenus, the three daughters of Minyas refused to join the other women in their nocturnal orgies, and for this were transformed into birds. (*See* AGRIONIA.) These and similar stories may point to the vigorous resistance offered to the introduction of the mystic rites of Dionysus or to some ceremony in which the god, or a priest representing him, was killed and probably brought to life again. *See* below. On the other hand, when the god was received hospitably he repaid the kindness by the gift of the vine, as in the case of Icarius of Attica (see ERIGONE).

The worship of Dionysus continued to flourish in Asia Minor, particularly in Phrygia and Lydia. His cult is closely associated with that of numerous Asiatic deities, as Sabazius (*q.v.*), and from the time of Alexander, he appears as conqueror of India. The other incidents in which he appears in a purely triumphal character are his transforming into dolphins the Tyrrhene pirates who attacked him, and his part in the war of the gods against the giants. The adventure with the pirates occurred on his voyage to Naxos, where he found Ariadne abandoned by Theseus. At Naxos Ariadne (probably a Cretan mother-goddess', was associated with Dionysus as his wife, and their marriage was annually celebrated by a festival. Having compelled all the world to recognize his divinity, he descended to the underworld to bring up his mother. Like most deities connected with vegetation, Dionysus, at least in Thrace, died and rose again. This is reflected principally in Orphic mythology, not in normal Greek belief. Zeus had by Persephone a wonderful child Zagreus. He was brought up secretly, watched over by Curetes; but the jealous Hera discovered where he was, and sent Titans to the spot, who, finding him at play, tore him to pieces and cooked and ate his limbs, while Athena gave his heart to Zeus. This myth is probably to be connected with the savage rite of *omophagia* (eating of raw flesh) in the worship of Dionysus, in which a victim, perhaps originally human in some cases, incarnating the god, was torn in pieces and sacramentally eaten raw. It is variously reconciled with the tale of Semele. (*See* also TITANS.)

Dionysus further possessed the prophetic gift, and at Delphi was received by the priesthood of Apollo on almost equal terms. His followers included spirits of fertility, as the satyrs, and in his ritual the phallus was prominent. He often takes bestial shape, and is associated with the panther, the lion, the snake, the tiger, the ass, the goat, and sometimes also the dolphin. His personal attributes are an ivy wreath, the thyrsus (*q.v.*), and the kantharos, a large two-handled goblet. His later representations in art show a youth of soft, nearly feminine form, occasionally an infant, but the earlier type is a bearded man. His title Dendrites ("he of the tree") arises most probably from his functions as a god of the productivity of nature; not of the vine only. For the connection of Dionysus with Greek tragedy *see* DRAMA.

BIBLIOGRAPHY.—*See* Farnell, *Cults* of the Greek States, v. (1910); J. E. Harrison, Prolegomena to the Study of Greek *Religion* (1903); Sir J. G. Frazer, *Golden Bough*, 3rd ed. see index *s.v.*; F. A. Voigt in Roscher's *Lexikon der Mythologie*; L. Preller, *Griechische Mythologie* (4th ed. by C. Robert); F. Lenormant (*s.v.* "Bacchus") in

Daremberg and Saglio's Dictionnaire *des antiquités;* O. Kern in Pauly-Wissowa's *Realencyklopädie* (1897) (with list of cult titles); E. Rohde, Psyche, 4th ed. ii. 103 ff.; O. Gruppe, *Griechische* Mythologie und Religionsgeschichte, ii. (1907). For a striking survival of Dionysiac rites in Thrace (Bizye), see Dawkins, in J. H. S. (1906), p. 191.

DIOPHANTINE EQUATIONS. About the middle of the third century, A.D., the Greek mathematician Diophantus wrote an epoch-making book entitled Arithmetica. It was important in at least three respects:—Essentially an algebra rather than an arithmetic, it was the first book to be recognized as an algebra; it contained problems requiring rational solutions which have proved to be too difficult for all mathematicians from the time of Diophantus to the present; it exhibited very ingenious methods of attacking many difficult problems of which it gave only a partial solution. The efforts of Pierre De Fermat, Leonhard Euler and other mathematicians to solve completely the difficult problems of Diophantus and other similar ones have given rise to a large part of what is called the analytic theory of numbers. For this reason, all indeterminate equations, with rational coefficients, for which a rational solution is required are called Diophantine *equations.*

Diophantine Equations, in Practical Problems.—If a banker wishes to change a dollar by means of five-cent coins (nickels) and twenty-five-cent coins (quarters) by including in the change at least one coin of each kind, he may ask himself in how many ways this can be done, and, by mental arithmetic, he may discover that the answer is three; that is, he can select 5 nickels and 3 quarters, 10 nickels and 2 quarters, or 1 j nickels and 1 quarter. In Diophantine form, this problem is to *find* all positive integral solutions of the equation $5x+25y=100$, or its equivalent $x+5y=20$, where x and y represent the numbers of nickels and quarters, respectively. Applying to $x+5y=20$ the known theory of the equation $ax+by=c$ (see NUMBER, THEORY), one finds that all solutions of $x+5y=20$, and only these solutions, are given by the formulae $x=5+5t$, $y=3-t$, t being an arbitrary constant commonly called a parameter. As (x, y) are both positive only when $t=0$, 1, or 2, the solutions sought are as stated above (5, 3), (10, 2) and (15, 1). This problem not only suggests that an indeterminate equation of the first degree may he useful, but it also exemplifies two important facts in the theory of such equations; viz., if a system of Diophantine equations of the first degree with specified coefficients has a solution, it can be found directly by use of known theory; and, when one solution of such a system is known, general formulae can be obtained which give without repetition all solutions of the system, and only these solutions, in terms of the known solution and certain parameters that appear only to the first degree.

Diophantine Equations of Higher Degree.—Nearly all Diophantine equations of degree higher than the first are difficult to solve, the difficulty increasing with the degree of the equations. On account of this fact and because of the practical and mathematical importance of solving indeterminate equations of the second degree, these equations have received more attention than have any other types of Diophantine equations. Consequently, the literature of indeterminate quadratics is extensive; it and the associated theory of third and fourth degree equations constitute the most important part of the classical Diophantine theory of to-day, which is one of the great treasures of number theorists.

One regrettable feature of this theory, however, is that it contains scarcely a principle that can be applied to more than one type of problem. Mathematicians still have to follow the example of Diophantus and devise a special mode of attack for nearly every Diophantine problem. There is a difference, however, between the procedure of Diophantus and that of mathematicians of to-day. For example, in Problem 8, Book II., of his Arithmetica (see T. L. Heath, Diophantus of Alexandria, 1910), Diophantus solves the problem of dividing a given square number into the, sum of two squares essentially as follows. Let the given square number be 16 and let x^2 be one of the required squares. Then $16-x^2$ must be equal to a square. Take a square of the form $(mx-4)^2$, where m is an arbitrary integer and 4 is the number which is the square root of 16; for example, take $(2x-4)^2$ and equate it to $16-x^2$. One thus obtains $4x^2-16x+16=16-x^2$, so that $x=16/5$. Hence the required squares are $256/25$ and $144/25$. The customary treatment of this problem at present would be to let N^2 be the given square number and to write $(mx-N)^2=N^2-x^2$. Since x is not zero, this equation implies that $x=2mN/(1+m^2)$, so that

$$x^2=4m^2N^2/(1+m^2)^2,$$

and the other required square is

$$N^2-x^2=N^2(1-m^2)^2/(1+m^2)^2.$$

As m is an arbitrary integer, the formulae just written give infinitely many solutions of the problem. This example not only illustrates one of Diophantus's processes, namely that of introducing an arbitrary parameter as a direct tneans to a desired solution, but it also shows how mathematicians since the time of Fermat have generalized both the statements and the solutions of many Diophantine problems. Indeed it was to the above problem that Fermat himself appended the famous theorem: $x^n+y^n=z^n$ has no solution *in positive* integers when n is an integer greater than two. No rigorous proof of this theorem has yet been published; nor has it been disproved.

In vivid contrast with Diophantus's desire for a single rational solution, is the modern mathematician's search for all solutions of the type that he seeks, which may be, for example, the rational solutions, the integral solutions, or the positive integral solutions. Indeed a single solution of a Diophantine equation is no longer of interest unless it has some special significance; *e.g.,* that of containing the largest integer that can appear in any positive integral solution of a given equation. The present tendency is to make as complete an analysis of Diophantine equations as is possible. Thus, in a given problem, one desires first to find all rational solutions, next all integral solutions, then all positive integral solutions, and the final touch is to discover any special properties which individual solutions possess.

The following well-known. theorems may increase one's understanding of the nature of the results that have been obtained in classical Diophantine theory:—

All solutions of the equation $x^2+y^2=z^2$ in relatively prime positive integers x, y, z are given by the formulae, $x=2mn$, $y=m^2-n^2$, $z=m^2+n^2$, where m and n are relatively prime positive integers and m is greater than n; furthermore, every set of numbers x, y, z defined by these formulae, when m and n are as just described, is a solution in positive integers of $x^2+y^2=z^2$.

The equation $x^2+y^2+z^2+w^2=u$, where u is a positive integer, has a solution in which x, y, z, w are non-negative integers.

The simultaneous equations $x^2+y^2=z^2$, $y^2+z^2=t^2$ have no solution in integers, x, y, z, t all being different from zero.

The equation $x^3+y^3=z^3$ has no solution in which x, y, z are all positive integers.

Every prime number of the form $8n+1$ or $8n+3$ is representable in the form x^2+2y^2; n, x and y being positive integers.

BIBLIOGRAPHY.—T. L. Heath, *Diophantus* of Alexandria (2nd ed. 1910), containing a discussion of Diophantus's works, the *Arithmetica,* the Porisms, and On Polygonal Numbers, besides a supplement "Notes, Theorems, and Problems by Fermat" and "Some Solutions by Euler"; E. Cahen, The'orie Des Nombres (1914); R. D. Carmichael, *Diophantine* Analysis (1915); L. E. Dickson, *History* of the *Theory* of Numbers (1920). (H. A. SI.)

DIOPHANTUS, of Alexandria, Greek algebraist, probably flourished about the middle of the 3rd century. Not that this date rests on positive evidence. But we gather from a passage of Michael Psellus (*Diophantus,* ed. P. Tannery, ii. p. 38) that he was not later than Anatolius, bishop of Laodicea from A.D. 270, while he is not quoted by Nicomachus (fl. *c.* A.D. 100), nor by Theon of Smyrna (c. A.D. 130), nor does Greek arithmetic as represented by these authors and by Iamblichus (early 4th century) show any trace of his influence, facts which can only be accounted for by his being later than those arithmeticians at least who would have been capable of understanding him fully. On the other hand he is quoted by Theon of Alexandria (who observed an eclipse at Alexandria in A.D. 365), and his work was the subject of a commentary by Theon's daughter Hypatia (d. 415). The Arithmetica, the great treatise on which the fame of

Diophantus rests, purports to be in 13 books, but none of the Greek mss. which have survived contain more than six (though one has the same text in seven books). They contain, however, a fragment of a separate tract on *Polygonal Numbers.* The missing books were apparently lost early, for there is no reason to suppose that the Arabs who translated or commented on Diophantus ever had access to more of the work than we now have. The difference in form and content suggests that the *Polygonal Numbers* was not part of the larger work. On the other hand the *Porisms,* to which Diophantus makes three references ("we have it in the Porisms that . . . "), were probably not a separate book, but were embodied in the *Arithmetica* itself, whether placed all together or spread over the work in appropriate places. The "Porisms" quoted are interesting propositions in the theory of numbers, one of which was clearly that *the difference between two cubes can be resolved into the sum of two cubes.*

Among the great variety of problems solved are problems leading to determinate equations of the first degree, in one, two, three or four variables, to determinate quadratic equations, and to indeterminate equations of the first degree in one or more variables, which are, however, transformed into determinate equations by arbitrarily assuming a value for one of the required numbers, Diophantus being always satisfied with a rational, even if fractional, result, and not requiring a solution in integers. But the bulk of the work consists of problems leading to indeterminate equations of the second degree, and these universally take the form that ohe or two (and never more) linear or quadratic functions of one variable x are to be made rational square numbers by finding a suitable value for x. A few problems lead to indeterminate equations of the third and fourth degrees, an easy indeterminate equation of the sixth degree being also found. The general type of problem is to find, two, three or four numbers such that different expressions involving them in the first and second, and sometimes the third, degree are squares, cubes, partly squares and partly cubes, etc., *e.g., to find three numbers such that the product of any two added to the sum of those two gives a square* (III. 15); *to find four numbers such that, if we take the square of tkeir sum* + *or* − *any one of them singly, all the resulting numbers are squares* (III. 19); *to find two numbers such that their product* + *or* − *tkeir sum gives a cube* (IV. 28); *to find three squares such that their continued product added to any one of them gives a square* (V. 21). Book VI. contains problems of finding *rational right-angled triangles* such that different functions of the parts (the sides and the area) are squares. A word is necessary on Diophantus' notation. He has only one symbol (written somewhat like a final sigma) for an unknown quantity, which he calls ἀριθμός (defined as "an undefined number of units"); the symbol may be a contraction of the initial letters αρ, as A^{Y}, K^{Y}, $A^{Y}A$ etc., are for the powers of the unknown (δύναμις square; κύβος, cube; δυναμοδύναμις, fourth power, etc.). The only other algebraical symbol is ⅄ for *minus,* plus being expressed by merely writing terms one after another. With one symbol for an unknown, it will easily be understood what scope there is for adroit assumptions, for the required numbers, of expressions in the one unknown which are at once seen to satisfy some of the conditions, leaving only one or two to be satisfied by the particular value of x to be determined. Often assumptions are made which lead to equations in x which cannot be solved "rationally," *i.e.,* would give negative, surd or imaginary values; Diophantus then traces how each element of the equation has arisen, and formulates the auxiliary problem of determining how the assumptions must be corrected so as to lead to an equation (in place of the "impossible" one) which can be solved rationally. Sometimes his x has to do duty twice, for different unknowns, in one problem. In general his object is to reduce the final equation to a simple one by making such an assumption for the side of the square or cube to which the expression in x is to be equal as will make the necessary number of coefficients vanish. The book is valuable also for the propositions in the theory of numbers, other than the "porisms," stated or assumed in it. Thus Diophantus knew that *no number of the form* $8n + 7$ *can be the sum of three squares.* He also says that, if $2n + 1$ is to be the sum of two squares, "n must not be odd" (i.e., *no number of the form* $4n + 3$, *or* $4n - 1$, *can be the sum of two squares),* and goes on to add, practically, the condition stated by Fermat, "and the double of it increased by one, when divided by the greatest square which measures it, must not be divisible by a prime number of the form $4n - 1$," except for the omission of the words "when divided . . . measures it."

BIBLIOGRAPHY.—The first to publish anything on Diophantus in Europe was Rafael Bombelli, who embodied in his Algebra (1572) all the problems of Books I.–IV. and some from Book V., interspersing them with his own problems. Next Xylander (Wilhelm Holzmann) published a Latin translation (Basle, 1575), an altogether meritorious work, especially having regard to the difficulties he had with the text of his ms. The Greek text was first edited by C. G. Bachet *(Diophanti Alexandrini arithmeticorurn libri sex, et de numeris multangulis liber unus, nunc primum graece et latine editi atque absolutissimis commentariis illustrati . . .* Lutetiae Parisiorum . . . MDCXXI.). A reprint of 1670 is valuable because it contains Fermat's famous notes; so far as the Greek test is concerned it is much inferior to the other. There are two German translations, one by Otto Schulz (1822) and the other by G. Wertheim (Leipzig, 1890), and an English edition in modern notation (T. L. Heath, *Diophantus* of *Alexandria: A Study in the History of Greek Algebra)* (Cambridge 1885; second edition 1910). The Greek text has now been definitively edited (with Latin translation, scholia, etc.) by Tannery (Teubner, vol. i. 1893; vol. ii. 1895). General accounts of Diophantus' work are to be found in the histories of mathematics and in Pauly-Wissowa; more elaborate analyses are those of Nesselmann (*Die Algebra der Griechen,* 1842), and G. Loria *(Le scienze esatte nell' antica Grecia,* 1914, pp. 845–919). (T. L. H.)

DIOPSIDE, an important member of the pyroxene group of rock-forming minerals. It is colourless, white, pale green to dark green or nearly black in colour, the depth of the colour depending on the amount of iron present, and is a calcium-magnesium metasilicate, $CaMg(SiO_3)_2$, crystallizing in the monoclinic system. Usually some iron is present, replacing magnesium, and when this predominates there is a passage to hedenbergite, $CaFe(SiO_3)_2$, a closely allied variety of monoclinic pyroxene; these are distinguished from augite by containing little or no aluminium. The specific gravity and optical constants also vary with the chemical composition; the specific gravity of diopside is 3·2, increasing to 3.6 in hedenbergite, and the angle of optical extinction in the plane of symmetry varies between 38° and 47° in the two extremes of the series. Crystals are usually prismatic in habit, with a rectangular cross-section, the angle between the prism faces *m,* parallel to which there are perfect cleavages, being 92° 50′. The name magnesium diopside is given to the solid solutions of diopside and enstatite commonly found in quartz-dolerites They are distinguished from diopside by smaller extinction angles and smaller angles between the optic axes.

Belonging to the same series with diopside and hedenbergite is a manganese pyroxene, known as schefferite, which has the composition $(Ca,Mg)(Fe,Mn)(SiO_3)_2$.

Diopside is easily prepared synthetically from a melt of its component oxides. The artificial crystals melt sharply at 1,391° C., and this temperature is used as a fixed point on the thermometer scale. (C. E. T.)

DIOPTASE, a rare mineral species consisting of acid copper orthosilicate, H_2CuSiO_4, that has occasionally been used as a gem-stone, especially in Russia and Persia. It has a fine colour, but a low degree of hardness and the transparency is imperfect, and it crystallizes in the parallel-faced hemihedral class of the rhombohedra1 system, in which there is only an axis of triad symmetry and a centre of symmetry. The crystals have the form of a hexagonal prism terminated by a rhombohedron. There are perfect cleavages truncating the polar edges of the primary rhombohedron. From these cleavage cracks internal reflections are often to be seen in the crystal, and it was on account of this that the mineral was named dioptase, by R. J. Hauy in 1797, from διοπτεύειν, "to see into." The crystals vary from transparent to translucent with a vitreous lustre, and are bright emerald-green in colour; they thus have a certain resemblance to emerald, hence the early name emerald-copper (German, *Kupfersmaragd).* Hardness 5; sp.gr. 3·3. The fine crystals from Mount Altyn-Tube on the western slopes of the Altai mountains, Asiatic Russia, line cavities in a compact limestone; they were first

brought to Europe in 1785. Excellent crystals have also come from the copper mines in the French and Belgian Congos and from South-West Africa.

DIOPTER. A unit of measurement used in optics to measure the power of a lens or lens system. The power of a lens is the reciprocal of its focal length, and when the focal length is expressed in metres the power of the lens is in diopters. Thus a lens whose focal length is one metre has a power of one diopter, a lens of focal length 50 cm. ($\frac{1}{2}$ metre) a power of 2 diopters, a lens of focal length 2 metres $\frac{1}{2}$ diopter and so on. (*See* LENS.)

DIORITE, the name given by Haüy to a family of rocks of granitic texture, composed of plagioclase felspar and hornblende. As they are richer in the dark coloured ferromagnesian minerals they are usually grey or dark grey, and have a higher specific gravity than granite. They also rarely show visible quartz. But there are diorites of many kinds, as the name applies rather to a family of rocks than to a single species. Some contain biotite, others augite or hypersthene; many have a small amount of quartz. Orthoclase is rarely entirely absent, and when it is common the rock becomes a monzonite. It is rare to find the pure types of "hornblende-diorite," "augite-diorite," etc., but in most cases the rocks contain two or more ferromagnesian silicates, and such combinations as "hornblende-biotite-diorite" are commonest in nature.

The felspar of the diorites ranges in composition from oligoclase to labradorite and is often remarkably zonal, the external layers being more alkaline than the internal. Small fluid enclosures and black grains, probably iron oxides, often occur in it in great numbers. Weathering produces epidote, calcite, sericite and kaolin. The biotite is always brown or yellow; the hornblende usually green, but sometimes brown or yellowish brown in those diorites which have affinities to lamprophyres. The augite is nearly always green, but sometimes has a reddish tinge; bronzite and hypersthene have their usual green and brown shades. Apatite, iron oxides and zircon are almost invariably present; sphere garnet and orthite are occasionally observed; calcite, chlorite, muscovite, kaolin, epidote and bastite are secondary. The structure is not essentially different from that of granite. The ferromagnesian minerals crystallize comparatively early and have some idiomorphism; the felspar usually follows and only in part shows good crystalline outlines. Orthoclase and quartz, if present, are last to separate out, and fill the spaces between the other minerals; often they interpenetrate to form micropegmatite. In many diorites the plagioclase felspar has crystallized before the hornblende, which consequently has less perfect outlines and forms irregular plates which enclose sharply formed individuals of felspar; this produces the ophitic structure (very common also in the dolerites). More rarely biotite and augite exhibit the same relations to the plagioclase. Orbicular structure also occasionally appears in these rocks; in fact the orbicular diorite of Corsica (also called "napoleonite" (*q.v.*) or "corsite") was for a long time the best-known example of this structure. Occasionally diorites have a parallel banded or foliated structure, but these must not be in any manner confounded with the epidiorites, which are metamorphic rocks without conspicuous foliation.

Diorites must also be distinguished from hornblendic gabbros, which contain more basic felspars, rarely quartz and occasionally olivine; but the boundary lines between diorites and gabbros are admittedly somewhat vague, e *g.*, some authors would call rocks gabbro which others would regard as augite-diorite. The hornblendites differ from the diorites in containing little felspar, and consist principally of hornblende. Among varietal designations given to rocks of the diorite family are "hanatite" for an augite-diorite with or without quartz (from the Schemnitz district), "granodiorite" for a quartz-hornblende-diorite (essentially the same as tonalite) from California, etc., "ornoite" for a hornblende-diorite rich in felspar, from Sweden. (J. S. F.)

DIOSCOREACEAE, a family of monocotyledonous plants which includes the yam (*q.v.*), the black bryony (*Tamus communis*), and the elephant's-foot (*q.v.*). There are nine genera and about 650 species, all climbing herbs or shrubs with tubers or rhizomes. The flowers are small, usually inconspicuous, unisexual or perfect, usually regular, the parts in threes. The fruits are for the most part a three-winged capsule, the seeds mostly winged. The family is economically important, as many species of Dioscorea are cultivated for their edible tubers, those of the greater yam (D. ulata) sometimes attaining a weight of 40 lb. Other cultivated species are D. *batatas*, D. *esculenta*, D. *cayenensis*, D. *bulbifera*, *D. pentaphylla* and D. *triloba*.

For a monographic treatment see R. Knuth, Dioscoreaceae. Pflanzenreich 87 (iv, 43): 1–278, fig. 1–69 (1924).

DIOSCORIDES, PEDANIOS (*fl. c.* A.D. 50), Greek medical man, served in the army of Nero. He is known through his *Materia Medica* which was very popular in the middle ages. It details the properties of about 600 medicinal plants and describes animal products of dietetic and medicinal value.

A Graeco-Latin text by K. Sprengel appeared at Leipzig (1829) and a German trans. by J. Berendes (Stuttgart, 1902).

DIP, in magnetism (see TERRESTRIAL MAGNETISM), the angle made by the direction of the earth's magnetic field and the horizontal is the angle of dip, commonly called the dip. In astronomy (*q.v.*) and surveying (*q.v.*) the dip of the horizon is the angular distance between the true horizon and the apparent horizon, due to the observer's elevation. In geology (*q.v.*) the angle which the line of maximum slope of a stratum makes with the horizontal.

DĪPAVAṂSA, a poem ("History of the Island") composed in Ceylon in the Pāli language, relating the history of Buddhism in India and its propagation in Ceylon. It belongs to the 4th century A.D., and is the earliest example of a purely historical compositicn relating to India. It contains 22 chapters, and begins with the Enlightenment of Buddha, the immediately following events, and his three legendary visits to Ceylon. Then follows the genealogy of the kings of Buddha's ancestry from the first king of this cycle (*kalpa*) down to Buddha himself and his son Rāhula. The really historical portion begins with chapter 4, the history of Buddhism in the Magadha kingdom down to the 3rd council in the reign of Asoka. From this point it continues with the history of Ceylon, the settlement of the island by king Vijaya, the subsequent kings down to Devānampiya Tissa, under whom Buddhism was introduced by Asoka's son Mahinda, with a continuation of the history of the island ending with king Mahāsena at the beginning of the 4th century A.D.

As the *Dīpavaṃsa* is the oldest connected account of Buddhism and of contemporary secular events in India for the first three centuries of its history, it is important to determine if possible in what sense it can be called historical. There are two circumstances to be first considered, the fact that its record of events (apart from purely local Sinhalese history) was compiled in India, and consequently cannot be treated as the composition or invention of a Sinhalese author, and secondly that it corresponds in important features with the Puriinas. The Purānas, like the *Dīpavaṃsa,* contain genealogies of kings which are traced up to the purely legendary beginnings of the cycle, and recent study has not only shown that the Puriinas contain genealogies belonging to actual lines of kings, but further that in the case of the Magadha kings between Buddha and Asoka both the Purānas and the *Dīpavaṃsa* rest on a common historical basis. This is further corroborated by the lists found in Jain works. What we possess is not a historical record in the modern sense, for the chroniclers recorded events uncritically, and accepted legends about quite historical persons. This is very different from free invention. What we have to guard against is not deliberate romancing, but faults due to the very defective means of transmitting and recording events, and the unhistorical attitude of the compilers. The probable mode of composition has been most closely studied by Oldenberg, who first edited the Dipavamsa, and by Geiger, who has edited the later chronicle, the *Mahāvaṃsa.* A native commentary (*ṭīkā*) on the *Mahāvaṃsa,* was compiled about A.D. 1000. References in it show that at that time there was in existence a Sinhalese historical work, which formed part of the great Sinhalese commentary on the Buddhist Scriptures. The existence of this Sinhalese commentary at least as early as the 4th century A.D. is known from frequent references found in the existing Pāli commentaries. It was on the basis of this work in Sinhalese that the *Dīpavaṃsa* was compiled, and its repetitions and the disjointed arrangement of various passages show that it must have been compiled from just such a source. The main details of the work correspond so closely with those in the Indian records (the Purānas and Buddhist Sanskrit works) that it is clear that they are of Indian origin. This Sinhalese work must have at first ended with the introduction of Buddhism into Ceylon by Mahinda, but it appears to have been later on extended to the reign of Mahāsena. This is the period

covered by the *Dīpavaṃsa,* and this work is probably a recension and adaptation of the whole of the Sinhalese work. These conclusions are essentially the views of Geiger, who has summarized his results about both the *Dīpavaṃsa* and the *Mahāvaṃsa* in his translation of the latter work. References will also be found here to the criticisms of R. O. Franke, whose attitude on the historical value of the chronicles is one of complete scepticism. (See MAHĀVAMSA.)

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DIP-CIRCLE. An instrument used for measuring the magnetic dip. It consists essentially of a magnetic needle pivoted at the centre of a graduated metal circle. The circle is mounted with its plane vertical and the axis about which the needle turns horizontal. If such an instrument is placed with the plane of the circle in the magnetic meridian the needle will lie in the direction of the earth's magnetic field. See TERRESTRIAL MAGNETISM.

DIPHENYL (phenylbenzene), an aromatic hydrocarbon found in that fraction of the coal-tar distillate boiling between 240°–300°C., from which it may be obtained by warming with sulphuric acid, separating the acid layer and strongly cooling the undissolved oil. It crystallizes in plates (from alcohol) melting at 70–71° C. and boiling at 254° C. It is sometimes called phenyl benzene, having the structure $C_6H_5{\cdot}C_6H_5$. It may be prepared by passing benzene vapour through a red-hot tube; by the action of sodium on brombenzene dissolved in ether; by the action of stannous chloride on phenyldiazonium chloride; by the decomposition of phenyldiazonium sulphate with warm benzene or with alcohol and copper powder, or a yield of 82% of diphenyl is obtained by heating iodobenzene with copper powder at 230° C.

See BENZIDINE for the industrially important derivative, diparadiaminodiphenyl.

DIPHILUS, of Sinope, poet of the new Attic Comedy and contemporary of Menander (342–291 B.C.). Most of his plays were written and acted at Athens, but he led a wandering life, and died at Smyrna (Athenaeus xiii. pp. 579, 583). He is said to have written 100 comedies, the titles of fifty of which are preserved. He sometimes acted himself. To judge from the imitations of Plautus (Casina from the Κληρούμενα, *Asinaria* from the Ὄναγός, Rudens from some other play), he was very skilful in the construction of his plots. Terence also tells us that he introduced into the *Adelphi* (ii. 1.) a scene from the Συναποθνήσκοντες, which had been omitted by Plautus in his adaptation (Commorientes) of the same play. The ancients were undecided whether to class him among the writers of the New or Middle comedy.

Fragments in H. Koch, *Comicorum Atticorum fragmenta,* ii.; *see* J. Denis, *La Comédie grecque* (1886), ii. p. 414; R. W. Bond in *Classical Review* (Feb. 1910, with trans. of *Emporos* fragm.).

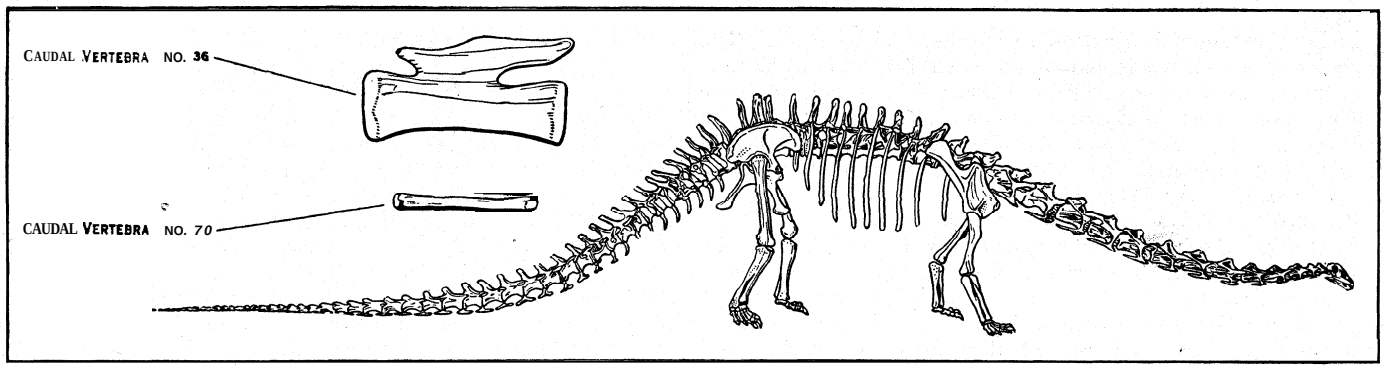
DIPHTHERIA, an acute infectious disease, accompanied by a membranous exudation on a mucous surface, generally the tonsils and back of the throat or pharynx.

As a rule, early symptoms are comparatively slight, viz., chilliness and depression. A slight feeling of uneasiness in the throat is experienced along with some stiffness of the back of the neck. The throat is reddened and somewhat swollen, particularly in the neighbourhood of the tonsils, the soft palate and upper part of pharynx, and there is tenderness and swelling of the glands at the angles of the jaws. The affection of the throat spreads rapidly, and soon the characteristic exudation appears on the inflamed surface as greyish-white specks or patches, increasing in extent and thickness until, in a well developed case, a yellowish-looking false membrane is formed, firmly adherent to the mucous membrane and if removed soon reproduced upon the raw, bleeding, ulcerated surface so left. It may cover the whole of the back of the throat, and the posterior nares, and spread downwards into the air-passages. Portions may be detached spontaneously, and expelled by coughing. There is pain and difficulty in swallowing, but unless the disease has affected the larynx no affection of the breathing. The voice acquires a snuffling character. When the disease invades the posterior nares an acrid, foetid discharge, and sometimes also copious bleeding, takes place from the nostrils. Along with these local phenomena there is in cases severe constitutional disturbance. While there may be no great amount of fever, there is marked depression and loss of strength. The pulse becomes small and frequent, the countenance pale, the swelling of the glands of the neck increases, and albumen appears in the urine. Unless favourable symptoms emerge death takes place within three or four days or sooner, either from the rapid extension of the false membrane into the air-passage, giving rise to asphyxia, or from a condition of general collapse, which is sometimes remarkably sudden. In cases of recovery the change for the better is marked by an arrest in the extension of the false membrane, the detachment and expectoration of that already formed, and the healing of the ulcerated mucous membrane beneath. Recovery, however, is slow, and it is many weeks before full convalescence is established. Even, however, where diphtheria ends favourably, a few weeks later paralysis of the soft palate and pharynx may occur, causing difficulty in swallowing and regurgitation of food through the nose, and giving a peculiar nasal character to the voice. Other forms of paralysis occurring after diphtheria are those affecting the muscles of the eye, which produce a loss of the power of accommodation and consequent impairment of vision, paralysis of both legs, and occasionally also of one side of the body (hemiplegia). These symptoms, after continuing for a variable length of time, almost always ultimately disappear.

Causation. — The exciting cause of diphtheria is a micro-organism, identified by Klebs and Loffler in 1883 (see BACTERIA AND DISEASE). It has been shown by experiment that the symptoms of diphtheria, including the after-effects, are produced by a toxin derived from the micro-organisms which lodge in the air-passages and multiply in a susceptible subject (see IMMUNITY). Cats and cows are susceptible to the diphtheritic bacillus, but actual cases among them are very rare; and fowls, turkeys and other birds have been known to suffer from a diphtheria-like disease, not due however, to the diphtheria bacillus; other domestic animals appear to be more or less resistant or immune. Children are far more susceptible than adults, but even children may have the Klebs-Löffler bacillus in their throats without showing any symptoms of illness, though such children are "carriers" (*q.v.*). Altogether there are many obscure points about this micro-organism, which is apt to assume a puzzling variety of forms.

Prevalence. — Diphtheria is endemic in all European and American countries, and the incidence varies greatly in different countries and, from year to year, even in the same country. In other words, diphtheria, though always endemic, exhibits at times a great increase of activity, and becomes epidemic or even pandemic.

Dissemination. — The contagion is spread by means which are in constant operation, whether the general amount of disease is great or small. Water, so important in some epidemic diseases, is believed not to be one of them. On the other hand, outbreaks of an almost explosive character, besides minor extensions of disease from one place to another have been traced to milk; but several cases have been ascribed to infection from cows with a diphtheritic affection of the udder. Human intercourse is the most important means of dissemination. the contagion passing either by actual contact, as in kissing, or by the use of the same utensils and articles, or by mere proximity. In the last case the germs must be supposed to be air-borne for short distances, and to enter with the breath. In the act of talking, tiny infected droplets are expelled into the air. It has been held that diphtheria is a rural rather than an urban disease, but this view is negatived when sufficiently numerous data over a long period of years are analysed. Diphtheria appears to creep about very slowly, as a rule, from place to place, and from one part of a large town to another; it forsakes one district and appears in another; occasionally it attacks a fresh locality with great energy, presumably because of the susceptibility of the inhabitants. who are, so to speak, virgin ground. But through it all personal infection is the chief means of spread.



FROM "MEMOIRS OF THE CARNEGIE MUSEUM"

SKELETON OF DIPLODOCUS CARNEGIEI, ABOUT ONE ONE-HUNDREDTH NATURAL SIZE. RECONSTRUCTED FROM FOSSIL REMAINS FOUND IN THE ROCKY MOUNTAINS. THE FEET ARE INCORRECTLY RESTORED

The acceptance of this doctrine has directed great attention to the practical question of school influence. There is no doubt whatever that it plays a very considerable part in spreading diphtheria. The incidence of the disease is chiefly on children, and nothing furnishes such constant and extensive opportunities for personal infection as school attendance. Many outbreaks have definitely been traced to schools. From a practical point of view the problem is a difficult one, but has been simplified by discovery of the Schick reaction and the prophylactic antitoxin treatment of those exposed to infection in whom the reaction is positive (see MEDICAL RESEARCH). All these considerations imply the necessity of segregating the sick in isolation hospitals. Of late years this preventive measure has been carried out with increasing efficiency, but, unfortunately, the complete segregation of infected persons is hardly possible, because of the mild symptoms, and even absence of symptoms, exhibited by some individuals. A further difficulty arises with reference to the discharge of patients. It has been proved that the bacillus may persist almost indefinitely in the air-passages in certain cases, and in a considerable proportion it does persist for several weeks after convalescence. On returning home such cases may, and often do, infect others. The method usually adopted is to retain the patient until the throat has been found free from B. diphtheria on each of three consecutive weekly bacteriological tests. These tests are generally started 12 days after the onset of the disease and made every two days. This still leaves the problem of dealing with persistent carriers unsolved.

Treatment.— Since the antitoxin treatment was introduced in 1894 it has overshadowed all other methods We owe this drug originally to the Berlin school of bacteriologists, and particularly to Dr. Behring. (*See* BACTERIA AND DISEASE; IMMUNITY; SERUM THERAPY.) Since then an enormous mass of facts has accumulated from all quarters of the globe, all testifying to the value of antitoxin in the treatment of diphtheria. The experience of the hospitals of the London Metropolitan Asylums Board for five years before and after antitoxin may be given as a particularly instructive illustration; and the subsequent reduction in the rate of mortality (12% in 1900, 11·3 in 1901, 10·8 in 1902, 9.3 in 1903, and an average of 9 in 1904–8) added further confirmation. Since then a further reduction has taken place. During 1923–26 the case mortality (annual reports of the chief medical officer of the Ministry of Health) was: 1923, 6·83%; 1924, 5.95; 1925, 5·81; 1926, 5.86.

Annual Case Mortality in Metropolitan Asylums Board's Hospitals.

Before Antitoxin		After Antitoxin.	
Year.	Mortality %	Year.	Mortality %
1890	33·55	1895	22·85
1891	30·61	1896	21.20
1892	29 51	1897	17·79
1893	30·42	1898	15·37
1894	29·29	1899	13·95

The number of cases dealt with in these five antitoxin years was 32,835, or an average of 6,567 a year, and the broad result is the reduction of mortality by about one-half. It is a fair inference that the treatment saved the lives of about 1,000 children each year in London alone. This refers to all cases. Those which occur in the hospitals as a sequel to scarlet fever, and consequently come under treatment from the commencement, show very much more striking results. The case mortality, which was 46·8% in 1892 and 58·8% in 1893, has been reduced to 3·6% since the introduction of antitoxin. This is a special example of the general law that the efficacy of antitoxin treatment varies inversely as the length of time that the disease has existed prior to administration of antitoxin. The following table (compiled from the annual reports of the Metropolitan Asylums Board), gives the case mortality of diphtheria on this basis:—

Day of disease on which antitoxin treatment was begun.	Case mortality %
1	1.62
2	4·73
3	10·37
4	14.60
5 and later	15·51

But the evidence is not from statistics alone. The beneficial effect of the treatment is equally attested by clinical observation. Adult patients have described the relief afforded by inoculation; it acts like a charm, and lifts the deadly feeling of oppression off like a cloud in the course of a few hours. Finally, the counteracting effect of antitoxin in preventing the disintegrating action of the diphtheritic toxin on the nervous tissues has been demonstrated pathologically. It has been said that diphtheritic paralyses are commoner since the introduction of antitoxin, but obviously the modern greater survival of diphtheria patients implies the existence of persons in whom these paralyses can be observed, who, formerly, would have died too early to manifest them.

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DIPLODOCUS, a gigantic extinct reptile, about 60ft. long, found in the Upper Jurassic rocks along the east side of the Rocky mountains. It is a member of the Sauropoda, a division of the Dinosaurs (*q.v.*). See Illustration above.

DIPLOMACY, the art of conducting international negotiations. The word is derived ultimately, through the French *diplomatie,* from the Greek word *diploma, i.e.,* the duplicate or copy of an act emanating from the sovereign of which the original is retained. Diplomacy has thus been defined as "the science of external relations, which has for its basis *diplômes* or written acts

of the sovereign." According to the *New Engtish Dictionary*, the word was first used in England so late as 1796 by Burke. The need for such a term was, indeed, only then beginning to be felt; for, though in a sense as old as history, it was only in quite modern times, even in Europe, that diplomacy developed into a uniform system, based upon generally recognized rules and directed by a diplomatic hierarchy having a fixed international status. (See *History*, below.)

Principles and Functions. — Though diplomacy is usually treated under the head of international law, it would perhaps be more consonant with the facts to place international law under diplomacy. The principles and rules governing the intercourse of states, defined by a succession of international lawyers, have no sanction except the consensus of the powers, established and maintained by diplomacy; in so far as they have become, by international agreement, more than mere pious opinions of theorists, they are working rules, established for mutual convenience, which it is the function of diplomatists to apply. The greater mass of diplomatic work, indeed, consists in giving particular application to rules generally admitted. This presents no special difficulty, though it demands technical knowledge. The rest of the work, however, is disproportionately harder, since it consists in adjusting disputes about matters to which the application of existing rules is doubtful, or to which they admittedly do not apply, or which stand beyond all rules as questions of high policy. In such debates, as Mr. Denys P. Myers has pointed out, the diplomatist is naturally an advocate; his object is not justice, but the advantage of the country he represents. In this aspect of its activities diplomacy must continue to be frank advocacy of particular interests, even though the dispute be heard before the high court of the League of Nations.

In the 18th century this would have been admitted without qualification. It is true that Frederick de Marselaer had declared in his *Legatus* (1626) that it was the function of an ambassador not only to study the interests of his sovereign, but "to work for the common peace and to study the convenience of foreign princes"; that writers like François de Callières (1716) and Vattel (1756) spoke of Europe as a kind of republic which it was the function of diplomacy to preserve; and that idealists, like the abbé de St. Pierre, had visions of the League of Nations; but in practice sovereigns regarded their dominions as so much real property, which it was the function of their "agents" to protect or to enlarge. Diplomacy thus resolved itself into a process of exalted haggling, conducted with an amazing disregard for the ordinary standards of morality, but with the most exquisite politeness, and in accordance with ever more and more elaborate rules. Much of the outcome of these dead debates became stereotyped in the conventions of the diplomatic service; but the spirit and methods of diplomacy have undergone a great change.

The change was due to two main causes: (1) the new sense of European solidarity, which was the outcome of the French revolutionary wars, and found expression in the series of congresses from 1814 onward, and (2) the growth of democracy. The process of change was gradual, as was to be expected; for diplomacy is not a thing apart, as some seem to imagine, but is intimately bound up with the organic life of states; it can only be effective if it speaks with authority; it can only speak with authority when, both in its personnel and its methods, it represents the ultimate sovereignty, whether this reside in an autocrat or in the people. With the changing constitution of states, then, there has been a constant adjustment of the methods of diplomacy. The process has, of course, not been uniform. George Canning, for instance, could appeal to public opinion in support of his foreign policy at a time when Metternich was suppressing all expressions of public opinion; but Canning represented a parliamentary government, Metternich an autocrat. But in spite of survivals of the old spirit, the 19th century witnessed an immense advance in the ethics of diplomacy. In 1853 the comte de Garden could speak of diplomacy as deriving its principles from "the common law of the European peoples," and define it as "the art of reconciling the interests of the peoples one with another." At the close of the century The Hague Conferences revived in a more promising form the ideal of international co-operation which, in 1815, had inspired Alexander I.'s Holy Alliance.

EFFECTS OF THE WORLD WAR

The failure of diplomacy to avert the awful disaster of the World War naturally strengthened the agitation, which had begun before the war, against the personnel and methods of the traditional diplomacy. Diplomatists were accused of being in league with capitalists and munition-makers, out of touch with the people, and habitually using language that was "false-friendly and circumlocutory." The cry went up for "open diplomacy" and "democratic control," and was strengthened by President Wilson's announcement (in the first of his Fourteen Points) that henceforth "diplomacy shall proceed always frankly and in the public view."

Open Diplomacy and Democratic Control. — In a democratic state the control of foreign policy must always ultimately rest with the representatives of the people, who hold the purse-strings. But the public conduct of negotiations is another matter. "How is the task of peace-maker to be pursued," asked Mr. Arthur (later, Lord) Balfour, in the House of Commons, "if you are to shout your grievances from the house-tops whenever they occur? The only result is that you embitter public feeling, that the differences between the two states suddenly attain a magnitude they ought never to be allowed to approach, that the newspapers of the two countries agitate themselves, that the parliaments of the two countries have their passions set on fire, and great crises arise, which may end, have ended sometimes, in international catastrophes." Mirabeau said much the same thing in the French National Assembly in 1790, and subsequent events bore out its wisdom; it was not the diplomatists, but the oratorical heat of the Assembly that plunged Europe into the wars of the Revolution. The world remembers the wars that diplomacy failed to avert; it has forgotten, or has never known of those — and they are many more — which diplomacy has averted by a conspiracy of silence.

So far as the practice of diplomacy is concerned, the war and the negotiations which followed have led to only three developments of any outstanding importance. The first, which needs no further discussion, is the provision of the covenant that all international agreements, to be generally recognized as valid, must be registered in the secretariat of the League of Nations. This is intended to ensure the publication of the result of negotiations. Its effectiveness is limited to the membership of the league; and accusations have been made from time to time of the continued existence of secret treaties even between league members. The second is the growth of the practice of diplomacy by conference. The third is the adoption of the principle that no important treaty can be considered to be concluded until it has been ratified by the legislatures of the chief signatory states.

Ratification of Treaties. — This last development was due, not to the desire to secure democratic control so much as to the uncertainty created by the rejection by the United States Senate of the Treaty of Versailles. In most states ratification had hitherto been the prerogative of the sovereign and was regarded as a mere formality, since treaties were negotiated and concluded by representatives armed by the sovereign with full powers. Whether the new rule will make for peace or not is an open question. Wherever the minister responsible for foreign policy can rely on a parliamentary majority, ratification is likely to remain a mere formality; but it is easy to see the confusion and delay that would arise if a treaty signed by several powers really had to run the gauntlet of the criticism and amendments of several popular assemblies. In this respect the example of the Cnited States has not been encouraging; for the fact that the treaty-making power is vested by the Federal Constitution in the President and Senate concurrently has often made the conclusion of treaties with the United States a very long and difficult process. In the foreign relations committee of the Senate democratic control has often resolved itself into party opposition

Diplomacy by Conference, — Just as after the Napoleonic wars personal meetings of sovereigns and their principal ministers

were found of service in clearing up misunderstandings and expediting business—so for a while during and after the World War the substitution for the ordinary diplomatic channels of direct personal correspondence and meetings between foreign ministers, was justified by the greatness and urgency of the problems to be discussed. With the establishment of more settled conditions, however, diplomatic intercourse has tended to revert to the normal channels, though the attendance of foreign ministers at the periodical meetings of the Council and Assembly of the League of Nations seems now to be an established custom.

This direct influence of foreign ministers on the conduct of negotiations has been increased by modern means of communication. But it would be easy to exaggerate the importance of this change as affecting the character and status of diplomatic agents. Foreign ministers must still depend for information and advice on the "man on the spot," and the success of their policy largely depends upon his qualities of discretion and judgment. The growth of democracy, moreover, has given to the ambassador a new importance; for he represents not only the sovereign to the sovereign, but the nation to the nation; and he may by his personal qualities do a large **amount** to remove the prejudices and ignorances which stand as a barrier between the nations.

The Personnel of the Diplomatic Service.—The great part played by ambassadors and diplomatists generally in the intercourse between nations makes the question of their qualifications of supreme importance. With the growth of democracy a demand arose in Britain for the "democratization" of the diplomatic service. This demand was reasonable enough, in so far as it aimed at making this service more perfectly representative. It had, too, some basis in history. In the early days of diplomacy princes, in choosing their agents. paid more attention to their skill as negotiators than to their rank, and ambassadors were not drawn from any particular class; they might be clerics, or soldiers, or lawyers, or even simple merchants. Louis XI. of France even sent his barber, Olivier le Daim, on diplomatic missions. It was not till the 18th century that a diplomatic service, in the modern sense, came into existence. The elaboration of court ceremonial, for which Versailles had set the fashion, made it desirable that diplomatists should be courtiers, and young men of rank began to be attached to missions, in order to learn the art of diplomacy. Thus arose that aristocratic diplomatic class which survived from the 18th century into the 19th.

The example set by France was not followed in Britain till after the Napoleonic wars. By his circular of Jan. 1, 1816, Castlereagh announced that "in order to provide a suitable succession of diplomatic servants, properly qualified etc.," the Prince Regent intended to nominate from time to time "to such of the Ambassadors or Envoys, as the emergency of the service might point out, one, or at the utmost two, attachés to be domesticated in his family." (F.O. 115. 25. archives No. 2). This was the beginning in Britain of the trained diplomatic service. When, some years later, the service was thrown open to competition, precautions were still taken to ensure that it should be manned by gentlemen, that is to say, by those who had "at least had the opportunity of mixing in society where good manners are to be expected." Thus candidates for examination had to have an income of at least £400 a year, and were nominated by the foreign secretary on the recommendation of persons of position.

This system was modified as the result of a report issued in 1914, by the royal commission on the civil service. One of its recommendations was that the diplomatic establishment of the Foreign Office and the diplomatic corps abroad should be amalgamated up to and including the grades of assistant under-secretary of state and minister of the lowest grade. This involved the abolition of the property qualification, which did not apply to the Foreign Office; and it was recommended that members of the service employed abroad should receive a suitable foreign allowance. After the publication of the findings of the commission the recommendation of the foreign secretary was made dependent on the report of a board of selection composed of members of the Foreign Office and of the diplomatic service. In this there was nothing revolutionary; and the effect of the putting in force of these recommendations has been to widen the area of selection for the service.

HISTORY

In its widest sense the history of diplomacy is that of the intercourse between nations, in so far as this has not been a mere brute struggle for the mastery; in a narrower sense, with which the present article is alone concerned, it is that of the methods and spirit of diplomatic intercourse and of the character and status of diplomatic agents. Whatever the influence of earlier practice, modern diplomacy dates from the rise of permanent missions, and the consequent development of the diplomatic hierarchy as an international institution. Of this the first beginnings are traceable to the 15th century and to Italy. There had, of course, during the middle ages been embassies and negotiations; but the embassies had been no more than temporary missions directed to a particular end, and conducted by ecclesiastics or nobles of a dignity appropriate to each occasion; there were neither permanent diplomatic agents nor a professional diplomatic class. To the evolution of such a class the Italy of the Renaissance, the nursing-ground of modern statecraft, gave the first impetus. This was but natural; for in Italy, with its numerous independent states, between which there existed a lively intercourse, and a yet livelier rivalry, diplomacy early played a part as great as, or greater than, war. Where all were struggling for the mastery, the existence of each depended upon alliances and counter-alliances, of which the object was the maintenance of the balance of power. In this school there was trained a notable succession of men of affairs. Thus, in the 13th and 14th centuries Florence counted among her envoys Dante, Petrarch and Boccaccio, and later on could boast of agents such as Capponi, Vettori, Guicciardini and Machiavelli. Papal Rome, too, as was to be expected, had always been a fruitful nursing-mother of diplomatists; and some authorities have traced the beginnings of modern diplomacy to a conscious imitation of her legatine system. *(See* Hinschius, *Kirchenrecht*, i. p. 498.)

It is, however, in Venice, that the origins of modern diplomacy are to be sought. The Venetians, in their turn, doubtless learned their diplomacy originally from the Byzantines, with whom their trade expansion in the Levant early brought them into close contact. (For Byzantine diplomacy *see* ROMAN EMPIRE, LATER.) So early as the 13th century the republic began to lay down rules for the conduct of its ambassadors. Thus in 1268, ambassadors were commanded to surrender on their return any gifts they had received, and about the same time it was decided that they were to hand in a written account of their mission; in 1288 this was somewhat expanded by a law decreeing that ambassadors were to deposit, within 15 days of their return, a written account of the replies made to them during their mission, together with anything they might have seen or heard to the honour or in the interests of the republic. These provisions, which were several times renewed, are the origin of the famous reports of the Venetian ambassadors to the senate, which are at once a monument to the genius of Venetian statesmen and a mine of historical material. *(See* Eugenio Albèri, *Le Relazioni degli ambasciatori Veneti al senato,* 15 vols. Florence, 1839–63.)

The origin of the change from temporary to permanent missions has been the subject of much controversy. The theory that it was due to the evolution of the Venetian consulates (*bajulats*) in the Levant into permanent diplomatic posts, and that the idea was thence transferred to the West, is disproved by the fact that Venice had established other permanent embassies before the *baylo* (*q.v.*) at Constantinople was transformed into a diplomatic agent of the first rank. Nor is the first known instance of the appointment of a permanent ambassador Venetian. The earliest record[1] is contained in the announcement by Francesco Sforza,

[1] The *apocrisiarii* (ἀποκρισιάριοι) or *responsales* should perhaps be mentioned, though they certainly did not set the precedent for the modern permanent missions. They were resident agents, practically legates, of the popes at the court of Constantinople. They were established by Pope Leo I., and continued until the Iconoclastic controversy brake the intimate ties between East and West. *See* Luxardo, *Das vordekretalische Gesandtschaftsrecht der Päpste* (Innsbruck, *1878)*; also Hinschius, *Kirchenrecht*, i. 501.

duke of Milan, in 1455, of his intention to maintain a permanent embassy at Genoa, and in 1460 the duke of Savoy sent Eusebio Margaria, archdeacon of Vercelli, as his permanent representative to the Curia[1]. Though, however, the early records of such appointments are rare, the practice was probably common among the Italian states. Its extension to countries outside Italy was a somewhat later development. In 1494 Milan is already represented in France by a permanent ambassador. In 1495 Zacharia Contarini, Venetian ambassador to the emperor Maximilian, is described by Sanuto (*Diarii*, i. 294) as stato ambasciatore; and from the time of Charles V. onwards the succession of ambassadors of the republic at the imperial court is fairly traceable. In 1496 "as the way to the British Isles is very long and very dangerous," two merchants resident in London, Pietro Contarini and Luca Valaressa, were appointed by the republic *subambasciatores;* and in June of the same year Andrea Trevisano arrived in London as permanent ambassador at the court of Henry VII[2]. Florence, too, from 1498 onwards, was represented at the courts of Charles V. and of France by permanent ambassadors.

During the same period the practice had been growing up among the other European powers. Spain led the way in 1487 by the appointment of Dr. Roderigo Gondesalvi de Puebla as ambassador in England. As he was still there in 1500, the Spanish embassy in London may be regarded as the oldest still surviving post of the new permanent diplomacy. Other states followed suit, but it was not till late in the 16th century that permanent embassies were regarded as the norm. The precarious relations between the European Powers during the 16th century, indeed, naturally retarded the development of the system. Thus it was not till after good relations had been established with France by the Treaty of London that, in 1519, Sir Thomas Boleyn and Dr. West were sent to Paris as resident English ambassadors, and, after the renewed breach between the two countries, no others were appointed till the reign of Elizabeth. Nine years before, Sir Robert Wingfield, whose simplicity earned him the nickname of "Summer-shall-be-green," had been sent as ambassador to the court of Charles V., where he remained from 1510 to 1517; and in 1520 the mutual appointment of resident ambassadors was made a condition of the treaty between Henry VIII. and Charles V. In 1517 Thomas Spinelly, an Italian, who had for some years represented England at the court of the Netherlands, was appointed "resident ambassador to the court of Spain," where he remained till his death in 1522. These are the most important early instances of the new system. Alone of the Great Powers, the emperor remained unrepresented at foreign courts. In theory this was the result of his unique dignity, which made him superior to all other potentates; actually it was because, as emperor, he could not speak for the practically independent princes nominally his vassals. It served all practical purposes if he were represented abroad by his agents as king of Spain or archduke of Austria.

All the evidence goes to prove that the establishment of permanent diplomatic agencies was deliberately adopted as an obvious convenience. But, while all the powers were agreed as to the convenience of maintaining such agencies abroad, all were equally agreed in viewing the representatives accredited to them by foreign states with extreme suspicion. This was justified by the peculiar ethics displayed by the new diplomacy. Machiavelli had gathered in The Prince and *The* Discourses on ***Livy,*** the principles underlying the practice of his day in Italy; Francis I., the first monarch to establish a completely organized diplomatic machinery, did most to give these principles a European extension. By the close of the 16th century diplomacy had become frankly "Machiavellian," and the ordinary rules of morality were held not to apply to the intercourse between nations. This was admitted in theory as well as in practice[3]. The situation is summed up in the famous definition of Sir Henry Wotton, which, though excused by himself as a jest, was held to be an indiscreet revelation of the truth: "An ambassador is an honest man sent to lie abroad for the good of his country." (See Pearsall Smith, Sir Henry *Wotton,* pp. 49, 126 et seq.) So universally was this principle adopted that, in the end, no diplomatist even expected to be believed; and—as Bismarck cynically avowed—the best way to deceive was to tell the truth.

But, in addition to being a liar ex *officio,* the ambassador was also "an honourable spy." "The principal functions of an envoy," says François de Callibres, himself an ex-ambassador of Louis XIV., "are two; the first is to look after the affairs of his own prince; the second is to discover the affairs of the other." A clever minister, he maintains, will know how to keep himself informed of all that goes on in the mind of the sovereign, in the councils of ministers, or in the country; and for this end "good cheer and the warming effect of wine" are excellent allies[1]. This being so, it is hardly to be wondered at that foreign ambassadors were commonly regarded as unwelcome guests. The views of Philippe de Commines were shared by theoretical writers as well as by men of affairs. Gentilis is all but alone in his protest against the view that all ambassadors were exploratores *magis quam* oratores, and to be treated as such. So early as 1481 the government of Venice had decreed the penalty of banishment and a heavy fine for any one who should talk of affairs of state with a foreign envoy, and though the more civilized princes did not follow the example of the sultan, who by way of precaution locked the ambassador of Ferdinand II., Jerome Laski, into "a dark and stinking place without windows," they took the most minute precautions to prevent the ambassadors of friendly powers from penetrating into their secrets. Charles V. thought it safest to keep them as far away as possible from his court, and so did Francis I. Henry VII. forbade his subjects to hold any intercourse with them, and, later on, set spies upon them and examined their correspondence—a practice by no means confined to England alone. To Paschalius the permanent embassies were "a miserable outgrowth of a miserable age[2]." Grotius himself condemned them as not only harmful, but useless, the proof of the latter being that they were unknown to antiquity. (De *jure* belli et *pacis,* Amsterdam, 1621, ii. c. 18, § 3. n. 2.)

Development of the Diplomatic Hierarchy.—The term corps *diplomatique* originated about the middle of the 18th century. "The Chancellor Fürst," says Ranke (xxx. 47, note), "does not use it as yet in his report (1754) but he knows it," and it would appear that it had just been invented at Vienna. "Corps diplomatique, nom qu'une dame donna un jour a ce corps nombreux de ministres étrangers à Vienne." The middle ages, however, knew no classification of diplomatic agents; the person sent on mission is described indifferently as *legatus,* orator, *nuntius, ablegatus* commissarius, procurator, *mandatarius, agens* or ambaxator (ambassator, etc.). In Gundissalvus, De legato (1485), the oldest printed work on the subject, the word ambasiator, first found in a Venetian decree of 1268, is applied to any diplomatist. Florence was the first to make a distinction; the orator was appointed by the council of the republic; the mandatorio, with inferior powers, by the Council of Ten. In 1500 Machiavelli, who held only the latter rank, wrote from France urging the Signoria to send ambasiadori. This was, however, rather a question of powers than of dignity. But the causes which ultimately led to the elaborate differentiation of diplomatic ranks were rather questions of dignity than of functions. The breakdown of feudalism, with the consequent rise of a series of sovereign states, or of states claiming to be sovereign, of very various size and importance, led to a certain confusion in the ceremonial relations between them, which had been unknown to the comparatively clearly defined system of the middle ages. The smaller states were eager to assert their dignity; the greater powers were equally

[1] N. Bianchi, *Le Materie politiche relative all' estero degli archivi di stato piemontese* (Bologna, Modena, 1875), p. 29.

[2] The first ambassador of Venice to visit England was Zuanne da Lezze, who came in 1319 to demand compensation for the plundering of Venetian ships by English pirates.

[3] Germonius, *De legatis principum et populorum libri tres* chap. vi. p. 164 (Rome, 1627); Paschalius, *Legatus* p. 302 (Rouen, 1598). So, too, Étienne Dolet in his *De officio legati* (1541).

[1] François de Callières, *De la manière de négocier avec les souverains* (Brussels, 1716). *See* also A. Sorel, *Recueil des instructions données aux ambassadeurs et ministres de France* (Paris, 1884), *e.g.,* vol. *Autriche,* pp. 77, 88, 102, 112.

[2] Paschalius, *Legatus* (1598), p. 447. So too Félix de la Mothe Le Vayer (1547–1625), in his *Legatus* (Paris, 1579).

bent on "keeping them in their place." If the emperor, as has been stated above, was too exalted to send ambassadors, certain states were soon esteemed too humble to be represented at the courts of the Great Powers save by agents of an inferior rank. By the second half of the 16th century, then, there are two classes of diplomatists, ambassadors and residents or agents, the latter being accounted ambassadors of the second class. At the first the difference of rank was determined by the status of the sovereign by whom or to whom the agent was accredited; but early in the 16th century it became fairly common for powers of the first rank to send agents of the second class to represent them at courts of an equal status. The reasons were various, and not unamusing. First and foremost came the question of expense. The ambassador, as representing the person of his sovereign, was bound by the sentiment of the age to display an exaggerated magnificence. His journeys were like royal progresses, his state entries surrounded with every circumstance of pomp, and it was held to be his duty to advertise the munificence of his prince by boundless largesses. Had this munificence been as unlimited in fact as in theory, all might have been well, but, in that age of vaulting ambitions, depleted exchequers were the rule rather than the exception in Europe; the records are full of pitiful appeals from ambassadors for arrears of pay, and appointment to an embassy often meant ruin, even to a man of substance. But the dignity of ambassador carried another drawback; his function of "honourable spy" was seriously hampered by the trammels of his position. He was unable to move freely in society, but lived a ceremonial existence in the midst of a crowd of retainers, through whom alone it was proper for him to communicate with the world outside. It followed that, though the office of ambassador was more dignified, that of agent was more useful.

Yet a third cause encouraged the growth of the lesser diplomatic ranks; the question of precedence among powers theoretically equal. Modern diplomacy has settled a difficulty which caused at one time much heart-burning, and even bloodshed, by a simple appeal to the alphabet. Great Britain feels no humiliation in signing after France, if the reason be that her name begins with G; had she not been Great, she would sign before. The vexed question of the precedence of ambassadors, too, has been settled by the rule as to seniority of appointment. But while the question remained unsettled it was obviously best to evade it by sending an agent of inferior rank to a court where the precedence claimed for an ambassador would have been refused.

Thus set in motion, the process of differentiation continues until the system is stereotyped in the 19th century. It is mainly a question of names. The ambassador extraordinary had originally been one sent on an extraordinary mission during which his authority superseded that of the resident ambassador. But by the middle of the 17th century the custom had grown up of calling all ambassadors "extraordinary," in order to place them on an equality with the others. The same process was extended to diplomatists of the second rank; and envoys (*envoyé* for *ablegatus*) were always "extraordinary," and as such took precedence over mere "residents," who in their day had asserted the same claim against the agents — all three terms having at one time been synonymous. Similarly a "minister plenipotentiary" had originally meant an agent armed with full powers (*plein-pouvoir*); but, by a like process, the combination came to mean as little as "envoy extraordinary" — though a plenipotentiary *tout* simple is still an agent, of no ceremonially defined dignity, despatched with full powers to treat and conclude. Finally, the evolution of the title of a diplomatist of the second rank is crowned by the high-sounding combination, now almost exclusively used, of "envoy extraordinary and minister plenipotentiary." The ultimate fate of the simple title "resident" was the same as that of "agent." Both had been freely sold by needy sovereigns to all and sundry who were prepared to pay for what gave them a certain social status. The "agent" fell thus into utter discredit, and those "residents" who were still actual diplomatic agents became "ministers resident" to distinguish them from the common herd.

The classification of diplomatic agents was for the first time definitively included in the general body of international law by the *Règlement*, March 10, 1815, at Vienna, and the whole question was finally settled at the congress of Aix-la-Chapelle (Nov. 21, 1818) when, the proposal to establish precedence by the status of the accrediting powers having wisely been rejected, diplomatic agents were divided into four classes: (1) ambassadors, legates, nuncios; (2) envoys extraordinary and ministers plenipotentiary, and other ministers accredited direct to the sovereign; (3) ministers resident; (4) chargés d'affaires. With a few exceptions (*e.g.*, Turkey), this settlement was accepted by all states, including the United States of America.

Rights **and** Privileges of Diplomatic Agents. — These are partly founded upon immemorial custom, and the result of negotiations embodied in international law. The most important, as it is the most ancient, is the right of personal inviolability extended to the diplomatic agent and the members of his suite. This inviolability is maintained after a rupture between the two governments concerned, and even after the outbreak of war. The habit of the Ottoman government of imprisoning in the Seven Towers the ambassador of a power with which it quarrelled was but an exception which proved the rule. The second important right is that of exterritoriality (*q.v.*), a convenient fiction by which the house and equipages of the diplomatic agent are regarded as the territory of the power by whom he is accredited. This involves the further principle that the agent is in no way subject to the receiving government. He is exempt from taxation and from the payment at least of certain local rates. He also enjoys immunity (1) from civil jurisdiction, *e.g.*, he cannot be sued, nor can his goods be seized, for debt; (2) from criminal jurisdiction, *e.g.*, he cannot be arrested and tried for a criminal offence. For a crime of violence, however, or for plotting against the State, he can be placed under the necessary restraint and expelled the country. The right of granting asylum claimed by diplomatic agents in virtue of that of exterritoriality, at one time much abused, is now strictly limited. A political or criminal offender may seek asylum in a foreign embassy; but if, after a formal request for his surrender, the ambassador refuses to deliver him up, the authorities may take the measures necessary to effect his arrest, and even force an entrance for the purpose. The "right of chapel" (droit de *chapelle*, or droit de *culte*), enjoyed by envoys in reference to their exterritoriality, *i.e.*, the right of free exercise of religious worship within their house, formerly of great importance, has been rendered superfluous by the spread of religious toleration.

During the World War certain questions were raised by the activities of the representatives of the belligerents in neutral states. In all neutral countries it was the duty of these representatives to obtain information useful to their governments, and to act as centres for an active propaganda of their views and aims. So long as this propaganda did not pass certain bounds no violence was done to the traditional principles of diplomacy. It was otherwise when diplomatic privileges and immunities were used to cover indirect attacks on the enemy through neutral interests. This was the case with the efforts of the Central Powers to interrupt the supply of munitions to the Allies from the United States. The discovery, in Sept., 1915, that Dr. Dumba, the Austrian ambassador, was proposing to finance strike movements on a large scale in the United States in order to hamper the manufacture of munitions led to his recall. Even more serious, however, was the subsequent discovery (October) that Capt. Boy-Ed and Capt. von Papen, the naval and military attaches to the German embassy, had been active in a plot to destroy American munition factories and American ships carrying munitions. Their subordinates, who were not covered by diplomatic immunity, were imprisoned; the two attaches were recalled at the instance of the United States Government. The same fate befell Count Luxburg, German minister in Buenos Aires, the author of the famous advice that ships carrying food from the Argentine to the Allies should be "spurlos versenkt" (sunk without leaving a trace). These notorious cases, characteristic of many others, were clearly condemned by the traditional standards of diplomacy. "The ambassador," Callières had written in the 18th century, "may suborn the prince's subjects for the purpose of obtaining information, but

not for the purpose of plotting against their master." Equally clear was the principle condemning the practice of the German diplomatists, especially in the United States, of plotting attacks on enemy states (*e.g.,* Canada, Ireland) under cover of their immunities. This was an abuse of diplomatic privilege, since it injured the State in which the plots were hatched by imperilling its neutrality.

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DIPLOMATIC is the science of the critical study of official as opposed to literary sources of history; that is to say, of charters, acts, treaties, contracts, judicial records, rolls, chartularies, registers and kindred documents. The employment of the word "diploma" as a general term to designate an historical document is of comparatively recent date. It is a Greek word, meaning literally a doubled or folded sheet, and was used by the Romans to denote, first, a passport or licence to travel by the public post and, later, any imperial grant of privileges. It was applied by the humanists of the Renaissance to important deeds and acts of sovereign authority, to privileges granted by kings and by great personages and by degrees its significance became extended to embrace the documents of the middle ages in general. The study of such documents, when Latin was the universal language of scholarship, was called *res diplomatica,* which, when learned books began to be written in the vernacular, was translated into "diplomatic."

History.—The first great text-book, the *De re diplomatica,* issued in 1681 by the learned Benedictine Dom Jean Mabillon, of the abbey of St. Germain-des-PrCs, was called forth by an earlier work by Daniel van Papenbroeck, the editor of the *Acta Sanctorum* of the Bollandists, who, with no great knowledge of archives, undertook to criticize the historical value of ancient records and monastic documents, and cast wholesale doubt on their authenticity. Mabillon's refutation of Papenbroeck's criticisms was complete, and was accepted by Papenbroeck himself. The *De re diplomatica* established the science on a secure basis; and, though its immediate result was a flood of controversy between the Benedictines and the Jesuits, it has been the foundation of all subsequent works on the subject

In Spain the Benedictine Perez published, in 1688, a series of dissertations following the line of Mabillon's work. In England Madox's *Formulare Anglicanum* (1702) and Hickes's *Linguarum septentrionalium thesaurus* (1703) both endorsed the principles laid down by the learned Frenchman. In Italy Maffei appeared with his *Istoria diplomatica* in 1727, and Muratori, in 1740, introduced dissertations on diplomatic into his great work, the *Antiquitates Italicae.* In Germany, the first diplomatic work of importance was that by Bessel, entitled *Chronicon Gotwicense* and issued in 1732.

France, however, the cradle of the science, has continued to be the home of its development. Mabillon had not taken cognizance of documents later than the 13th century, but a more comprehensive work was compiled by two later Benedictines. Dom Toustain and Dom Tassin; viz, the *Nouveau Traitk de diplomatique,* in six volumes, 1750–65, which embraced more than diplomatic proper and extended to all branches of Latin palaeography. Although the arrangement of this book is faulty, it contains a mass of valuable material, and more modern compilers have made extensive use of it.

As a result of the Revolution, the archives of the middle ages lost in France their juridical and legal value; but this rather tended to enhance their historical importance. The taste for historical literature revived. The Académie des Inscriptions fostered it. In 1821 the Ecole des Chartes was founded; and, though at first it did little, it received a further impetus in 1829 by the issue of a royal ordinance re-establishing it. Thenceforth it has been an active centre for the teaching and encouragement of the study of diplomatic throughout the country, and has produced results which other nations may envy. In Germany and Austria there has also been a systematic study of diplomatic archives, more or less with the support of the state; nor has the science been neglected in Italy. In England a late start was made, but much has been done within recent years to make up for lost time. The publications of the Public Record Office and of the department of mss. in the British Museum are now very numerous and are issued more regularly than in former times. The publication and criticism of documents are functions of various learned societies; and there are lectureships in palaeography and diplomatic at several universities.

Classification of Documents.—Documents may be classified under the two main heads of public and private deeds. In the former category are the legislative, administrative, judicial and diplomatic documents emanating from public authority in public form: laws, constitutions, ordinances, privileges. grants and concessions, proclamations, decrees, judicial records, pleas, treaties; in a word, every kind of deed necessary for the orderly government of a civilized state In early times many of these were comprised under the general term of "letters," *litterae,* and to the large number of them which were issued in open form and addressed to the community the specific title of "letters patent," *litterae patentes,* was given. Those which were issued in closed form under seal on the other hand were known as "close letters," *litterae clausae.*

Under the category of private documents are included not only the deeds of individuals, but also those of corporate bodies representing private interests, such as municipal bodies and monastic foundations. The largest class of documents of this character is composed of conveyances of real property and other title deeds. These are commonly described by the generic name of "charters," and are to be found in thousands, not only in the great public repositories, but also in the archives of municipal and other corporate bodies throughout the country and in the muniment rooms of old families. There are also the records of the manorial courts preserved in countless court-rolls and registers; while many scattered muniments of the dissolved monasteries represented by collections of charters and chartularies, or registers of charters, have fortunately survived and exist both in public and in private keeping.

The formalities observed by the different chanceries of mediaeval Europe, which are to be learned from a study of the documents issued by them, are so varied and often so minute that it is impossible to give a full account of them within the limits of the present article We can only state some of the results of the investigations of students of diplomatic.

Papal Chancery. — First and foremost stands the papal chancery, which has served as a model for all others. Organized in remote times, it adopted for the structure of its letters a number of formulae and rules which became more and more precise from century to century. The apostolic court being organized from the first on the model of the Roman imperial court, the early pontiffs naturally collected their archives, as the emperors had done, into *scrinia* (boxes). Pope Julius I., A.D. 337–353, reorganized the papal archives and Pope Damasus, A.D. 366–384, built a record office at the Lateran. The collection and orderly arrangement of the archives provided material for the establishment of regular diplomatic usages, and the science of formulae naturally followed.

For the study of papal documents four periods have been defined, each being distinguished by some particular development of forms and procedure. The first period is reckoned from the earliest times to the accession of Leo IX., A.D. 1048. For almost the whole of the first eight centuries no original papal documents have survived. But copies are found in canonical works and registers, many of them false, and others probably not transcribed in full or in the original words, but still of use, as showing the growth of formulae. The earliest original document is a fragment of a letter of Adrian I., A.D. 788. From that date there is a series, but documents are rare before the beginning of the 11th century, all of which exist, being written on papyrus. The latest existing papyrus document is dated A.D. 1022, the earliest on vellum A.D. 1005. The nomenclature of papal documents even at an early period is rather wide. In their earliest form they are letters, called in the documents themselves *litterae,* epistola, *pagina, scriptum,* sometimes *decretum.* A classification, generally accepted, divides them into: (1) Letters or Epistles: the ordinary acts of correspondence with persons of all ranks and orders; including constitutions (a later term) or decisions in matters of faith and discipline, and encyclicals giving directions to bishops of the whole church or of individual countries; (2) Decrees, being letters promulgated by the popes of their own motion; (3) Decretals, decisions on points of ecclesiastical administration or discipline; (4) Rescripts (called in the originals *preceptum,* auctoritas, *privilegium*), granting requests to petitioners. The comprehensive term "bull" (the name of the leaden papal seal, *bulla,* being transferred to the document) did not come into use until the 13th century.

The second period of papal documents extends from Leo IX. to to the accession of Innocent III., A.D. 1048–1198. At the beginning of the period formulae tended to take more definite shape and to become fixed; but it was under Urban II., A.D. 1088–99, that the principal formulae became stereotyped. The distinction between documents of lasting and those of transitory value became more exactly defined; the former class being known as greater bulls, bullae *majores* (also called *privilegia*), the latter lesser bulls, bullae *minores.* The introduction of subscriptions of cardinals as witnesses to greater bulls had gradually become a practice. Under Victor II., A.D. 1055–57, the practice became more confirmed, and after the time of Innocent II., A.D. 1130–45, the subscriptions of the three orders were arranged according to rank, those of the cardinal-bishops being placed in the centre under the papal subscription, those of the priests on the left, and those of the deacons on the right.

By degrees the use of the lesser bulls almost entirely superseded that of the greater bulls, which became exceptional in the 13th century and almost ceased after the migration to Avignon in 1309. In modern times the greater bulls occasionally reappear for very solemn acts, as bullae consistoriales, executed in the consistory.

The third period of papal documents extends from Innocent III. to Eugenius IV., A.D. 1198–1431. The pontificate of Innocent III. was a most important epoch in the history of the development of the papal chancery. Formulae became more exactly fixed, definitions more precise, the observation of rules and precedents more constant. The staff of the chancery was reorganized. The existing series of registers of papal documents was then commenced. The growing use of lesser bulls for the business of the papal court led to a further development in the 13th century. They were now divided into two classes, *tituli* and *mandamenta.* The former conferred favours, promulgated precepts, judgments, decisions, etc.; the latter comprised ordinances, commissions, etc., and were executive documents.

In the fourth period, extending from 1431 to the present time, the *tituli* and mandamenta have continued to be the ordinary documents in use; but certain other kinds have also arisen. Briefs (brevia), or apostolic letters, concerning the personal affairs of the Pope or the administration of the temporal dominion, or conceding indulgences, came into general use in the 13th century in the pontificate of Eugenius IV. They are written in the italic hand on thin white vellum, and the name of the Pope with his style as papa is written at the head of the sheet; *e.g.,* Eugenius papa iiii. They are closed and sealed with the Seal of the Fisherman, *sub anulo* Piscatoris. Briefs have almost superseded the mandamenta.

Merovingian Chancery. — Of the chancery of the Merovingian line of kings of France as many as 90 authentic diplomas are known, and of these 37 are originals, the earliest being of the year 625. The most ancient examples were written on papyrus, vellum superseding that material towards the end of the 7th century. All these diplomas are technically letters and were authenticated by the king's subscription, that of the referendarius (the official charged with the custody of the royal seal), the impression of the seal, and exceptionally by subscriptions of prelates and great personages. The royal subscription was usually autograph; but, if the sovereign were too young or too illiterate to write, a monogram was traced by the scribe. They are of two classes: (1) Precepts, conferring gifts, favours, immunities, and confirmations, entitled in the documents themselves *praeceptum, praeceptio, auctoritas;* some drawn up in full form, with preamble and ample final clauses; others less precise and formal; (2) Judgments (judicia), which required no preamble or final clauses as they were records of the sovereign's judicial decisions; they were subscribed by the referendary and were sealed with the royal seal.

Carolingian Chancery. — The diplomas of the early Carolingians differed but little from those of their predecessors. The royal subscription was in form of a sign-manual or mark, but Charlemagne elaborated this into a monogram of the letters of his name built up on a cross. Most of his diplomas were authenticated by the subscription of the chancellor and impression of the seal. A novelty in the form of dating was also introduced, two words, datum (for time) and *actum* (for place), being then employed. The character of the writing of the diplomas, founded on the Roman cursive hand, which had become very intricate under the Merovingians, improved under their successors, yet the reform which was introduced into the literary script hardly affected the cursive writing of diplomatic until the latter part of Charlemagne's reign. The archaic style was particularly maintained in judgments, which were issued by the private chancery of the palace, a department more conservative in its methods than the imperial chancery. It was in the reign of Louis Debonair, A.D. 814–840, that the Carolingian diploma took its final shape. A variation then appears in the monogram, that monarch's sign-manual being built up, not on a cross as previously, but on the letter H, the initial of his name Hludovicus, and serving as the pattern for successive monarchs of the name of Louis.

In the Carolingian chancery the staff was exclusively ecclesiastical; at its head was the chancellor, whose title it traced back to the *cancellarius,* or petty officer under the Roman Empire, stationed at the bar or lattice (*cancelli*) of the basilica or other law court and serving as usher. As keeper of the royal archives his subscription was indispensable for royal acts. The diplomas were drawn up by the notaries, an important body, upon whom devolved the duty of maintaining the formulae and traditions of the office. It has been observed that in the 9th century the documents were drawn carefully, but that in the 10th century there was a great degeneration in this respect. Under the early Capetian kings there was great confusion and want of uniformity in their diplomas, and it was not until the reign of Louis VI., A.D. 1108, that the formulae were again reduced to rules. The acts of

the imperial chancery of Germany followed the patterns of the Carolingian diplomas, with little variation down to the reign of Frederick Barbarossa, A.D. 1152–1190.

England. — For the study of diplomatic in England material exists in two distinct series of documents, those of the Anglo-Saxon period and those subsequent to the Norman Conquest. The Anglo-Saxon kings appear to have borrowed, partially, the style of their diplomas from the chanceries of their Frankish neighbours, introducing at the same time modifications which give those documents a particular character marking their nationality. In some of the earlier examples the lines of the foreign style are followed more or less closely; but very soon a simpler model was adopted which lasted in general construction down to the time of the Norman Conquest. The royal charters were usually drawn up in Latin, sometimes in Anglo-Saxon, and began with a preamble or exordium, in the early times of a simple character, but later drawn out not infrequently to great length in involved and bombastic periods. Then immediately followed the disposing or granting clause, often accompanied with a few words explaining the motive, such as for the good of the soul of the grantor; and the text was closed with final clauses of varying extent, protecting the deed against infringement, etc.

In early examples the dating clause gave the day and month (often according to the Roman calendar) and the year of the indiction; but the year of the Incarnation was also immediately adopted, and later the regnal year also. The subscriptions of the king and of the personages witnessing the deed, each preceded by a cross, but all written by the hand of the scribe, usually closed the charter. A peculiarity was the introduction in many instances, either in the body of the charter or in a separate paragraph at the end, of the boundaries of the land granted, written in the native tongue. The sovereigns of the several kingdoms of the Heptarchy, as well as those of the United Kingdom, usually styled themselves *rex*. But from the time of Aethelstan, A.D. 825–840, they also assumed fantastic titles in the text of their charters, such as: *rex et primicerius, rex et rector, gubernator et rector, monarchus* and particularly the Greek *basileus* and *basileus industrius*. At the same time the name of Albion was also frequently used for Britain.

A large number of documents of the Anglo-Saxon period, dating from the 7th century, has survived, both original and copies entered in chartularies. Of distinct documents there are nearly two hundred; but a large proportion of these must be set aside as copies (both contemporary and later) or as spurious deeds.

Although there is evidence of the use of seals by certain of the Mercian kings, the method of authentication of diplomas by seal impression was practically unknown to the Anglo-Saxon sovereigns, save only to Edward the Confessor, who, copying the custom which obtained upon the Continent, adopted the use of a great seal.

Immediately after the Norman Conquest of England the old tradition of the Anglo-Saxons. disappeared. The Conqueror brought with him the practice of the Roman chancery, which naturally followed the Capetian model; and his diplomas of English origin differed only from those of Normandy by the addition of his new title, *rex Anglorum,* in the superscription. But even from the first there was a tendency to simplicity in the new English chancery, not improbably suggested by the brief formalities of Anglo-Saxon charters, and, side by side with the more formal royal diplomas, others of shorter form and less ceremony were issued, which by the reign of Henry II. had quite superseded the more solemn documents. By the reign of John these simpler forms had taken final shape, and from this time the acts of the kings of England have been classified under three heads; viz.: (1) Charters, generally of the pattern described above; (2) letters patent, in which the address is general, the king himself is his own witness, and the great seal is appended; (3) close letters, administrative documents conveying orders, the king witnessing.

The style of the English kings down to John was, with few exceptions, *Rex Anglorum;* thenceforward, *Rex Angliae.* Henry II. added the feudal titles, *dux Normannorum* et *Aquitanorum et comes Andegavorum,* which Henry III. curtailed to *dux Aquitaniae.* John added the title *dominus Hiberniae;* Edward III., on claiming the crown of France, styled himself *rex Angliae et Franciae,* this title being borne by successive kings down to the year 1801; and Henry VIII., in 1521, assumed the title of *fidei dejensor.* The formula *Dei gratia* does not consistently accompany the royal title until the reign of Henry II., who adopted it in 1173.

The forms adopted in the royal chanceries were imitated in the composition of private deeds, which in all countries form the mass of material for historical and diplomatic research. The student of English diplomatic will soon remark how readily the private charters, especially conveyances of real property, fall into classes, and how stereotyped the phraseology and formulae of each class become, only modified from time to time by particular acts of legislation. The brevity of the early conveyances was maintained with only moderate growth through the 12th, 13th and 14th centuries. The different kinds of deeds must be learned by the student from the text-books, but a particular form of document which was especially in favour in England should be mentioned. This was the chirograph (Gr. χείρ, a hand, γράφειν, to write), which is found even in the Anglo-Saxon period, and which got its name from the word *chirographum, cirographum* or *cyrographum* being written in large letters at the head of the deed. At first the word was written, presumably, at the head of each of the two authentic copies which the two parties to a transaction would require. Then it became the habit to use the word as a tally, the two copies of the deed being written on one sheet, head to head, with the word between them, which was then cut through longitudinally in a straight, or more commonly waved or indented line, each of the two copies thus having half of the word at the head. Any other word, or a series of letters, might thus be employed for the same purpose. The chirograph was the precursor of the modern indenture, the commonest form of English deeds, though no longer a tally. In other countries, the notarial instrument has performed the functions which the chirograph and indenture have discharged for us.

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of Anglo-Saxon Manuscripts (charters), (1878–84); G. F. Warner and H. J. Ellis, Facsimiles of Royal and other Charters in the *British* Museum (1903). (E. M. T.; F. B.)

DIPLOPIA, seeing a single object as double, occurs whenever one of the two eyes leaves the correct position of fixation, *i.e.,* when one eye cannot focus on an object simultaneously with the other eye. An object clearly seen by the normal eye gives rise to an image in the deviated eye to one side of the macula, and is referred by the mind to a position different from that which it really occupies. Thus there seem to be two objects, one clearly seen with the normal eye, and one indistinctly seen by the deviated eye. Causes of deviation of one eye are (1) disturbances in the motor apparatus of the eye, (2) tumor or abscess in the orbit, (3) limitation of motion of the eyeball from without. Paralysis, or weakness of one or more of the eye muscles, is by far the commonest cause of ocular deviation, and it is in those cases which come on suddenly that diplopia is a striking feature. It occurs frequently in alcoholic intoxication and in encephalitis lethargica and less often in poisoning by lead or carbon monoxide, and in certain acute infections such as diphtheria and polioencephalitis.

DIPNOI: see LUNG-FISH; FISHES.

DIPOENUS and **SCYLLIS,** early Greek sculptors, who worked together, and are said to have been pupils of Daedalus. Pliny assigns to them the date 580 B.C., and says that they worked at Sicyon, which city from their time onwards became one of the great schools of sculpture. They also made statues for Cleonae and Argos. They worked in wood, ebony and ivory, and apparently also in marble. It is curious that no inscription bearing their names has come to light.

DIPPEL, JOMANN KONRAD (1673–1734), German theologian and alchemist, son of a Lutheran pastor, was born near Darmstadt on Aug. 10, 1673. He studied theology at Giessen, and then pharmacy and medicine, taking his M.D. degree at Leyden in 1711. He discovered Prussian blue, and by the destructive distillation of bones prepared Dippel's animal oil. Dippel was one of the most learned men of his time. He died near Berleburg on April 25, 1734 having practised at Amsterdam as a physician and afterwards at the Court of Sweden.

Dippel's works (mostly written under the pseudonym of Christianus Democritus) were published at Berleburg (1743). See W. Bender: J. K. *Dippel* (Bonn, 1882).

DIPPER or WATER-OUSEL, a bird about the size of a thrush, squatly built and of an active disposition. The dipper (*Cinclus* cinclus) haunts the rocky streams of Europe and North Asia. The dipper, belonging to a small family of its own, the Cinclidae, feeds upon small fresh-water molluscs and crustacea, which it captures under the water, walking along the bottom of the stream and aiding its progress with its wings. It can also swim on the surface of the water, despite the fact that its feet are not webbed. The upper parts are dark, the throat and breast white, and the belly has a chestnut band. Its ringing song may be heard even in winter. The white eggs, four to seven in number, are laid in a cup-shaped nest of grass, lined with dead leaves, and completely encased and domed with moss, except for a small hole to admit the bird. There are many Old World forms.

In North America, this species is replaced by C. *mexicanus* in the mountains of the west. The American bird lacks the white throat of the European form, which it otherwise resembles closely. The Costa Rican dipper (C. *ardesiacus*) of the highlands of Costa Rica and Chiriqui is similar, with the general colour a lighter gray.

DIPSACACEAE, a family of dicotyledonous plants, the best-known member of which is the teasel (*q.v.*). The family includes ten genera and 150 species. The scabiouses (Scabiosa Knautia) also belong to this family.

DIPSOMANIA, a term formerly applied to the attacks of delirium (*q.v.*) caused by alcoholic poisoning. It is now sometimes loosely used as equivalent to the condition of incurable inebriates, but strictly should be confined to the pathological and insatiable desire for alcohol, sometimes occurring in paroxysms.

DIPTERA, the term used in zoological classification for the two-winged or true flies which form one of the largest orders of insects. Their chief character is expressed in the name of the order (Gr. δίς double, and πτερά wing) and, with certain aberrant exceptions, flies possess a single pair of membranous wings corresponding with the anterior pair in other winged insects: hind wings are absent and are represented by a pair of small knobbed organs termed halteres or balancers. The mouth parts are always adapted for sucking and sometimes for piercing also, and the various organs combined form a proboscis. Flies undergo complete metamorphosis and their larvae are always devoid of legs and most often have a much reduced head: the pupae are either free or enclosed in a hardened shell or puparium. The foregoing definition embraces over 50,000 described species and, of this number, about 3,000 kinds inhabit the British Isles, but new species are continually being found in almost all countries. As a rule, flies are of small or moderate size: some species are even minute, measuring one millimetre long. while some Australian robber flies exceed three inches in wing-expanse with a body length of one and three-quarters inches. The majority of flies are diurnal and frequent flowers for their nectar or haunt decaying organic matter of diverse kinds. Some species, however, are predaceous upon smaller insects, while a number of others, including mosquitoes and horse flies, have acquired blood-sucking habits, chiefly in the female. It is in virtue of this latter propensity that the order has acquired great significance in relation to medicine and public health. The pathogenic organisms of malaria, sleeping sickness, elephantiasis, yellow fever and other diseases are transmitted to man through the intermediary of blood-sucking flies. Diptera are generally of sombre coloration, but some species (hover flies) are conspicuously banded, others (the green-bottles, etc.) are metallic green or blue, while several kinds are densely hairy and coloured like bees. The sexes are generally closely alike, but in some flies with long antennae those organs are densely plumose in the males, and in many species the compound eyes are placed much closer together in the male than in the female, sometimes nearly meeting. Linnaeus first used the term "diptera" in its modern sense.

General Structure. — The head is generally a somewhat spherical capsule, with much of its surface often occupied by the compound eyes and the antennae exhibit diverse forms (fig. 1) of important significance in classification. The mouth-parts (fig. 2, 3) are highly modified for sucking: mandibles are only present in those flies that feed by piercing, and are lancet-like: the maxillae in such flies are of similar form but usually they are reduced, partly fused with the head and chiefly represented by their palpi: the labium is membranous and forms the greater part of the proboscis, and its apex is expanded to form two sucking lobes or labella. The thorax is fused into a single mass chiefly formed by the large mesothorax, and the legs have five-jointed tarsi. The membranous wings (fig. g) frequently have the venation reduced and there are but few cross-veins: in certain parasitic and other flies wings are absent. In the female the abdomen often has its terminal segments tubular and retractile, forming an ovipositor. The tracheae are frequently expanded to form large air-sacs, while the digestive system usually has a special food-reservoir opening into it by a narrow duct. In many flies the ganglia of the ventral chain are fused into a single mass and, in some cases, the female reproductive organs are adapted to retain the larvae for a variable period after developing from the eggs.

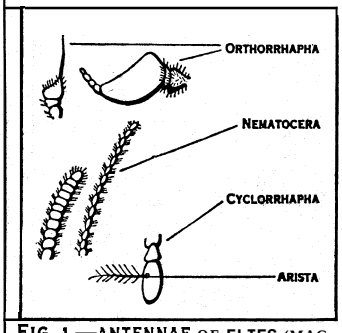


FIG. 1.—ANTENNAE OF FLIES (MAGNIFIED)

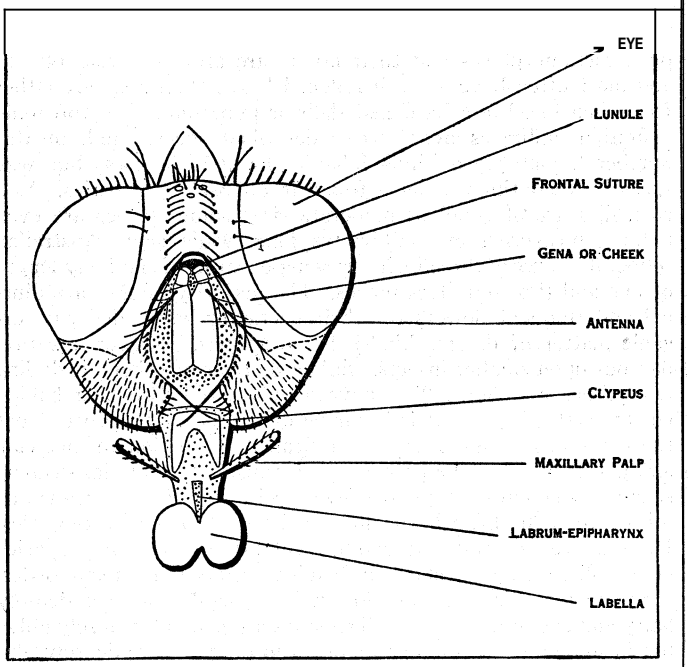
Classification. — The classification of flies is of a very technical character and is somewhat simplified in the following scheme. There are two main sub-orders which embrace a large number of families, only the more important of which are noted below.

SUB-ORDER I. NEMATOCERA

Mostly slender flies with elongate antennae of seven or more joints: maxillary palpi four or five jointed. Wings with median cell usually absent. Larvae with an evident head, pupae free.

The Nematocera include 13 families; the most important are the following:

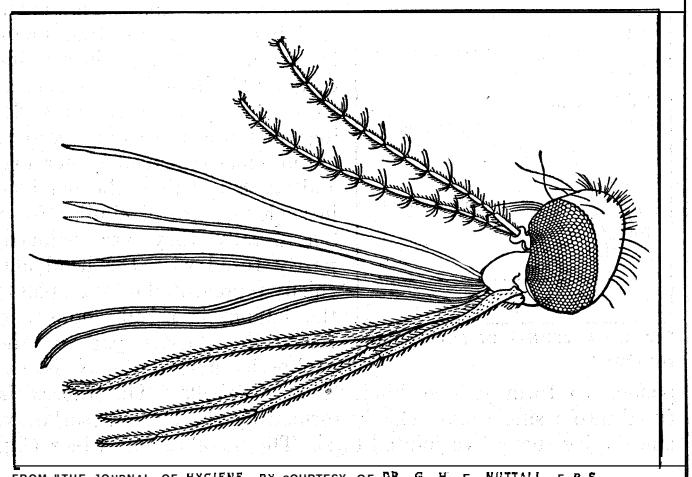
The *Tipulidae* include the crane-flies or "daddy-long-legs" which



FROM DR. IMMS, "GENERAL TEXT-BOOK OF ENTOMOLOGY" (METHUEN & CO.)

FIG. 2.—HEAD AND MOUTH PARTS OF A FLY ALLIED TO THE HOUSE-FLY

are recognizable on account of their large size and very long fragile legs. The larvae of several species are greyish objects called "leather jackets" which live underground and feed upon



FROM "THE JOURNAL OF HYGIENE" BY COURTESY OF DR. G. H. F. NUTTALL, F.R.S.

FIG. 3.— HEAD AND MOUTH PARTS OF AN ANOPHELES MOSQUITO, SHOWING PIERCING AND SUCKING APPARATUS

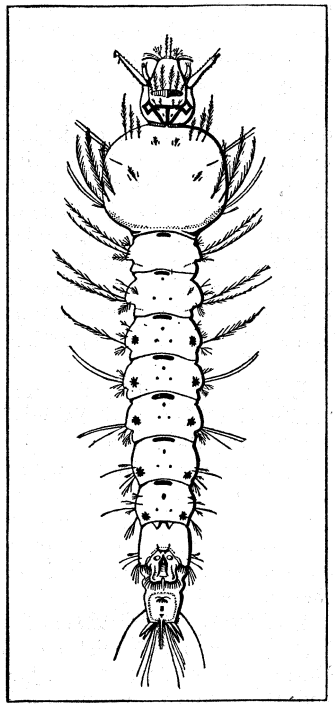
roots. Crane-flies include many species and are found all over the world.

The *Culicidae* (fig. 4) are known as gnats or mosquitoes (*q.v.*): the body and wings are invested with scales and the mouth-parts are stylet-like and used for sucking blood. Their larvae and pupae live in water and are very active. More than 1,500 species are known and at least 25 kinds occur in Great Britain. The common gnats are species of the genus *Culex* while members of the genus *Anopheles* are concerned with the transmission of the malaria organism.

The *Chironomidae* or midges resemble mosquitoes in form, but scales are wanting and the mouth-parts are usually degenerate. Their larvae and pupae are mostly aquatic and red or green in colour, the red larvae being known as blood-worms.

The *Cecidomyidae* or gall midges (fig. 5) are minute flies with very few veins to the wings and the antennae bead-like and adorned with circlets of long hairs. Their larvae are often orange in colour, with a minute head: they live in plant-tissues, forming galls of various types.

Mention should also be made of the *Mycetophilidae* or fungus midges and the tiny hairy *Psychodidae* which comprise the moth-flies, sand-flies and the *Simuliidae*, or buffalo gnats.



FROM "THE JOURNAL OF HYGIENE"

FIG. 4.— LARVA OF AN ANOPHELES MOSQUITO, WHICH RESTS JUST BELOW AND PARALLEL WITH THE SURFACE FILM OF STAGNANT WATER. BY THE USE OF OIL, THE AIR TUBES ARE FOCUSSED AND THE LARVA

SUB-ORDER II. BRACHYCERA

Mostly stoutly built flies whose antennae are three to six jointed and maxillary palpi one or two jointed. Wings usually with a median cell. Larvae generally with a much reduced head, (fig. 8) pupae free or enclosed in puparium.

This large sub-order is divisible into two series as follows:

Series I. ORTHORRHAPHA.—*Head without a frontal suture: antennae with a terminal bristle or prolongation* (fig. 1). *Larvae with a reduced head; pupae free and splitting by means of a dorsal fracture.*

There are 14 families in this series, of which five are mentioned below.

The *Stratiomyidae* are more or less flattened flies usually with white, yellow or green markings, while some are metallic. The scutellum is often spiny and the last antennal joint is generally ringed. More than 1,000 species are known and their larvae live in water or damp earth; the pupae are loosely enclosed in the last larval skin.

The *Tabanidae* (fig. 6) or horse-flies have a broad head, piercing mouth-parts and brilliantly coloured eyes. The costal vein is prolonged right round the wing and the halteres are hidden by a membranous scale or squama. The various species of *Tabanus* and the clegs *(Haematopota)* are troublesome blood-suckers, attacking man, horses and cattle. Their larvae frequent damp earth and bear circlets of papillae around many of the segments. The family is widely distributed, none of the species is very small and over 2,000 kinds are known.

The *Asilidae*, or robber flies, are large insects with long, hairy bodies and elongate, bristly, prehensile legs. They prey upon other insects, extracting their body-fluids by means of their piercing mouth-parts. Their larvae live in soil and rotting wood.

The *Empidae* have similar habits but are not hairy and are less robustly built; a tuft of hairs, forming a mouth-beard, present in *Asilidae*, is absent in this family. Both families are widely distributed and include many species.

The *Bombyliidae*, or bee-flies (fig. 7), are usually densely pubescent and bee-like with a long projecting proboscis, slender stiff legs and often marbled wings. The flies suck nectar from flowers, and their larvae are chiefly parasitic upon those of solitary bees. Although only nine species occur in Britain, at least 2,000 kinds are known from various parts of the world. None of the above types are remarkable for brilliancy of colouring.

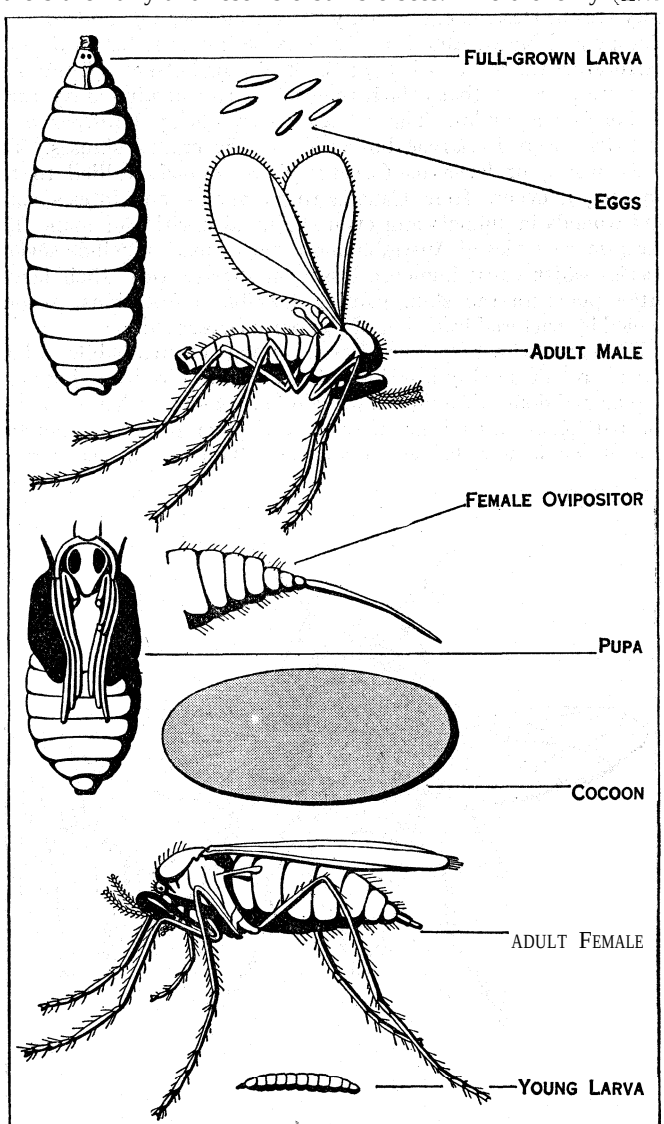
Series II. CYCLORRHAPHA. *Head usually with a fronfal suture with a small hard plate or lunule* (fig. 2) *above it: antennae with*

a dorsal bristle or arista (fig. 1). *Larvae with only a vestige of a head: pupae enclosed in the hardened larval skin or puparium* (fig. 8) *which ruptures by means of a circular fracture.*

In these flies a kind of bladder (the ptilinum) is protruded through the frontal suture in order to force open the puparium, thus allowing the insect to emerge: the bladder is then withdrawn into the head.

Superfamily I. Syrphoidea.—*Frontal suture rudimentary or absent: lunule prerent.*

Three families belong here, the most important being the *Syrphidae*, or hover flies, distinguished by the spurious vein, which crosses the wing without reaching the outer margin, and by the presence of an inner vein running parallel with the apical wing-margin (fig. 9). Many of these flies are banded like wasps, while others are hairy and resemble bumble bees. The drone fly (*Eristalis tenax*) is a familiar example and, like most of the other species, hovers in the air with rapidly vibrating wings. The larvae exhibit diverse habits; many are predaceous upon aphids, etc, while others are scavengers in decaying matter or in the nests of bees and wasps.



BY COURTESY OF THE U.S. DEPARTMENT OF AGRICULTURE

FIG. 5.—THE LIFE HISTORY OF THE ROSE MIDGE (DASYNEURA RHODOPHAGA), A NATIVE OF THE UNITED STATES

Superfamily **II. Muscoidea.**—*Frontal suture and lunule present.*

This is an immense group containing many families, some of which are ill-defined and difficult to separate. The fruit-flies (fam. *Trypaneidae*) usually have prettily marked wings and their larvae attack various fruits, mine leaves (as in the celery fly) or form galls. The gout-fly of barley and the frit-fly of oats are well-known members of the family *Oscinidae*. The *Agromyzidae* include many flies whose larvae mine the leaves and other tissues of plants. The *Muscidae* are a very important family most of whose larvae are scavengers, or prey upon other fly larvae. Well-known examples are the common house-fly, *Mwca domestica* (*q.v.*), the blue-bottles (*Calliphora*) and the Tsetse flies, *Glossina* (*q.v.*). The *Tachinidae* include a great number of bristly flies, bearing a general resemblance to the house-fly. Most of their larvae are internal parasites, especially of caterpillars, and are important natural agents in restraining the abundance of other insect life. The *Oestridae* are seldom found as flies, but their larvae live as parasites of domestic and other animals and are more commonly met with. The Ox warble flies (*Hypoderma*) live as larvae beneath the hide of cattle, and larvae of the bot flies (*Gastrophilus*) are troublesome intestinal parasites of horses *Muscidae* fly parasites have been found in Australia.

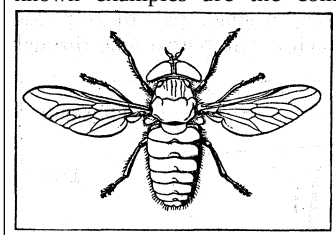


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FIG. 6.—THE BRITISH HORSE-FLY, (TABANUS MACULICORNIS)

Superfamily **III. Hippoboscoidea** (*or* **Pupipara**).—*Frontal suture and lunule present. Flattened leathery flies living parasitically upon mammals and birds: the larvae are retained within the bodies of the females until about to pupate.*

Three families belong here, the most important being the *Hippoboscidae* which include the forest-fly (*Hippobosca equina*) and its allies: the wingless sheep ked or tick (*Melophagus ovinus*) and the genus *Ornithomyia*, which infests birds, are also included. The families *Nycteribiidae* and *Streblidae* include highly aberrant insects found in many parts of the world living on bats. The members of the first-mentioned family are all wingless creatures of spider-like form.

Reproduction and Development.— *The* eggs of flies are of diverse forms and are usually laid in large numbers: thus, a single house-fly in warm countries may deposit over 2,000 eggs during her life. By this insect they are deposited in masses of 100–150, while by *Culex* mosquitoes they are laid in compact groups forming rafts which float on the surface of water. Many other flies deposit their eggs separately wherever there is sufficient food to nourish the larvae. Most flies pass through more than one generation in a season and in the presence of abundant larval food and a high temperature, generation after generation may result. As a rule only a few days are spent in the egg, and in some flies the eggs are retained within the female until they have developed into larvae. In the Tsetse flies and the *Hippoboscoidae* the whole larval life is passed in this manner, and under such circumstances the larvae are nourished on a special secretion provided by the female fly. When fully grown, these larvae are "born" one at a time, at long intervals, and they quickly change into pupae. Dipterous larvae never bear legs (fig. 8), they are commonly elongate and somewhat vermiform in shape, and only in certain families is the head fully formed. In most cases, they bear only an anterior and a posterior pair of spiracles, or the latter pair alone may be present. Owing to their legless condition, fly larvae pass a concealed life in the tissues of plants, burrowing in soil or in decaying refuse and dung, in the bodies of insects or other animals, or in water. Perhaps the most remarkable life is that spent by an American fly whose larvae inhabit petroleum pools in California; certain midge larvae occur in the sea and other dipterous larvae

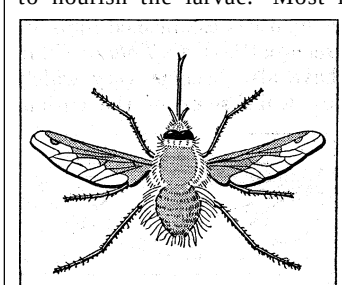

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FIG. 7.—THE BRITISH BEE-FLY (BOMBYLIUS MAJOR), WHICH HAS EXTERNAL RESEMBLANCE TO A BEE

frequent hot springs. With this diversity of habitat there is found a wide range of food preference. Probably more fly larvae feed on decaying organic matter than on anything else; only in a comparatively small number of families do we find exclusively plant-feeders, but a considerable number of families have larvae that are predaceous or parasitic in habit. There are many structural adaptations which fit the larvae to their mode of life. Thus, most of the parasitic forms have only a single pair of spiracles, situated at the caudal extremity. Such larvae bore a hole through

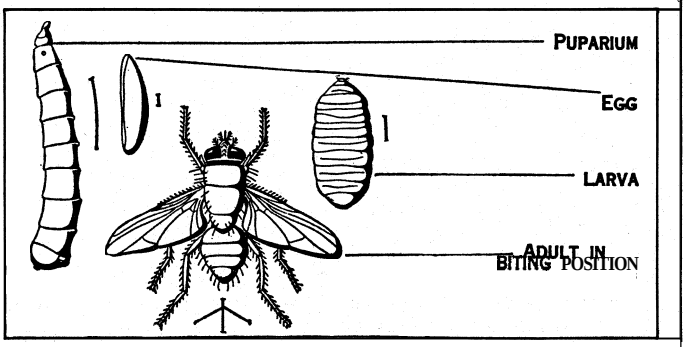

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FIG. 8.— THE EUROPEAN HORN-FLY (HAEMATOBIA SERRATA), A BLOOD-SUCKING FLY BREEDING IN COW DUNG, NOW FOUND IN AMERICA

their host's skin, and insert their tail-end therein in order to breathe the outer air. Some Tachinid larvae work their spiracular extremity into a main trachea of the host insect and breathe the contained air. Mosquito larvae have a similar disposition of the spiracles and keep their tail extremity above the water when taking in air. When about to pupate, fly larvae do not usually form cocoons, the pupae being protected by the medium in which the larvae lived. Among the more primitive groups of flies the pupae are free, but in the Cyclorrhapha the final larval skin persists around the pupa and hardens into a barrel-like puparium (fig. 8).

Geographical Distribution. — It may be said briefly that all the important families of flies are very widely distributed but certain of the smaller groups are more restricted in their range. As a rule the largest and most striking members occur in the tropics where some of the most exaggerated developments of form are also found. Generally, however, the members of a given family have a very constant facies, whether they come from the tropics or from temperate regions. The house-fly is practically cosmopolitan and is found wherever man has established himself; many other flies such as *Lucilia* (green-bottles), *Calliphora* (blow flies) and Stomoxys (stable fly) have also become very widely distributed through human agencies, while some of the curious bat-parasites (Nycteribiidae) have a wide distribution dependent upon that of their hosts. On the other hand, the Tsetse flies (Glossina) are confined to Africa south of the Sahara, and the small family *Acanthomeridae* belongs to tropical America and the West Indies. Flies are also met with in very isolated situations. The curious wingless crane-fly, Chionea, is found in Europe and North America on the surface of snow, while other wingless or semi-wingless Diptera are found on the shores of Kerguelen and other far-distant ocean islands.

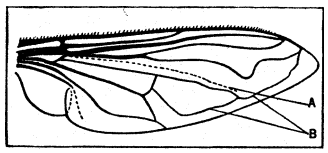


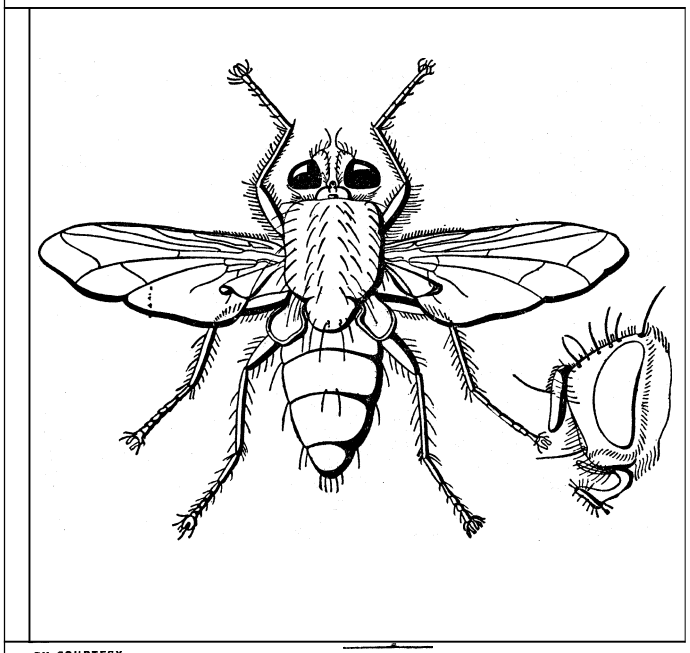
FIG. 9.— WING OF THE DRONE-FLY (ERISTALIS TENAX)
A. Spurious vein; B. branches of median

Geological Distribution. — Diptera is one of the latest orders of insects to appear in geological time and is not met with until the Upper Lias of Europe, where certain Nematocera occur. There appears to be no certain evidence of the existence of the higher families until the Tertiary period. In Baltic amber and in the beds at Florissant, Colorado, numerous fossil flies occur.

Economic Importance. — No order of insects exceeds the Diptera in economic importance. A large number of flies in their larval stages are destructive to cultivated plants. Among the most important of these is the frit fly (Oscinella frit) of Europe and North America, which is destructive to growing oats, while the closely allied gout fly (Cltlorops *taeniopus*) produces swollen deformations of the ear-bearing shoots of barley. Leather-jackets, or larvae of certain crane-flies, cause much damage to the roots of cereals and other crops, while the cabbage root-fly (*Chortophila* brassicae) and the onion fly (*Hylemyia antiqua*) entail losses to growers of those vegetables. The Hessian fly (Mayetiola destructor) is also a severe pest of cereals, both in Europe and North America. Mention must also be made of the Mediterranean fruit-fly (Ceratitis capitata) which attacks almost all kinds of succulent fruits in many tropical and warm regions, including south Europe.

There are other flies whose larvae are injurious to man and domestic animals, and the affections induced by their presence are included under the general term of *myiasis*. Included in this category are the Oestridae, especially the warble flies (Hypoderma) of Europe and North America, which cause immense losses through perforating the hides of cattle; the larvae of bot-flies (*Gastrophilus*) are parasites that attach themselves to the alimentary canal of horses and mules. The related sheep bot-fly (*Oestrus* ovis) troubles sheep, its larvae burrowing in the cranial sinuses. The screw-worm, or larva of Clzrysomyia *macellaria* (allied to the house-fly), occurs from Canada to Patagonia and infests sores and wounds in animals and even the nasal cavities of man. The sheep-maggot flies of Australia and other countries include several species which cause immense losses on sheep farms: their larvae often puncture the skin, causing horrible-infestations, accompanied by bacterial infection of the parts concerned.

There are also numerous flies of blood-sucking habits, whose larvae are not directly injurious. Certain kinds are irritating pests of man and domestic animals, while others of similar habits convey the pathogenic organisms of certain virulent diseases from one animal, or human being, to another. Thus, many species of



BY COURTESY OF THE U.S. DEPARTMENT OF AGRICULTURE

FIG. 10.—TACHINID FLY (TACHINA LARVARUM): FEMALE AND HEAD IN PROFILE, MAGNIFIED

Anopheles mosquitoes are the direct carriers of malaria parasites from man to man. Yellow fever is only contracted when the mosquito Aedes *aegypti* (formerly known as Stegomyia fasciata) sucks the blood of man after having previously fed upon an infected person (fig. 3). Another mosquito, *Culex* fatigans, is a carrier of the filaria worm which induces the disfiguring disease of elephantiasis, while the Tsetse fly (Glossina) is a carrier of the pathogenic organisms (Trypanosomes) of sleeping sickness in man and of nagana in domestic animals. The minute moth flies (fam. Psychodidae) include the blood-sucking genus *Phleboto-*

mus, the members of which are small enough to pass through the meshes of mosquito curtains. Sand-fever or pappataci fever of Southern Europe, North Africa, etc., is transmitted from man to man by a member of this genus. Mention must also be made of the horse-flies (fam. Tabanidae) a species of which (*Tabanus striatus*) has been shown to transmit the pathogenic organism of surra among horses and other animals in the Orient.

The house-fly (*Musca domestica*), although innocent of blood-sucking habits, is a dangerous carrier of the germs of typhoid, infantile diarrhoea and other diseases. Being attracted to excrementous matter, often containing disease germs, the insect's mouth-parts and body thus become contaminated and its faeces include ingested bacilli. Flies infected in this way readily contaminate food which consequently becomes a source of infection to human beings.

The economic importance of Diptera is not confined to their injurious activities: on the other hand, there are many species which are valuable auxiliaries to man. The majority of the predaceous and parasitic forms are beneficial: many larvae of the hover flies (fam. *Syrphidae*), for example, are important agents in reducing the excessive multiplication of plant lice, while the parasitic larvae of the Tachinidae destroy vast numbers of other insects. The rôle of the latter flies as natural controlling agents has led to their practical utilization in several parts of the world. Thus, the sugar cane borer beetle (*Rhabocnemis* obscura) in the Hawaiian Islands is so successfully parasitized by the Tachinid *Ceromasia sphenophori,* introduced into those islands from New Guinea, that it is now largely under control. Other Tachinidae have been introduced from Europe and Japan into North America to assist in the control of the gypsy moth, and quite recently conspicuous success has attended the importation of the fly *Ptychomyia* rentota from Malaysia into Fiji, where it is now parasitizing the caterpillars of the coco-nut moth.

BIBLIOGRAPHY.—A useful handbook of the order is S. W. Williston, Manual of *N.* American Diptera (New Haven, 1908). No general work exists on the British species and the analytical tables given by W. J. Wingate, "A Preliminary List of Durham Diptera" (in Trans. *Nat. Hist. Soc.* Northumb. Durham and Newcastle, ii., 1906) form the only comprehensive paper; references to the more important literature on British Diptera are given by P. H. Grimshaw in *Proc.* Roy. Physical *Soc.* Edin., xx., 1917. The Diptera *Danica* by W. J. Lunbeck, being written in English, will be found of assistance, and also the various fascicles of the Faune de France; the two volumes of British Flies by G. H. Verrall deal exhaustively with the Syrphidae and certain families of the Orthorrhapha. As a modern comprehensive work, E. Lindner, Die *Fliegen der Palaeartischen* Region (Stuttgart) is important. The British species are catalogued by G. H. Verrall, A List of British Diptera (1901), while the Katalog der Palaeartischen Diptera (Budapest, 1903–05) covers a wider field; for the American species J. M. Aldrich, Catalogue of N. American Diptera (Smithsonian *Misc.* Coll. 46, 1905) contains useful bibliographical references.

Among special works on individual subjects, L. *C.* Miall and A. Hammond, The Harlequin *Fly* (1900); C. G. Hewitt, The House Fly (1914); E. E. Austen, British Blood-sucking Flies (1906); E. E. Austen and E. Hegh, Tsetse Flies (1922); H. *C.* Lang, Handbook of British *Mosquitoes* (1920); and two volumes, Flies and Disease, by E. Hindle and G. S. Graham-Smith, respectively, may be mentioned. Among the few books of a popular character are L. C. Miall, Natural History of *Aquatic* Insects (1902) and J. H. Fabre, The Life of *the* Fly (English trans. from Souvenirs *Entomologiques* (1913).

(A. D. I.)

DIPTERAL, the term applied to temples that have a double range of columns in the peristyle, as in the temple of Diana at Ephesus.

DIPTYCH, (1) Two writing-tablets hinged or strung together, used in the Roman empire for letters and documents, especially (made of bronze) for the discharge of time-expired soldiers; also (made of wood or ivory, sometimes of gold or silver, and containing the sender's name and portrait) for a token of a consul's, praetor's or aedile's entrance into office, which he issued to his friends and the public generally (Gr. δίπτυχος, two folding).

(2) In the early Christian Church the names of eminent members and benefactors, living or dead, were recorded on diptychs and read aloud from the ambo or from the altar, thereby securing the prayers of the church; especially. in each church, were the names of those who had been its bishops recorded. The reading of these names during the canon of the mass gave rise to the term *canonization.*

The diptych formed the germ of the elaborate system of festologies, martyrologies and calendars which developed in the church. It went by various names in the early church—mystical tablets, anniversary books, ecclesiastical matriculation registers or books of the living. According to the names inscribed a diptych might be a *diptycha episcoporum, diptycha mortuorum* or diptycha vivorum.

The richly ornamented outsides of consular diptychs sometimes found their way into church treasuries, where they were eventually used as covers for copies of the Gospels, or for liturgical prayers; and their tradition was continued in the use of the diptych or triptych form for works of Christian devotional art.

(R. A. S. M.)

DIR, an independent state in the North-West Frontier Province of India, lying to the north-east of Swat. It commands the greater part of the route between Chitral and the Peshawar frontier. The trouble between the khan of Dir and Umra Khan of Jandol were factors that led up to the Chitral Campaign of 1895. During that expedition the khan made an agreement with the British Government to keep the road to Chitral open in return for a subsidy. Including the Bashkars. an aboriginal tribe allied to the Torwals and Garhuis, who inhabit Panjkora Kohistan, the population is estimated at about 100,000.

DIRCE, in Greek legend, daughter of Helios the sun-god, the second wife of Lycus, king of Thebes. After her death (see ANTIOPE) her body was cast into a spring near Thebes afterwards called by her name.

DIRECT ACTION. The use of trade union action for political ends, a theory imported into Britain from French syndicalist sources. Theoretically, trade union action for political ends can include other methods than the strike, and was originally intended to do so—as, for example, sabotage (*q.v.*) on a large scale, the boycott and use of the trade union label. But none of these, except perhaps the first, can be effective for political pressure, and "direct action" in fact has been confined to the strike. Since the object of direct action is to bring pressure upon the whole political system, only a large strike is of use, and "direct action" invariabiy has meant either a general strike or a strike affecting so many vital industries that it might as well be general.

The idea was taken to England in the early years of the 20th century from the writings of Lagardelle, Griffuelhes and Sorel, the propagandists of the French C.G.T. (Confederation General du Travail, General Confederation of Labour, see SYNDICALISM). Political action of the ordinary kind was opposed by syndicalists, but pressure by trade union action on a Government was held to be permissible, as being the one means which did not injure but strengthened working class solidarity through the trade unions. "Useful laws can be won by direct action," said M. Sorel—a remarkable concession to politicalism—and added that "the determining factor in politics is the poltroonery of the Government."

"Direct action" strikes may be divided into three classes according to their object: (1) Strikes against war, (2) social general strikes, or revolutionary strikes, (3) strikes to force a Government to enact or refrain from enacting certain legislative or administrative measures. Not all general strikes are "direct action": the famous Swedish general strike of 1909, for example, was a purely industrial battle between the employers and employed.

Direct Action Against War.—(I) An actual strike against a war has never yet been effectively carried out, although it has been, of the three, the proposal which has secured most enthusiasm. J. Keir Hardie (Britain) and Edouard Vaillant (France) were most active before the World War in pressing for its adoption by the Socialist International (see INTERNATIONAL), and the motion to this end is generally known by their combined names. It was received with coolness, particularly by the German delegates who were on principle opposed to general strikes and further argued that an explicit statement of this kind would make the German Social Democratic Party illegal. The proposal was eventually referred to the Bureau to ascertain the opinion of the various national parties and their industrial organizations. By August 1914 only a trivial number of these had answered. The

policy of the Socialist International in August 1914 was therefore defined by a compromise resolution drafted by Jean Jaurès, "Should war break out it is their (the Socialist Parties) duty to bring it promptly to an end and with all their energies to use the political and economic crisis created by the war to rouse the masses of the people and to hasten the fall of capitalist domination."

This resolution, literally taken, would have meant revolution as a reply to the declaration of war; it was, however, not applied by any but the Russian section (in March 1917). Since the war the idea of direct action against war has been much more powerfully supported. In this connection the intervention of the "Council of Action" in 1920, whose strike threat removed the possibility of war with Russia, must be cited.

Revolutionary Direct Action:—(a) The "social general strike," has figured on the programmes of many syndicalist groups, especially of the Industrial Workers of the World (*q.v.*). But it has never, in western Europe, actually been called, unless we count upheavals in Spain (and especially Catalonia) before the war, which were directed by political elements. The "Communalist" insurrections of 1873, for example, were accompanied by extensive cessations of work, and in one or two towns juntas of the International were for a short while actually in power. The only important cases of direct action with the object of subverting the whole political constitution of a state took place in Russia in 1905. The first strike took place on Oct. 17 and lasted till Nov. 1; many middle class elements (doctors, lawyers, etc.) in Moscow and St. Petersburg took part and the Government was severely shaken. Extended suffrage and an effective constitution were granted. The Tsarist Government, however, quickly recovered and began to withdraw its concessions and, as a first step, excluded Poland from the provisions of its decree. In reply the St. Petersburg Soviet, or Council of Workers and Peasants' deputies, which had become the recognized revolutionary authority, called a second political general strike (Nov. 14). The Government, however, learning from its previous experience, merely stood aside and allowed the workers to feel the full brunt of the consequent hunger and disorganization. As the Soviet had no troops, nor was able to seduce the garrison, it had to call off the strike on Nov. 19 without securing concessions. On Dec. 20, as a result of the arrest of the whole Soviet, another general strike was called, which in Moscow turned into an insurrection, which was suppressed.

Limited Direct Action:—(3) Direct action to force a Government to take or refrain from a certain measure has, contrary to a general impression, frequently been practised. As a political instrument, however, it has been much discredited by the levity with which the French C.G.T. has called general strikes without adequate preparation. In 1909 and in 1919 complete fiascoes resulted, and since the division of French trade unions into "C.G.T. U.," "C.G.T." and "C.G.T. autonome," general strike calls have been issued with even less reflection, especially by the first-named body (*e.g.* the "Sacco-Vanzetti strike" of 1927).

In earlier years, even in France, considerable victories were achieved. Direct action was taken in 1902–03 to secure the closing of the private Labour exchanges, in 1903 to secure state technical education and in 1905–06 for the eight-hour day. In the first case the success was complete, in the second some advantages were secured and in the third none. In 1902 the Swedish trade unions called a limited three-day general strike to destroy a reactionary Government franchise bill, which was withdrawn. In 1893 a Belgian general strike secured universal suffrage, but general strike calls in 1902 and 1913 for further suffrage reform, though punctually obeyed, secured no advantages. Pre-war experience of limited direct action indicated that the object desired must be one that the Government would rather voluntarily concede than face the dislocation of industry, but at the same time must be sufficiently far-reaching to secure the enthusiasm of the workers and the neutrality of sections of the middle class. Thus the Dutch general strike of 1903 (to secure trade union rights for civil servants) met with scarcely any response.

The most famous cases of limited direct action are, of course, the threatened British general strike of 1925 and the actual general strike of 1926 (see GENERAL STRIKE). An unusual but startlingly successful form of direct action is the strike in defence of a threatened form of Government. In Germany, in 1920, the "Kapp putsch," by which a group of monarchist officers had overturned the Republican government, was expeditiously ended by a general strike called with the assent of the fallen rulers.

See G. D. H. Cole, *The World of* ***Labour*** (1913); R. W. Postgate, *The Bolshevik Theory* (1920); *W.* Mellor, *Direct Action* (1920).

(R. W. P.)

DIRECT ADVERTISING, a type of advertising distinguished by the fact that it is conducted by delivering by post (mail), by person or otherwise the announcement of an advertiser directly to specific individuals instead of by publishing it in a newspaper or magazine to the public in general. Direct advertising commonly takes such forms as catalogues, sales letters, folders, circulars, broadsides, pamphlets, booklets, post-cards, novelty pieces, house organs and package inserts. If any of such material is sent to individuals through the post, such advertising is called direct-mail advertising.

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DIRECTIONAL ANTENNA. An antenna having the property of radiating or receiving radio waves in larger proportion along some directions than others. A directional antenna used as a transmitting antenna Is sometimes called a "directive antenna." If the angle within which the radiation is substantially confined is a small one, the antenna may appropriately be described as a "beam antenna." A type of antenna known as a "coil antenna" consisting of one or more complete turns of wire has directional characteristics and has the property of radiating or receiving radio waves in larger proportion in angular regions 180° apart than in other directions. One type of directional receiving antenna used particularly at low radio frequencies consists of a comparatively low horizontal aerial having a physical length of the same order of magnitude as that of the signaling waves to be received. Such an antenna is known as a "wave antenna."

DIRECTOIRE STYLE, a loose term designating, in architecture, furniture, etc., the transitional work between the restrained classicism of the Louis XVI. style (see LOUIS STYLES) and the Roman heaviness of the Empire style (*q.v.*); so-called from the French Directory which was in power 1795–99. The style is characterized by a gradual loss of the delicacy and grace of Louis XVI. forms and a growing enthusiasm for purely Roman motives.

DIRECTOR, NAVAL: see GUNNERY, NAVAL.

DIRECTORS: see COMPANY LAW.

DIRECTORY, literally, that which guides or directs, and hence a book giving directions for public worship, *e.g.*, the *directorium* or *ordo* of the Roman Church. The term now usually signifies a book containing the names, addresses and occupations, etc., of the inhabitants of a town or district, a list of the users of a telephone system, or of the members of a particular profession or trade. The name Directoire or Directory was given to the body which held the executive power in France from Oct. 1795 until Nov. 1799. (See FRENCH REVOLUTION.)

DIRGE, a song sung at funerals or in commemoration of the dead; derived from the antiphon, Dirige, *Domine,* Deus *meus,* in conspectu tuo *viam meam* (adapted from Ps. v. 9), of the opening psalm in matins for the dead in the Roman Catholic Church.

DIRICHLET, PETER GUSTAV LEJEUNE (1805–1859), German mathematician, was born at Diiren on Feb. 13, 1805. He was educated at Cologne, and later held professorships at Breslau and Berlin, and in 1855 he succeeded Gauss at Göttingen. He became a member of the Berlin Academy in 1832 and a foreign member of the Paris academy in 1854. Dirichlet's chief work was on the theory of numbers; he was the first to lecture on this subject at a German university. His researches on complex numbers were published in the *Berichte* der Berliner Akademie in 1841, 1842 and 1846; they were edited by Dedekind in 1863. Dirichlet also wrote on the theory of potential, on equations of the

fifth degree and on definite integrals. In addition he wrote a number of memoirs on the work of Gauss, in order to make it more intelligible, but he did not live long enough to complete this work. Dirichlet died at Gottingen on May 5, 1859.

DIRIGIBLE: see AIRSHIP.

DIRIGIBLE BALLOON: see AIRSHIP.

DIRK, a dagger, particularly the heavy dagger carried by the Highlanders of Scotland. The dirk as worn in full Highland costume is an elaborately ornamented weapon, with cairngorms or other stones set in the head of the handle, which has no guard. Inserted in the sheath there may be two small knives. The dirk, in the shape of a straight blade, with a small guard, some 18in. long, is worn by midshipmen in the British navy. The origin of the word is doubtful. The earlier forms were dork and durk, and the spelling dirk, adopted by Johnson, represents the pronunciation of the second form. The name seems to have been early applied to the daggers of the Highlanders, but the Gaelic word is biodag, and the Irish *duirc,* often stated to be the origin, is only an adaptation of the English word. It may be a corruption of the German *Dolch,* a dagger. The suggestion that it is an application of the Christian name "Dirk,.' the short form of "Dieterich," is not borne out, according to the New *English* Dictionary, by any use of this name for a dagger, and is further disproved by the earlier English spelling. In Highland full dress, the skean *dhu,* a small dirk, is carried in the stocking.

DIRSCHAU: see TCZEW.

DISABILITY, a term used in law to denote an incapacity in certain persons or classes of persons for the full enjoyment of duties or privileges. Thus, persons under age, insane persons, convicted felons are under disability to do certain legal acts. This disability may be absolute or relative. In the latter case (*e.g.,* drunken or insane persons) the incapable person cannot rely on his condition if it was unknown to his co-contractor at the time the alleged obligation was contracted.

D'ISALGUIER, ANSELME (*fl.* 1380–1420), a French traveller, as far as is known the first European to see the river Niger. He was a nobleman of Languedoc and had a château near Toulouse. He was fond of travel and natural history and was a man of letters. He had made various journeys before in 1402 he set out on his principal expedition, which brought him in 1405 to Gao, then a flourishing city on the Niger 400m. below Timbuktu. There he married Salam Casais, a Songhai princess—a Muslim negress. In 1413 he returned to Toulouse, having crossed the Sahara to Tunisia and in the Mediterranean narrowly escaped capture by pirates. With him he brought his wife, a daughter (Marthe) six years old and half a dozen attendants. One of these attendants was skilled in the knowledge of herbs and in 1419 cured the Dauphin (afterwards Charles VII. of France) of an illness. D'Isalguier wrote an account of his travels and produced a dictionary in Arabic, Tuareg and Songhai, with Latin and French equivalents. These books are now lost. They were in the library of the Jesuits' college at Lyons at the end of the 17th century, where they were consulted by the Abbé Tricaud, who refers to them in his *Essais* de *littérature* pour la connaissance des *livres* (Paris, 1702) though the Abbé shows no interest in the light d'Isalguier's narrative must have thrown on a puzzling problem of African geography—the course of the great river Niger. Memories of d'Isalguier and his black household—he had a grandson known as "The Moor"—long lingered at Toulouse and in a still existing 15th-century ms., *Historie* chronologique des *Parlements* de Languedoc, written by a suitor for Marthe's hand, an account of d'Isalguier's travels is inserted.

See Ch. *de* la Roncière, La *Découverte de l'Afrique* du *Moyen Age,* vol. iii. (Cairo, 1927).

DISARMAMENT. The word disarmament is used to cover two distinct conceptions: first, the complete abolition of all military armament, desired by a certain school of advanced thinkers; second, the reduction and limitation of national armaments by a general international agreement accepted by all, or almost all, States. In the former sense of the word, disarmament cannot yet be said to be practical politics. In the second sense it is one of the great problems of the day.

Partial Disarmament by Treaty.—Some attempts to achieve a concrete reduction and limitation of armaments were made before the World War of 1914–18. In isolated instances, where agreements were made between countries geographically remote from the rest of the world, a measure of success was obtained. Thus some South American republics reduced their armaments in accordance with arrangements made by treaty, while in a number of cases two countries agreed to the demilitarization and sometimes to the actual neutralization of the zone surrounding the frontier between them. The most striking example of disarmament by friendly agreement is that of the 3,000-m. land frontier between Canada and the United States. which has been demilitarized since 1818. Another is the frontier between Norway and Sweden, which was neutralized when the two countries separated in 1905. But whenever any attempt was made to reach a general agreement on disarmament, as for example, at The Hague Conferences (*q.v.*) of 1899 and 1907, failure was immediate and complete, and in the 20 years preceding 1914 all the more powerful governments spent an ever-increasing proportion of their national wealth and resources in building up greater fleets and armies.

Since the War great armaments, almost on the 1914 scale, have been maintained, but nevertheless disarmament in the second sense has become a matter of practical politics.

Disarmament under the Peace Treaties of 1919.—In the first place, the principle of disarmament was effectively applied to the States defeated in the War. Under the treaties of peace, Germany, Austria, Hungary and Bulgaria accepted an immense reduction and a rigid limitation of the armed forces which they respectively maintained. The treaty clauses relating to these armed forces were worked out in the greatest possible detail and laid down the number of men, the equipment, transport and armament which each of the four States was allowed to maintain, Germany's army being fixed at a total of 100,000 long-term volunteers and all heavy artillery, tanks, aircraft, poison gas, etc., being absolutely forbidden.

Although it was one-sided, this disarmament of the former enemy powers was nevertheless a considerable factor in the general post-War situation and in itself did much to make general disarmament practically important. For, apart from its obvious political effect, the preamble to Part V. of the Treaty of Versailles contains an express obligation: "In order to render possible the initiation of a general limitation of the armaments of all nations, Germany undertakes strictly to observe the military, naval and air clauses which follow."

Provisions of the Covenant.—In the second place, specific obligations with regard to disarmament were imposed upon all the members of the League of Nations by Article 8 of the Covenant. In this article, recognized by the authors of the Covenant to be fundamental to the successful working of the League, the members "recognize that the maintenance of peace requires the reduction of national armaments to the lowest point consistent with national safety and the enforcement by common action of international obligations." The article goes on to provide that the Council of the League "shall formulate plans for such reduction for the consideration and action of the several governments." To this must also be added the final act of the Conference of Locarno in 1925, in which new undertakings to carry out Article 8 were made by the Great Powers there assembled.

Third, these obligations have been supported by the personal pledges of statesmen of all parties and countries. Thus among British statesmen Lord Grey, Lord Cecil, Mr. Macdonald, Mr. Baldwin, Sir Austen Chamberlain and others have declared that both in the interests of the British empire and of the world at large it is necessary to secure a general and mutual reduction of armaments without delay. Lord Grey summed up their arguments in a single sentence by saying that "if civilization cannot destroy armaments, armaments will destroy civilization."

Article 8 of the Covenant is an undertaking by the members of the League to co-operate in preparing a plan of disarmament and in making the treaty required to bring that plan into effect.

In the fulfilment of this task the principal rôle is assigned to the council, which has first to prepare a plan for the "consideration and action of the several governments," and which is subsequently to control its observance.

The Temporary Mixed Commission.— It was not the council, however, but the Assembly of the League which took the first important step towards executing Article 8. At the first Assembly in 1920 a resolution was adopted calling for the creation (by the council) of a special committee of experts of various kinds to study disarmament and to draft a scheme. On this committee, the "Temporary Mixed Commission," there were appointed military, naval, air, economic and financial experts, and to them were added also some persons of political experience. It first met in 1921 and early in its discussions Lord Esher produced a scheme, restricted to the limitation of the land-armaments of Europe.

But the European members of the Commission almost unanimously rejected this scheme. They contended that reduction of armaments could not come alone but must be accompanied by arrangements, supplementary to those of the Covenant, for ensuring the security of members of the League against aggressive attack. This conclusion was summarized in four resolutions drafted by Lord Robert (now Viscount) Cecil and adopted by the Temporary Mixed Commission and subsequently by the third Assembly in 1922, the gist of which was that disarmament to be effective must be general, and that "security" and disarmament must go together.

Security Negotiations.— On the foundation of these four important resolutions the Temporary Mixed Commission proceeded in the following year to draw up the Draft Treaty of Mutual Assistance. The purpose of this draft treaty was to provide a system of general security which would permit the calling of a disarmament conference. Disarmament was intimately linked to the general scheme by the provision that none of its undertakings of mutual guarantee would come into effect until a plan of disarmament had been actually adopted and carried out. The treaty of mutual assistance was not, in fact, adopted by the succeeding Assembly, but the fifth Assembly in 1924 elaborated the Geneva protocol, which was founded on the same principles and which again was conditional upon disarmament. (See SECURITY.)

The Geneva protocol, in its turn, failed to secure sufficient acceptance by leading governments to bring it into force, and instead, the method of regional pacts was attempted in the Locarno treaties. This again failed to produce a general sense of security and so at the eighth Assembly in 1927 the whole question of security as the basis for disarmament was again raised, and the Assembly unanimously adopted resolutions which restated the two fundamental principles upon which the earlier negotiations of the Temporary Mixed Commission and the fifth Assembly had been conducted. These principles were: First, that "every state should be sure of not having to provide unaided for its security by means of its own armaments, but should be able to rely also on the organized collective action of the League of Nations." Second, that "there should be systematic preparation of the machinery to be employed by the organs of the League with a view to enabling the members of the League to perform their obligations" by joint action against an aggressor.

Thus the whole course of the discussions and negotiations on the subject between 1919 and 1927 proved conclusively the essential connexion between security and disarmament. On the problem of security those years witnessed much progress, though generally acceptable results were not definitely obtained. In other respects, however, less progress was made. Quite apart from the problem of security, disarmament itself in its technical and technical-political aspects is an extremely intricate matter. It can hardly be expected that other governments will accept freely the simple but drastic system imposed on Germany and her allies, desirable though it might be that they should do so.

Technical Difficulties.— But the technical difficulties of a more elastic system are great. The success of the Washington naval conference *(see* WASHINGTON TREATY) did not give any indication of the lines on which they could be solved, for not only is naval disarmament infinitely simpler than military and air disarmament, but even among naval units the Washington treaties dealt with only two categories of fighting ships.

The failure of the conference convened by President Coolidge in 1927, on the other hand, showed how greatly technical difficulties may complicate the political. problem of finding agreement about armaments, unless adequate technical solutions for them have been prepared and adopted in advance. Happily, even before the Coolidge conference met, the sixth Assembly of the League in 1925 recognized the importance of this side of the matter and decided that its study should be begun in order that, when security had been obtained, the work of the disarmament conference might be rapidly carried through. On the proposal of the sixth Assembly, the council set up the so-called preparatory commission, which through two technical sub-committees (one military and one economic) made an exhaustive study of all the technical problems involved in a general disarmament treaty. On the basis of the reports of these sub-committees the preparatory commission began, March 1927, to draw up a draft general treaty into which the Disarmament Conference could fit the scales of armament on which it might agree. At its session in March 1927 the commission made some progress with its draft treaty, agreeing on methods for limitation of man-power in armies, navies and air forces, and for the limitation of military aircraft. It could reach no agreement on naval questions, however, and its draft scheme is still most imperfect. The eighth Assembly, however, urged that its work should be rapidly completed, and perhaps under this stimulus definite results may be obtained. The prospect of definite results has been strengthened by the movement of opinion created by the resignation of Lord Cecil from the British Cabinet in Aug. 1927. The ground for his resignation was that the British government might have avoided the failure of the Coolidge conference had they attached sufficient weight to the making of a naval agreement with the United States. It is also necessary to mention the proposals of the U.S.S.R. for total disarmament within four years put forward in the Preparatory Commission in Nov. 1927 by the Russian delegate, Litvinoff. Litvinoff offered on behalf of his government to accept any reasonable compromise that would mean a real reduction of armament. In conclusion, it may be said that the negotiations on disarmament which have so far taken place have been based on the following generally accepted principles:

1.—That general security is a necessary condition of general disarmament;

2.—That the organization of a system of "sanctions" through League of Nations machinery is the only road to security;

3.—That to this end the "gap" in the Covenant, by which recourse to aggressive war is in certain cases legitimate, must be abolished, and aggressive war in all cases made an international crime;

4.—That no scheme of disarmament can succeed unless it is accepted by all or almost all governments and unless it covers every kind of weapon and military preparation;

5.—That only through the permanent machinery of the League can the necessary preliminary preparation for a disarmament conference be carried out;

6.—That no plan for general disarmament will give confidence to governments and peoples unless it is supported by an international system of control and supervision, which again can only be organized through the machinery of the League; and

7.—That in a first disarmament treaty only small reductions will probably be made, but that there must be successive subsequent revisions and reductions at regular intervals of time.

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DISCANT: see **DESCANT.**

DISCHARGE, a word meaning relief from a load or burden, hence applied to the unloading of a ship, the firing of a weapon, the passage of electricity from an electrified body, the issue from a wound, etc. From the sense of relief from an obligation, "dis-

charge" is also applied to the release of a soldier or sailor from military or naval service, or of the crew of a merchant vessel, or to dismissal from an office or situation. In law, it is used of a document or other evidence that can be accepted as proof of the release from an obligation, of the legal release of a person in custody on a criminal charge, and of the legal release of a bankrupt from debts provable in the bankruptcy with certain exceptions. It is also applied to the reversal of certain judicial orders. In divorce, where the order *nisi* is not made absolute, it is said to be discharged.

DISCHARGING ARCH, in architecture, an arch (*q.v.*) built over a lintel or square-headed opening, so as to take the weight of the wall above off the horizontal head of the opening. In the great pyramid of Giza (c. 3000 B.C.), the entrance passage is roofed with slabs of stone, but above these, great blocks, set leaning against each other at the top so as to leave a triangular space beneath, form what is probably the earliest discharging arch extant. Discharging arches of circular or segmental shape are frequent in Roman buildings, and by the time of Diocletian, the custom of decorating these arches with an architrave had arisen. This usage, which apparently was of Syrian origin, became rather common during a considerable part of the Byzantine period of architecture.

DISCIPLES OF CHRIST or **CHRISTIANS,** an American Protestant denomination, founded by Thomas Campbell, his son Alexander Campbell (*q.v.*) and Barton Warren Stone (1772–1844). Stone had been a Presbyterian minister prominent in the Kentucky revival of 1801, but had revolted because the synod had condemned Richard McNemar, one of his colleagues, for preaching (as Stone had done) counter to the Westminster Confession, on faith and the work of the Holy Spirit in conversion. He had organized the Springfield Presbytery, but in 1804 with his five fellow ministers signed "The Last Will and Testament of the Springfield Presbytery," giving up that name and calling themselves "Christians." Like Stone, Alexander Campbell had adopted (in 1812) immersion, and, like him, his two great desires were for Christian unity and the restoration of the ancient order of things. But the Campbellite doctrines differed widely from the hyper-Calvinism of the Baptists whom they had joined in 1813, especially on the points on which Stone had quarrelled with the Presbyterians; and after various local breaks in 1825–30 the Reformers were practically all ruled out of the Baptist communion (1832). The Campbells gradually lost sight of Christian unity, owing to the unfortunate experience with the Baptists and to the tone taken by those clergymen who had met them in debates; and for the sake of Christian union it was peculiarly fortunate that in Jan. 1832 at Lexington, Kentucky, the followers of the Campbells and those of Stone (who had stressed union more than primitive Christianity) united. Campbell objected to the name "Christians" as sectarianized by Stone, but "Disciples" never drove the name out of use.

During the Civil War the denomination escaped an actual scission by following the neutral views of Campbell, who opposed slavery, war and abolition. In 1849 the American Christian Missionary Society was formed; it was immediately attacked as a "human innovation," unwarranted by the New Testament, by literalists led in later years by Benjamin Franklin (secretary of the missionary society in 1857), who opposed all church music also. Isaac Errett (1820–88) was the most prominent leader of the progressive party, which was considered corrupt and worldly by the literalists, many of whom, in spite of his strenuous efforts, broke off from the main body, especially in that territory embraced by the states of Indiana, Kentucky, Tennessee, Arkansas and Texas.

The main body appointed in 1890 a standing committee on Christian union; their aim was not for absorption, as was clearly shown by their answer in 1887 to overtures from the Protestant Episcopal Church regarding Christian unity. The credal position of the Disciples is simple: great stress is put upon the phrase "the Christ, the Son of the living God," and upon the recognition by Jesus of this confession as the foundation of His church; agreement with Baptists is only as to immersion, which is considered "the primitive confession of Christ and a gracious token of salvation" and as being "for the remission of sins"; they deny the authority over Christians of the Old Covenant, and Alexander Campbell held this view so forcibly that he was accused by Baptists of "throwing away the Old Testament." The Lord's Supper is celebrated every Sunday, the bread being broken by the communicants. The Disciples are not Unitarian, but they urge the use of simple New Testament phraseology as to the Godhead. The church government of the Disciples of Christ is congregational in character.

See Errett Gate's *History of the Disciples of Christ* (N.Y. 1905), in "The Story of the Churches" series, and his *Early Relation and Separation of Baptists and Disciples* (Chicago, 1904); B. B. Tyler's *History of the Disciples of Christ* in vol. xii. of "The American Church History Series" (N.Y., 1894); and article "Disciples of Christ" by H. L. Willett in Hastings, *Encyclopaedia of Religion and Ethics,* vol. iv.

(P. AT.)

DISCLAIMER, a renunciation or disavowal. In law the term is used more particularly in the following senses: (1) in the law of landlord and tenant, the direct repudiation of that relation by the tenant setting up a distinct title either in himself or some third party; (2) in the law of bankruptcy, where the trustee may "disclaim" onerous property (see BANKRUPTCY); (3) in the law of trusts, the refusal or renunciation of the office or duties of a trustee; (4) in the law of patents, the renunciation, by amendment of specifications, of a portion of an inventor's claim to protection.

DISCONTINUANCE: see PRACTICE AND PROCEDURE.

DISCONTO-GESELLSCHAFT, BERLIN, established in 1851 as a cooperative credit-association, carries on since 1856 in the form of a Commandit joint stock company all lines of commercial and issuing banking business. By its promoting and issue activities its name is prominently connected with the home and colonial economic development. Numerous important German and foreign loans have in the past been floated under its auspices.

Since 1901 the Disconto-Gesellschaft extended its technical organisations beyond Berlin throughout Germany. The taking over of the Norddeutsche Bank in Hamburg and of the A. Schaaffhausen'scher Bankverein in Cologne carried its sphere of business also to oversea countries and the Rhenish Westphalian district. Since the absorption of the Stahl and Federer A.G. in Stuttgart (Wurttemberg) and the Bank fur Thuringen vorm. B. M. Strupp in Meiningen (Thuringen) the Disconto-Gesellschaft owns 127 branches and branch offices covering the whole of Germany. Participations are furthermore held in the Süddeutsche Disconto-Gesellschaft A.G., Mannheim, and in the banking firm of L. Pfeiffer, Cassel.

The expansion of the business of the Disconto-Gesellschaft led to the establishment of subsidiary banks abroad and participation in other European banks: the Handelmaatschappij H. Albert de Bary and Company in Amsterdam, Kreditbank in Sofia and the bank's interest in the banking firm of Ephrussi and Company in Vienna. In oversea countries the Disconto-Gesellschaft founded in conjunction with the Norddeutsche Bank in Hamburg the Brasilianische Bank für Deutschland, now Banco Brasileiro Allemao in Rio de Janeiro with branches in Sao Paulo, Santos, Porto Alegre, Recife, Bahia, further the Banco de Chile y Alemania in Valparaiso with branches in Santiago, Concepcion, Temuco, and Valdivia. In addition to the foregoing the bank also took an active and leading part in the foundation of the Deutsche-Asiatische Bank in Shanghai. In Oct. 1929 a merger was arranged with the Deutsche Bank (*q.v.*), the capital and reserves of the Disconto-Gesellschaft then standing at about 186,000,000 Reichsmark.

(H. Fu.)

DISCOUNT AND DISCOUNT HOUSES. In trade a deduction from the price of an article, allowed to a buyer who pays cash, is called a discount. In the money market, the word usually means the rate allowed to the buyer for cash of a bill of exchange due at some future date. For example, if the rate of discount for six months' bills is 4% per annum, the buyer on Jan. 1 of a bill for £1,000 due on July 1 will give £980 for it. The market rate of discount is, to a great extent, regulated by the rate officially

announced by the Bank of England, or by the central bank in other financial capitals.

Discount houses are companies and firms which specialize on the business of buying and selling the bills drawn on English banks, accepting houses, merchants and others. They make their profit by working with a capital which is small in relation to their total commitments and borrowing large sums from banks and other lenders, employing these sums in the purchase of bills which they either hold until maturity, or, more usually, sell later to the banks or to any other buyer who wants a short and liquid investment. Weir rate of profit thus depends on the difference between the rate of interest that they have to pay for the money that they borrow and the rate of discount that they are able to charge to those from whom they buy bills, of which they normally have a large stock in hand. The balance sheet of the National Discount Company, dated Dec. 31, 1927, showed bills discounted—that is, bought—£50,000,000 and bills rediscounted—that is, resold—£24,000,000, leaving a net holding of £26,000,000. It also held £5,000,000 in investments and loans and more than £500,000 in cash. Its paid-up capital was only £1,000,000 and it had borrowed over £29,000,000 in the form of "deposits and sundry balances." Before the war, the bills handled in the money market consisted almost entirely of those created in the course of trade and private financial operations, but now owing to the enormously increased amount of Treasury bills outstanding, and also to the increased extent to which trade is financed by bank advances, an important part of the business of the discount houses is in Treasury bills issued weekly by tender. In other centres, where monetary specialization has not been carried so far as in London, discount companies and firms are generally non-existent or unimportant; but they have been successfully developed in New York, since the establishment of the Federal Reserve system. (See MONEY MARKET.)

DISCOVERY: see PRACTICE AND PROCEDURE.

DISCOVERIES AND INVENTIONS: see INVENTIONS AND DISCOVERIES.

DISCRIMINATION, SENSIBLE, the awareness by a person or an animal of a difference between two very similar sensations or sensory excitations. The capacity for sensible discrimination is called differential sensitivity. The sensory difference discriminated may be one of quality, as the hue of colours or the pitch of tones, or of the intensity, extent or, less often, duration or some other aspect of the sensory impression. The just noticeable difference, often called the "j.n.d.," between the stimuli of two sensations, when statistically determined by the methods of psychophysics (*q.v.*), is the differential threshold (limen). The corresponding sensed difference was thought by Fechner to constitute a unit for the measurement of sensation, but scientific psychology has rejected this view on the ground that all j.n.d.'s cannot be proved to be equal. It was believed for a time that a sensory scale varied by discrete steps, each quantum of sensation being a j.n.d., but it is now thought that sensation is a continuous function of its stimulus for the following reason. If we begin with a tonal pitch corresponding to 435 vibrations per second, we may have to increase the frequency to 435.5 before a difference in pitch is sensed. In such a case the differential limen is 0·5 vibrations per second. However, if we begin with a stimulus of 435·3 then the sensed difference would be expected to occur at 435.8. It thus appears that there are no fixed critical points in the tonal scale, and the conclusion is that there is an infinite number of sensations in the scale, but that two very similar sensations given together can not be discriminated from each other unless they differ by an amount that is, more often than not, greater than the limen.

On the side of quality there has been a great deal of interest in determining how many different sensations can be discriminated from one another under favourable conditions. Approximate results indicate that the normal human eye can discriminate about 150 hues in the psychological spectrum from red to yellow to green to blue and back, through the purples, to red again; that it can discriminate about 800 greys between black and white; and that, for the intermediate illuminations, there are perhaps an odd hundred discriminable saturations in the fading out of the best saturated colours into grey. Light and dark colours give fewer discriminable degrees of saturation, but the total tale of discriminably different visual sensations is probably as great as two million. Between the highest and the lowest audible tone there would seem to be about 10,000 discriminably different pitches, of which music seldom uses more than 400.

The iacts of the sensible discrimination of intensity are the basis of Weber's Law, which states that the least discriminable difference, in terms of the stimulus, is always proportional to the total magnitude of the stimulus. Thus it is possible, in as far as Weber's Law holds, to state the differential intensive limen as a fraction. For illumination it is thought to be about $\frac{1}{100}$, that is, to say, a sensed difference is created when the illumination is increased by & of its amount; *e.g.,* from 100 to 101. For the sensible discrimination of lifted weights the fraction is about $\frac{1}{40}$; for light pressure upon the skin it is about $\frac{1}{20}$; for tone it is about $\frac{1}{10}$ and for intensity of smell of the order of $\frac{1}{4}$ to $\frac{1}{3}$.

(E. G. BOR.)

DISCUS THROWING. The art of throwing from a circle 8ft. 2½in. diameter to the greatest distance, and so that it falls within a 90° sector marked on the ground, an implement weighing 4 lb. 6.4 oz. known as a discus. The sport was common in the days of Homer, who mentions it repeatedly. It formed part of the pentathlon, or quintuple games, in the ancient Olympic games and is fully described by Statius (*Thebais,* 646–721). Judging by specimens found by excavators, the ancient discus was a circular plate of stone, later of metal, some 8in. or gin. in diameter, and weighed from 4 lb. to 5 lb., although one of bronze, probably a trophy, preserved in the British Museum weighs over 8 pounds. To the Greeks discus throwing was a splendid builder-up.

Throwing the discus was introduced as an event in modern athletics at the revived Olympic games first held at Athens in 1896, and in the same year was instituted as a Swedish championship. The Olympic victor at Athens was Garrett, U.S.A., 95ft. 7½in., and the first Swedish champion, Helgesson, 97ft. 5½in. Since then throwing the discus has become a recognized event in the athletic championship meetings of all nations. America adopted the event in 1897, champion C. H. Henneman, 118ft. gin., and England in 1911, champion W. E. B. Henderson, 106ft. 11in. Since the war the records have improved considerably. World's record, Willi Schröder, Germany, Magdeburg, Germany, April 28, 1935, 174ft. 2½in.; Olympic record, Kenneth Carpenter, U.S.A., Berlin, Germany, August 5, 1936, 165ft. 5·39in.; U.S.A. record, Paul Jessup, Pittsburgh, Pa., August 23, 1930, 160ft. 8⅞in.; English record, D. R. Bell, Achilles Club, 1936, 142ft. 10½in. The recent advance in records is due to an increasing number of competitors employing improved technique. The Olympic contests which set the world's standard and enable us to trace the progress that has been made, have resulted as follow:—1896, Garrett (U.S.A.), 95ft. 7½in.; 1900, Bauer (Hungary), 118ft. 2$\frac{9}{10}$in.; 1904, M. Sheridan (U.S.A.), 128ft. 10½in.; 1908, M. Sheridan (U.S.A.), 134ft. 2in.; 1912, A. R. Taipale (Finland), 148ft. 1in.; 1920, E. Nicklander (Finland), 146ft. 7$\frac{3}{10}$in.; 1924, C. Houser (U.S.A.), 151ft. 5$\frac{1}{16}$in.; 1928, C. Houser (U.S.A.), 155ft. gin., 1932, J. Anderson (U.S.A.), 162ft. 4⅞in.; 1936, Kenneth Carpenter (U.S.A.), 165ft. 5·39in.

A great deal of discussion has taken place as to the method of throwing the discus employed by the ancient Greeks. Theories have been based upon the description of the sport as given by Statius and upon a reconstruction of Myron's statue of a discus thrower (*discobolos*) which may be seen in the British Museum. This statue portrays the thrower in the act of hurling the missile, and Norman Gardiner holds that a wrong attitude has been adopted by the restorer. Dr. R. Tait McKenzie calls the "Greek style," insisted upon at the first modern Olympic games, "absurd and ridiculous," and says it "could never have been in use among the ancient Greeks" (see Exercise in *Education* and Medicine, 1924). F. A. M. Webster (see *Athletics* of To-Day), however, contends that the reconstruction is substantially correct and that the discus thrower is correctly posed in the attitude from which commences the turning movement that precedes the delivery of

the missile in all modern forms of discus throwing.

The so-called "Greek style" of discus throwing was included at the Athenian Celebration, 1906 (Jaervinen, Finland, 115ft. 4in.), and at the London Olympiad, 1908 (Sheridan, U.S.A., 124ft. 8in.), but without any great success, so that the event has since been abandoned. In the Greek style the thrower places himself upon an inclined pedestal, stretches the arms above the head with the discus held between the hands. He then turns the trunk to the right, bends the body at the waist, allows the right hand holding the discus to swing up behind and places the left hand on the right knee, as in Myron's *Discobolos*. From this position the thrower straightens out his body, hurls the discus forward and leaves the pedestal in the instant of making the throw.

The modern style, which has now entirely superseded the Greek style, provides a more graceiul and a more natural series of movements. The essence of this style is that the discus must be slung out and not really thrown at all; the athlete's difficulty lies in controlling an implement which can be retained under and against the hand and wrist only by centrifugal force and such slight pressure as the tips of the fingers are able to exert.

The discus, as used in modern competitions, is composed of a smooth metal rim, permanently attached to a wood body, brass plates set flush into the sides of the wood body, and, in the exact centre of the discus, a means for securing the correct weight, which must be not less than 4 lb. 6.4 oz. The brass plates, circular in form, may not be less than zin. nor more than $2\frac{1}{2}$in. in diameter. The sides taper in a straight line from the beginning of the curve of the rim to a line at a distance of 1in. from the centre of the discus. The largest dimension comprises a circle not less than $8\frac{5}{8}$in., the thickness through the centre is not less than $1\frac{3}{4}$in., and $\frac{1}{4}$in. from the edge, not less than $\frac{1}{2}$in.

Method **of** Throwing the Discus.—Preparatory to making a throw the athlete holds the discus in the right (best) hand so that the edge rests against the joints of the fingers nearest to the tips. He takes up his position in the rear half of an 8ft. $2\frac{1}{2}$in. circle with the feet about 18in. apart and his left side turned in the direction in which the throw is to be made. The discus is swung up above the head, where it is met and supported by the fingers of the left hand. The right arm next swings back until it reaches a point behind and higher than the right shoulder. From this position, after two or three preliminary swings have been made and the right hand is at its highest point, the athlete commences a $1\frac{1}{4}$ turn in a kind of dancing time with the right arm hanging loosely down. The first pivotal movement is upon the left foot; when a half turn has been made the weight is transferred to the right foot, upon which the turning movement continues. As the left foot again takes the ground, at the front edge of the circle, the right leg begins to push the body forward and there is a violent turn of the right shoulder, but the arm is still kept trailing behind and the actual throwing movement does not commence until the right arm is well off the right shoulder. The left leg forms a point of resistance as the throw is made and the discus departs through the air mounting upwards but flying gyroscopically flat. It is a curious phenomenon that a well-thrown discus will mount tilted to the right until it reaches the highest point in the trajectory, thereafter travelling perfectly flat for a short distance, before beginning to fall earthwards tilted to the left.

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(F. A. M. W.)

DISINFECTANTS, substances employed to neutralize the action of pathogenic organisms and prevent the spread of infectious disease. Putting on one side sunlight, perhaps the best of all disinfectants, these agents may be divided into three classes:—1st, volatile or vaporizable substances, which attack impurities in the air; 2nd, chemical agents, for acting on the diseased body or on the infectious discharges therefrom; and 3rd, the physical agencies of heat and cold. Among the first class, formic aldehyde takes foremost place. It acts more rapidly than equal quantities of sulphurous acid, and does not affect colours. It is non-poisonous, though irritating to the eyes and throat. With the exception of iron and steel it does not attack metals. For destroying vermin sulphurous acid is more powerful than formic aldehyde. Camphor and some volatile oils have been employed as air disinfectants, but mask and do not destroy bad odours. In the second class all antiseptic substances may be reckoned; but the substances chiefly employed are oxidizing agents, as potassium permanganate ("Condy's fluid") and solutions of the so-called "chlorides of lime," soda and potash, with the chlorides of aluminium and zinc, soluble sulphates and sulphites, solutions of sulphurous acid, and the tar products—carbolic, cresylic and salicylic acids. Of the physical agents cold is not practically available by artificial means; heat is used for purifying and disinfecting clothes, bedding and textile substances generally, a temperature of about 250° being employed in the form of steam under pressure. For the thorough disinfection of a sick-room all three classes of disinfectants may be required.

DISINTEGRATOR. A term rather loosely used, but generally applied to a machine which breaks up and reduces materials by impact, as distinct from one which grinds between rollers, or amongst a mass of loose balls in a rotating drum. There are two

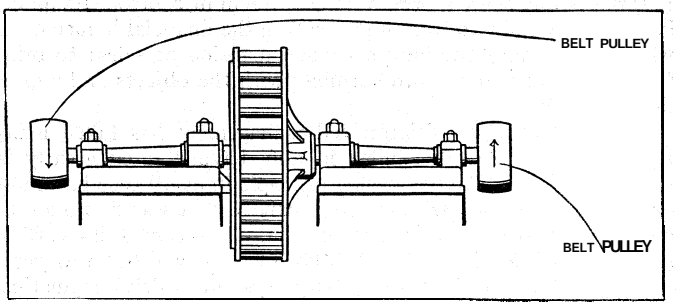

FIG. 1.—CAGE TYPE DISINTEGRATOR. IN WHICH A CAGE OF STEEL BARS REVOLVES WITHIN A CAGE TURNING IN THE OPPOSITE DIRECTION
The cages are enclosed in a steel plate casting (not shown) so that material thrown in is violently hurled about between the bars and broken up into the desired state of fineness

main classes of disintegrators: the cage or reel and the hammer types, the latter being the more powerful. Among the substances broken up and ground more or less finely in disintegrators are coal, coke, slag, sand, shale, chalk, limestone, pitch, plaster, starch, clay, shells, gypsum, barytes, rock salt, glue, bark, soap, bones, fertilizers, cattle foods, brick-bats, stone, limestone, iron oxide, linoleum colours, printer's ink and other products. The more fibrous materials such as bark, rubber, asbestos, leather, herbs, etc., may be shredded up by a machine consisting of a set of revolving knives flying past a set of stationary ones, but in other cases pure

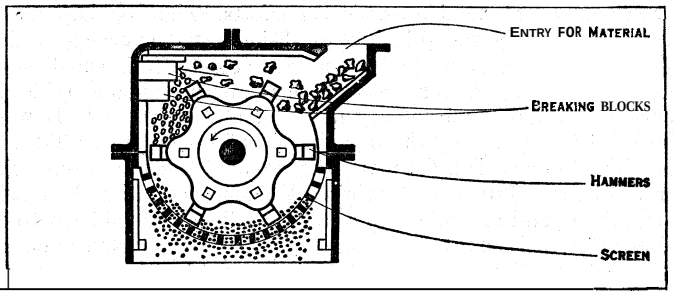

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FIG. 2.—HAMMER TYPE DISINTEGRATOR. WHICH SMASHES THE MATERIAL INTO SMALL PIECES AGAINST THE BREAKING BLOCKS. ANY LARGE CHUNKS UNABLE TO PASS THROUGH THE SCREEN ARE PICKED UP BY THE HAMMERS AND THROWN ONCE MORE AGAINST THE BLOCKS

impact is the disintegrating medium. The cage machines have a couple of cages, one within the other, composed of steel bars or beaters, which revolve in opposite directions (fig. 1.). The figure shows the machine with the casing removed; when the stuff is fed through a hopper, it is thrown with great violence amongst the bars and broken up. The speed of revolution ranges in various machines from 300 to 2,000 revolutions per niinute. For fine disintegration a machine with duplicated sets of cages is employed.

Hammer or beater machines consist of a revolving set of swing-hammers which beat the material small within the casing. The disintegrating action may occur while the material is "in the air," or when it is smashed against steel blocks within the strongly built casing. Fig. 2 shows the latter action; as the hammers whirl round at about a thousand revolutions a minute they catch the stuff fed into the hopper and hurl it against the blocks, the rebound being caught by succeeding hammers; and the material is finally reduced to the fineness required before it can pass through the screen. The inside of the machine is lined with steel plates which can be renewed when worn through. Some machines are built with a pocket into which fall any odd pikces of iron (termed tramp iron) which accidentally get in with the material. This safety device prevents serious damage to the various parts of the mill. A big crusher will break up 700 tons of limestone in the hour.

DISINTERESTED MANAGEMENT. A term historically associated with the regulation and control of the liquor trade; describing a system of management which has for its distinctive object the removal of private profit interest from the sale (in some cases from the manufacture also) of alcoholic beverages. It is not in any sense a prohibitionist system of control. Its object is rather to eliminate from liquor selling the financial inducements which in ordinary trading press for expansion of sales; to bring the motives of trading into harmony with the objects and aim of licensing laws.

In actual practice disinterested management has taken many forms which, although similar in aim, have diifered greatly in scope and effect. The underlying principle in every case has, however, been the same. Disinterested management was first adopted on an extensive scale in Scandinavia. It received its earliest statutory sanction in the Swedish law of 1855, which, a few years later, gave birth to the "Gothenburg" system of drink regulation, which may be said to have inspired most of the schemes of disinterested management which have since been adopted in different parts of the world. The growth of the system was rapid and the example of Sweden was quickly followed by Norway and Finland. In 1920 the latter country adopted statutory prohibition, but in Sweden and Norway (both spirit drinking countries) disinterested management is now legally established as the sole method of sale for both spirits and wine. The principle has also received statutory recognition in a permissive form in the Danish law of 1924, and in Estonia.

In Great Britain the principle of disinterested management, although lacking explicit statutory sanction (save only in the case of the State management schemes which were organized during the World War), has been variously applied. The earliest experiments date from the late '70s of last century. They were isolated experiments, but notable as pioneer efforts. The first important attempt to apply the principle of disinterested management in Great Britain, was made by the People's Refreshment-House Association Ltd., which has now some 175 licensed houses (chiefly village inns and small country hotels) under its control. It was followed (1900–01) by the organization of Public House Trusts, of which the late Earl Grey was the founder. There are some 14 or 15 of these Trusts in the United Kingdom, of which three are in Scotland and one in Ireland. Most of them are affiliated to a Central Association but operate as separate companies on a county basis. These Trusts have 92 licensed houses under their management and control. In addition there is Trust Houses Ltd. —a separate and independent company which is not now organized on a county basis and has 180 houses under its control. All of these Trust houses—272 in number (exclusive of the 175 houses controlled by P.R.H.A.)—are managed on the principle of disinterested management.

There are, also, in the mining districts of Fifeshire and in one or two other Scottish areas, a number of so-called "Gothenburg" houses, controlled by local registered companies, in which the principle of disinterested management is applied.

The **Carlisle** Experiment. — The most complete and important practical application of the principle in Great Britain is, however, represented by the three State management areas in Carlisle and District, Gretna and Cromarty Firth. In these three areas the liquor trade is under direct Government control and the undertakings have statutory authorization. The Carlisle undertaking is far the most important of the three. It has (save for two hotels and one restaurant) a complete monopoly of the sale of alcoholic liquors in the city of Carlisle and in a large adjacent area, and a partial monopoly in other districts. It also owns and operates the breweries. The undertaking, established in 1916, is directed by a central advisory council, responsible to the Home Secretary, and assisted by a local advisory committee which includes representatives of the local authorities, licensing justices, magistrates, trades council, etc., in the management area. The undertaking is in a sound financial position. By March, 1917, it had repaid, with interest, the whole of the capital liabilities and charges (some £900,000) incurred in the acquisition and development of the properties, and is now a valuable revenue-producing asset, the property of the State, which receives the whole of its profits.

Elsewhere the principle of disinterested management in the form of State control has been adopted on a large scale. In Russia, the State vodka monopoly, founded by M. Witte in 1894, and repealed in 1914 by the late tsar's edict establishing prohibition, has been re-established by the Soviet Government; while in Canada, seven of the nine provinces have substituted Government sale for prohibition. In Poland the State monopoly principle was adopted for spirits in 1924. It applies in the main at present to the production and wholesale distribution of spirits, but includes sale arrangements also. Until 1934 spirits will be sold both in State premises and in private licensed premises. After that date in State premises only. In Germany there has long been a State spirit monopoly, but it is concerned only with the production and wholesale distribution of spirits. (See TEMPERANCE; PROHIBITION; GOTHENBURG LICENSING SYSTEM; LOCAL OPTION.) (A. SH.)

DISMAL SWAMP, a large marshland lying partly in south-central Virginia and partly in north-central North Carolina. Now somewhat reduced by drainage, the original area was about 40 m. long and from 15 to 25 m. wide. The region in which the swamp lies is a slightly undulating plain, with an elevation of from 10 to 20 ft. above sea-level. The maximum elevation is in the heart of the swamp, whither the slope grades toward sea-level. Along the western margin a well-defined ancient sea beach, the Nansemond escarpment, rises from 5 to 50 ft. to constitute a natural boundary. Numerous waterways, most having their source in or near Dismal Swamp, traverse the region.

Drummond lake, the interior pool, is about seven m. long, and five wide, and 15 ft. deep. Dismal Swamp is the major north-eastern extension of the great palustrine forest which once dominated the landscape of much of the Coastal plain of the United States and of the lower flood plains of its southern streams, a forest characterized by cypress (*Taxodium distichum*), black gums (Nyssa *biflora* and N. *aquatica*), "juniper" (Chamaecyparis *thyoides*), swamp cotton gum (N. *uniflora*) and water ash (*Fraxinus caroliniana*). Not all the area is forest-covered, however, there being extensive bands and patches of marsh grassland as well. The whole area of the swamp may be drained, but the cost of reclamation would probably make it an unprofitable venture. The forest cover has been in large measure removed.

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DISORDERLY HOUSE, a house of prostitution; more generally, in law, a house in which the conduct of its inmates is such as to become a public nuisance, or a house where persons congregate to the commission of crime. In England, by the Disorderly Houses Act, 1751, the term includes common bawdy houses or brothels, common gaming houses, common betting houses and disorderly places of entertainment. Under that statutc unlicensed places of public entertainment were deemed to be disorderly houses if within 20m. of the cities of London and Westminster. Brothels are now dealt with by the Criminal Law

Amendment Acts, 1885 to 1922, and charges can be dealt with summarily, but for a second or subsequent offence the accused can demand trial by a jury. The letting out for gain for indiscriminate prostitution of a room or rooms in a house will make it as much a brothel in law as if the whole house were let out for the purpose. Where, however, a woman occupies a house or room which is frequented by men for the purpose of committing fornication with her she cannot be convicted of keeping a disorderly house (see PROSTITUTION). Gaming and betting houses are prohibited and penalties are imposed by two Gaming Acts, 1845 and 1854, and the Betting Act, 1853.

DISPENSATION, a term with two main applications, (1) to the action of administering, arranging or dealing out, and (2) to the action of allowing certain things, rules, etc., to be done away with, relaxed. Of these two meanings the first is to be derived from the classical Latin use of dispensare, literally, to weigh out, hence to distribute, especially of the orderly arrangement of a household by a steward; thus *dispensatio* mas, in theology, the word chosen to translate the Greek οἰκονομία, economy, *i.e.,* divine or religious systems, as in the Jewish, Mosaic, Christian dispensations. Dispensation in law is, strictly speaking, the suspension by competent authority of general rules of law in particular cases. Its object is to modify the hardships often arising from the rigorous application of general laws to particular cases, and its essence is to preserve the law by suspending its operation, *i.e.,* making it non-existent, in such cases. It follows, then, that dispensation, in its strict sense, is anticipative, *i.e.,* it does not absolve from the consequences of a legal obligation already contracted, but avoids a breach of the law by suspending the obligation to conform to it, *e.g.,* a dispensation or licence to marry within the prohibited degrees, or to hold benefices in plurality.

1. Ecclesiastical Law.—In the theory of the canon law the dispensing power is the corollary of the legislative, the authority that makes laws, and no other, having power to suspend them. The dispensing power, like the legislative authority, was formerly invested in general councils and even in provincial synods; but in the West, with the gradual centralization of authority at Rome, it became ultimately vested in the pope as the supreme lawgiver of the Church. Subject, however, to the supreme jurisdiction of the pope, the power of dispensation continued to reside in the other organs of the Church in exact proportion to their legislative capacities, *i.e.,* in provincial synods in respect of regional rules laid down by them, and in bishops in respect of rules laid down by them for their dioceses. In the earlier periods of the papacy the tendency was to disclaim all authority to make concessions and grant relief from traditional rules; but as time went on and the Church expanded, this rigid attitude proved impossible to maintain, and the principle of "tempering" the law when forced to do so "by the exigencies of affairs or of the times" (*rerum* vel *temporum* angustia), as laid down by Gelasius (494), was adopted into the canon law itself. The principle was, of course, singularly open to abuse. In theory it was laid down from the first that dispensations were only to be granted in cases of urgent necessity and in the highest interests of the Church; in practice, from the 11th century onwards, the power of dispensation was used by the popes as one of the most potent instruments for extending their influence. Dispensations to hold benefices in plurality formed, with provisions and the papal claim to the right of direct appointment, a powerful means for extending the patronage of the Holy See and therefore its hold over the clergy, and from the 13th century onwards this abuse assumed vast proportions (Hinschius, *Kirchenrecht*, iii. p. 250). Even more scandalous was the almost unrestrained traffic in licences and dispensations at Rome, which grew up, at least as early as the 14th century, owing to the fees charged for such dispensations having come to be regarded by the Curia as a regular source of revenue (Woker, Das *kirchliche Finanzwesen* der *Päpste*, Nördlingen, 1878, pp. 75, 160). Loud complaints of these abuses were raised in the reforming councils of Constance and Basel in the 15th century, but nothing was done effectually to check them.

The actual practice of the Church is based upon the decisions of the council of Trent, which left the mediaeval theory intact while endeavouring to guard against its abuses. The proposal put forward by the Gallican and Spanish bishops to subordinate the papal power of dispensation to the consent of the Church in general council was rejected, and even the canons of the council of Trent itself, in so far as they affected reformation of morals or ecclesiastical discipline, were decreed "saving the authority of the Holy See" (Sess. xxv. cap. 21, de ref.). At the same time it was laid down in respect of all dispensations, whether papal or other, that they were to be granted only for just and urgent causes, or in view of some decided benefit to the Church (urgens *justaque causa et* major *quandoque utilitas*), and in all cases gratis. The payment of money for a dispensation was ipso facto to make the dispensation void (*Sess.* xxv. cap. 18, de ref.).

Church of England.—By an Act of Henry VIII. (1534), it was enacted that neither the king, his successors, nor any of his subjects should henceforth sue for licences, dispensations, etc., to the see of Rome, and that the power to issue such licences, dispensations, etc., "for causes not being contrary or repugnant to the Holy Scriptures and laws of God," should be vested in the archbishop of Canterbury for the time being, who at his own discretion was to issue such dispensations, etc., under his seal, to the king and his subjects. The power of dispensation thus vested in the archbishops partly fell obsolete, partly has been curtailed by subsequent statutes, *e.g.,* the Pluralities Act of 1838. It is now confined to granting dispensations for holding two benefices at once, to issuing licences for non-residence, and in matrimonial cases to the issuing of special licences. The dispensing power of bishops in the Church of England survives only in the right to grant marriage licences, *i* e., dispensations from the obligation to publish the banns. Though, however, these licences and dispensations are given under the archiepiscopal and episcopal seals, they are actually issued by the commissaries of faculties and vicars-general (chancellors), independently, in virtue of the powers conferred on them by their patents. This has led, since the passing of the Divorce Acts and the Marriage with a Deceased Wife's Sister Act, to a curiously anomalous position, licences for the remarriage of divorced persons having been issued under the bishop's seal, while the bishop himself publicly protested that such marriages were contrary to "the law of God," but that he himself had no power to prevent his chancellor licensing them.

See article "Dispensation" and kindred topics in the Catholic Encyclopaedia; in Herzog-Hauck, Realencyclopadie (by Hinschius); Wetzer and Welte's Kirchenlexikon (2nd ed.); also F. Lichtenberger, *Encyclopédie* des sciences *religieuses* (Paris, 1878), *s.v.* "Dispense"; and Phillimore, Ecclesiastical *Law*.

2. *Constitutional* Law.—The power of dispensation from the operation of the ordinary law in particular cases is, of course, everywhere inherent in the supreme legislative authority, however rarely it may be exercised. Divorce (in Ireland) by act of parliament may be taken as an example which still actually occurs. On the other hand, the dispensing power once vested in the crown in England is now merely of historical interest, though of great importance in the constitutional struggles of the past. This power possessed by the crown of dispensing with the statute law is said to have been copied from the dispensations or *non* obstante clauses granted by the popes in matters of canon law; the parallel between them is certainly very striking, and there can be no doubt that the principles of the canon law influenced the decisions of the courts in the matter. It was, for instance, very generally laid down that the king could by dispensation make it lawful to do what was *malum prohibitum* but not to do what was *malum in* se, a principle of the canon law, but one difficult to reconcile with English legal principles, since no act is legally *malum* unless forbidden by law. This was pointed out by Chief Justice Vaughan in the celebrated judgment in the case of Thomas v. *Sorrell,* when he rejected the distinction between *mala* in se and *mala prohibita* as confusing, and attempted to define the dispensing power of the crown by limiting it to cases of individual breaches of penal statutes where no third party loses a right of action, and where the breach is not continuous, at the same time denying the power of the crown to dispense with any general penal law. This judgment, as Sir William Anson points out, only

showed the extreme difficulty of limiting the power ascribed to the crown, a standing grievance from the time that parliament had risen to be a constituent part of the state. So long as the legal principle by which the law was "the king's law" survived there was in fact no theoretical basis for such limitation, and the matter resolved itself into one of the great constitutional questions between crown and parliament which issued in the Revolution of 1688. The supreme crisis came owing to the use made by James II. of the dispensing power. His action in dispensing with the Test Act, in order to enable Roman Catholics to hold office under the crown, was supported by the courts in the test case of *Godden* v. *Hales,* but it made the Revolution inevitable. By the Bill of Rights the exercise of the dispensing power was forbidden, except as might be permitted by statute. At the same time the legality of its exercise was admitted by the clause maintaining the validity of dispensations granted in a certain form before Oct. 23, 1689.

See Anson, *Law and Custom of the Constitution,* pt. i. "Parliament," 3rd ed., pp. 311–319; F. W. Maitland, *Const. Hist. of England* (Cambridge, 1908), pp. 302, etc.; Stubbs, *Const. Hist.* ss. 290, 291.

(W. A. P.)

DISPERSION: *see* LIGHT.

DISPLACEMENT TONNAGE. In shipping, a term used to describe the actual weight of the water displaced by a ship. It is measured by ascertaining the cubic space occupied by that part of the ship which is immersed and dividing this by 35, a ton of sea water measuring 35 cubic feet. The term is employed to describe the tonnage of warships. (See SHIPPING: TONNAGE.)

DISPOSAL BOARD. The conclusion of the World War found the British Government engaged in gigantic preparations for a decisive campaign in 1919. The consequent problems of liquidation of war commitments and disposal of surpluses which faced Great Britain on the conclusion of the war were far more complicated and difficult of solution than those facing any other nation, allied or enemy. These problems divided themselves into two main heads, viz., the liquidation of war contracts, and the disposal of property and stores surplus to peace requirements.

In January 1919 His Majesty's Government decided to entrust the liquidation of Ministry of Munitions contracts, and the sale of war surpluses belonging to all Government departments, to the Minister of Munitions, Lord Inverforth, who, as Surveyor General of Supply at the War Office, had controlled many of the purchases. The organization set up by Lord Inverforth was controlled in the main by eminent business men who gave their services to the State in a voluntary capacity. On the Ministry of Munitions ceasing to exist in March 1921, this policy was continued by the Disposal and Liquidation Commission of which Sir Howard Frank was chairman, the Commission in turn being succeeded by a Treasury Advisory Committee under the chairmanship of Sir Charles Barrie.

At the Armistice, the Ministry of Munitions had contracts outstanding to the number of 34,862 and their value was approximately £355,000,000, including contracts for aircraft engines and materials amounting to £154,000,000, and for guns, arms, tanks and ammunition amounting to over £99,000,000. Of the outstanding contracts, 3,722 of a value of approximately £17,000,000 were in respect of supplies still definitely required, leaving nearly 31,000 contracts valued at about £338,000,000 for immediate liquidation.

The settlement of these contracts necessitated the scrutiny of 750,000 separate claims. This not only involved the examination of the bills of each contractor for work, but also for the recovery by the Ministry of any sums due from him for raw material supplied on debit, the accounting for material issued to him without charge, the adjustment of subsidies, the recovery of loans in respect of capital expenditure, the agreement of inventories of Government plant remaining on hand, the settlement of disputes in regard to defective material and the fixing of prices regarding supplies to and by the contractor by means of cost investigation.

In spite of these complications, the great majority of these contracts were disposed of by the end of 1920 at comparatively small expense to the State.

Disposal **of** Surpluses.—The problem of selling to the best advantage public assets becoming surplus owing to the termination of the War was, it will be realized, one of extraordinary magnitude and complexity. The property to be disposed of was lying all over the world, much of it in regions that had been recently wasted by war, where its handling was extremely difficult and its disposal *in situ* almost impossible. The surplus property not only comprised vast quantities of raw materials, such as wool, flax and hides, enormous quantities of unwrought metals—platinum, copper, brass, zinc, steel and iron—railway lines in France, Egypt, Palestine and Macedonia, tugs, barges and other seagoing craft at home and abroad, harbour installations such as those at Richborough, Calais, Dunkirk, Dieppe and Taranto, whole towns such as Gretna, factories and housing estates, but also over 350,000 different types of stores, which had been used for war purposes.

Initially the Ministry was confronted with the difficult task of locating and listing the huge quantities of stocks, particularly those in war areas. For disposal purposes it was essential that the stocks should be properly sorted and classified.

Nor was the disposal of these stocks a mere matter of selling at the highest prices. Many other considerations were involved, for example, the necessities of British trade and manufacture, the avoidance as far as possible of labour dislocation at home, the obtaining of transport facilities at reasonable cost, the release of army personnel guarding property and stores in war areas, etc. Subject to these considerations, the policy adopted throughout was to dispose of the property and stores by public tender, auction or private treaty as rapidly as the market could absorb them, and at highest prices obtainable.

So energetically were sales pushed forward that before the severe slump in prices took place in the late summer of 1920, over three-quarters of the surpluses had been sold. There is little doubt that the sales of articles of general utility early in 1919 proved a death blow to the worst forms of post-war profiteering.

Many of the surpluses were by their nature quite unsuitable for disposal in their existing forms, *e.g.,* shells and ammunition, of which approximately 5,000,000 tons were broken down at home and abroad and their residuals—steel, brass, copper, resin, etc.,—sold for commercial purposes. **A** considerable quantity of ammunition proved unsafe to break down and was at suitable points dumped in the sea. The same course had to be followed with enormous quantities of poison gas, the cylinders containing it being dumped many miles out at sea. In this work and the dumping of ammunition a fleet of sea-going barges and tugs were employed for nearly two years after the Armistice.

As regards other warlike stores, while it would not be true literally to say that swords were turned into ploughshares, all possible steps were taken to secure the utilization for commercial purposes of such stores, and with a great measure of success.

The total sales of surplus stores and properties (excluding raw materials on trading accounts—wool, flax, leather, etc.) amounted to £350,000,000. The principal groups of sales at home were, in round figures, as follows:—

Lands, buildings and factories	£15,000,000
Timber, huts and building materials, etc.	16,000,000
Plant and machinery, railway material and dock equipment	25,000,000
Textile, leather and equipment	34,000,000
Ferrous metals	21,000,000
Non-ferrous metals	51,000,000
Chemicals and explosives	29,000,000
Mechanical and horse transport	20,000,000
Food	8,000,000
River and canal craft	3,000,000

In addition to the sales at home there were large sales of surpluses abroad, including:—

France and Belgium	£40,000,000
Army of the Rhine	3,000,000
Italy	3,000,000
Egypt	9,000,000
Army of the Black Sea	3,500,000
'Iraq	10,000,000
India	10,000,000
United States and Canada	4,000,000

The sales on the Continent of Europe were made where possible in sterling, but the depreciation of Continental exchanges following the war had an adverse effect on Continental sales.

Sales of raw materials (wool, flax, leather, etc.) were over £330,000,000, a net profit of £78,000,000, of which £44,000,000 accrued to the British Exchequer, £34,000,000 going to various Dominions under profit sharing schemes. Sales, including raw materials, were over £680,000,000. (D. N.)

DISPOSITION, a term used in psychology to characterize the manner in which instinctive tendencies operate in the human organism. The total pattern of instinctive mechanisms *is* a person's disposition. The great variety of human dispositions is due to the innumerable combinations of relative intensities with which instinctive impulses may assert themselves in different individuals. One person may be very irascible or pugnacious, another timid, another meek and docile, etc. The quality of these dispositions depends upon the relative strengths of the underlying instincts. Excessive preponderance of any one instinctive tendency makes for an unbalanced personality. The term *disposition* is also used in psychology to characterize the total personality as modified by past experience. In this sense disposition would include the effect of habits and acquired attitudes as well as instinctive tendencies.

DISRAELI, BENJAMIN: *see* BEACONSFIELD, BENJAMIN DISRAELI, EARL OF.

D'ISRAELI (or DISRAELI), **ISAAC** (1766–1848), English man of letters, father of the earl of Beaconsfield (*q.v.*), was born at Enfield in May, 1766. His father, Benjamin D'Israeli, migrated from Venice to London in 1748 and belonged to the London congregation of Spanish and Portuguese Jews.

When Isaac D'Israeli was about 14 his father sent him to live with his agent at Amsterdam, where he worked under a tutor for four or five years. Here he studied Bayle and Voltaire, and became an ardent disciple of Rousseau. Here also he wrote a long poem against commerce, which he produced as an exposition of his opinions when, on his return to England, his father announced his intention of placing him in a commercial house at Bordeaux. Young D'Israeli was sent to travel in France, and spent some time in literary circles in Paris, returning to London in 1788. A poem printed in *The Gentleman's Magazine,* attacking Peter Pindar (John Wolcot) brought him the friendship of his opponent and of H. J. Pye, who helped to persuade his father that it would be a mistake to force him into a business career. D'Israeli dedicated his first book, *A Defence of Poetry,* to Pye in 1790. Henceforth his life was passed in the way he best liked—in quiet and almost uninterrupted study. In 1802 he married Maria Basevi, by whom he had five children, of whom Benjamin (afterwards Lord Beaconsfield and Prime Minister of England) was the second. He died at his seat at Bradenham house, Buckinghamshire, on Jan. 19, 1848.

Isaac D'Israeli is the author of the *Curiosities of Literature* (1791, subsequent volumes in 1793, 1817, 1823 and 1834). It is a miscellany of literary and historical anecdotes, of original critical remarks, and of interesting and curious information of all kinds, animated by genuine literary feeling, taste and enthusiasm. He also wrote *Miscellanies, or Literary Recreations* (1796), the *Calamities of Autlzors* (1812–13), and the *Quarrels of Authors* (1814). Towards the close of his life D'Israeli projected a continuous history of English literature, three volumes of which appeared in 1841 under the title of the *Amenities of Literature.* But of all his works the most delightful is his *Essay on the Literary Clzaracter* (1793), which, like most of his writings, abounds in illustrative anecdotes. In the famous "Pope controversy" he supported Byron and Campbell against Bowles and Hazlitt by a defence of Pope in the form of a criticism of Joseph Spence's *Anecdotes* contributed to the *Quarterly Review* (July 1820). In 1797 D'Israeli published three novels; one of these, *Mejnoun and Leila, the Arabian Petrarch and Laura,* was said to be the first oriental romance in English. His last novel *Despotism, or the Fall of the Jesuits,* appeared in 1811, but none of his romances was popular. He also published a slight sketch of Jewish history, and especially of the growth of the Talmud, entitled the *Genius of Judaism* (1833). He was the author of two historical works—a brief defence of the literary merit and personal and political character of James I. (1816), and a learned *Commentary on the Life and Reign of King Charles I.* (1828–31).

Of the amiable personal character and the placid life of Isaac D'Israeli a charming picture is to be found in the brief memoir prefixed to the 1849 edition of *Curiosities of Literature,* by his son Lord Beaconsfield.

DISS, a market town in the Southern parliamentary division of Norfolk, England; near the river Waveney (the boundary with Suffolk), 95 mi. N.E. by N. from London by the L.N.E. railway. Pop. of urban district (1938) 3,297. The town lies pleasantly upon a hill rising above a mere, which drains to the Waveney, having its banks laid out as public gardens. The church of St. Mary exhibits Decorated and Perpendicular stone and flint work. There is a corn exchange and the agricultural trade is considerable; agricultural implements are manufactured. The poet and satirist, John Skelton (d. 1529), was rector there in the later part of his life, and is doubtfully considered a native of Diss. Area 3,674 acres.

DISSECTION, the separation into parts by cutting, particularly the cutting of an animal or plant into parts for the purpose of examination.

DISSEMINATION, of seeds, *see* ANGIOSPERMS: *Dissemination.*

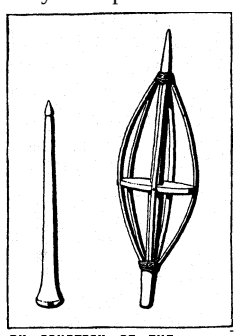
DISSENTER, one who dissents or disagrees in matters of opinion, belief, etc. The term, from Lat. *dis-sentire,* to disagree, is, however, practically restricted to the special sense of a member of a religious body in England which has separated from the Established Church; and while it has included English Roman Catholics, who in the original draft of the Relief Act of 1791 were styled "Protesting Catholic Dissenters," it is in practice restricted to the "Protestant Dissenters" referred to in sec. ii. of the Toleration Act of 1688. The term is not applied to those bodies who dissent from the Established Church of Scotland; and in speaking of members of religious bodies which have seceded from established churches abroad it is usual to employ the term "dissidents" (Lat. *dissidere,* to dissent). In this connotation the terms "dissenter" and "dissenting," which had acquired a somewhat contemptuous flavour, have tended since the middle of the 19th century to be replaced by "nonconformist," a term which did not originally imply secession, but only refusal to conform in certain particulars (*e.g.,* the wearing of the surplice) with the authorized usages of the Established Church. Still more recently the term "nonconformist" has in its turn, as the political attack on the principle of a State establishment of religion developed, tended to give place to the style of "Free Churches" and "Free Churchman." All three terms are now in use. (*See* BAPTISTS; CONGREGATIONALISM; METHODISM, etc.)

DISSOCIATION, a separation or dispersal, the opposite of association but of wider application (*see* ASSOCIATION). In chemistry the term is given to chemical reactions in which a substance decomposes into two or more substances, and particularly to cases in which associated molecules break down into simpler molecules. Thus the reactions $NH_4Cl \rightleftarrows NH_3 + HCl$, and $PCl_5 \rightleftarrows PCl_3 + Cl_2$ are instances of the first type; $N_2O_4 \rightleftarrows 2NO_2$, of the second. When this breakdown is effected by heating, the process is termed "thermal dissociation." Electrolytic or, as it is termed, ionic dissociation is the separation of a substance in solution into ions (*see* ELECTROLYSIS; CHEMICAL ACTION: *Ionic Theory*).

In psychology dissociation is an abnormal condition of the mind wherein the usual connection between various mental elements is lost. Ordinary lapses of memory represent dissociations, in normal minds, between the idea or object which cannot be called to mind and the clue or stimulus idea which formerly sufficed to recall the thing desired. Abrupt changes of mood, or change of interest from one subject to another, in normal people may represent emotional dissociation. When large, combined groups of ideas and emotions (complexes) become dissociated from other similar groups, the resulting condition is known as dissociation of personality. Such dissociation is held accountable for many insane conditions. (*See* DEFENCE MECHANISMS.) In this condition a successful lawyer has been known to draw all his money from the bank, disappear without reason and subsequently open a small shop in a distant city without memory of his former life.

DISSOLUTION, the act of dissolving or reducing to constituent parts, especially of the bringing to an end an association such as a partnership or building society. A dissolution of parliament in England is the end of its existence (see PARLIAMENT).

DISTAFF, in the early forms of spinning, the "rock" or short stick round one end of which the flax, cotton, or wool is loosely wound, and from which it is spun off by the spindle. The "distaff" or "spindle" side of a family refers to the female branch, as opposed to the "spear" or male branch. Jan. 7, the day after Epiphany, was formerly known as St. Distaff's day, as women then began work again after the Christmas holiday.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, NEW YORK
FLAX WHEEL DISTAFFS USED IN A COLONIAL HOUSEHOLD

DISTANCE. The length in a straight line between two objects, or the interval in time between two periods or events. In military language distance means the space between men or bodies of troops measured from front to rear.

DISTEMPER. A distemper in its simplest form consists of whiting, glue (size) and water, and is sometimes called whitewash. The glue acts as a binder, preventing the coatings from rubbing off. Distempers so made are exceedingly cheap, cover well, and are quickly and easily applied with large brushes, but they will not stand washing. They are largely used for whitening ceilings and cheap interior decorative work. When, in course of time the coatings become dirty, it is quite an easy and inexpensive matter to wash them off and apply a fresh coating.

Distempers are sold in the form of a thick paste or jelly, or as a dry powder, and only require mixing with cold or warm water to make them ready for use. A good distemper can be made according to the following recipe: Take 14 lb. of gilders' whiting and cover with water. Allow it to stand overnight. Next morning pour off the excess of water and work up well. **A** small amount of ultramarine blue mixed with water should be added to the whiting to improve the colour. Add about 5 lb. of hot jelly size to the whiting and mix well. Strain through a sieve and it is then ready for use. If it is desired to keep the distemper for any length of time before use, a small amount—about 1 oz.—of alum or borax should be added as a preservative.

Coloured Distempers.—By the addition of coloured pigments to the white distemper a large variety of beautiful shades may be obtained. The pigments used for tinting distempers must be permanent to light and perfectly fast to lime and alkalies. Since they are used largely on cement and plaster walls which contain free lime and alkali, such colours as Prussian blue, chrome yellow, Brunswick green, vermilionette, etc., cannot be used, as the alkali would quickly act on them and destroy their colour. In their place permanent pigments, which are fast to light and alkali, such as ultramarine blue, zinc chrome, Hansa yellow, lime green, Venetian red, etc., must be substituted. The following lime-proof colours should, when mixed with 14 lb. of white distemper, produce approximately the shades given in the right hand column:—

Colours.	***Tint** Produced.*
602. Pale French ochre	Cream.
6oz. Lime yellow	Primrose.
1lb. Venetian red	Salmon pink.
1lb. Venetian red 3lb. Yellow ochre	Terra cotta.
1lb. Venetian red 1lb. Lime blue	French grey.
2oz. Bright lime red 2oz. Lime blue	Lavender.
4oz. Pale lime blue	Bluebell.
8oz. Lime blue	Light blue.
1lb. Lime green 4oz. Yellow ochre	Sage green.
4lb. Lime green 8oz. Lime yellow	Apple green.
5lb. Bright lime red	Pompeian red.

Water Paint or Washable Distemper.—Although the terms "distemper" and "water paint" are often used synonymously, it is generally accepted that the word "distemper" should be limited to the non-washable compositions made according to the directions indicated. These simple distempers contain sufficient binder to prevent their rubbing off, but not enough to enable them to stand washing.

The term "water-paint," on the other hand, denotes a superior type of modern distemper which contains—in addition to the usual distemper ingredients—a proportion of oil or varnish, which acts as an additional binding agent. With these additional ingredients a good water paint should give insoluble coatings on drying, and the coatings should adhere so firmly that they can be washed a few days after application. This property is very valuable, as walls coated with these washable sanitary distempers, which have become dirty in course of time, can be easily cleaned and freshened up by simply sponging over with clean cold water.

Water-paints have also much better covering and hiding power than the ordinary distempers, because, in addition to whiting, a proportion of lithopone, zinc white or other strong pigment is incorporated, which increases their body or opacity, and gives more solid coatings.

Since they contain oils, varnishes, etc., these water paints are sold in paste form only. The paste is of a soft jelly-like consistency which only requires mixing with cold or warm water to thin it to a suitable consistency for use.

Water paints are largely used as flat wall paints for interior decoration. They are comparatively cheap and can be obtained in a large variety of beautiful shades. They dry very quickly after application, with a pleasing mat or flat finish; and on account of the firmness of adhesion and insolubility of these paints it is possible to apply a second coat a few hours after the first coat has dried, without working up the first coat. This property is very useful in those cases where two or more coats are necessary in order completely to hide the surface which is being painted, and give what is known as a "solid" effect.

Flat distempered surfaces are often "stippled" or dabbed whilst still wet with a special flat soft hair brush known as the "stippler." By this process all brush marks that might otherwise be in evidence are removed, and the surface is given a beautiful mat velvet-like finish.

When painting large wall areas, as in town halls, council chambers, schools and so on, these water paints are often applied by means of a spraying machine; in this way very large areas can be quickly and successfully covered with the distemper.

Water paints are manufactured as follows:—About 10 lb. of strong glue or size powder are put in a steam-pan, covered with 10 gal. of water and left to soak overnight; steam is then passed through till all the glue has gone into solution. The steam is turned off and about 1 gal. of linseed oil, copal varnish or mixtures of these is then added, and the whole well beaten up until an emulsion is formed. A small proportion of carbolic acid, formaldehyde, or other preservative is added to the emulsion, otherwise it would go mouldy if kept for any long period. This medium—usually known as petrifying liquid—is then mixed while hot with roughly its own weight of white base consisting of whiting, lithopone, blanc-fixe, or mixtures of these, and ground through stone-mills. The resultant thin paste is then packed in kegs or tins where it sets on cooling to a soft jelly-like consistency. The coloured distempers are obtained by adding the necessary quantity of lime-fast colour to the white base during the grinding process. There are some paste distempers on the market which are made by using casein—an insoluble white product obtained from skimmed milk—in place of glue or size. In these varieties the casein is dissolved in water with the aid of some alkali, such as carbonate of soda, ammonia or borax, which is added to the water in order to render the casein soluble. The procedure is then carried on in the way already described.

Outside **Distempers.**—For outdoor use only those distempers should be employed which have been specially made for the purpose Even when so manufactured these outside distempers. although largely used, will not last more than a year or two, and they do not possess the same durability and wearing properties as an ordinary paint.

Outside quality distempers contain more oil than is generally used in the preparation of distempers for indoor use. This helps to bind them better, and serves as a protective agent against weathering influences. They should be thinned ready for use with a medium—known as petrifying liquid—which is specially made for this purpose, and is of a similar composition to the medium in which the pigments are ground in making the paste distemper.

Powder Distemper.—Dry distempers (called calcimines in America) consist of whiting or carbonate of lime with either finely powdered glue or casein as their binding agent. They are manufactured by grinding the whiting and powdered glue or casein in special grinding and sifting machinery in order to get a thorough incorporation of all the ingredients. Great care must be taken to see that all the materials are thoroughly dry before mixing, as even a small amount of moisture present would make the powder cake and set up hard, and of course render it useless. A little borax, salicylic acid, alum or other dry preservative is added to keep the dry powder sweet and prevent any decomposition that might take place on standing.

In the case of coloured distempers, sufficient lime-fast pigments are incorporated during the mixing process in order to give the desired shade.

These dry distempers are now very largely used both in this country and America on account of their comparative cheapness. The following recipes will give a general idea as to their composition:—

(1.)	Whiting	100lb.
	Fine powdered size	8lb.
	Powderedalum	2oz.
(2.)	Whiting	100lb.
	Dry slaked lime	5lb.
	Sodacarbonate	2lb.
	Casein	5lb.
(3.)	Whiting	100lb.
	Dry slaked lime	14lb.
	Powdered borax	1½lb.
	Casein	12lb.

These white dry distempers may be tinted to any desired shade by adding lime-fast colours. (J. G. Be.)

DISTEMPER IN ART

Distemper is one of the earliest known mediums of painting. It was used extensively by the Greeks and Egyptians. It consists of a mixture of powdered colour with size and it differs from tempera in which process egg is the medium used. The French call all such mixtures *détrempe* but in England the egg mixture is known as *tempera* and the size mixture as *distemper*.

The colours are first ground in water and then mixed at the moment of use with size kept liquid in a *bain-marie*. This practise is necessitated by the fact that the proportion of the size required varies according to the nature of the powder used.

The method is useful for quick work as it is fluid and dries rapidly. It is durable though soluble in water. At the present day it is used chiefly by scene-painters but certain French artists, such as Degas and Vuillard, have made good use of it.

DISTEMPER: *see* CANINE DISTEMPER.

DISTICH, a couplet, consisting originally of a hexameter and pentameter line, containing a single idea, as exemplified in the Greek Anthology. Modern examples are to be found in the works of Goethe and Schiller. *See* VERSE.

DISTILLATION, an operation involving the conversion of a substance into vapour which is subsequently condensed to the liquid form. The process is exemplified at its simplest when steam from a kettle plays upon a cold surface, producing drops of *distilled* water. The term, which was originally applied to the separation of spirituous liquors from fermentation processes, now has a far wider application, and distillation is an integral part of many manufacturing processes. It has for its object the separation of liquids from solids, as pure water from sea water, or the separation of two or more liquids, petrol, or gasolene, and paraffin, or kerosene, from crude petroleum.

The simplest distillation apparatus consists of three parts: the *still* or *retort* in which the liquid is heated, the *condenser*, to cool the vapours, and the *receiver*, to collect the *distillate*. This is satisfactory for the purification of liquids containing solids. For the separation of several liquids, of which the components, in normal cases, distil in the order of their boiling points, the apparatus requires elaboration. These components do not usually distil exactly at their boiling points, but over a range of temperature, so that some overlapping of the boiling ranges is usual. To overcome this difficulty the vapours are led through a *still head* or *column* in which a sorting out of the components occurs. In this way the distillate may be collected in *fractions* (technically *cuts*), and the operation is termed *fractional* distillation.

FIG. 1.—DISTILLATION APPARATUS OF ABOUT A D. 1556. IN THE FOREGROUND RETORTS ARE BEING HEATED IN A VESSEL OF WATER, ATTACHED TO RECEIVING FLASKS BY ALEMBICS OR HEADS

Some substances decompose when heated to their boiling points. This may often be avoided by taking advantage of the fact that a lowering of pressure over the surface of the liquid lowers the temperature at which that liquid boils. This may be achieved by *vacuum* distillation, or by *steam* distillation, when steam is passed into the substance, which then volatilizes with the steam at a much lower temperature. When solid substances are heated to give gaseous or liquid products the operation is termed *dry* distillation. If the procedure involves a breakdown of complex materials into simpler substances (elementary or compound) the process is described as *destructive* distillation. (*See* COAL TAR and TARS, LOW-TEMPERATURE CARBONIZATION.) Finally, there is *sublimation*, in which a solid distils to give a solid without the intervention of a liquid phase.

Historical **Note.**—Distillation appears to have been used by the earliest experimentalists. Aristotle (384–322 B.C.) mentions that pure water is made by the evaporation of sea-water. Pliny the elder (A.D. 23–79) describes a primitive method of condensation, in which the oil obtained by heating rosin is collected on wool placed in the upper part of the still. The Alexandrians added a head or cover to the still, and prepared oil of turpentine by distilling pine resin.

The Arabians improved the apparatus by cooling the tube leading from the head, or *alembic*, with water, and discovered a number of essential oils by distilling plants and plant juices, alcohols from wine, and distilled water. By its use, the alchemists were enabled to study hydrochloric, nitric and sulphuric acids in a relatively pure state.

Modern laboratory practice owes much to the introduction, since 1850, of the condenser named after Liebig (fig. 2), and of the *reflux* condenser by Kolbe and Frankland. The latter is a condenser arranged vertically so that the condensed vapours return continually to the distilling vessel, and allows of the continued boiling of a liquid without loss. Dittmar and Anschütz introduced, independently, *reduced pressure* distillation, and fractional distillation was aided by the advent of the still-heads of Wurtz (1855), Linnemann (1871), and le Bel and Henninger (1874).

Distillation will now be dealt with in more detail under the headings:—(I) simple distillation, (2) fractional distillation, (3) reduced-pressure distillation, (4) high-vacuum distillation, (5) steam distillation, (6) dry distillation, (7) theory of distillation, (8) distillation in technology, and (9) distillation of water.

(1) Simple **Distillation.**—*Retorts* are now rarely used. Laboratory distillation in its simplest form is carried out in the apparatus depicted in fig. 2.

The diagram is self-explanatory, but it may be remarked that laboratory ware is usually constructed in glass, and connected together by means of corks or rubber bungs. When the materials to be distilled are corrosive to cork or rubber, the distilling flask,

condenser and receiver are connected by ground-glass joints, or they may be fused together with the blow-pipe, thus giving an all-glass apparatus. Heating of the *distilling flask* is effected in a variety of ways depending upon the volatility and inflammability of the substance to be distilled. It may be by direct gas flame, or indirectly through a sand-tray or wire gauze, by electric hot plate, by internal heating of the liquid by platinum wire, or by

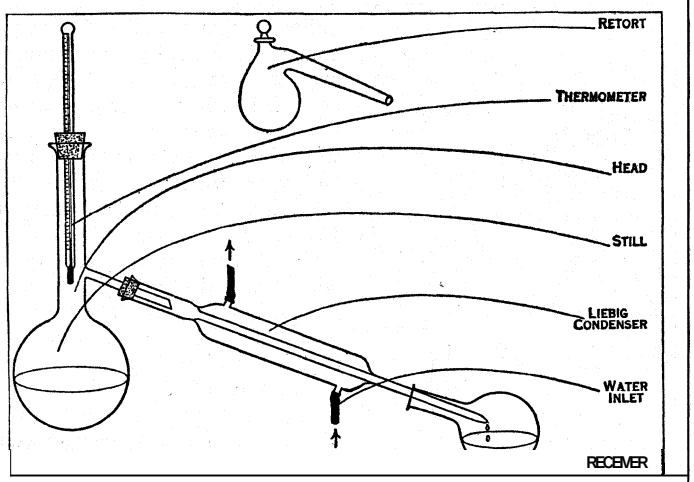


FIG. 2.— TYPICAL LABORATORY DISTILLATION APPARATUS
The vapour passes from the still to the Liebig Condenser, where it is condensed by cold water circulating in the water jacket, the distillate being collected in the receiver

immersion in a steam, oil or fusible metal bath. Some liquids boil explosively when heated and the phenomenon is known as *bumping*. This may be prevented by placing small pieces of porcelain, pumice, capillary tubing or other porous material in the still. In distilling substances likely to decompose when heated in air, an inert gas is led through the apparatus during the operation,

It will be seen from figs. 1 and 2 that the modern still is similar in principle to that of the alchemists, but a thermometer is added to facilitate control of the process. This is usually placed so that its bulb is near the point at which vapour leaves the still. Consequently a part of the mercury in the thermometer may be at

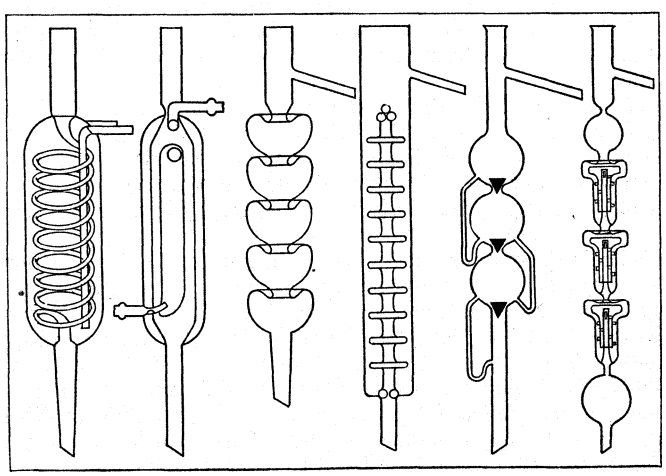


FIG. 3 — EXAMPLES OF LABORATORY CONDENSERS AND COLUMNS
From left to right: Inland Revenue Condenser; Double Surface Condenser; Pear Column: Rod and Disc Column; Le Bel-Henninger Column; Young Evaporator Column

a lower temperature than that in the bulb. To obtain the true temperature a correction for "exposed stem" is applied to the observed reading.

The choice of condenser in any given case is governed by the volatility of the substance to be distilled. With substances boiling above 170° C, air cooling of an elongated side tube is generally sufficient, but for ordinary work the Liebig *single surface* condenser (fig. 2) is used. For very volatile organic liquids the double *surface* (fig. 3) is necessary. Numerous types arc available, but the difference lies mainly in the ingenuity with which the internal members are designed to give the maximum cooling surface. The *spiral* or *worm* condenser is a compact form of the Liebig, an example being the British Inland Revenue pattern.

(2) Fractional Distillation.— Fractional distillation implies the separation of mixtures of substances of different boiling point. The nearer these boiling points are to one another, the more difficult is the operation. It is facilitated by elongation of the distilling flask neck, or by adding what is known as a *fractionating* column.

Numerous columns have been devised, but all work on the principle of allowing the more volatile portion of the vapour to proceed to the condenser whilst returning the less volatile to the still. Of the three main types, the plain column, of which the Wurtz *bulb* and the Young *pear* columns are modifications, is the least efficient. The second class of column is maintained at the temperature at which the most volatile constituent of the vapour distils. The third type, better known as the *dephlegmator* type, is the most widely used. In this the ascending vapours from the still bubble through portions of the already condensed vapour. The Linnemann modification passes the vapour through condensate temporarily collected on platinum gauzes at constrictions in the column. The le Bel–Henninger embodies a further development of the idea, and successive bulbs are connected by syphons (fig. 3). The Young *rod* and *disc*, the Hempel *glass bead*, the Raschig and the Lessing *rings* and the Young *evaporator* columns are all extensions of the same principle. Dufton (1919) has devised a very simple column which consists of a wire wound spirally in the annular space between a closed centre member and the outer column body. It is simple to construct, efficient in operation and is essentially a laboratory adaptation of the commercial column due to Foucar.

(3) **Reduced-pressure Distillation.**—Distillation under reduced pressure is adopted when dealing with substances which normally boil at inconveniently high temperatures, or with decom-

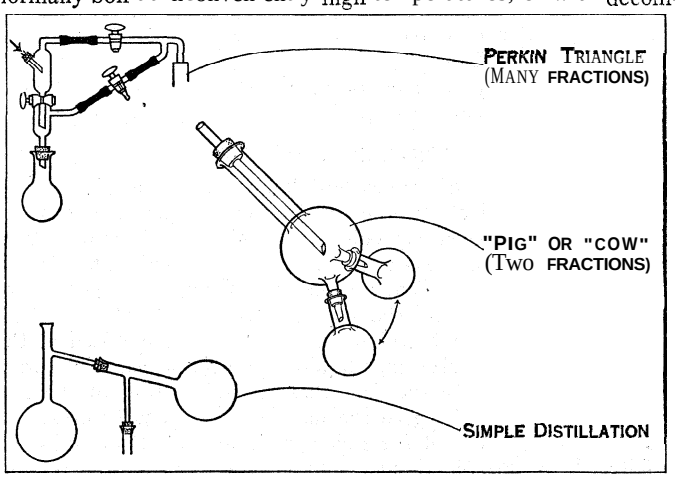


FIG 4.— LABORATORY RECEIVERS FOR DISTILLATION WORK UNDER REDUCED PRESSURE, THE TYPE USED DEPENDING ON THE NUMBER OF FRACTIONS TO BE COLLECTED

position under atmospheric pressure. The apparatus used differs but little from that already described. The receiver is connected by thick-walled rubber tubing to a manometer, for determining pressure, and to some form of vacuum pump. To avoid bumping the usual method is to introduce a fine stream of gas bubbles through the liquid by means of a capillary tube reaching to the bottom of the still. A very common form of apparatus for this work is the Claisen flask, which has two necks, one holding the capillary tube, and the second the thermometer.

If it is required to collect fractions under reduced pressure, some special form of receiver is necessary. A Bredt ***pig*** (fig. 4) is used for two or three fractions, the Perkin *triangle* is useful for a series of fractions where the distillate is fairly mobile, whilst the Brühl apparatus is most suitable for the distillation of solids, as fatty acids or waxes.

(4) **High-vacuum Distillation.**—Whereas reduced pressure distillation implies distillation at pressures of 5–15 mm of mer-

cury, it is an advantage for some purposes to go much lower, from 1 mm. down to X-ray vacuum conditions. Krafft used a cathode vacuum for distilling paraffin waxes, and to-day high-vacuum distillation is being used for purification of various gland extracts for medicinal purposes. Ordinarily, a typical high-vacuum distillation set, embodies a distillation flask with Wurtz head, which may be further improved by the insertion of a Dufton column. The distiilate is delivered into a Briihl multiple receiver having special glands to stand up to extreme vacuum conditions. The vacuum in this case is maintained by a Kaye annular-jet mercury vapour pump, backed by a Cenco Hyvac rotary oil pump. Such an apparatus is capable of maintaining a working vacuum of 0·0001 mm. of mercury at the receiver when distilling paraffin waxes.

(5) Steam Distillation.— In this operation steam, generated as a rule but not invariably in separate apparatus, is passed into the still, and the resulting mixed vapours are condensed in the usual manner. The process is equivalent to reduced pressure distillation, for Dalton's "Law of Partial Pressures" is applicable, and the substance distilled with steam only attains the temperature corresponding to its partial pressure. Thus benzaldehyde, which boils at 178·3° C at 760 mm, distils with steam at 97·9° C, corresponding to its partial pressure of 56.5 millimetres. This is, in effect, a reduction in pressure of 703·5 millimetres. Familiar instances of the use of this method are the separations of ortho- and para-nitrophenols, and of aniline and nitrobenzene, of which the first in each pair is volatile in steam. Liquids other than water can be used in analogous operations. Alcohol is used to remove phenol from the condensation product of phenol and formaldehyde. (See RESINS, SYNTHETIC.)

(6) Destructive and Dry **Distillation.**—These processes refer to operations on solid materials. The dry distillation of calcium acetate gives acetone. The destructive distillation of wood gives acetone, acetic acid and methyl alcohol; and of coal, coal gas, benzene and a multitude of other chemical products. Dry distillation is best carried out in shallow stills with small batches of material. Caking may be partially prevented by mixing the charge with sand or pumice.

(7) Theory of Distillation.— The general observation that under constant pressure a pure substance boils at constant temperature leads to the conclusion that the distillate which comes over while the thermometer records only a small variation is of practically constant composition. On this depends all *rectification* or separation by distillation. The theory of distillation is complex, and we shall confine ourselves to mixtures of two components, A and B, of which three cases are to be recognized, according as the two are: (1) quite insoluble in each other, (2) miscible only within limits, and (3) miscible in all proportions.

When the components are completely immiscible the vapour pressure of one is not influenced by the other, and the mixture distils at the temperature at which the sum of the partial pressures equals that of the atmosphere. Both components distil in constant proportion until one disappears, when the residue distils if the temperature is raised. The composition of the distillate is determinate if the molecular weights of the components and the vapour pressures at the temperature of distillation are known. It is not proposed to enter into this in detail, but it may be noted that in steam distillation the low volatility of a substance may be off-set by its high molecular weight.

When distilling a mixture of partly miscible components a distillate of constant composition is obtained so long as two layers are present; *i.e.*, A dissolved in B and B in A, since, in accordance with the second law of thermodynamics, these solutions emit vapours of the same composition. The composition of the vapour is not, however, the same as that of either layer. As the distillation proceeds one layer diminishes more rapidly than the other until one remains, which then distils as a completely miscible mixture.

The distillation of completely miscible mixtures is the most common practically, and the most complex theoretically. Such mixtures are of three kinds, depending upon the relative solubilities of the vapours in the liquids.

(i.) If the vapour of A is readily soluble in the liquid B, and the vapour of B in A, there will exist a mixture of A and B having a lower vapour pressure than any other mixture. The vapour pressure-composition curve is convex to the axis of composition, the maximum vapour pressures corresponding to pure A and B, and the minimum to some mixture of A and B. On distilling such a mixture two components, in varying amounts, come over until the still contains the mixture of minimum vapour pressure, which then distils at constant temperature. Nitric acid of boiling point 86" C, forms a mixture with water, boiling point 100° C, which boils at a constant temperature of 120·5° C, and contains 68% of acid.

(ii.) If the vapours are sparingly soluble in the liquids, there will exist a mixture having a maximum vapour pressure. The vapour pressure-composition curve is concave, the minima corresponding to the pure components. On distilling this mixture a mixed vapour of constant composition distils, leaving one or other of the components. Propyl alcohol and water furnish an example.

(iii.) If the vapour of A is readily soluble in B, and the vapour of B sparingly so in A, and if the vapour pressure of A is greater than that of B, then the vapour pressure of mixtures of A and B approximates to a linear function of the composition. On distilling this mixture, pure A comes over first, followed by mixtures in which the quantity of B continually increases. As a consequence A and B can be completely separated by a sufficient number of distillations. As an example we have methyl alcohol and water.

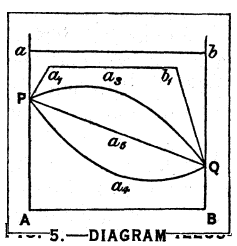


FIG. 5.—DIAGRAM ILLUSTRATING THEORY OF DISTILLATION OF IMMISCIBLE, PARTLY MISCIBLE AND MISCIBLE MIXTURES

These five cases have been illustrated in one diagram by van't Hoff. In fig. 5, AB is the axis of composition, AP the vapour pressure of A, BQ of B. For immiscible liquids the vapour pressure curve is the horizontal line ab, where $aP = QB$, and $bQ = AP$. For partially miscible liquids the curve is Pa_1b_1Q. The horizontal line a_1b_1 corresponds to the two layers of liquid, and the inclined lines Pa_1, Qb_1, to the solutions of B in A and A in B. The curves Pa_4Q, having a minimum at a_4, Pa_3Q, with a maximum at a_3, and the straight line Pa_5Q correspond to the types (i.), (ii.) and (iii.), of the completely miscible mixtures

(8) Distillation in Technology.— Distillation in all its forms is used in chemical technology. The type of apparatus in any particular process is conditioned by various factors, such as the nature of the original mixture and the available means of heating. The simplest still consists of a closed cylinder of cast or wrought iron, provided with a tubular neck. If horizontal, the ends are usually convex, but if vertical, the base may be either concave or convex. The convex bottom has the advantage of increased heating area and ease of cleaning, but the disadvantage that the run-off is at the point of maximum heat. In the concave type the run-off comes at the edge, but the still is difficult to clean. Tar stills are often of the vertical type, whilst horizontal ones are popular in the petroleum industry. Pipe stills in which the charge is pumped continuously through a heated coil are used to some extent.

A complete still is provided with a hemispherical head, and, in addition to the large opening to carry away vapours, may be fitted with: (1) bearings for stirring gear, (2) pressure or vacuum gauge, (3) inlet and outlet for closed steam coil, (4) a tube reaching to the bottom of the still to introduce live steam, (5) closed tubes to carry thermometers, (6) man holes for charging, (7) inspection windows, and (8) a safety valve. Such stills are made in a large variety of materials—cast and wrought iron, copper, mild steel, nickel and aluminium are common. Lead-lined stills are used, and for food products or fine chemicals enamelled or even glass-lined stills are particularly useful. Fused silica is used for nitric acid distillation, and glass and stoneware for bromine and iodine.

Stills may be heated by solid combustible, as coal, coke or anthracite, or gas fired. Steam may be used either as open steam, actual steam distillation, or closed, in which steam is the heating medium only. Indirect heating has the advantage over direct

firing that there is no tendency to local overheating or burning, and it is subject to closer control. Steam-heated stills can be regulated by ingenious devices which automatically ensure that the concentration of the distillate is unaffected by change in steam pressure.

Mention should here be made of an important modern development in distillation technique. In the T.I.C. method of tar distillation molten lead is commonly used as the medium for the transfer of heat from the furnace to the actual charge. A continuous stream of tar is introduced on to the surface of molten lead in a labyrinth shaped like an Archimedian spiral. The method has the important advantage that any coke or pitch formed is readily removed from the surface of the lead, and the process becomes perfectly continuous. Since only a small amount of tar is in the still at any one time the plant is particularly flexible.

In commercial practice three main types of column are used, the *packed* column, based on the laboratory Hempel, the *perforated plate,* and the *bubbler hood* or *bell* columns. In recent types of packed column special fillings are used, such as those of Raschig, Lessing, Goodwin and Prym. The Raschig filling consists of open cylinders of any suitable material, varying in size according to the operation. In plate columns, the fractionating effect is obtained by bubbling the vapour through films of liquid on perforated plates. Since efficiency depends upon the relation between the rate of evaporation and the size of hole, the apparatus is not very flexible. The bubbler hood or bell type column is extensively used in the rectification of alcohol. In these columns condensed liquid is maintained at constant level in each section, and the ascending vapour forced, as streams of fine bubbles, through the liquid by means of slotted bells placed over the up-going vapour tubes.

Of condensers, the *worm, tubular* and *open surface* may be mentioned. An example of the popular worm type is shown without water jacket in Plate II. In the tubular condenser a counter-current effect is obtained and the cooling water flows rapidly past the vapour tubes, whilst in the open surface type, the vapour passes through a bank of tubes cooled by trickling water and is thus condensed.

There is one important operation, primarily of distillation, where the product left in the still is the first consideration. This is known as *evaporation,* and may be applied to operations as various as those for obtaining salts from sea water, to concentration of milk or tomato juice to give edible products.

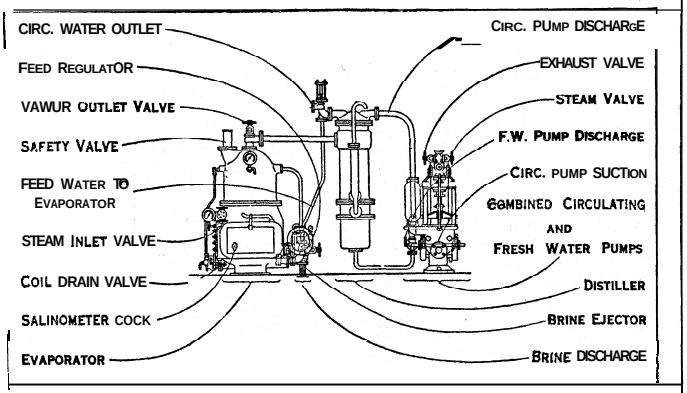


FIG. 6.— SECTION OF WEIR ADMIRALTY TYPE OF EVAPORATING AND DISTILLING UNIT. EXTENSIVELY USED IN THE BRITISH NAVY, AS IT IS COMPACT, EFFICIENT AND ECONOMICAL

(9) Distillation of Water.—Water free from dissolved gases and salts is indispensable in many scientific and industrial operations. The laboratory still for the purpose is very simple. The boiler, fed by warm water from the condenser, is usually of copper, and the head and worm of copper or tin.

The problem of the economic production of potable water from sea water is very old. In 1683, Fitzgerald patented a process for "the sweetening of sea water." Hales (1739) gives a history of the earlier attempts in his book, *Philosophical Experiments.*

Early forms of the modern apparatus were invented by Chaplin of Glasgow, Rocher of Nantes, and by Gallé and Mazeline of Havre. The Normandy apparatus was effective and economical. and extensively used in the British navy, but owing to its expensive and complicated structure it has largely given place to the Weir type of plant (fig. 6).

The modern plant consists of three main parts, the evaporator, distiller and condenser. In some types of condenser the tubes are of oval section, as in the German Pape-Henneberg, or crescent-shaped as in the Quiggins. Royles' plant uses the Row patent tube consisting of tubes indented alternately at right angles. An important feature of such tubes is that they are self-scaling in use. In distilling plant for ship-board use compactness is the first essential, whilst for terrestrial work the more elaborate form of apparatus such as the Mirlees-Watson *sextuple effect* evaporator (Plate *V.)* gives strikingly economical results.

BIBLIOGRAPHY.—Laboratory distillation is discussed in all books on practical organic chemistry, and its theory in treatises on physical chemistry. S. Young and Collaborators' *Distillation Principles and Processes* (London, 1922), and C. Mariller's *Distillation et Rectification des Liquides Industriels* (Paris, 1925) are both excellent general books combining treatment of the theory and practice of industrial distillation. In addition, the former gives a detailed analysis of laboratory column performances. C. Elliot's *Distillation Principles* and *Distillation in Practice* (London, 1925) treat the problem from the view-point of a chemical engineer. C. S. Robinson's *Element of Fractional Distillation* (New York, 1922) should also be included for reference. (E. Ho.)

DISTOMUM: *see* TREMATODES; PLATYHELMINTHES.

DISTORTION, in radio, a term denoting change in wave form which takes place as a wave passes through a circuit or transmission medium. Wave form distortion may consist of: (1) The presence in an output wave of a circuit of components having frequencies not present in the original wave due to circuit elements having non-linear characteristics; (2) a change in the relative amplitude of the component frequencies of a wave due to variation in the transmission efficiency of the circuit or transmission path for different frequencies included in the range involved; (3) a change in the relative phases of the component frequencies. Two or more of these forms of distortion may be present simultaneously.

DISTRESS, pressure, especially of sorrow, pain or ill-fortune. As a legal term, the action of distraining or distraint, the right of a landlord to seize cattle or goods of his tenant for non-payment of rent, or the right of a person upon whose land cattle stray to seize the cattle "damage feasant" (doing damage). The cattle or goods so seized are taken without legal process as a pledge to compel the satisfaction of a demand or the redress of an injury. They can only be retained until the owner makes satisfaction. "Distress damage feasant" is also applicable to inanimate things on the land, if doing damage thereto, or to its produce. Such distress must be made during the actual trespass, and by the person aggrieved by the damage. Distress for rent however is the sense in which the term is most frequently used in its legal signification. The power of distress appears to have been derived from the feudal law and to have been substituted for a forfeiture of the tenant's holding. Until the statute 2 and 3 Will. and M. sess. 1 c. 5 the chattels distrained remained only as a pledge in the hands of the landlord and could not be sold.

Rents at common law are of three kinds, rent-service, rent-charge and rent-seck and at common law distress was incident to rent-service and by special reservation to a rent charge. A rent reserved by a lease is rent-service. Distress was not incident to rent-seck until the Landlord and Tenant Act 1730. That statute also extended the remedy of distress to rents of assize and chief rents and thereby in effect abolished the most material distinction between them. But a right of distress is not incident to an obligation to pay provided for in an agreement, which is only a licence and does not create the relationship of landlord and tenant between the parties.

All personal chattels are distrainable with the following exceptions:— (i.) *goods absolutely privileged:* (a) things in actual use; (b) fixtures (*q.v.*); (c) goods delivered to a person in the way of his trade; (d) perishable goods; (e) goods in the custody of the law; *e.g.,* goods already taken in execution by the sheriff;

(f) animals ferae *naturae* (dogs and tame deer and deer in an enclosed park may be distrained); (g) Crown property; (h) goods of an ambassador or his servants on the premises of an embassy; (i) certain articles exempted by special acts of parliament; *e.g.*, gas or water meters; (j) hired agricultural machinery and breeding stock in circumstances coming within the provisions of the Agricultural Holdings Act 1923; (k) goods of an under-tenant or lodger (Law of Distress Amendment Act 1908); (l) wearing apparel and bedding of the tenant or his family, and the tools and implements of his trade to the value of £5 (Law of Distress Amendment Act 1858); (ii.) goods conditionally *privileged, i.e.*, privileged if there are sufficient goods of other kinds on the premises to satisfy the distress: (a) implements of trade not in actual use; (b) beasts of the plough and sheep; (c) agisted stock if the Agricultural Holdings Act 1923 applies.

In order to obtain the protection afforded by the Law of Distress Amendment Act 1908, it is necessary for the under-tenant or lodger, who seeks protection, to make a declaration in writing and serve it on the landlord, his bailiff or agent employed to levy the distress after (not before) the landlord has levied the distress or authorized it to be levied. The declaration must be set out (i.) that the tenant has no interest in the goods in question and that they are the property of the person making the declaration, (ii.) the rent then due by the under-tenant or lodger, (iii.) the rent payable in future, and (iv.) an undertaking to pay all such rent to the landlord until the arrears then distrained for have been paid off. An inventory of the goods in question must be annexed.

A distress for rent may not be made after sunset and before sunrise, nor on a Sunday. It may not be made till rent is in arrear. At common law a distress could not be made after the expiration of the lease, but since the Landlord and Tenant Act 1709 it may be made at any time within six months of the termination. By the National Health Insurance Act 1924 s. 102, where an insured person is receiving sickness benefit under that act and a medical practitioner certifies that the levying of a distress would endanger the insured's life, the levy must be postponed during the currency of the certificate. The certificate is of no effect until it has been sent to the insurance committee and recorded in a special register. It operates for one week but may be renewed weekly for three months but not longer. The register may be inspected without fee. In the cases of premises to which the Rent and Mortgage Interest Restrictions Acts apply distress cannot be levied without leave of the court.

Six years' arrears are recoverable in ordinary cases, but if the Agricultural Holdings Act applies only one year's arrears are recoverable.

If the tenant become bankrupt the right of distress is limited to six months' rent prior to the adjudication. If more be due that must be proved for in the bankruptcy (Bankruptcy Act 1914 s. 35). If a company is being wound up its goods cannot be distrained without leave of the court (Companies [Consolidation] Act 1908 ss. 142 and 211).

The distress for rent must be made on the land demised except in the case of the king or queen regnant and except in the case of fraudulent removals and certain rents for quarries in the Forest of Dean. Chattels clandestinely or fraudulently removed from the premises may be followed within 30 days after their removal, unless in the meantime they have been sold *bonâ fide* and for valuable consideration. Again if a landlord or his agent come to distrain cattle which he sees upon the land, and the tenant or any other person drive the cattle off the land the landlord or his agent may follow them; but this does not hold if the landlord or his agent does not see the cattle on the land or the cattle stray from the land of their own volition.

A distress may be made by the landlord himself or a certified bailiff (Law of Distress Amendment Act 1888 s. 7). This certificate is granted by a county court judge. He may be removed by the judge for extortion or misconduct. He should have an authority in writing from his employer called a "distress warrant." This warrant does not require a stamp. The outer door of the tenant's house cannot lawfully be broken open in order to make a distress but if the outer door be open an inner door may be broken open if necessary.

The chattels distrained must be impounded. By the Protection of Animals Act 1911 s. 7 a person impounding any animal must supply it with a sufficient quantity of wholesome and suitable food and water. The landlord cannot sell the chattels distrained to himself. Before any sale takes place enquiry should be made at the county court registrar's office to ascertain whether the goods have been replevied (see REPLEVIN); if that is not so and the rent due and charges for the distress remain unpaid at the end of five days (which must be extended at the request in writing of the tenant to 15 days) the goods should be sold for the best price which can be obtained for them (see AUCTION). The overplus, if any, must be repaid to the tenant.

Duties and penalties imposed by act of parliament (*e.g.*, payment of rates and taxes) are also sometimes enforceable by distress. (A. SD.)

In the United States, the process is recognized by most of the states for the taking of a personal chattel from the person to secure satisfaction for a demand.

DISTRESS, RELIEF OF. Public relief of the destitute in Great Britain is dealt with in the article POOR LAW; here we are concerned only with aspects arising out of unemployment. For relief of unemployment in the U.S.A., see RELIEF: Federal *Relief*.

The first serious attempt to treat this problem as separate from Poor Law procedure was made by the Unemployed Workmen Act, 1905, which removed these men from the pauper class. Under it were established distress committees of the councils of boroughs and urban districts with a population of not less than 50,000 (with certain special arrangements in the case of London), and central committees in the counties. The members of the distress committees were drawn from the councils, the boards of guardians, and co-opted persons (one at least of whom had to be a woman), and the central bodies comprised representatives of the committees and of the county councils, with co-opted members and persons nominated by the Local Government Board (after 1919 the Ministry of Health); their expenses were met by a fund supplied by voluntary contributions and by moneys raised from the rates, the latter being limited to a rate of ½d in the £ or, with the sanction of the minister, 1d., rate aid being confined to establishment charges, the cost of emigration or removal and the acquisition of land.

It was the duty of the distress committees to make themselves acquainted with the conditions of labour in their area and, if so required by the central body, to receive, inquire into, and discriminate between applications from unemployed persons; in suitable cases they might endeavour to find work for an applicant, but they could not themselves provide or contribute towards the provision of work for such. The central bodies superintended and, as far as possible, co-ordinated the action and aided the efforts of the distress committees, and could provide temporary work with the object of fitting the recipient for work of a regular character.

For many reasons—*e.g.*, the failure of the alliance between voluntary charity and rate aid, the burdening of the distressed area itself with the cost of its unemployed, and the unwieldy method of appointing the committees—the Act was never a success; its repeal was advised in 1909 by the Royal Commission on the Poor Law, and many times subsequently; in 1910 an important part of the work of the committees was transferred to the newly formed Labour Exchanges; and in 1929 the Act was finally repealed by the Local Government Act.

The Local Government Act, inter *alia*, abolished the boards of guardians and transferred their functions, with most of those of the Poor Law authorities, to the county and borough councils. which were empowered to set up "Public Assistance Committees" charged with the carrying out of these duties, and local sub-committees known as Guardian's Committees. The former are made up of councillors or aldermen and co-opted members; the latter of nominees of the district council, members of the county council for the area divisions. and co-opted members. In both cases co-opted members may not number more than one third of the total membership and must include some women; among them are usually ex-members of the former Poor Law authorities and frequently members of such bodies as the Voluntary Hospitals Asso-

ciation and the Personal Service League. There is no statutory limit to the numbers serving on the public assistance committees, but the guardian's committees may not comprise less than 12 nor more than 36 members.

The public assistance committee administers the Poor Law in the area over which it has control and is responsible for the supervision and management and all the various Poor Law Institutions as well as for general relief. It may delegate certain of its functions to other committees but its work in connection with the relief of distress is done through its own guardians' committee and other committees (as "Welfare", "Outdoor Relief", etc.) appointed for special purposes.

Pt. 11 of the Poor Law Act, 1930, gave the public assistance committees further powers, especially in the matter of the recovery of the cost relief; and in 1931 the Unemployment Insurance (National Economy) (No. 2) Order laid upon them the duty of investigating applications for relief from unemployed persons of 18 years or over claiming, under the Unemployment Act, 1927, that they are in need of assistance by way of transitional payments (the "needs test"). Relief, when awarded must not exceed the amount the applicant would obtain through insurance, and must be given in cash, not in kind. By 1933, when unemployment in Great Britain had passed its height, the Ministry of Health admitted that the relief of distress among the able-bodied unemployed was a State responsibility, and in 1934 a further Unemployment Act was passed upon this principle.

DISTRIBUTION. In economics, the manner in which the income of a community, won by its own production or gained in fruitful exchanges with other communities, is divided up among its members. The national output, or aggregate of services and material goods produced by the capital and labour of a nation, is a continuous stream, which is always flowing, and which is divided up among the agents of production in certain shares. The lenders of physical goods take rent; the lenders of capital take interest; management takes profit; labour takes wages or salaries. The national and local governments levy taxes upon all these for the expenses of government, and in so doing change to some extent. large or small, the nature of the distribution, among private claimants, as when the taxation of the well-to-do is used to pay an old-age pension.

The manner of the distribution of the national dividend is determined by the law of supply and demand. Each contributor to the national product brings to market his goods or his services, his property, or his labour, for sale or hire. If he owns physical property he offers it for hire and obtains whatever rent the condition of the property market affords. If he possesses money, he may lend it at the highest rate of interest he can get at the risk he is willing to hazard. If lie is a captain of industry, he sells his managing power, and if he is a man of consummate ability he can obtain a high price for his services, for the supply of such men is always relatively small. If he is a workman, he brings his skill and strength to market, bargaining either individually or collectively for the best reward he can get. In each of these matters, the law of supply and demand operates, modified by powers of monopoly or quasi-monopoly.

The subject of distribution is thus of paramount interest, and its consideration has engaged the close attention of economists of all schools, of political parties, of statesmen framing industrial and social legislation, and of finance ministers levying taxation. In these pages, the economic issue is discerned under ECONOMICS, CAPITAL, MONOPOLY and INHERITANCE; socialistic views under COLLECTIVISM, SOCIALISM, GUILD SOCIALISM and ANARCHISM; the practical industrial issues under INDUSTRIAL RELATIONS, TRADE UNIONS, CO-OPERATION, CO-PARTNERSHIP, PROFIT-SHARING and EMPLOYEE STOCK OWNERSHIP; the actual distribution of wealth and the national product under WEALTH AND INCOME, DISTRIBUTION OF; and ESTATE DUTIES.

DISTRIBUTION, IN TRADE: see MARKETING.

DISTRIBUTION OF ANIMALS. A solution of the problems of zoogeography, which attempts to explain the distribution of animals on the earth, may be sought in two directions. We may investigate the distribution of related groups of animals in the separate regions of sea and land. and from this seek to draw conclusions as to former connections betueen the present habitats of related forms. the historical aspect. or we may inquire what animal forms dwell together in places showing certain conditions of environment, and by what characters they are adapted to existence under these conditions, the oecological aspect, which is considered here.

For animal life to succeed at all, certain general conditions must be fulfilled; if but one is lacking, animal life also is absent. One of these primary conditions is water. In places such as extremely arid deserts, where water-supply and dewfall fail completely for long periods, no animal can live

To many animals light is not immediately necessary. In subterranean caverns, and in the great depths of the ocean (1,700m.), light is absent, yet animals live in these places provided they can find food Light is indispensable, however, to green plants since it supplies the energy for the manufacture of organic substances. Animals are dependent on organic food, and so ultimately, upon plants Light, therefore, is indirectly necessary to animals.

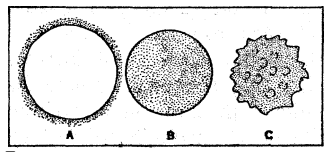


FIG 1.—MAMMALIAN RED BLOOD CORPUSCLES IN SALT SOLUTIONS: A 0.2%; B. 0.75%: C. 1.0%

All life is confined within certain limits of temperature. Albumin, the chief constituent of protoplasm, coagulates at about 70° C. Protoplasm, too, cannot live if its fluid content is frozen, *i.e.*, at temperatures below about -1° C. Thus animal life is absent in the hottest springs (some lower animals, such as Protozoa, rotifers, snails, can live in hot springs of 45°–50° C); while no animals are present in the perpetual snows of mountains.

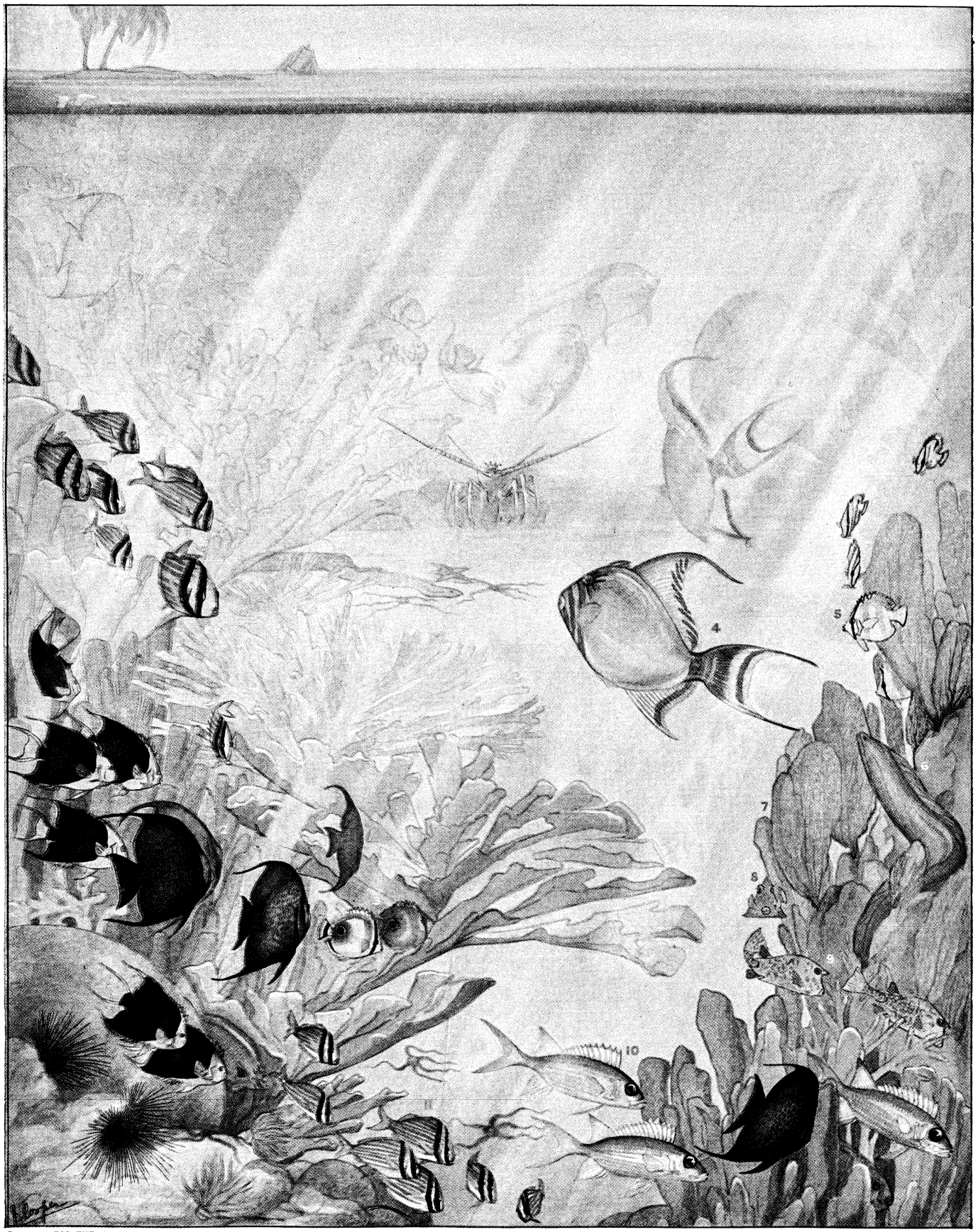
Food is absolutely essential to all animals. In addition to organic materials (albumin, carbohydrates, fats), oxygen is needed, to combine with the products of the breaking-down of organic food, and thus liberate energy. There are some places where oxygen and therefore animal life is absent; in the depths of scme parts of the ocean and in volcanic places where carbon dioxide (CO_2) escapes from the ground, *e.g.*, the floor of the Grotto del Cane at Pozzuoli, near Naples.

The quantity of moisture, warmth and oxygen, required by an animal varies in different species; some are able to manage with little, others need much, while others again are indifferent to the amount Animals requiring amounts of moisture, warmth or oxygen (whether great or small) not varying beyond narrow limits are termed stenohygrous, stenothermic or stenoxybiont, respectively; those having wide limits, euryhygrous, eurythermic or euroxybiont; animals in all respects indifferent are euryoekous, those requiring definite quantities stenoekous. Euryoekous animals generally have a wider distribution than stenoekous.

The different regions of the earth occupied by living beings, the sea, fresh water and dry land, are fundamentally different in the conditions they offer and in the demands they make.

Sea.—The sea is the home of life. In it are represented all the structural types in which animal life manifests itself. Echinoderms, Tunicates, Cephalopoda, many groups of worms, Radiolaria and Foraminifera are confined to the sea Myriapoda and Amphibia only are not represented there. Salt water of the concentration of sea-water is the true medium for protoplasm Seawater has the same osmotic pressure as the fluid in protoplasm For that reason it withdraws no materials from the protoplasm, neither does it give up any to it. If human blood is examined in salt solutions of strengths such as 0·2%, 0·75% and 1%, the fate of the red corpuscles differs greatly in each cace (fig 1. A–C.) In 0·75% NaCl they remain unchanged; this solution is isotonic with the fluid they contain. In 0·2% NaCl the corpuscles give up colouring matter to the salt solution, swell and ultimately burst (a). In 1% NaCl they shrivel *(c)*, water having been withdrawn from them. Animals living in the sea are situated similarly to the corpuscles in the 0·75% salt solution; they need not isolate their inner medium from the environment.

In the sea, too, the conditions of life undergo least change. All seas communicate with one another, and their waters are con-



PAINTED FOR THE ENCYCLOPÆDIA BRITANNICA BY ISABEL COOPER FROM MATERIAL COLLECTED UNDER WATER BY MEANS OF A DIVING-BELL

THE LIFE OF A WEST INDIAN CORAL REEF

1. Rock Beauty (*Holocanthus tricolor*)
2. Black Angel Fish (*Pornacanthus Arcuatus*)
3. Four-eyed Fish (*Chaetodon capistratus*)
4. Queen Trigger Fish (*Balistes vetula*)
5. Butterfly Fish (*Chaetodon ocellatus*)
6. Queen Moray (*Lycodontis funebris*)
7. Sea Fan (*Gorgonia flabellum*)
8. Buffalo Trunkfish (*Lactophrys trigonus*)
9. Cowfish (*Lactophrys tricornis*)
10. Squirrel Fish (*Holocentrus ascensionis*)
11. Pork Fish (*Anisotremus virginicus*)

tinually mingled. The salinity, therefore, is about the same in all regions, the temperatures are similar, and vary much less than in fresh water, or in the atmosphere. The amount of oxygen present is very constant. Exceptions are secondary seas having only a narrow connection with the ocean, such as the Mediterranean and Baltic.

Fresh Water.—Fresh water, on the contrary, is dangerous to living organisms on account of the small amount of salts contained in solution. As in the red corpuscles in 0·2% NaCl, water is continually passing into the protoplasm. The inward permeation of water may be prevented either by strong armour, as in water insects, the animal body shutting itself off from the environment; or, more frequently, the water which passes in is constantly discharged. Thus all fresh-water Protozoa possess a contractile vacuole (fig. 2), which contracts rythmically, and discharges water to the exterior. In multicellular fresh-water animals the same result is reached by the action of the kidneys. Fresh-water animals, however, have less competition, for only relatively few marine animals are able to counteract the ill-effects of fresh water. Fresh water offers a rich food supply, but this must be earned.

Land.—Terrestrial life offers a number of favourable conditions. Oxygen is present in much greater quantities than in water. Further, dry land, in contrast to the sea, offers abundant vascular plants as food. These advantages, however, are not easily obtained. The amount of moisture in the air is generally far from saturation point, and puts the animals in danger of desiccation. The outer skin, and, above all, the respiratory organs, with their large, permeable surfaces, must be protected from excessive evaporation. Only members of three groups of animals can survive life in a dry atmosphere, gastropods, arthropods and vertebrates. Gastropods have in their shells a protection against desiccation; they emerge only when there is sufficient moisture. Terrestrial arthropods have their chitinous armour. Among the vertebrates, the horny epidermis lessens evaporation. In all three groups the respiratory organs have been removed to the interior of the body. Snails have a pulmonary cavity; millipedes, insects and spiders have internal air-tubes (tracheae); air-breathing vertebrates have lungs. In all these animals life takes place in the inner albuminous salt solution, not in the atmosphere.

The air also offers a new condition in its lesser density. Water supports the animal body, leaving little work for muscles and supporting organs. In the air, on the contrary, the body must be supported and compact to retain its form. All terrestrial animals, therefore, have skeletons; snails their shells, arthropods their chitinous armour and vertebrates their bony skeletons. Further, water supports, or retards the sinking of, much floating matter, such as small plants or animals, and the disintegration products of organisms (detritus), and this is carried as food to the animal population. For this reason, fixed animals may be present in water in great numbers. In terrestrial life, animals must search for their food, and fixed forms, except some parasites (*e.g.*, cochineal insects), do not occur.

Most terrestrial plants cannot be utilized by animals without undergoing further processes because the albumin, fat and starch are all enclosed in a cellulose envelope. Animals, except some snails (*e.g.*, Helix *pomatia*), possess no ferment in their gastric juice which will dissolve this substance. The cellulose membrane must therefore be broken up to liberate the food. Thus snails tear the cells to small pieces by their radulae; arthropods fragment vegetable food with their jaws; mammals chew with their teeth; and birds grind up food in their gizzards. The numerous herbivores render possible the existence of carnivores; many insects, almost all amphibians and reptiles, and many birds and mammals are insectivorous or predatory.

One particular difficulty to which terrestrial animals are generally exposed is the great variations of temperature. In the sea, the temperature of the water over large areas is subjected only to slight and gradual variations. The daily variations are also slight. In fresh water the temperature does not sink below zero; in deep water it is unusual for it to sink below 4° C. Only in summer, in the smallest basins, does it reach 25°–30° C. On land also there are regions with only slight diurnal and seasonal temperature variations, *e.g.*, tropical forests. The difference between diurnal and nocturnal temperatures, however, is usually considerable. The difference between the extreme temperatures of different seasons at certain places is very large. In Central Europe it amounts to 90° F, in Werchojansk (Eastern Siberia) it even reaches 180° F. During the winter, life in the sea and in fresh water goes on unchecked, although isolated species hibernate. On land, in the temperate and frigid zones, all life becomes torpid under the influence of winter cold; even the nightly cooling of the air makes many animals sluggish. The organization of terrestrial animals is profoundly influenced by variations of temperature; muscles become stiff, glandular activity ceases. If, however, an animal can produce inside itself by metabolic processes a favourable temperature, and can maintain this through nervous control, it is freed from these temperature variations. Such animals are termed homoiothermal (warm-blooded animals). Homoiothermal animals have, nevertheless, to pay a price for this advantage; they become slaves to their increased food-requirements. Poikilothermal (cold-blooded) animals can fast for long periods; a snake or frog can go without food for six months, and aestivating snails for four or five years. Homoiothermal animals, on the contrary, quickly succumb to lack of food.

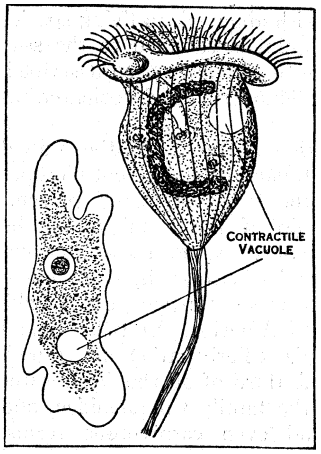


FIG. 2.—AT LEFT, AMOEBA, AND AT RIGHT, VORTICELLA (CILIATE INFUSORIAN)

The Conditions **of** Dispersal.—In the various regions inhabited by living organisms, the sea, fresh water, and dry land, animal dispersal is influenced in different ways, and the barriers opposed to it differ. The seas are in communication with one another in all parts of the earth; though the present connections between the Indo-Pacific and the Atlantic are in polar and sub-polar regions and, on that account, are impassable for warm-stenothermal animals. For most marine animals, however, dispersal depends on their powers of migration. Sedentary animals can extend their range only during the short, free-living, larval life, but powerful swimmers like sharks and mackerel are found in all warm seas. Isolation, however, is an important factor in transformation of species. The great variety of marine animals is therefore astonishing, when we consider the similarity of conditions of life in the various seas.

In inland waters conditions are quite different. This region is divided into innumerable small sections, such as streams, rivers, lakes and ponds separated by insurmountable obstacles in seas and land, Standing waters in particular are very varied in the materials they hold in solution, in conditions of light and temperature, in the fertilizing matter they receive, and therefore in their plant life. This wide-spread isolation under the influence of environment might give rise to the development of numerous different species, and to great variability within the limits of each species. but actually the fauna of fresh water is very rich in cosmopolitan genera and species, and, over the whole earth, shows great similarity. The origin of this is the transitory nature of fresh waters. Even in historic times, rivers have changed their courses, dwindled and dried up. Small standing waters are also apt to dry up. Lakes gradually become filled up. The existence of enclosed basins is not of sufficient duration for a thorough transformation of the species dwelling in them. Newly-arisen waters become populated from those already in existence by organisms which can either fly from one basin to the other, or be carried as spores by winds or water-birds. It is only in deep, and therefore ancient, basins that a characteristic fauna has been able to develop, as in Lake Baikal (1,373m. deep), and Lake Tanganyika (590m.).

Dry land is divided into many small, more or less isolated,

sections by seas, mountains, deserts and rivers. But terrestrial animals have very variously developed organs of locomotion, and therefore the effect of isolation varies. The great environmental differences have a similarly isolating effect. The transformation of species is thus exceedingly vigorous on dry land, but is confined to those animals able to live there (gastropod molluscs, arthropods and vertebrates). The sea is a much more extensive arena for iiving organisms. Nevertheless, $\frac{4}{5}$ of all animal species are terrestrial. We are acquainted with about 3,000 living species of Coelenterata and Echinoderma, animals confined to the sea; on the other hand, 400,000 species of insects have been described. But the range of variation among echinoderms and coelenterates is much greater than in the insects.

Prolonged isolation gives a striking character to the animal life of a district. The variety of the fauna in the different biotopes arises through transformation of the stock originally present. For that reason the interrelationship of the members of the fauna is much greater than in districts where continual intermixture is possible with forms which wander in from the surrounding regions. Such differentiation is found in the Caspian sea, in Lake Baikal, in Madagascar and in South America. In Lake Baikal 79 species of fresh-water Tricladida (Turbellaria) are found, more than half the known species. A third of all the fresh-water fishes in South America belong to the family Characinidae, and include mud- and plant-eating, and even carnivorous forms. Among mammals, the numerous adaptations shown by rodents of the family Hystricomorpha is most remarkable.

Area of Distribution. — The region occupied by a species is known as its area of distribution. The size of the area varies in the different species; it depends on the presence of suitable dwelling places, on the barriers limiting dispersal, on the powers of migration of the species and the facility with which it may be transported, on its oecological value, and on its history.

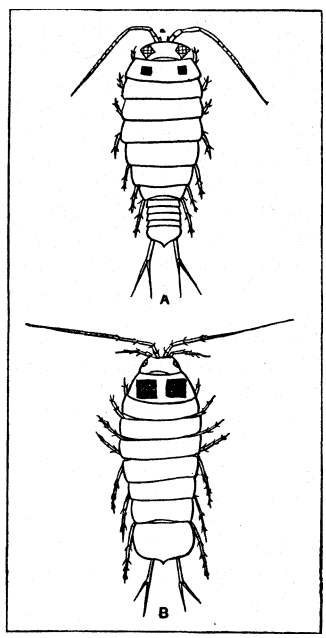
Species with restricted range are termed stenotopic, those with wide range, eurytopic. Species becoming extinct, or newly-arisen, often have a restricted range; examples of the former are the primitive lungfish, Neoceratodus (Murray river, Australia), and the lizard, Sphenodon (New Zealand); of the latter, the moth *Cymatophora* or var. *albigensis* in the industrial districts of England and Hamburg. **A** closely confined habitat also hinders dispersal; such are Lake Baikal and the Hawaiian islands, with their many endemic species. Changes in the area of a species may take place before our eyes; the jigger flea (*Sarcopsylla penetrans*) first arrived in Africa in 1872, and since that time has spread from the west coast to the east. The inner limit of size of an area varies with the size of the animal and the nature of its food. Carnivores require a larger range than herbivores of the same size. For this reason beasts of prey cannot exist on small islands. Cosmopolitan species are those present generally over the whole earth wherever they can find suitable dwelling places. (A cosmopolite, however, is not found in all the regions supporting life, *i.e.*, the sea, fresh water and dry land.) As examples may be mentioned the edible mussel (*Mytilus* edulis), found in all the seas of the world, the brine shrimp (Artemia salina) universally present in salt marshes.

Small districts are generally poor in species, large districts having the same conditions are richer. Thus the number of species of fishes decreases in proportion to the size of the river plus its tributaries: —

	Million sq km.	*Species*
Amazon	7	700
Congo	3.7	380
Mississippi	3.3	2j6
Rio de la Plata (with the Uruguay)	3·1	359
Ganges and Brahmaputra	1·75	170
Indus	0 965	113

Biotope and **Biocoenosis.**—A district showing uniformity in environmental conditions is uniform also in animal population; it is called a biotope (habitat). A small birch mood, a cavern or a rocky coast is a biotope. A biotope may often be subdivided into areas having particular conditions, and, therefore, a particular kind of fauna; *e.g.*, a pool in a cavern. These are termed facies. Similar biotopes are included in larger units termed biochores; the biotope "green forest" is included in the biochore "forest." Biochores are grouped in larger units, termed biocycles. These are sea, fresh water and dry land. These divisions are independent of the zoological distributions, which have to do with the systematic relationship of the animal population.

The animal population of a biotope is not a haphazard collection; the members are in close association one with another, and, together with the plant life, form a unit of a distinctive kind, an association of forms of life, or biocoenosis. To the biocoenosis belong all organisms, plant or animal, present in the biotope. They influence one another mutually, and are in many ways dependent on each other. Producers (chiefly plants), and consumers (animals), dwell beside one another, but the products of animal metabolism are food for the plants, and animals are often necessary for the fertilization of flowering plants. Among the animals themselves there are bonds, such as hunter and prey, host and parasite; they may live in symbiosis or compete as rivals. Should one kind of organism become eliminated, or get the upper hand, many members are affected, favourably, or otherwise —the balance of the biocoenosis is disturbed.



FROM A. ROGENHOFER, "ZUR KENNTNIS DES BAUES DER KEFERDRUSE BEI ISOPODEN"

FIG. 3.—A. MARINE, AND B. FRESH-WATER ISOPODS, THE BLACK SQUARES SHOWING THE RELATIVE SIZES OF THE NEPHRIDIA (MAXILLARY GLANDS)

Every biotope has a population of characteristic constitution. Not all members of a biocoenosis are characterized in similar ways, or confined to one particular biotope. There are animals present only in certain biotopes, *e.g.*, the brine shrimp (*Artemia*), in salt inland waters; they are the predominant forms in this biotope, and in its biocoenosis, and are termed eucoenic. Animals always present in a biotope, but also constantly found in other localities, are termed tychocoenic; thus, the wolf and eagle are found on the steppes, but are also characteristic of mountainous and forest regions. Xenocoenic animals are chance members of the biocoenosis, into which they may have been forced from the surrounding district, or through which they may be passing.

The inhabitants of the same biotope are subject to the same environmental conditions, and must be in harmony with them. Thus they may resemble one another in certain respects without being related. Necessity brings about quite definite adaptations through selection. The stricter the selection, the more marked are the common characteristics. Organisms dwelling in the moss on rocks, trees or walls, are often completely dried up by the sun; they can all endure desiccation and almost entirely discontinue their vital functions without suffering injury.

ANIMAL DISTRIBUTION IN THE SEA

The distribution of life in the sea is dependent on factors partly physical, partly chemical. Density and viscosity are the primary factors governing the floating of organisms in the water. (See PLANKTON.) The pressure of the water increases with the depth. A column of sea water of average density measuring 10·07 metres exerts a pressure of one atmosphere per sq m. of surface, so that in the greatest known depths of the ocean (10,793 metres), a pressure of almost 1,072 atmospheres prevails. The pressure of the water, however, has no perceptible influence on the distribution of the animals Animal life is present at great depths, and the plankton and fishes of the open sea may undertake, in one night, vertical migrations of 300 metres and more without being injured by alteration of the pressure by about 30 atmospheres.

The brittle star *Ophiocten sericeum,* is present in depths varying from 6 to 4,370 metres; it is eurybathic. Species confined to particular depths are termed stenobathic; *e.g.,* the reef-building corals, which flourish only to a depth of 30 metres.

Waves.—The movements of the water, which at different times and places undergo many changes, are of particular importance to animal life. Waves reach to depths of several hundred metres. Currents may reach similar depths. The breakers make a heavy demand on the coastal dwellers; in the North sea the strength of their impact averages 15 tons per sq. metre. Animals dwelling on rocky coasts within the region of the breakers must protect themselves from injury. This is accomplished either by the animals attaching themselves to the substratum, or by the formation of strong shells. As examples of fixed animals the acorn-shells *(Balanus)* may be mentioned; others which adhere by a strong foot are the gastropods *(Patella, Littorina)*; the mussel *Mytilus* anchors itself by its byssus threads. In the deeper layers where movements are felt, sessile animals are able to bend, and have some elasticity of movement; in still waters they are rigid; *e.g.,* the Bryozoon, *Caberea boryi,* in the North sea. Marine currents are very important for the distribution of fixed animals, since they serve as means of transport for the free-living larvae.

Temperature.—Temperature is very important. The temperature of the surface water decreases, in general, towards the poles, but this is modified by warm and cold currents. The temperature decreases, also, with depth, and at the bottom is down to about zero. Owing to the great surface currents, more water is carried towards the poles than away from them, and, as the cold water at the poles is heavier than the water of the equatorial regions, there is a steady shifting of the deeper layers towards the equator. These cold, deep currents cannot penetrate secondary seas separated from the main ocean by ledges not far below the surface.

Related animals show marked variations under the influence of differences of temperature. Frequently the size of individuals of the same species increases with decreasing temperature towards the poles and in deep water layers. The shell of the gastropod *Nassa clausa* reaches a height of 12·7mm. in the Skagerak; at Spitzbergen it measures 38mm. Similarly, the Isopod, *Serolis bromleyana,* measures 16mm. at depths of 730 metres, and at 3,600 metres, 54mm. Giant species, *i.e.,* species which greatly exceed in size related forms, are found comparatively frequently in polar seas and in deep water. This may be ascribed to the influence of temperature. The hydropolyp, *Branchiocerianthus imperator,* which attains a height of 2 metres in depths of more than 3,000 metres, is an example. Other effects of low temperature are the greater amount of yolk in the eggs, and the frequent occurrence of brood-nursing. The multitude of brood-nursing forms in all classes of echinoderms in the Arctic and Antarctic is remarkable. It is noteworthy that the annelid *Cirratulus cirratus,* which in temperate seas deposits its eggs, at the Falkland islands practises brood-nursing.

The cold waters of the Arctic and the Antarctic are sharply divided from one another by warmer seas. To many cold-stenothermal animals this barrier is insuperable. Eurythermal animals may, indeed, be distributed through all seas, notwithstanding the variety of temperature. The fact that many species present at both poles are absent in the intervening regions has attracted particular attention. Since, in general, the area of a species is continuous, this bi-polarity requires explanation. Bi-polarity of species is by no means common. Some apparently bi-polar species are found in the intervening regions in the cold deep strata, *e.g., Calanus finmarchicus.* In other instances the two polar forms are also related to a species found in the intermediate region. Thus, the bi-polar Foraminiferan *Globigerina pachyderma* is related to *G. dutertrei* of warm seas. Bi-polar species, therefore, are derived from cosmopolitan through parallel modification of peripheral forms under the influence of environment.

Chemical Composition.—The chemical composition of the sea is very uniform, in consequence of the general mingling of the waters. The salinity at a depth of 300 metres is about 35, but is lower in surface water in estuaries, and in polar regions when the ice is melting. Considerable variations in salinity are found only in secondary seas shut off from the general mixture of the waters. These have a higher or lower salinity according to the ratio between the amount of river-water received and the amount of evaporation taking place. The Red sea has a high salinity (over 40%), so has the Mediterranean (38%); the Baltic has a low salinity. In the Baltic the influence on the animal population of the decrease in salinity is very striking. The number of species decreases, in proportion to the decrease in salinity, in an easterly direction *(see* Table).

Salinity		Marine fishes	Ascidians	Lamelli-branch molluscs	Gastropods	Opistho-branchs	Amphipods	Decapods
20%	Kattegatt	..	20	88	85	..	113	55
12%	Kiel Bay	75	5	23	17	23	18	9
7%	Middle Baltic	40	..	6	3	2	11	2
4%	Gulf of Bothnia	23	..	4	1	..	5	..

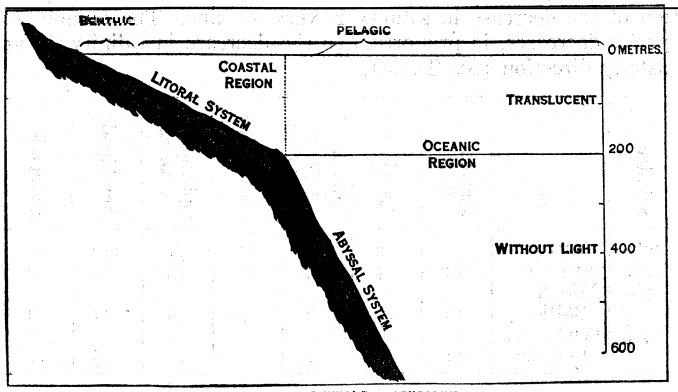
The size of the species also decreases in the same direction. The edible mussel *(Mytilus edulis)* at Kiel, attains a length of 110mm., further in the Baltic, it measures over 50mm., in the Gulf of Finland 27mm., in the Gulf of Bothnia, 21mm.

The quantity of carbon dioxide, nitrogenous salts and other materials necessary to plants in the water of any region is particularly important in determining the amount of life. If these materials are abundant, plant life flourishes and consequently animals find plenty of food. The sources of this food are, first, the products of animal metabolism and of the disintegration of dead organisms. Carbon dioxide and nitrogenous salts are only of use, however, in the upper, illuminated strata of the water, where the light is sufficient to supply energy for the assimilation processes of plants. The dead bodies of organisms which inhabit the open sea sink to the bottom, and, in great depths of the ocean, are withdrawn from the metabolic cycle. Their disintegration products can be used only in shallow seas where mixture of the water takes place right down to the bottom. In deep seas they may be of use in places where rising currents bring water from the depths to the surface. It happens, therefore, that coastal regions, shallow seas like the North sea, and banks such as the Dogger, show great wealth of life. Rising currents are found chiefly on the west coasts of continents where, owing to prevailing winds off the land, the surface water is driven away from the coast, and a compensating current from the depths flows towards it. No sea water is so teeming with life as those currents which set in towards the land in tropical regions, *e.g.,* off the coasts of Portugal and Chili. A quantity of fertilizing matter for plants is brought down to the sea, particularly by rivers. The region most richly supplied with river-water is the Atlantic-Arctic, into which more than half the earth's surface is drained. The Pacific is the poorest in this respect, particularly in its eastern portion. This, with its great depth, accounts for the poverty of its life compared with other oceans.

Oxygen is present everywhere in sufficient quantity in the surface waters of the open sea. In the depths, the influx of currents of polar surface water brings sufficient oxygen, and, since the disintegration of dead organisms goes on very slowly in the cold water of these depths, this oxygen is not used up in the process. In secondary seas where such currents are absent matters are different. In the eastern Mediterranean, the deeper layers of the water lack oxygen, and have a large quantity of carbon dioxide; on this account they contain hardly any life. This also applies to the greatest depths of the Baltic. In the Black sea, some Norwegian fjords, and in Walfisch bay on the west coast of Africa, the bottom water contains sulphuretted hydrogen produced by the disintegration of organic remains.

The Zones of Life in the Sea.—In the biocycle "the sea" two principal regions may be distinguished. These differ completely in their conditions of life, and, therefore, in their animal popula-

tion also (fig. 4). They are the "benthic region" (floor of the sea), and the "pelagic region" (open sea). The benthic fauna consists of animals attached to the sea bottom. Pelagic animals are not attached to the bottom, and maintain themselves floating or swimming in the water. Benthic and pelagic regions can be subdivided into two areas, that penetrated by light (on an average from the surface down to 200 metres), and a dark or abyssal



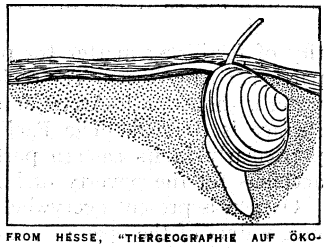
FROM PRUVOT, "ANNEE BIOLOGIQUE" (C REINWALD COPYRIGHT H BONNAIRE)

FIG. 4.—ZOOLOGICAL DIVISIONS OF THE SEA

region. The illuminated portion of the benthic region is termed the "littoral zone."

Littoral Zone.—In the littoral zone the bottom may be firm or shifting. A shifting bottom shows a flat surface, and varies according to its constituents, gravel, sand or mud. Rocks form a hard bottom, and the coast in such places is generally precipitous. The Binds of animals found in the littoral are determined by the type of bottom and by the movements of the water. The littoral is divided into three zones according to the movements of the water; (r) the tidal zone, between high and low tide marks, (2) the shallow water zone, or region affected by the waves, (3) the still water zone, which extends from the shallow water zone to the upper limit of the abyssal region.

A stony shore in the tidal zone is almost entirely without life, all organisms being killed by friction of the stones against one another. In shallow water, sandy bottoms which are often disturbed are not inhabitable for many animals. In places, however, where plants (Zostera, Posidonia) flourish, the sand is bound together, and animals find hiding places under the leaves and among the roots; sessile animals can find places for attachment; food (mud, detritus) is present, so that here a characteristic fauna is established. In deeper water, and in the shelter of projecting islands and sandbanks, a rich fauna may develop also near the surface, on sand and ooze. Sessile animals, certainlv, are not often found on shifting bottoms, owing to the danger of being buried; but oysters settle on the shells of molluscs, or on stones, and the edible mussel (Mytilus) attaches itself by its byssus to the floating branches of *Fucus*. On the other hand, shifting bottoms teem with animals which burrow under the surface, and so render themselves invisible to enemies. Such are the lob-worm (*Arenicola*), and other annelids, *Balanoglossus*, the heart urchin (*Echinocardium*), and numerous bivalves, which usually have smooth, flat shells for digging, and which obtain food and oxygen from the surface by siphons (fig. 5). These are followed into the sand by the starfish *Astropecten aurantiacus* and the predatory snail *Natica*. Crustaceans, amphipods, shrimps and the lancelet, *Amphioxus*, also burrow in the sand. Flat fishes, the star-gazer (*Uranoscopus*), weever (*Trachinus*) and blenny (*Blennius*) work themselves in just beneath the surface, gazing upwards with eyes situated on the upper surface of the head. The sand shelters also



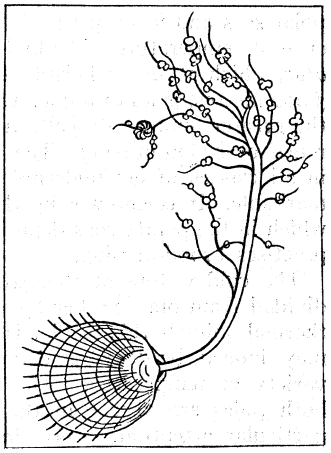
FROM HESSE, "TIERGEOGRAPHIE AUF ÖKOLOGISCHER GRUNDLAGE" (GUSTAV FISCHER)

FIG. 5.—PEPPER MUSSEL (SCROBICULARIA PIPERATA) IN SAND
On the left inhalant syphon, on the right the exhalant one, clear of water

minute animals which find room for movement between the sand-grains:—acoelous Turbellarians, Archi-Annelida, Tardigrada and Gasterotricha. The principal animals found on the sand are the ophiuroids, some gastropods (*Turritella*, Aporrkais), annelids and crabs.

Rocky coasts, in contrast to flat, shifting bottoms, offer a firm substratum for plants (particularly Laminaria and *Fucus*), and for sessile animals. Clefts, holes and caves offer shelter from the force of the waves. Sessile animals fix themselves by preference to the kelp, and to its places of attachment. Some construct hiding-places by boring holes in the rocks, *e.g.*, the boring sponge, Vioa, the boring bivalves *Pholas* and *Lithodomus*, and sea urchins such as *Strongylocentrotus*. Those animals, however, which dwell upon the rock surface, are armoured and protected against attack by hard shells or by weapons, Sponges have sharp spicules of silica, polyps and Anthozoa stinging-cells (cnidoblasts), echinoderms spiny armour, snails and bivalves strong, often spiny shells. Many crustaceans on rocky bottoms have spiny cuticles; some, however, hide themselves by placing algae, sponges, or polyps on their backs, while some of the fishes have poisonous spines (*Scorpaena*). Animals dwelling within the region of the breakers require protection against the battering of the waves, and so are firmly attached (see above). This region exercises a keen selective influence; only a few species can withstand the force of the waves, but this affords them protection from enemies. Thus the edible mussel (*Mytilus*) has a wide distribution in the littoral region, but usually is represented by solitary individuals; in the region of the breakers, however, where they are not exposed to attack, mussels are packed together in large numbers.

Coral reefs may be compared to rocky coasts. They consist of the dwellings of the reef-building corals, which attach themselves to the firm substratum, and offer dwellings and hiding places for many kinds of animals. These reefs are confined to a belt in the tropical seas, extending from 30° N. to 27° S., since the coral polyps require a temperature of at least 20·5° C. This accounts for their absence on the west coasts of Africa and America, where cold currents set in towards the shore. Calcareous algae, Bryozoa, some gastropods and other organisms take part with the corals in the formation of the reef. Reef-building corals cannot live below a depth of about 30 metres, since they live in symbiosis with algae (*Zooxanthella*), which inhabit the walls of the enteron of the polyp, and require light for assimilation. The delicate colours of corals are obtained from the algae. All reef-dwelling animals have vivid colours (Plate I.). The numerous species of corals of which a reef is composed are so arranged that in the zone of the breakers, strong, resistant forms are found. In deeper water, and in places where there is shelter from the waves, the delicately tinted, branching forms occur. Many kinds of animals find retreats in the numerous holes and cavities of the reefs, among them worms, crustaceans, gastropods and fishes. Some fishes feed on the coral polyps, and bite the ends of the branches with their beak-like jaws (Pomacentridae and Plectognathse).



FROM CHUN, "WISSENSCHAFTLICHE ERGEBNISSE DER DEUTSCHEN TIEF-SEE EXPEDITION"

FIG. 6.—DEEP-SEA BRACHIOPOD: STALK WITH OUTGROWTHS TO WHICH FORAMINIFERA ADHERE

Pelagic Zone.—The inhabitants of the open water or pelagic region have common peculiarities connected with floating. Living matter is somewhat heavier than sea-water; therefore, to float, animals must possess special adaptations. The rapidity with which a body sinks varies in proportion to its weight. It decreases with increased form-resistance (such as expansion of the under-surface): The weight of a living organism is lessened by the sparing use of skeletal material (lime, silica), and by the accumulation of lighter

substances (fat, air) in the body. The shells of floating animals, therefore, are small and thin, as in pelagic Foraminifera. The phosphorescent animal *Noctiluca,* many free-swimming crustaceans, the eggs of pelagic fish (*e.g.,* cod, flat fishes) contain fat-globules; further, the accumulation of fat in the liver of many fishes, and the blubber of penguins, seals and whales lessens the effective weight. Air-bladders are the most effective means of diminishing weight, and are found in many Siphonophora and in bony fishes (Teleosteans). Form-resistance is increased by enlargement of the under-surface. The most usual way is by absorption of sea-water into the body. This does not increase the weight, but distributes it over a greater area. Thus arises the gelatinous tissue frequent in pelagic animals. Water forms 96% of the jelly-fish, *Aurelia* aurita. In small animals, the under-surface may be increased by flattening the body, or by horizontally disposed processes which serve as floats; *e.g.,* pelagic nemertines (flattened like cakes), the Plzyllosoma-larvae of crustaceans, copepods (*Sapphirina*). If such means do not suffice, movements are made to assist in the prevention of sinking, as the lashing of the cilia of pelagic larvae and turbellarians, the beating of the ciliated plates of Ctenopliora, the muscular movements of annelids, and crustaceans. Swimming occurs when the muscular movements are sufficiently strong to render the animal's path independent of the movements of the water. Swimming is almost entirely confined to fishes, some cuttlefishes, and animals not primarily marine, such as turtles, penguins, whales and seals.

Those living organisms which float free in the water are termed the plankton (*q.v.*). The constitution of the plankton of the open sea differs from that of the coastal regions, or of shallow seas. The oceanic plankton consists entirely of forms which pass their whole life floating in the water (holoplanktonic). Examples are Siphonophora, Ctenophora, Chaetognatha, some crustaceans and gastropods, salps, and the ascidian, Pyrosoma. In coastal regions, in addition to such holoplanktonic forms, there are numerous animals pelagic only at some period of their life (meroplanktonic), in particular, the larval forms of benthic animals. The composition of the coastal plankton is therefore much more changeable than that of the oceanic plankton. The coastal plankton has its lower limit at a depth of 200 metres, but it may be driven beyond this by storms or currents. Coastal waters are much richer in life than oceanic. In the open ocean, however, the amount of life is not the same in all parts. In the Atlantic, the polar regions are much richer than the tropical. The poorest catch in the tropical Atlantic contained 763 organisms per litre of water, the richest catch in cold waters 76,915. There are, however, stretches of tropical seas which have a rich plankton, such as parts of the Indian ocean. The plankton forms the food of many fishes, such as herrings.

Abyssal Region. — The deep, unilluminated, abyssal region of the ocean is not without inhabitants, but plants naturally are absent. Since no building-up of organic substances can take place, the basic food of abyssal animals consists of the dead organisms which sink from the surface. The greater the depth, the less food reaches it. The number of species of the various groups of animals decreases with the depth; the following examples are taken from the crabs in the collective tow-nettings of the "Challenger" Expedition:—

Depth, in metres	0-36	36–180	180–360	360–900	900–1800	1800
Number of species	190	75	28	21	3	2

Benthos: — The benthos is composed partly of those animals which, by setting up eddies in the water, waft food towards themselves, and partly of those feeding on ooze. Echinoderms are particularly numerous among the latter. The soft ooze of the deep sea, which is about the consistency of soft butter, forms a very unstable substratum. For this reason, sessile animals have either long stalks (glass-rope sponges), or their basal end spreads out into root-like processes (horny corals, crinoids, branchiopods) (fig. 6). Deep water sea-urchins and sea-cucumbers (Holothuria) are frequently flattened. Bottom-dwelling crustaceans have elongated legs, the lower surface of which is often broadened by rows of bristles (setae). The power of emitting light is frequently found in animals inhabiting the dark abysses, though it occurs also in the illuminated water-layers. Sea-pens, horny corals, starfishes and many others emit diffuse light. More than 40% of the fishes from depths of over 900 metres possess light-organs. Nevertheless, light in the depths is scanty. For this reason, the eyes of deep-sea crustaceans and fishes are often enlarged. Deep-sea animals are of one colour (monotonic), usually dark brown or red. The uniformity of temperature conditions and the slight degree of movement of the water favour wide distribution of animals in the deep sea. Many are cosmopolitan, but there are also local species.

THE DISTRIBUTION OF ANIMALS IN INLAND WATERS

While in many respects conditions of life in the ocean are equable, owing to the general intermingling of the waters, those in inland waters show great differences in the various regions. This is due to the splitting up of these waters into many larger or smaller sections, and is reflected in the variety of their populations.

The chemical composition of inland waters is very changeable, particularly as regards lime salts. In granite and porphyry regions it may be as little as 24mg. per litre, while in limestone regions it may rise to 420mg. per litre. Some animals, such as the water-flea *Holopedium* gibberum, and the pearl mussel (*Margaritana margaritifera*) dislike them. Others require them, *e.g.,* most molluscs. The salinity also is very varied. In the Rhine, the water contains 0·14g. NaCl per litre. When the salinity rises above 0·3g. we speak of "salt" water. In the salt marshes of Lorraine, the water contains between 50 and 110g. NaCl per litre; in the Dead sea, as much as 237·5g. No living organism can exist in such a high salinity. In bog-water, the large quantity of humus is unfavourable to life.

The amount of oxygen in inland waters varies with time and place. It is highest in the eddying waters of mountain torrents, and in shallow ponds with dense plant growth when exposed to the sun, as this causes the plants to give off much oxygen, On the other hand, in late summer, the oxygen at the bottom of some lakes is completely used up, so that animals particularly requiring it, such as some fishes (Coregonus), cannot live there.

The temperature of inland waters undergoes much greater variations than that of the sea. Inland waters are usually shallow; they are seldom more than 300 metres deep, while the majority are not deeper than 10 metres. In ponds and pools, the depth is considerably less. There is, therefore, a high ratio of surface to volume; heating and cooling take place rapidly. In temperate regions, a constant temperature is found only in springs welling up from great depths, in deep parts of lakes and in waters in caves; cold-stenothermal animals are found only in such places.

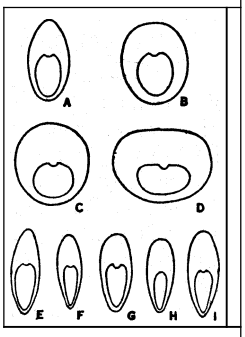
Light does not penetrate so deeply in inland waters as in the sea, on account of their more turbid condition, Usually, it penetrates only 30–40 metres; the lower limit of plant life is often at only 7 metres or less. In general, shallow waters have more plant life and therefore more animal life than deep ones.

The movements of the water are particularly important to aquatic animals. Flowing water and standing water make quite different demands on their inhabitants, and have therefore different types of population. They differ in chemical composition, thermal conditions, depth and extent. Rivers are almost always fresh, the flow preventing accumulation of matter in solution. Flowing water takes longer to warm, and cools more rapidly than standing water, and the difference of temperature between the surface and the depths is less on account of intermingling. There are, however, intermediate conditions. The rapidity of the current depends on the fall of the land. The Rhine, at its source, has a fall of 2·5% (2·5 metres in 100); the Upper Rhine from Basle to Bingen about 0·05%, the Lower Rhine, 0·012%. The Volga, in its whole course, has a fall of only 0·007%, and the Lower Amazon only 0·0019%; they show conditions resembling those of standing water.

Flowing Water. — Flowing waters are almost always connected with the sea. Their animal life, apart from forms not primarily aquatic such as insects and pulmonate gastropods, was originally derived thence. A continual immigration still takes place, particularly in the tropical region of the Indies. Some fishes ascend rivers from the sea only at spawning time (anadromous fishes),

e.g., the sturgeon (Acipenser) and salmon (Salmo salar); others ascend the rivers as young animals and descend to the sea to spawn, *e.g.*, the eel (*Anguilla anguilla*). These are katadromous fishes. Euryhaline, marine invertebrates (*e.g.*, copepods, amphipods, oysters) penetrate estuaries, and there mingle with the fresh-water inhabitants.

The velocity of river currents may be classed as "below average," "average" and "above average," according to the degree of the fall. In sluggish rivers (below average) erosion is minimal, and deposition of sediment maximal. Fine mud sinks down and forms a nutritious ooze on the bottom. This supports many detritus-eaters, such as worms, molluscs and insect larvae. At the average rate of flow, erosion and sedimentation maintain a balance, and the bottom is covered with gravel. In rapid streams (above average) erosion prevails, and deposition of sediment is minimal; the bottom is formed of large stones, which, by their movements, would crush to pieces any living organisms among them. The inhabitants must be adapted to this movement of the water. The different stretches of rivers harbour different animal populations. As regards fishes, rivers, from mouth to source, have been divided into the region of bream, of barbel, of grayling and of trout. Sharp delimitation, however, is not possible. In slowly flowing waters various kinds of fishes may be present, good swimmers and poor, with rounded bodies or with flat, provided the temperature and amount of oxygen are suitable. The stronger the current, the greater the swimming powers a fish must possess to resist it. In such places, we find fishes predominating which are round in transverse section, and so are not spun round on their axis by the whirling of the waters (fig. 7). For this reason, the number of species of fish decreases as we approach the source; the continually increasing demands made by currents and falling temperature have a selective influence. Fishes of 49 species are found in the Rhine; of these 41 are found in Holland, 33 in the Upper Rhine below the Falls, 25 above the Falls; at 700 metres above sea-level 11 species are found, at 1900 metres three species, the trout (Salnzo fario), minnow (Phoxinus laevis), and loach (*Cobitis* barbatula). Above 1900 metres the shallow alpine streams contain no fish.



FROM HESSE, "TIERGEOGRAPHIE AUF ÖKOLOGISCHER GRUNDLAGE"

FIG. 7.—DIAGRAM OF SECTIONS THROUGH FISHES

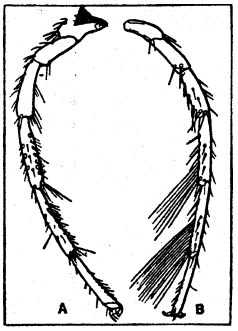
A. Brown Trout, B. Minnow, C. Loach, D. Miller's Thumb, E. Bream, F. Prussian Carp, G. Common Carp, H. Bitterling, I. Rudd

The mountain stream aifords the best instance of a characteristic fauna. The animals here take on a certain general stamp, since none can live except those able to accommodate themselves to the severe conditions of temperature and current. All have adaptations which prevent them being swept away by the current. Some are flat, and creep under stones (*Gammarus*, insect larvae), others adhere firmly by a broad sole or sucker (turbellarian worms, gastropods), or with special kinds of suckers (larvae of the gnat Blepharocera, fishes and tadpoles of tropical mountain streams), others spin threads which form a strong attachment to the bottom (larvae of the sandfly *Melusina*, pupae of mayflies). They are often flat and depressed to offer the least possible hold to the current. Since they are not strong swimmers, their power of movement is limited compared with that of related forms; *e.g.*, the water-mites of mountain streams do not swim and have limbs without swimming-bristles (fig. 8). The inhabitants of mountain brooks are generally eurythermal, or cold-stemthermal. Animal communities which require a constant low temperature are found chiefly in springs (the turbellarian *Planaria alpina*, the gastropod Bythinella *dunkeri*).

Standing Inland Waters.—In these regions the absence of currents gives rise to special conditions. An inland basin becomes rich in food material for animals, and in fertilizing matter for plants, brought down by winds and rain. Thus lakes having no outlet are richer in life than those which possess one; in the latter the quantity of plankton is in inverse ratio to the force of the outflow. In shallow basins, where the bottom is greater in proportion to the water-mass than in deep ones, and where, in all parts, light penetrates from top to bottom and permits plant-life, the mass of living organisms is generally greater than in larger and deeper basins. Of 20 Swedish lakes in which this has been studied, the smallest has the largest proportion of fish (113 K g per Ha), the largest (Lakes Wener and Maelar) only 2.7 Kg. per Ha.

In shallow basins circulation of the water takes place through winds, and thus the lower layers are aerated; as in Lake Balaton in Hungary. In deeper lakes, where no such complete mingling of the water is possible, the lower layers are aerated by convection currents set up by the cooling of the surface water in the cold season. In summer in lakes rich in organic life much oxygen is used up in the disintegration of the dead organisms which sink to the bottom, so that the amount of oxygen in the deep layers may be scanty, or absent. This excludes many animals from such depths, and gives a definite character to the composition of the fauna.

Larger basins of such depth that the greater part of the bottom is free from vegetation are described as lakes; in contrast to these are the ponds, pools and puddles, termed collectively small water basins. In lakes we distinguish a shore region (littoral), a deep water zone and a region of open water.



FROM THIENEMANN, "DIE BINNENGEWASSER" (SCHWEIZERBART)

FIG. 8.—LEGS OF WATER-MITES, GENUS LEBERTIA

A. Bachform (*L. complexa*), B. Teichforrn (*L. insignis*)

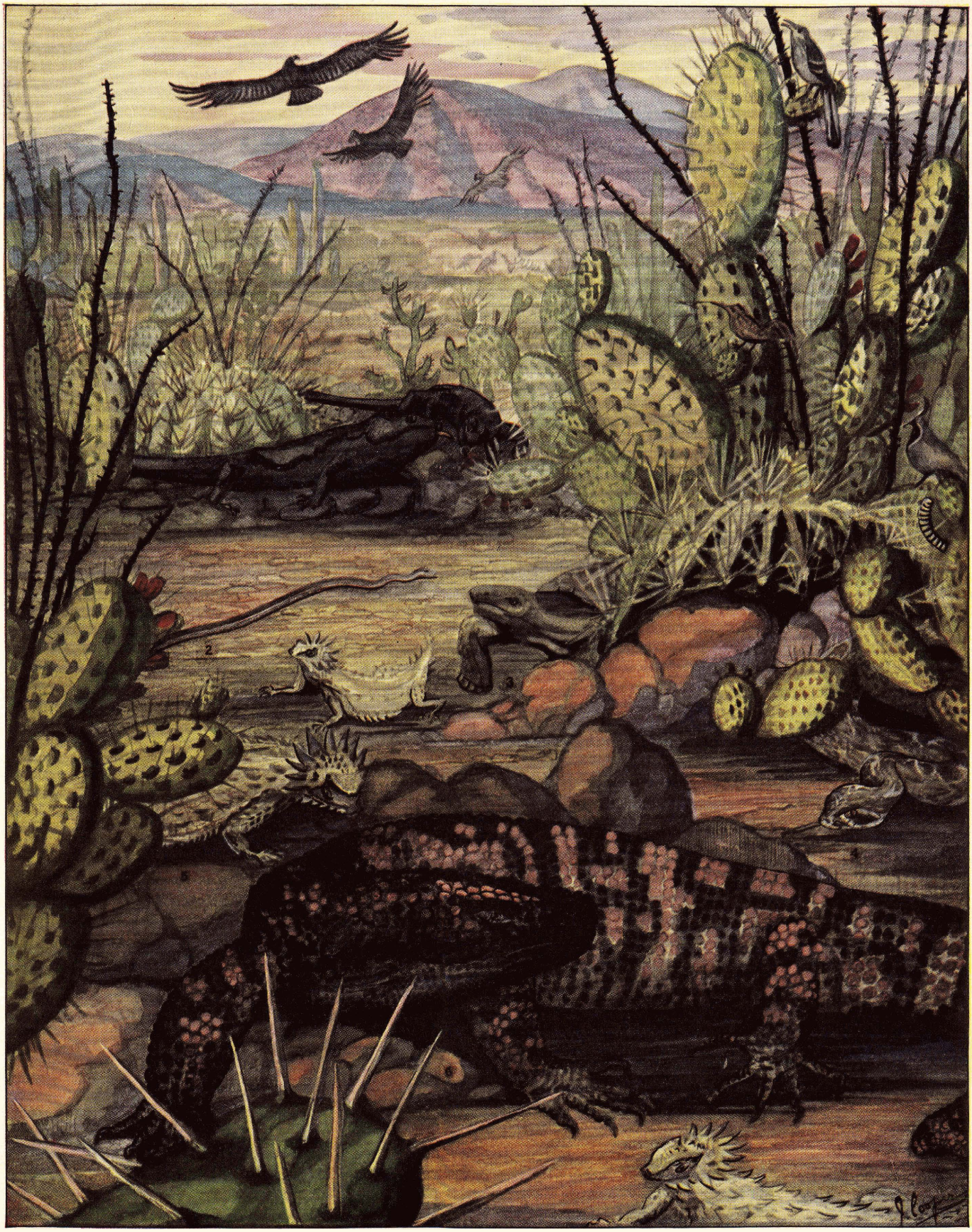
The outer portion of the littoral, which in summer is occasionally left dry, is poor in life. On the other hand, the deeper littoral region where there are plants for food and hiding places is the richest in living organisms.

The open water is populated by plankton, and by fishes which feed on it, *e.g.*, *Alburnus, Coregonus*. The bottom fauna is varied. Three types of lakes are distinguished, eutrophic, oligotrophic and dystrophic. The eutrophic type, with flat shores overgrown with vegetation, and with a rich plankton, has its deep layers filled up with putrifying ooze composed of the disintegrating bodies of plankton organisms or detritus. Only animals able to make use of the smallest quantities of oxygen are able to live there, *e.g.*, oligochaetes (Tubificidae), larvae of the harlequin-fly *Chironomus*. Both these have haemoglobin in their blood, apparently enabling them to use fully whatever oxygen is present. In oligotrophic lakes, with steep banks and little vegetation, the plankton is scanty, and the bottom therefore has less ooze; other insect larvae are found here (*Tanytarsus* larvae). In spite of the greater supply of oxygen, the number of organisms is less because of the smaller amount of food. Dystrophic lakes are those with bog-water, in which the acidity caused by humus is unfavourable, and the deficiency in lime also excludes many animals. The plankton here is chiefly animal, and consists mainly of rotifers and small crustaceans, which feed on colloidal matter in the humus.

In ponds and pools the fauna is similar to that of the overgrown littoral zone of eutrophic lakes. Decaying vegetable matter is present in sufficient quantity to provide food and oxygen for the growth of plants and only the great variations in temperature are unfavourable. In pools and puddles there is often a rich fauna of small rotifers, crustaceans and insect larvae. In waters liable to dry up periodically a particularly characteristic fauna is found. In temperate regions these waters are small, but in subtropical steppe areas (South African pans) they are sometimes of much greater extent. In such places animals must pass through stages of development quickly, and therefore must be small; and they need some protection against desiccation. Many produce hard-shelled resting ova (Hydra, rotifers, Cladocera) or spores (gemmules of sponges, statoblasts of Bryozoa), others are able to sur-

FROM HESSE, "TIERGEOGRAPHIE AUF ÖKOLOGISCHER GRUNDLAGE" (GUSTAV FISCHER)

FIG. 9.—HEADS OF (A) ARCTIC FOX (VULPES LAGOPUS), (B) COMMON FOX (VULPES VULPES) AND DESERT FOX (VULPES CERDO)



PAINTED FOR THE ENCYCLOPEDIA BRITANNICA BY ISABEL COOPER AFTER HABITAT GROUPS IN THE AMERICAN MUSEUM OF NATURAL HISTORY

REPTILES INHABITING THE DESERT REGION OF THE SOUTH-WESTERN UNITED STATES

1. Chuckwalla *(Sauromalus obesus),* the largest lizard in the United States. It is herbivorous and is considered edible by the Indians
2. Sonoran racer *(Masticophis semilineatus),* a small harmless snake
3. The desert tortoise *(Gopherus agassizii),* a terrestrial member of the turtle family that makes its home in holes in the ground
4. Texas rattlesnake (*Crotalus atrox),* the most dangerous of all south-western snakes because of the great amount of poison it can inject into its victims. It feeds largely upon mammals
5. The regal horned toad *(Phrynsoma solare),* a small, harmless lizard
6. Gila monster *(Heloderma suspectum),* the only poisonous lizard in the world. It inhabits Arizona and New Mexico and sometimes attains a length of two feet

round themselves by a capsule formed by a glandular secretion (the small annelid Aeolosoma, some copepods), and some burrow into the ooze and form a capsule of mud around themselves (phyllopod crustaceans, fishes such as *Protopterus*). Lastly, there are animals which can dry up into a cyst without losing their power of living, such as many rotifers (Philodina) and Nematoda (thread worms). These groups can live also in the mossy growth on rocks and tree trunks.

In salt lakes and pools the number of species decreases with increasing salinity. Those able to endure the greatest salinity are the brine-shrimp (Artemia salina), and a number of fly larvae, but even the brine-shrimp suffers changes with increasing salinity, the bristles become stunted, the size of the animal decreases, it becomes enfeebled, and finally disappears. In the Dead sea, in Palestine, the salinity is so high that all life is absent.

THE DISTRIBUTION OF TERRESTRIAL ANIMALS

The environmental conditions which influence the distribution of terrestrial animals are much more complicated than those brought to bear on aquatic animals. The chemical composition of the air is not important, as complete intermixture can take place very quickly. Only in a few places where carbon dioxide is present does this accumulate in limited areas, by reason of its weight, and render them uninhabitable by animals, as in the Grotto del Cane, at Pozzuoli. More important is the physical condition of the atmosphere, that combination of conditions called climate, and which is not present in water in such complexity. Such climatic factors are atmospheric moisture, temperature, atmospheric movements and solar radiation, some of which change periodically.

Moisture. — The amount of atmospheric moisture varies with time and place. Where the air is saturated, as in tropical rain-forests, even soft-skinned animals (planarians, leeches) can live out of water without danger of drying up. In such places a rich fauna and flora is found. Life is scarcest in regions where atmospheric moisture periodically fails completely, as in desert regions far from the sea. There are animals, however, which can live in a moderately dry atmosphere, as they can limit their evaporation of water as required. Air-breathing animals may be divided into moist-air breathers and dry-air breathers. To the former belong snails, many insects, such as ephemerids and mosquitos, all amphibians, buffaloes, hippopotami and some South American monkeys. These are characterized by the possession of numerous skin glands, liquid urine and watery excrement. Dry-air breathers include most insects, reptiles and birds; they have no skin glands, and excrete uric acid; among mammals, many rodents, some antelopes, roe-deer and camels; these have few skin glands, dry excrement and concentrated urine.

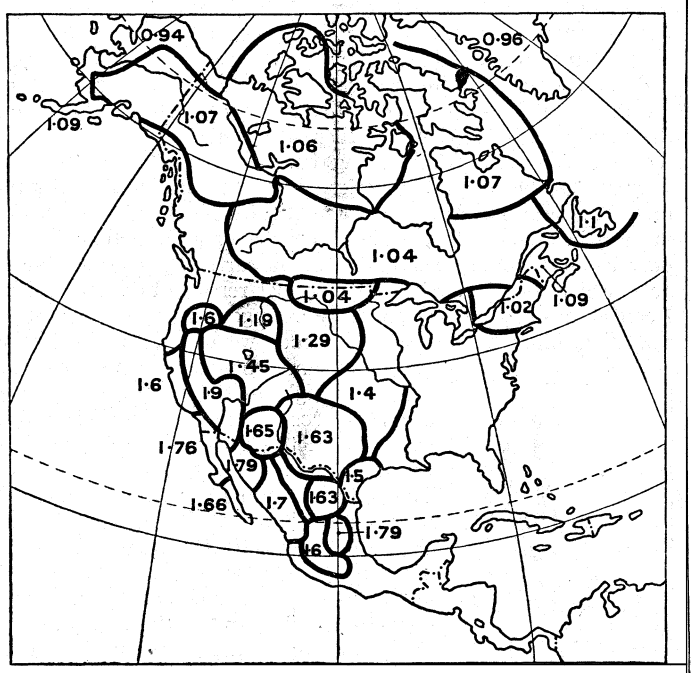


FIG. 10. — MAPSHOWING THE VARIATIONS DUE TO TEMPERATURE IN THE LENGTH OF EARS IN COMPARISON WITH LENGTH OF SKULL IN NORTH AMERICAN HARES (LEPUS)

Temperature. — Although the quantity of atmospheric moisture in many ways influences the distribution of air-breathing animals, the effects of temperature are still greater. The temperature of air varies to a much greater degree than that of water, and does so more rapidly and more extensively. Whilst in water the lower limit of temperature is 0° C (+32° F), in air it may sink to −67·8° C (−80° F) (at Werchojansk); on the other hand, it may, in instances, rise to 56·6° C (101·7° F). The greatest difference between the highest and lowest mean monthly temperatures in any place is at Werchojansk, where it amounts to 66·3° C; daily variations at 22° C occur in elevated steppes.

The distribution of animals, therefore, is determined by the degree of warmth they require. Animals limited to a uniformly high temperature, *i.e.*, warm-stenothermal animals, in temperate regions live only in particularly warm localities, especially on chalk soil. As examples may be mentioned the green lizard (Lacerta *viridis*), and the praying mantis (Mantis religiosa), when found north of the Alps. Cold-stenothermal animals, on the other hand, inhabit places with a lower temperature; *e.g.*, snails of the genus *Vitrina* are found on the summits of the Alps, on Mt. Kilimanjaro and in the Cameroons, but are absent in warm parts.

Homoiothermal (warm-blooded) animals are not immediately influenced by their surrounding temperature. The temperature of the surroundings, however, by its variations renders difficult the regulation of internal heat. The problem of the limitation of the amount of heat given off is solved in various ways. Thick coverings of hair or feathers, or the deposition of fat beneath the skin are the most important; in many birds air-sacs assist in maintaining a protective warmth round the internal organs. It is important, also, that the surface-area of the body, where heat radiation takes place, should be lessened. Birds, as compared with mammals, have a very small surface in proportion to mass. Among mammals the external ear and the tail are parts where much heat is given off, and for this reason they are smaller in animals dwelling in cold regions than in their relatives in warmer parts. For instance, the ears of the Arctic fox are small, those of the European fox are larger and those of the desert fox largest (fig. 9). The length of the ears in comparison with that of the skull in North American hares (Lepus), is shown in fig. 10.

Since large animals have a relatively smaller surface-area than small ones, this implies in them a diminution of the giving-off of heat. Of two dogs weighing 20kg. and 3·2kg., having surface-areas of 7,500 and 2,423 sq.cm. respectively, the larger had a surface-area of 375 sq.cm. per kg. of body-weight, the smaller 757 sq.cm., *i.e.*, about double the area; the larger produced in 1 unit of time from 1kg. of mass 45 calories, the smaller 88 calories; the amount of heat given off, therefore, rises in proportion to the surface-area. It is worthy of note that warm-blooded animals in cool regions usually attain a larger size than the corresponding species in warmer climates (Bergmann's rule). Fig. 11 shows the increase in size, corresponding to decrease in temperature, in the Great Horned or American eagle owl. The coldest parts of a faunal region are therefore centres of maximal forms, while the warmest parts are centres of minimal forms. In the Palaearctic region warm-blooded species have a minimum size on the south coast of the Mediterranean, while in northern Siberia they reach their maximum size. In North America Alaska is a centre of maximum size, for example: — among mammals the bear (*Ursus* gyas), the fox and the moose (*Alce gigas*); among birds, the eagle-owl (Bubo *virginianus*), the Alpine lark (Otocoris *alpestris*) and the pine grosbeak (Pinicola *enucleator*), all being larger than normal. Smaller forms are in Florida and Lower California.

Peculiarities of Tropical Fauna. — A uniform climate is found chiefly in some tropical regions of America, Africa and India, particularly in tropical forest areas. These are distinguished by the absence of seasonal changes, and by offering optimum conditions of moisture, warmth and light. The abundant

vegetation permits rich development of animal life. Poikilothermal animals enjoy almost the same favourable conditions as have been established internally as the optimum in homoiothermal animals. Homoiothermal animals require considerably less food than in temperate regions. Many classes of animals attain a considerable size in the tropics, *e.g.*, numerous insects, millipedes, spiders, snails. Here amphibians and reptiles attain maximum size.

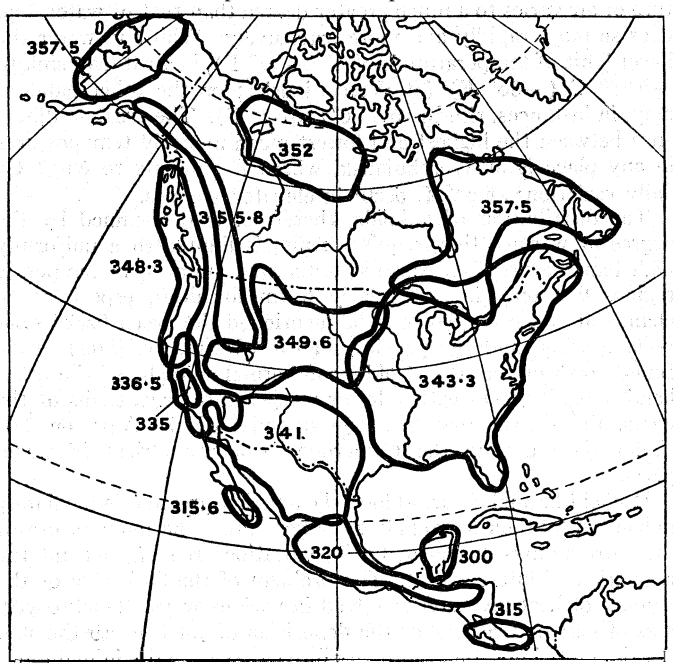


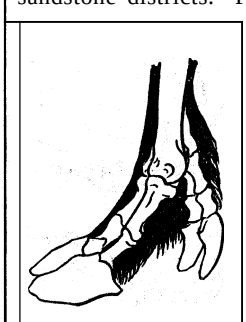
FIG. 11.— MAP SHOWING VARIATIONS IN THE SIZE OF THE GREAT HORNED OWL (BUBO VIRGINIANUS) OF NORTH AMERICA. THE NUMBERS INDICATE THE WING-LENGTHS IN MILLIMETRES

Brilliant colours and clearly defined markings are characteristic of tropical animals. The number of living organisms is enormous. Development takes place quickly, generation following generation in rapid succession. The butterfly *Danaus chrysippus* in the northern parts of its area of distribution is represented by one generation a year, but in the Philippines it requires only 23 days for complete development. Among mammals also development is accelerated, as puberty is reached much sooner (in the 12th year in man). The number of species is astonishing. South America has 4,560 species of Lepidoptera, while the whole of the Palaearctic region (Asia north of the Himalayas, Europe and north Africa) has only 716. The Brazilian states of Para and Amazonas have 1,117 species of birds, *i.e.*, almost as many as the whole Palaearctic region (1,218). The number of individuals of a single species, however, is usually limited; of insects and spiders it is often easier to collect 100 different species than 100 individuals of one species. The absence of seasons causes reproduction to go on during the whole year; one may find at any time of the year eggs, larvae, pupae and fully developed animals.

Temperate **Regions.**—On the other hand, in regions where periodical changes of temperature give rise to seasons, animals are subjected to conditions varying from times of plenty to times of need. It is immaterial whether the changes be between summer and winter, or between rainy season and dry. Summer and the rainy season bring the most favourable conditions, winter and drought the least favourable. Animal life languishes under unfavourable conditions, lack of warmth in one place bringing about a state similar to lack of moisture in another. When, however, the bonds are loosed, the awakening of the animal world is the more effectual owing to the simultaneous appearance of many species. Most species immediately set about reproduction; the chirping of crickets, the croaking of frogs, and particularly the songs of birds, together with the awakening of plant-life, is in sharp, refreshing contrast to the desolation of winter and the dry season. In winter, or the dry season, many terrestrial animals cease their vital activities. Aestivation in time of drought is common among insects, spiders and snails; frogs and toads creep into holes in the earth or other hiding-places, and remain there in a death-like sleep. Crocodiles dig themselves into the mud of pools which are drying up, and rest beneath the hardened crust. This habit of sleeping through the dry season is also found among mammals; *e.g.*, the aardvark (Orycteropus) in Africa. In winter, poikilothermal animals hibernate in a similar way; this may also occur in warm-blooded animals, which undergo a drastic fall of temperature and a slowing-down of the rate of metabolism. Such are hedgehogs, bats, dormice and marmots. Among birds, however, we find neither hibernation nor aestivation; they withdraw from the reach of unfavourable seasons by migrating, Migration (*q.v.*) occurs also among mammals, brought about by seasonal changes of weather. It occurs among South African antelopes, reindeer and bats. Among birds of temperate regions, we may distinguish a general resident population, which dwells the whole year in the same locality; migratory birds present only for the breeding season (summer visitors) or only in the non-breeding season (winter visitors) or occurring on passage between their summer and winter habitats. According to the climate of the habitat the same species may be resident in one locality and migratory in another. Thus in England birds such as starlings and song-thrushes remain throughout the winter; in central Europe they migrate. Some birds travel great distances; the summer and winter quarters of *Sterna paradisea* are 17,700km. apart. The change from rainy season to dry causes migration, as in Africa.

The nature of the soil of a locality is important in determining the composition of its population, particularly as regards the higher forms of life. Among mammals the two-legged jumping animals require a hard substratum, which offers a firm foothold. These are found in all the steppe regions of the earth. Such are jerboas, the jumping hare *pedetes*, and the kangaroo group of marsupials. Running animals, such as carnivores which go upon their toes, and ungulates, which place only the tips of the toes on the ground, favour a hard soil, where there is least friction. Ungulates living on sand, bog or snow, have the surface of the hoof expanded to prevent sinking; they have three or four toes (pigs and tapirs), or two toes bearing elongated hooves, which can diverge widely, as in *Gazella loderi*, the marsh antelope, and the reindeer (fig. 12). In reptiles which live on loose sand the toes sometimes have fringes along the sides.

Soil.—Of the chemical constituents of the soil, chalk merits the first consideration. Animals which require much lime for building up their bodies thrive better on chalky ground than on soil poor in lime. Among mammals this is particularly noticeable in deer, which require lime for the annual renewal of their antlers. Roebuck in limestone regions have stronger antlers than those in sandstone districts. Further, the body-weight of the roedeer is greater in limestone districts. In Württemberg the weight of the carcase of the roedeer in limestone regions exceeds 14kg, but in districts with little lime in the soil (sandstone, moorland) it is below 14kg. The amount of lime in the soil, and, therefore in the drinking water, affects mankind also; this shows itself particularly plainly in the teeth. The number of decayed teeth in school-children is much higher in regions poor in chalk than in those rich in it. Snails are more numerous in limestone regions, both in species and in individuals, owing to the number of hiding places present, to the chemical composition of the soil and to thewarmthof thechalk.



FROM CUVIER, "LE REGNE ANIMAL"

FIG. 12.— TOES OF FOREFOOT OF REINDEER (RANGIFER)

Other animals require a large amount of salt in the soil, and are widely distributed on sea-coasts; inland, they are found only on salt ground, as at Stassfurt and in similar localities. This applies particularly to the small beetles (Staphylinidae, Carabidae) and other insects. Salt is sought after by mammals also, particularly by herbivores; places where it crops up are much resorted to by ruminants, and in primaeval forests they have paths converging to them from all directions.

The Fauna **of** Forests. — Large forests are found only in regions where, during the four months vegetative season, a minimum temperature of 10° C prevails, a minimum rainfall of 50cm. and an atmospheric humidity of more than 50% saturation. The dense covering of the tree-tops hinders penetration of heat-rays, evaporation of moisture and air-currents. For this reason, temperature, humidity and air-currents vary much less than in open country. The density of forests, moreover, varies greatly; all grades are found from the tali, hot, impenetrable, dripping rain-forests of the tropics, to the Bght pine forests near the tree limit on mountain slopes and in the sub-arctic region. The peculiarities of forest animals are seen most plainly in the tropical rain-forests, which form an immense zone round the earth at the equator, and include the Congo forest region, the forests of southern Asia and the islands of that region and the selvas of the Amazon.

Orientation is possible only for short distances, eyes and organs of smell are not much use; the sense of hearing is the most useful. The gregarious forest animals, therefore, such as birds and monkeys, are noisy, in contrast to those of open country. The light is subdued and much reflected; brilliant colours do not show up; protective coloration is rendered unnecessary by the restriction of the outlook. Flying and running are hampered; the true forest birds are usually poor fliers, but are good at gliding and climbing. Some forest animals, such as elephants and large swine, are able to force their way through; others are small and slender, stand lower in front than behind, carry the head low, and are able to squeeze through narrow places, *e.g.*, forest antelopes (*Cephalolophus, Tragelaphus*), forest deer (muntjac) and agutis (*Dasyprocta*). Many birds and mammals are equipped with sharp claws (woodpeckers, squirrels, martens); others have gripping-feet (parrots, monkeys, arboreal marsupials), some have prehensile tails (many South American monkeys, the porcupine *Erethizon,* the anteater, various marsupials).

Climbing animals in forest regions include also many reptiles and amphibians, such as the laterally-compressed tree Agamidae of the Old World, and the tree-iguanas of the New World, the long, slender tree-snakes and numerous tree-frogs. Parachuting animals, which can prolong their leaps from tree to tree by their expanded under-surface, are confined to forests; such are frogs of the genus *Rhacophorus,* the flying dragon (Draco *volans*), the flying phalangers (Petaurus, Petauroides, Acrobates), the flying squirrels (*Anomalurus,* Petaurista), and the flying lemurs (*Galeopithecus*). Some tree-frogs have become so adapted to arboreal life that they have forsaken the ground even for reproduction; laying their eggs in the collections of water on the epiphytic Bromliaceae; or the eggs are carried until they hatch in dorsal pouches, in gular sacs or in the mouth. A number of active animals use the forest only as a dwelling place, and seek their food in open country; *e.g.,* birds of prey, wolf, fox, buffalo and stag. The conditions of the forest are uniform; the food supply is poor and therefore the population is sparse; on the other hand, the borders of forests and forest glades where there is plenty of light swarm with life, since there is room for free movement and an abundance of vegetable food combined with protective shelter.

The more a forest departs from the extreme type of the tropical rain-forest, the more the characteristic peculiarities of its inhabitants are effaced. In the forests of temperate regions the characteristics of the fauna are mostly determined by the nature of the forest; entirely green forests have a different animal population from entirely coniferous forests, while mixed forests have an intermediate type of population. In green forests gastropods are represented by many species, in pine forests they are almost absent. Many forest insects are restricted in diet either to green or to coniferous trees. Green forests are preferred by the black grouse (Tetrao *tetrix*), the pheasant, song-thrush, blackbird and whitethroat; and by the dormouse (*Muscardinus avellanarius*) among mammals. Coniferous forests are preferred by the capercaillie (Tetrao urogallus), great black woodpecker (*Picus* martius), nutcracker (Nucifraga), crossbill (*Loxia*), siskin (*Carduelis spinus*) and gold-crest (Regulus).

Fauna of Open Country.--Open country is in every respect in contrast to forest regions. Forests ate not found where moisture and warmth are insufficient; in such places only grass and shrubs are present. Such lack of moisture is often found in great plains, both elevated and low-lying. But there are numerous grades of open country, from savannahs and steppes to pre-desert (shrub steppe), and desert. The gradations depend on the degree of precipitation; this is greatest in subxerophilous grasslands; in arid steppes it is confined to the rainy season, and in waterless deserts it may be absent for years. In the rainy season, such regions show very diverse appearances, but in the dry season they are much more alike. All have an absence of protective foliage, and, on this account, variations of temperature and humidity are great, and atmospheric currents are strong.

In general only animals which can endure a dry atmosphere are able to exist in open country; those requiring moisture in the air, such as gastropods and amphibians, are rare. An extraordinary number of animals seek shelter in holes and burrows in the ground from storms, enemies and variations of temperature. Here **we** find ants and other brood-nursing Hymenoptera, and termites. Among burrowing reptiles are the Caspian tortoise (Clemmys *caspica*), skunks and many snakes (*Typhlopidae, Eryx, Psammophis*). Among mammals, rodents show the greatest number of burrowing forms, such as the marmots (Marmotta), prairie-dogs (*Cynomys*), sousliks (Spermophilus), rats, voles, hamsters (Cricetus), jerboas, porcupines, the South American Hystricomorpha (*Ctenomys, Dolichotis, Viscacia*), and rabbits (*Lepus cuniculus*); they often live in large communities, and undermine extensive areas. Armadillos (*Dasypus*), ant-bears (*Orycteropus*), wart-hogs (*Phacochoerus*), and predatory animals (*e.g., Canis* cerdo in Africa) dig holes for themselves in open country. The birds are ground-breeding forms, but others such as eagles, which usually nest in trees, occasionally breed on the ground in such regions. Others again make their nests in the holes of rodents, *e.g.,* the burrowing owl (Speotyto). In such regions, where there is little cover, the colouration of the animals is frequently adapted to that of the surroundings; the less cover present, the greater the degree of adaptation. This is found to the greatest degree in deserts, where the most varied kinds of animals have coloration similar to that of the ground (Plate II.). A few insects which have special protection in their hard cuticle (some Tenebrionidae), or which eject a poisonous fluid against attackers (the locust Eugaster *guyoni*), have a striking black colouration.

Agile animals are particularly characteristic of open country, Here are found running birds such as the ostrich, partridge, desert jay (Podoces) and larks. The solipeds and two-legged jumping animals are inhabitants of open country. Visual and olfactory organs assist orientation, as the outlook is wide and the winds carry scents. Animals of open country, in contrast to those of forests, make little noise. Gregarious animals are particularly common. The subxerophilous grasslands are the richest game regions of the world; the North American prairies formerly harboured enormous herds of bison; the South African plains swarm with herds of ungulates.

Plains where winter is the dry season and those covered with snow at this season differ in several respects. In the dry season the former offer food in dry grass and its seeds, which keeps life from dying out. In regions where the grass in winter is covered by snow, vegetation decays and is useless as food; all animals hibernate or migrate. When the dry season is past and the first rains begin, life awakens suddenly, but where there is snow, plants and animals awaken gradually at the end of the winter. All these peculiarities are most marked in desert regions with their extreme conditions of life; the scarcity of animal life and the sharp competition, the frequency of protective coloration, the paler coloration of the animals, are all direct effects of climate.

Fauna **of** Mountain Regions. — In mountain regions there is generally sufficient moisture for the growth of forests, but, with the decrease of temperature in proportion to increase of altitude, the forests are confined to a zone, higher or lower according to latitude. In the Colombian Andes the limit of trees is 3,300 metres above sea level, in the Swiss Alps, on an average 1,800 metres. The forest fauna extends to this limit; above, and adjoining it from the lower limit of the region of snow, a characteristic

alpine fauna is found. As the height above sea-level increases, atmospheric pressure and temperature decrease. The low atmospheric pressure, *i.e.,* the small quantity of oxygen in the air, causes an increase in the number of red blood corpuscles in homoiothermal animals. Plain-dwelling mammals suffer from lack of oxygen if they ascend high ("mountain sickness"). Nevertheless, mammals are able to dwell at heights of more than 6,000 metres; *e.g.,* the rodent Ochotona wollastoni at 6,125 metres on Mt. Everest. More important is the decrease in temperature, and the shortening of the warmer season in alpine regions. For these reasons the number of species decreases rapidly with increasing altitude. In Switzerland up to 700 metres there are 178 species of birds, up to 1,800 metres 178 species (partly other kinds), in the Alpine region (up to 2,700 metres) go species, in the region of the snows only 8 species. The species of gastropods, insects and mammals show a similar decrease. The special conditions of temperature at ground-level lessen, for small animals, the unfavourable climate of mountain regions. In consequence of the strength of the sun's rays, the surface layers of the ground, and the air in the tussock-growth of plants which covers them, is rapidly heated; on summer days with an air temperature of 23° C, the temperature at the surface of the ground may rise to 40–50°. Insects, mites, gastropods, salamanders and lizards are able, therefore, to move about in search of food; at night they find shelter from the cold in the surface layers of the earth and under stones. Flying insects are comparatively scarce; at sunset, all of them settle on the ground. The steepness of the mountain slopes facilitates the removal of loose earth by rain and torrents. In many places the rock is exposed and harbours a peculiar fauna; birds, such as the Alpine creeper (*Tichodroma*), those which nest in cliffs, such as the Alpine chough (*Pyrrhocorax-graculus*) and the Alpine swift (*Apus* melba), and ruminants such as the chamois, ibex, musk-deer and yak, which have broadly expanded hooves, enabling them to get foothold. Among insects, those with complete metamorphosis preponderate; in particular, beetles, Lepidoptera, Diptera; Orthoptera and Hemiptera, which require more warmth, are poorly represented. On the other hand, springtails are numerous. Among Hymenoptera the most numerous are humble-bees, with a hairy covering to the body, which retains the heat generated by their movements. The shorter time amphibians require for development, the higher they ascend the mountain slopes, for the higher a pool, the shorter the time it remains free of ice. In Rana fusca, Hyla, Bufo, Alytes, Bombinator, the tadpole stage lasts from 85 days increasing to 134 days; their upper limit is from 2,600 metres decreasing to 1,500 metres. The upper limit of reptiles is connected with their manner of reproduction, viviparous species ascending highest. In the Alps, the common lizard Lacerta vivipara ascends to more than 3,000 metres, the common viper (*Vipera* berus) to 2,750 metres, the slow-worm (*Auguis fragilis*) to 2,000 metres. Oviparous reptiles inhabit the lower slopes. Viviparous forms and therefore their embryos, are constantly exposed to the sun, while deposited eggs are usually in the shade, and are only warmed by the sun from time to time. Homoiothermal animals are more independent of temperature, but are very dependent on food; to obtain it, they often migrate down towards the valleys in winter. Most alpine birds are non-migratory; migratory species are relatively scarce. Homoiothermal animals in high mountains are often larger than their relatives in the plains; *e.g.,* the tree-creeper (Certhia familiaris) and the hedge-shrew (Mus sylvaticus) of the Swiss Alps. Many specifically mountain dwellers cannot live in the plains; they are isolated in the mountain ranges by the surrounding lowland, and have been transformed into geographical races; *e.g.,* the ibex (Capra ibex) of the Alps, Caucasus, Taurus mountains, Mt. Sinai and Abyssinia.

Fauna of Polar Regions.—Varieties similar to those in the fauna of the lower slopes of mountains are present in regions approaching the North Pole. Organisms in the Arctic and in the Antarctic regions are very different, owing to the difference in the climate. In Arctic regions there is a short summer, with sunshine and higher temperatures, which awakens plant and animal life; in the Antarctic, although the winter is not quite so cold, the summer is cooler, and the sky is constantly overcast, and therefore little life develops on land. Arctic and the highest alpine regions have many species in common, which are absent in the intervening areas; such are the Alpine hare (Lepus timidus), the ptarmigan (*Lagopus* mutus), the gastropod *Acanthinula harpa,* and some lepidopterans, which traversed the warmer intervening areas during the Glacial Period. The number of arctic insects is not great; Diptera and Lepidoptera are most abundant, Orthoptera and Hemiptera are rare. Among Hymenoptera, bumble-bees are relatively numerous, and are strikingly large, thus having proportionately smaller surface to give off heat. The few species of gastropods are small. Amphibians and reptiles are found only in the southern portion and these species are the same as those ascending highest in mountain regions. Homoiothermal animals are characterized by adaptations for conservation of heat; they are sturdy, have short appendages (ears and tail) and a thick covering of fur or feathers. The white colour of so many polar birds and mammals is important in reducing heat radiation. Experiments have shown that the proportion of heat given off by light-coloured and black guinea-pigs is as 100:124. Polar mammals do not hibernate, as the frozen ground provides no protection from temperatures below freezing point. The number of birds and mammals is small, apart from those which find their food in the sea. In eastern Greenland, besides polar bears and seals, only seven kinds of mammals are found (the hare, lemming, musk-ox, reindeer, ermine, arctic fox and wolf). In Spitsbergen, there are only two kinds, the reindeer and arctic fox. In the Antarctic terrestrial birds and mammals are absent; all homoiothermal animals are confined to the sea.

Animals of Islands.—The characteristic peculiarities many island faunas have in common are due chiefly to isolation. Animals of islands are originally derived from those of continents, and the sea forms a barrier preventing the influx of the parent-species. This barrier, however, is not insuperable. In many cases land connections were formerly present. Such islands are termed "continental," in contrast to "oceanic" islands, which have arisen in the sea by volcanic agency, or as coral reefs, and were originally devoid of terrestrial animals. Isolation brings about differentiation of species, each form developing its peculiarities undisturbed by intercrossing with the original stock. This process being continued, races are produced confined to certain localities. In all islands the length of the time of separation, and the degree of isolation, *i.e.,* the distance from the mainland, is important; the longer and more complete the isolation, the greater the degree of differentiationof the species. Madagascar has long been isolated; forms of Ethiopian origin are here so greatly differentiated that, for example, all non-volant mammals except a few later immigrants belong to endemic genera, and, usually, also to sub-families and families not found elsewhere. On the other hand, the British Isles, which have been separated only since the end of the Glacial Period, have only one peculiar vertebrate (the red grouse).

In ancient oceanic islands, the number of endemic species increases with the distance from the mainland. While the Azores, in addition to endemic species, have many in common with Europe and Africa, most of the fauna of St. Helena is endemic, and in that of the Hawaiian islands (more than 3,000km. from the mainland) there are numerous genera, and among gastropods and birds, families also, which are not found elsewhere.

The isolation of oceanic islands by the sea implies selection in the fauna. Mammals, amphibians and freshwater fishes are unable to overcome this obstacle, and are therefore absent. Reptiles can seldom reach such islands, but birds can do so much more frequently. Flying insects may be carried to them by winds, and some even reach them unassisted. Terrestrial gastropods and wood-boring insects (*e.g.,* weevils) reach them on driftwood.

Isolated regions offer shelter from rivals and enemies. Thus, in Tasmania, the carnivorous marsupials *Thylacinus* and Sarcophilus can hold their own, but on the Australian continent they succumb to the imported dingo. Loss of the power of flight, which often occurs in birds inhabiting islands, is connected with the absence of mammals; in the Galapagos Islands there is a flightless cormorant (*Nannopterus*), in New Zealand the kiwi (Apteryx). On other islands, flightless birds have become extinct in historical

times, as in Mauritius. The large size of the birds found on islands may be connected with the loss of flying powers; the limit of size imposed by flight disappeared when this was abandoned. On the other hand, we frequently find dwarf varieties of mammals on islands; on the islands of the Red sea *Gazella arabica* does not exceed a third the normal weight of the species.

Some of the peculiarities of animals of islands are explained by the climate. On small islands feeble fliers are in danger of being carried out to sea by strong winds. For this reason most insects on the Polynesian islands take shelter from wind; in the East Frisian island few flying insects are found. Animals which feed on these insects (flycatchers, swallows, small bats, etc.) are also absent. On the storm-swept islands of the Subantarctic, numerous insects have vestigial wings (of eight species of flies in Kerguelen one only has normal wings).

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DISTRIBUTION OF PLANTS: *see* PLANTS: *Distribution and Ecology*.

DISTRIBUTION OF TERMS. In logic a term is said to be distributed in a proposition when explicit reference is made to its whole extent or extension. Otherwise (that is, not only when reference is made explicitly to a part only of the extension of the term, but when explicit reference is simply not made to its whole extension) it is said to be undistributed. Thus, in a proposition of the form *No S is P* both the subject and the predicate are distributed. In the form *Some S is P*, neither *S* nor *P* is distributed. In *All S is P*, *S* is distributed, but P is not. Lastly, in *Some S is not P*, *S* is not distributed, but *P* is. Briefly, only universal propositions distribute the subject term (S), and only negative propositions distribute their predicate *(P)*. Naturally, singular terms (including proper names used as singular terms) are always distributed, for they only refer to one object, and cannot refer to less. The importance of the distribution of terms arises from the fact that it is a principle of formal inference that no term may be distributed in this conclusion unless it was distributed in the premises. That is why, *e.g.*, All *S is P* can only be converted into *Some P is S* (not into *All P is* S), and *Some S is not P* cannot be converted at all.

See A. Wolf, *Essentials of Logic* (1928).

DISTRIBUTION OF WEALTH. This expression has been applied both to the distribution of wealth and to the distribution of income. To a considerable extent. the distribution of income is bound up with the distribution of wealth and capital. and for convenience of reference the two subjects are treated in this work in the article WEALTH AND INCOME, DISTRIBUTION OF.

DISTRIBUTIVE LAW, in algebra the law which asserts that $a(b+c+d) = ab+ac+ad$, one of two factors *(a)* being distributed, as it were, among the parts *(b*, c and *d)* of the other factor *(b+c+d)*. Stated in words, the result of first adding several numbers and then multiplying the sum by another number is the same as the result of first multiplying each of the several numbers separately by the other number and then adding the products. For example, $2(5+3)=2\times8=16$; and $2\times5+2\times3=10+6=16$. The law is equally valid for negative, fractional, irrational, and complex numbers.

DISTRIBUTOR, in electrical engineering, a form of switch, generally rotary, arranged so that it transmits successive electrical impulses to definite points in a given order *(see* HIGH-TENSION MAGNETO).

DISTRICT, a word denoting in its more general sense, a tract or extent of a country, town, etc., marked off for administrative or other purposes, or having some special and distinguishing characteristics *(see* LOCAL GOVERNMENT, etc.). In mediaeval Latin the word *districtus* is defined by Du Cange as *Territorium feudi, seu tractus, in quo Dominus vassallos et tenentes suos distringere potest;* and as *justitiae exercendae in eo tract~facultas.* It was also used of the territory over which the feudal lord exercised his jurisdiction generally. In British India the word is used to represent the *zillah,* an administrative subdivision of a province or presidency.

In the United States of America the word has many administrative, judicial and other applications. In South Carolina it was used instead of "county" for the chief division of the State other than in the coast region. In the Virginias, Tennessee, Georgia, Kentucky and Maryland it answers to "township" or precinct, elsewhere the principal subdivision of a county. It is used for an electoral "division," each State being divided into Congressional and State legislatorial districts; and also for a political subdivision either of an unorganized or an organized Territory.

DISTRICT OF COLUMBIA: *see* WASHINGTON, D.C.

DISTYLE, the term given to a portico of two columns, especially in the phrase "distyle in antis," when the columns are between antae. *(See* ANTAE and TEMPLE.)

DITA BARK, the bark of a fruit tree *(Alstonia scholaris)* growing in the Philippines and elsewhere, and containing valuable medicinal properties.

DITHMARSCHEN or **DITMARSH** (in the oldest form of the name *Thiatmaresgaho,* Dietmar's Gau), a territory between the Eider, the Elbe and the North sea, forming the western part of the old duchy of Holstein. It contains about 550sq.m., half of which consists of good pasture land, preserved from inroads of the sea by banks and dams, the other half being mostly waste. The district was subjugated and Christianized by Charlemagne, and ranked as a separate *Gau,* probably included in the countship of Stade. Ultimately the archbishops of Bremen claimed supremacy over the land; but the inhabitants, who had developed and consolidated a systematic organism for self-government, made obstinate resistance, and rather attached themselves to the bishop of Schleswig. Ditmarsh continued part of the Danish dominions till the disastrous battle of Bornhoved in 1227, when its former independence was regained. The claims of the archbishop of Bremen were now so far recognized that he exercised the royal rights of *Heerbann* and *Blutbann,* and was represented first by a single *advocatus,* or *Vogt,* and afterwards by one for each of the five Döffts, or marks, into which the land was divided after the establishment of Meldorf. The community was governed by a *Landrath* of 48 elective consuls, being 12 from each of the four marks. In 1319 and 1404 the inhabitants defeated the invasions of the Holstein nobles; and though in 1474 the land was nominally incorporated with the duchy by the emperor Frederick III., the attempt of the Danish king Hans and the duke of Gottorp to enforce the decree in 1500 resulted only in their complete rout in the marshes of the Dussend-Diiwels-Warf. During the early part of the following century Ditmarsh was the scene of violent religious conflict; and, thus weakened, it was obliged in 1559 to submit to partition among its three conquerors—King Frederick II. of Denmark and Dukes John and Adolphus. A new division took place on Duke John's death in 1581, by which Frederick obtained South Ditmarsh, with its chief town of Meldorf, and Adolphus obtained North Ditmarsh, with its chief town of Heide; and this arrangement continued till 1773, when all the Gottorp possessions were incorporated with the Danish Crown.

See Dahlmann's edition of Neocorus, *Chronik von Dithmarschen* (Kiel, 1827), and *Geschichte Danemarks* (1840–44); Michelsen, *Urkundenbuch zur Geschichte des Lnndes Dithmarschen* (1834), *Sammlung altdithmarscher Rechtsquellen* (1842), and *Dithmarschen im Verhältniss zum bremischen Erzstift;* Kolster, *Geschichte Dithmarschens, nach F. R. Dahlmanns Vorlesungen* (1873).

DITHYRAMBIC POETRY, the description of poetry in which the character of the dithyramb is preserved. It remains quite uncertain what the derivation or even the primitive meaning of the Greek word διθύραμβος is. It was, however, connected from earliest times with the choral worship of Dionysus. The earliest dithyrambic poetry was probably improvised by priests of Dionysus at solemn feasts and expressed, in disordered numbers, the excitement and frenzy felt by the worshippers. The dithyramb was traditionally first practised in Naxos; it spread to other islands, to Boeotia and finally to Athens. Arion is said to have introduced it at Corinth, and to have allied it to the worship of Pan. It was thus "merged," as Professor Gilbert Murray says, "into the Satyr-choir of wild mountain-goats" out of which sprang the earliest form of tragedy. It flourished in Athens until

after the age of Aristotle. So far as we can distinguish the form of the ancient Greek dithyramb, it must have been a kind of irregular wild poetry, not divided into strophes or constructed with any evolution of the theme. It was accompanied on some occasions by flutes, on others by the lyre. Pindar, in whose hands the ode took such magnificent completeness, is said to have been trained in the elements of dithyrambic poetry by Lasus of Hermione. In the opinion of antiquity, pure dithyrambic poetry reached its climax in a lost poem, *The Cyclops*, by Philoxenus of Cythera, a poet of the 4th century B.C. In modern literature, although the adjective "dithyrambic" is often used to describe an enthusiastic movement in lyric language, and particularly in the ode, pure dithyrambs have been extremely rare. The *Baccho in Toscana* of Francesco Redi (1626–98), which was translated from the Italian, with admirable skill, by Leigh Hunt, is a piece of genuine dithyrambic poetry. *Alexander's Feast* (1698), by Dryden, is the best example in English. But perhaps more remarkable, and more genuinely dithyrambic than either, are the astonishing improvisations of Karl Mikael Bellman (1740–95), whose Bacchic songs form one of the most remarkable bodies of lyrical poetry in the literature of Sweden.

DITTERSBACH, a town of Germany, in the Prussian province of Silesia, 3 m. by rail S.E. from Waldenburg and 50 m. S.W. from Breslau. It has coal-mines, bleach-fields and match, chemical and benzole works. Population (1933) 15,392.

DITTERSDORF, KARL DITTERS VON (1739–1799), Austrian composer and violinist, was born in Vienna on Nov. 2, 1739, his father's name being Ditters. He took the name of Dittersdorf on his ennoblement in 1773. The boy Ditters was a brilliant violinist and attracted the attention of Prince Joseph Frederick of Hildburghausen (1702–1787), who gave the boy, now eleven years old, a place in his private orchestra—the first of the kind established in Vienna. Later he obtained a place in the Vienna opera; and subsequently in 1761 he accompanied Gluck to Italy where his violin-playing won him great renown. He became conductor of the orchestra of the bishop of Grosswardein, a Hungarian magnate, at Pressburg. He set up a private stage in the episcopal palace, and wrote for it his first "opera buffa," *Amore in musica.* His first oratorio, *Isacco figura del Redentore,* was also written during this time; but the scandal of performances of light opera by the bishop's company, even on fast days and during Advent, outweighed this pious effort; the Empress Maria Theresa sharply called the bishop to order; and he, in a huff, dismissed his orchestra (1769). After a short interlude, Ditters was again in the service of an ecclesiastical patron, Count von Schafgotsch, prince bishop of Breslau, at his estate of Johannisberg in Silesia. At Johannisberg Ditters also produced a comic opera, *Il Viaggiatore americano* and an oratorio, *Davide.* The title rôle of Davide was taken by Signora Nicolini, whom Ditters married. In 1773 his oratorio *Ester* was produced in Vienna. After the peace of Teschen (1779) he again became conductor of the reconstituted orchestra of the bishop of Breslau. From this time forward his output was enormous. In 1780 ten months sufficed for the production of his *Giobbe* (Job) and four operas, three of which, *Doktor und Apotheke* (1786), *Das Rotkäppchen* (1788) and *Hieronymus Knicker* (1789) had a great success. But when the bishop died in 1795 his successor dismissed the composer with a small money gift. Poor and broken in health, he accepted the asylum offered to him by Ignaz Freiherr von Stillfried, on his estate near Neuhaus in Bohemia, where he continued to write operas, symphonies and pianoforte pieces. He died on Oct. 1, 1799, praying "God's reward" for whoever should save his family from starvation. On his death-bed he dictated to his son his *Selbstbiographie* (autobiography).

While in the work of Boccherini we trace the influence of Haydn as a force tending to disintegrate the polyphonic suite-forms of instrumental music, in Dittersdorf on the other hand we see the popular conception of the modern sonata and dramatic style. Six of Dittersdorf's symphonies on the *Metamorphoses* of Ovid were republished in 1899 (ed. J. Liebeskind, Leipzig), the centenary of his death. The end of the representation of the conversion of the Lycian peasants into frogs is prophetically and ridiculously Wagnerian in its ingenious expansion of rhythm and eminently expert orchestration.

See his *Selbstbiographie,* published at Leipzig, 1801 (English translation by A. D. Coleridge, 1896); an article in the *Rivista musicale,* vi. 727; the article "Dittersdorf" in Grove's *Dictionary of Music and Musicians; K.* Kalbs *Dittersdorfiana* (1900), with bibliography; and L. Riedinger, *Karl von Dittersdorf als Opernkomponist* (1914).

DITTO, that which has been said before, the same thing (from the Lat. *dictum,* something said, Ital. *detto,* aforesaid), frequently abbreviated into "do."

DIU, an island and town of India, belonging to Portugal, and situated at the southern extremity of the peninsula of Kathiawar. The district (area 20 sq.m.), which inciudes the village of Goala on the mainland and the fortress of Simbor, j m. W., is subject to the governor-general of Goa. Pop. of the island (1921) 13,844. The anchorage is protected from the sea, but the depth of water is only about 2 fathoms. The channel between island and mainland is navigable only by small craft. The town is surrounded by a wall with towers at regular intervals. Its trade is decayed. There are remains of several fine ancient buildings. The cathedral of Sé Matriz, dating from 1601, was formerly a Jesuit college. The Portuguese under treaty with Bahadur Shah of Gujarat, built a fort here in 1535, but were besieged in 1538 and 1545. The second siege is one of the most famous in Indo-Portuguese history.

DIURETICS, the name given to remedies which, under certain conditions, stimulate an increased flow of urine. Some are absorbed into the blood and stimulate the kidneys directly, causing an increased flow of blood; others act through the nervous system. A second class act in congested conditions of the kidneys by diminishing the congestion. Another class (saline diuretics) are effectual by virtue of their osmotic action. A fourth class are diuretic by increasing the blood pressure within the vessels in general, and the Malpighian tufts in particular,—some, as digitalis, by increasing the strength of the heart's contractions, and others, as water, by increasing the amount of fluid circulating in the vessels. Some remedies, as mercury, although not diuretic themselves, when prescribed along with those which have this action, increase their effect. The same substance may act in more than one way; *e.g.,* alcohol, besides stimulating the secretory organs directly, is a stimulant to the circulation, and thus increases the pressure within the vessels. Caffeine acts in nearly every way mentioned above. Together with digitalis it is the most efficient remedy for cardiac dropsy. A famous diuretic pill, known as Guy's pill, consists of a grain each of mercurial pill, digitalis leaves and squill, made up with extract of henbane. Digitalis, producing its diuretic effect by its action on heart, vessels and kidneys, is much used in the oedema of mitral disease, but must be avoided in chronic Bright's disease, as it increases the tension of the pulse, already often dangerously high. Turpentine and cantharides are not now used as diuretics, as they are too irritating to the kidneys.

DIURNAL MOTION, the apparent motion of the heavens from east to west resulting from the earth's rotation on its axis from west to east. The axis of this apparent motion passes through the celestial poles (coincident in direction with the earth's axis) so that the stars appear to describe circles around the pole star.

DIURNAL VARIATION. The small daily change in value of the magnetic quantities, dip, declination and the horizontal component of the earth's magnetic force. *(See* TERRESTRIAL MAGNETISM.)

DIUSHAMBE (now STALINABAD), a small town in Turkistan, capital of the Tadzhik S.S.R., situated south of the Hissar Mountains, but north of the town of Hissar, on the Diushambe river, a tributary of the Kafirnigan river which flows into the Amu-Darya. Pop. (1935) 60,000. It is the centre of a fertile loess area, producing grains (including rice), cotton, melons, grapes, apricots and other fruits. The town itself is built on a loess cliff and its streets and gardens and water tank are shaded by poplar trees. Formerly of little importance, for its main link with the U.S.S.R. was a caravan route to Samarkand, Stalinobad has developed rapidly since its connection by rail with Termez (124 miles) and the establishment of air communications with Termez and Kagan.

It is also a base for the All-Union Academy of Science.

DIVAN (dē-vahn′ or dī-văn′), Persian word, probably from Aramaic, meaning a "counting-house, bureau, tribunal"; thence, on one side, the "account-books and registers" of such an office, and on another, the "room where the office or tribunal sits"; thence again, from "account-book, register," a "book containing the poems of an author," arranged in a definite order (alphabetical according to the rhyme-words), perhaps because of the saying, "Poetry is the register (*dīwān*) of the Arabs," and from "bureau, tribunal," "a long seat, formed of a mattress laid against the side of the room, upon the floor or upon a raised structure or frame, with cushions to lean against" (Lane, Lexicon, 930 *et* seq.). All these meanings existed and exist, especially "bureau. tribunal," "book of poems," and "seat"; but the order of derivation may have been slightly different. The word first appears under the caliphate of Omar (A.D. 634–644). Later, as the state became more complicated, the term was extended over all the government bureaux. The divan of the Sublime Porte was for long the council of the empire, presided over by the grand vizier. (See DEWAN; also Von Kremer, *Culturgeschichte* des Orients, i. 64, 198.)

DIVER, a name applied to many birds, but properly restricted to the family Colymbidne, containing the single genus Colynzbus. They are sea-birds, strong swimmers, and feed mainly on fish. Their legs are set far back on the body, so that they cannot walk more than a few steps at a time; sometimes they progress on land by a series of bounds. They fly well when once on the wing, and usually resort to fresh water for breeding purposes. The red-throated diver (C. stellatus) has a patch of bay on the throat in summer dress. This is replaced by black in the beautifully striped black-throated diver (C. *arcticus*). The Pacific loon (*Colymbus,* or ***Gavia*** *pacifica*) resembles the black-throated diver.

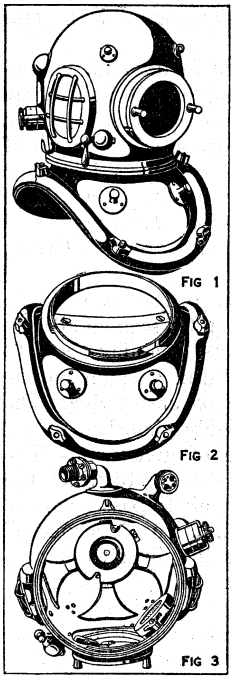
The largest form is the great northern diver (*C. immer*) which has a black back, marked with white spots, a black head and neck, and two semi-collars of black and white vertical stripes. These birds inhabit the Arctic seas of both New and Old Worlds. They breed in the Hebrides, Scandinavia, Canada, Iceland and other suitable places in the North. The American form is usually called loon (q.v.). There is a remarkable mutual courtship, in which the birds may run erect over the surface of the water (see J. S. Huxley, Journ. *Linn. Soc.,* 1923).

DIVERS, EDWARD (1837–1912) English chemist, was born in London on Nov. 27. 1837. He was educated at the City of London school and the Royal College of Chemistry and then studied medicine at Queen's college, Galway, where he also acted as assistant and demonstrator. Between 1853 and 1873 he held a number of posts at the medical schools of several London hospitals where he lectured on materia medica, on medical jurisprudence, and on physics and chemistry. In 1873 he accepted the post of professor of chemistry to the Imperial Government of Japan and stayed in Japan until he retired in 1899. Divers supervised the building and equipment of his own laboratories at the newly built engineering college. In 1886 the college was incorporated in the newly organized imperial university and Divers was transferred to the college of science of that university. After his retirement he lived in London, where he died on April 8, 1912.

It is remarkable that Divers was a great experimental chemist, although he had very bad eyesight and after an accident in the laboratory in Japan, became practically blind. His early work in Japan included an examination of Japanese minerals, which led to some fruitful work on tellurium and selenium. This was followed by work on the compounds of nitrogen and sulphur and on the composition of Japanese bird lime, the manufacture of calomel in Japan and Japanese meteorites and springs.

DIVERS AND DIVING APPARATUS. The earliest reference to the practice of diving occurs in the Iliad, 16, 745–750, where Patroclus compares the fall of Hector's charioteer to the action of a diver diving for oysters. Thucydides mentions the employment of divers during the siege of Syracuse to saw down the barriers which had been constructed below the surface of the water with the object of obstructing and damaging any Grecian war vessels which might attempt to enter the harbour. At the siege of Tyre, divers were ordered by Alexander the Great to impede or destroy the submarine defences of the besieged as they were erected. Livy records that in the reign of Perseus considerable treasure was recovered by divers from the sea. By a law of the Rhodians, their divers were allowed a proportion of the value recovered.

Early Diving Appliances.— The earliest mention of any appliance for assisting divers is by Aristotle, who says that divers were sometimes provided with instruments for drawing air from above the water and thus they were able to remain a long time under the sea (*De* Part. *Anim.* 2, 16), and also that divers breathed by letting down a metallic vessel which did not get filled with water but retained the air within it (Problem. 32, 5). It is also recorded that Alexander the Great made a descent into the sea in a machine called a *Colimpha,* which had the power of keeping a man dry, and at the same time of admitting light. Pliny also speaks of divers engaged in the strategy of ancient warfare, who drew air through a tube, one end of which they carried in their mouths, whilst the other end was made to float on the surface of the water. Roger Bacon in 1240, too, is supposed to have invented a contrivance for enabling men to work under water; and in Vegetius's De Re *Militari* (editions of 1511 and 1532, the latter in the British Museum) is an engraving representing a diver wearing a tight-fitting helmet to which is attached a long leathern pipe leading to the surface where its open end is kept afloat by means of a bladder.



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FIGS. 1 TO 3.—HELMET
Fig. 1.—A diver's helmet complete with corselet
Fig. 2.—Corselet
Fig. 3.—Interior of helmet showing valves and telephone connections

Repton invented "water armour" in the year 1617, but when tried it was found to be useless. G. A. Borelli in the year 1679 invented an apparatus which enabled persons to go to a certain depth. It embodied means for altering the specific gravity of the diver, but was not practical. John Lethbridge, a Devonshire man, in the year 1715 contrived "a watertight leather case for enclosing the person." This leather case held about half a hogshead of air, and mas so adapted as to give free play to arms and legs, so that the wearer could walk on the sea bottom, examine a sunken vessel and salve her cargo, returning to the surface when his supply of air was getting exhausted. It is said that Lethbridge made a considerable fortune by his invention. The next contrivance worthy of mention and most nearly resembling the modern diving-dress was an apparatus invented by Kleingert, of Breslau, in 1798. This consisted of an egg-ended metallic cylinder enveloping the head and the body to the hips. The diver was encased first of all in a leather jacket having tight-fitting arms, and in leather drawers with tight-fitting legs. To these the cylinder was fastened in such a way as to render the whole equipment airtight. The air supply was drawn through a pipe which was connected with the mouth of the diver by an ivory mouthpiece, the surface end being held above water after the manner mentioned in Vegetius, viz. by means of a floating bladder attached to it.

In 1819, Augustus Siebe invented his "open" diving dress worked in conjunction with an air force pump. The dress consisted of a metal helmet formed with a shoulder-plate attached to a jacket of waterproof leather. The helmet was fitted with an air inlet valve to which one end of a flexible tube was attached, the other end being connected to the air pump. The air, which kept the water down below the diver's chin, found its outlet at the edge of the jacket, exactly as it does in the case of the diving bell. Excellent work was accomplished with this dress—work which could not have been attempted before its introduction—but it was still far from perfect. It was absolutely necessary for the diver to

maintain an upright, or but very slightly stooping, position whilst under water; if he stumbled and fell, the water filled his dress, and, unless brought quickly to the surface, he was in danger of being drowned. To overcome this and other defects, Siebe carried out a great many experiments, extending over several years, which culminated, in the year 1830, in the introduction of his "close" dress in combination with a helmet fitted with air inlet and regulating outlet valves. Though, of course, many great improvements have been introduced since Siebe's death, in 1872, the fact remains that his principle is in universal use to this day. The submarine work which it has been instrumental in accomplishing is incalculable.

Modern Apparatus.—A set of ordinary modern diving apparatus consists essentially of seven parts, viz:—(*a*) An air pump, (b) an incompressible helmet with breastplate, or corselet, (c) a compressible, or flexible, waterproof diving dress, (d) a length of flexible non-collapsible air tube, with metal couplings joining it to pump and helmet, (e) a pair of weighted boots, (f) a pair of lead weights for breast and back, (g) a life-line. Most apparatus is fitted with a telephone, and submarine lamps are also largely used.

Helnzet (figs. 1, 2 and 3).—The helmet proper is separate from the corselet, and is secured to the latter by segmental'neck rings which are provided on both these parts, enabling them to be connected together by one-eighth of a turn, a catch on the back of the helmet preventing any chance of unscrewing. The helmet and corselet are usually made of highly planished tinned copper, the valves and other fittings being of gun metal. The helmet is provided with a non-return air inlet valve to which the air supply pipe is attached. This valve allows air to pass from the pump to the helmet, but not in the reverse direction. A regulating air outlet valve fitted to the helmet enables the diver to control the amount of air in the dress, and hence his buoyancy. By screwing up the valve, he retains the air in the dress, and so maintains or increases his buoyancy; by unscrewing it he allows the air to escape, thus causing the dress to become deflated, with a consequent loss of buoyancy. On reaching the bottom and starting work, the diver will adjust his valve so as to maintain himself comfortably in equilibrium, altering the adjustment only when he wishes to ascend; that is, of course, assuming, as should be the case, that air is pumped to him at a uniform rate. Thick plate glass windows are fitted to the helmet. The front window is detachable from the helmet, usually by unscrewing, though some helmets are fitted with hinged windows similar to those used for ships' scuttles.

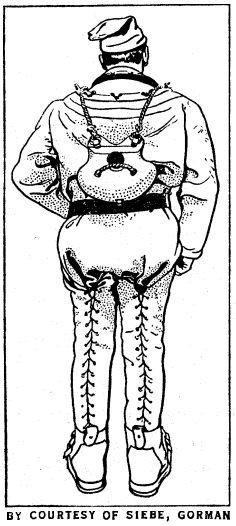

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FIG. 4.—DIVING DRESS WITH LACED LEGS

Dress (fig. 4).—The diving dress is a combination suit which is made of two layers of tanned twill with pure rubber between, and which envelops the whole body from foot to neck, the sleeves being fitted with vulcanized rubber cuffs which make a watertight joint round the diver's wrists. The dress is also fitted with a vulcanized rubber collar, which is secured to the corselet, or breastplate, of the helmet in such a manner as to render all watertight.

Air Pipe.—The diver's air pipe is flexible and non-collapsible. At the ends are fitted metal couplings for securing the pipe to the pump and helmet respectively.

Boots.—To maintain himself in an upright position under water, the diver wears heavily weighted boots (about 32 lb. the pair).

Weights.—Two lead weights, 40 lb. each, one on the back and one on the chest, ensure the diver's equilibrium under water.

Life-line.—The diver's life-line is for use in case of emergency, for hauling the diver to the surface, and also for making signals, the diver and his attendant having a pre-arranged code in which varying numbers of pulls or jerks on the life-line have definite meanings. When the telephone is provided, the telephone wires are embedded in the life-line.

Diver's *Telephone* (fig. 5).—This most useful instrument was introduced by Siebe, Gorman & Co. and is used to-day throughout the British and many other navies. Means are provided whereby the attendant at the surface can converse with No. 1 or with No. 2 diver, or with both together. He can also put No. 1 diver into communication with No. 2, himself hearing their conversation. The telephone wires are embedded in the life-line, which has metal connections at each end for attaching to helmet and battery box. The diver's telephone receiver is situated generally in the crown of the helmet, and the transmitter between the front glass and one of the side glasses. The diver can ring a bell or buzzer at the surface by pressing with his chin a contact-piece situated inside the helmet.

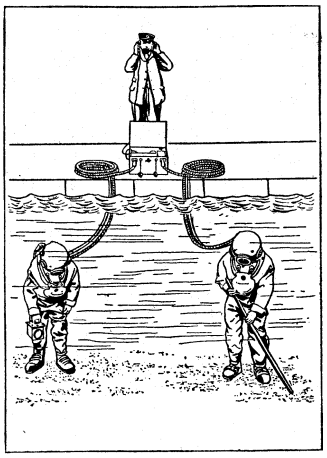

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FIG. 5.—TELEPHONE APPARATUS WHICH ENABLES DIVERS TO CONVERSE WITH ATTENDANTS AND ONE ANOTHER

Submarine Electric Lamps. (fig. 6).—Very many forms of submarine lamps are available. Of these, the most widely used are those which incorporate incandescent electric bulbs, ranging in candle-power from 5,000 down to about 50, the former being supplied with current from the surface, the latter being self-contained with accumulator batteries in a watertight case.

Air Pumps.—Diver's air pumps are of various patterns, depending principally upon the depth of water in which work is being carried out, since the greater the depth of water the greater the quantity of air required by the diver. The pumps are of the reciprocating type and are mostly manually operated. Fig. 7 shows the Siebe-Gorman two-cylinder double-acting pump (removed from its teak chest) adopted by the British Admiralty. Pressure gauges are provided which indicate the pressure of air which the pump is supplying, and the depth at which the diver is working. The cylinders are water-jacketted to ensure a supply of cool air to the diver.

Air *Compressors* driven by electric motors, oil and steam engines are sometimes employed. In these cases the air is delivered into steel reservoirs, the divers' air pipes being connected to an air control panel which receives its air from the reservoir, so that in case of a breakdown of the motive power, a reserve of air sufficient to bring the diver safely to the surface is assured. A typical machine of this description is shown in fig. 8. In the pearl and sponge fisheries the small boats from which the divers work are sometimes propelled by oil engines which also drive the air compressors.

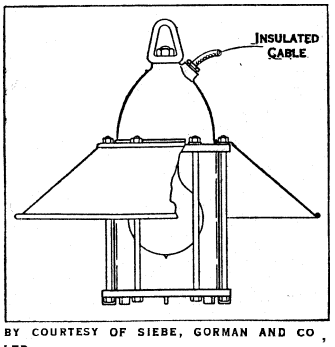

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FIG. 6.—3000 CANDLE-POWER SUBMARINE ELECTRIC LAMP, WITH REFLECTOR

The type of air pumping apparatus employed varies with the depth of water and the conditions under which the diving operations are conducted. Examples of manually-operated and power-driven pumps are shown.

The Diver's Air Supply.—The diver's air supply must be adequate both in volume and pressure—the volume sufficient to ensure proper ventilation of the helmet, and the pressure fully equal to that which corresponds to the depth of water at which the diver msy be working In fresh air, there is only ·03% of carbon dioxide, and, at ordinary atmospheric pressure, no ill effects are felt

until 3% of the gas is present. As a diver descends, the pressure is increased and the effect of a small percentage of carbon dioxide in his helmet becomes greater.

J. S. Haldane, who conducted deep diving experiments for the British Admiralty, found from a large number of analyses of air issuing from the diver's helmet, that 1·5cu.ft. of air per minute would be needed to keep the percentage of carbon dioxide at a safe level. This volume of air is required at all depths, so that the actual quantities required at different depths down to 231ft. are as follows:—

Depth in fathoms	Depth in feet	Pressure per sq. in. above atmospheric pressure, in lb.	Quantity of air at atmospheric pressure required per min. by the diver cu. ft.
0 . . .	0		1·5
5½ . . .	33	14·7	3·0
11 . . .	66	29·3	4·5
16½ . . .	99	44·0	6·0
22 . . .	132	58·7	7·5
27½ . . .	165	73·4	9·0
33 . . .	198	88·1	10·5
35 . . .	210	94·0	11·0
38½ . . .	231	102·8	12·0

Effects **of** Air Pressure on **the** Diver.—When a diver descends into the sea, the extra air pressure to which he is subjected is instantly transmitted to the whole inside of his body. At great depths his blood vessels and tissues become saturated with nitrogen. It should be remembered that a gas in contact with a liquid on which it has no chemical action is absorbed by the liquid in amounts proportional to the pressure of the gas at the time. In the lungs we have the blood practically in contact with the air, which consists of three important gases—oxygen, nitrogen and carbon dioxide. Of these, the nitrogen alone can remain and accumulate in the blood; the oxygen is used up by the tissues, and the breathing prevents the pressure of carbon dioxide from increasing, so that the only gas which accumulates in abnormal quantity in the blood when the diver is under pressure is the nitrogen.

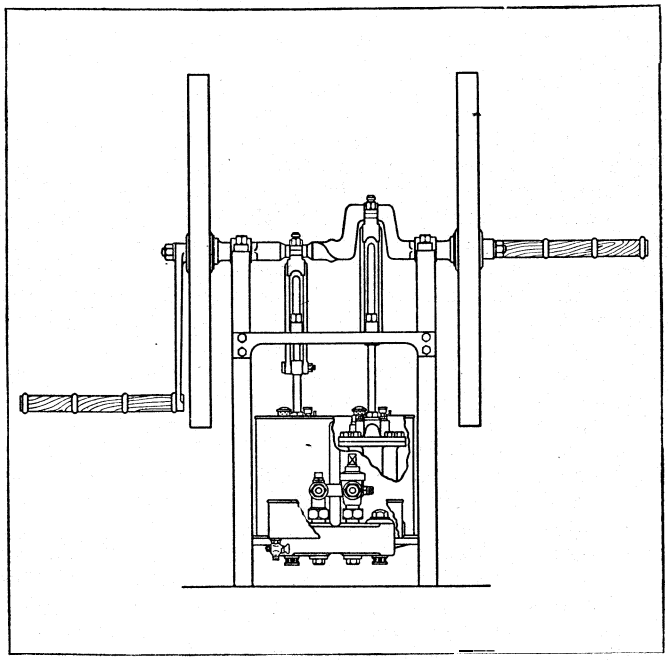

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FIG. 7.— MANUALLY OPERATED 2 CYLINDER DOUBLE-ACTING DIVERS' AIR PUMP. SHOWING VALVES AND AIR-DISTRIBUTING ARRANGEMENT FOR ONE OR TWO DIVERS

When gas is forced into a soda-water bottle under pressure, the water appears to be unchanged so long as the pressure is kept up, but the moment the pressure is reduced, by the removal of the cork, we see the gas come bubbling off the liquid. J. S. Haldane has applied the analogy to diving. He says: "The diver is the soda-water bottle, and his blood the fluid in the bottle. As the diver descends, nitrogen under pressure is forced into contact with his blood, which takes up the nitrogen from the air. So long as he stays below under that pressure, his blood appears to be unaltered; when however, he rises, the excess of nitrogen that the blood has taken up begins slowly to bubble off; if the blood were as fluid as water, it would come off as rapidly as from the soda water. Fortunately for the diver, the blood is a thickish, albuminous fluid, in which bubbles do not readily form, and, as far as we can see, it can retain about twice the amount in solution that water can keep at any given pressure. Every diver knows that it is quite safe to come up from a depth of five or six fathoms to the surface as

Up to		Pressure Lbs. per sq. in.	Time under water, *i.e.* from surface to beginning of ascent	Stoppages in minutes at different depths. feet						Total time for ascent in minutes
Feet	Fathoms			60	50	40	30	20	10	
33	5½	15	No limit	.	.	.	.	.	.	0 to 1
48	8	21	Up to 1hr.	.	.	.	.	.	.	1½
			1 to 3hrs.	.	.	.	.	.	5	6½
			Over 3 ,,	.	.	.	.	.	10	11½
66	11	29½	Up to 15min.	.	.	.	.	.	.	2
			15 to 30 ,,	.	.	.	.	.	5	7
			30 to 48 ,,	.	.	.	.	2	8	12
			48 to 60 ,,	.	.	.	.	3	10	15
			1 to 1½hrs.	.	.	.	.	4	13	19
			1½ to 2 ,,	.	.	.	.	5	15	22
			2 to 2½ ,,	.	.	.	.	5	20	27
			Over 2½ ,,	.	.	.	.	10	20	32
84	14	37	Up to 10min.	.	.	.	.	.	3	5
			10 to 20 ,,	.	.	.	.	.	5	7
			20 to 30 ,,	.	.	.	.	3	8	13
			30 to 40 ,,	.	.	.	.	4	13	19
			40 to 45 ,,	.	.	.	.	5	15	22
			45 to 55 ,,	.	.	.	.	8	16	26
			55 to 65 ,,	.	.	.	.	9	18	29
			65 to 75 ,,	.	.	.	.	10	20	32
96	16	42½	Up to 10min.	.	.	.	.	1	3	7
			10 to 20 ,,	.	.	.	.	3	5	11
			20 to 30 ,,	.	.	.	.	5	11	18
			30 to 35 ,,	.	.	.	.	5	15	22
			35 to 45 ,,	.	.	.	2	8	15	27
			45 to 55 ,,	.	.	.	5	10	15	32
108	18	48	Up to 5min.	.	.	.	.	.	3	6
			5 to 10 ,,	.	.	.	.	.	5	8
			10 to 15 ,,	.	.	.	.	3	5	11
			15 to 20 ,,	.	.	.	.	4	8	15
			20 to 25 ,,	.	.	.	1	5	10	19
			25 to 30 ,,	.	.	.	3	7	10	23
			30 to 35 ,,	.	.	.	4	8	13	28
			35 to 40 ,,	.	.	.	5	10	15	33
132	22	59	Up to 5min.	.	.	.	.	.	5	8
			5 to 10 ,,	.	.	.	.	3	7	13
			10 to 15 ,,	.	.	.	2	5	7	17
			15 to 20 ,,	.	.	.	3	7	10	23
			20 to 25 ,,	.	.	.	4	8	13	28
			25 to 30 ,,	.	.	.	5	10	15	33
144	24	64½	Up to 6min.	.	.	.	.	2	5	10
			6 to 12 ,,	.	.	.	3	5	5	16
			12 to 16 ,,	.	.	.	4	7	7	21
			16 to 20 ,,	.	.	1	4	8	10	26
			20 to 25 ,,	.	.	2	5	10	12	32
168	28	75	Up to 5min.	.	.	.	.	2	5	10
			5 to 10 ,,	.	.	2	3	5	5	18
			10 to 13 ,,	.	1	2	4	6	8	24
			13 to 16 ,,	.	2	3	5	7	10	30
192	32	86	Up to 5min.	.	.	.	1	3	5	12
			5 to 10 ,,	.	1	2	3	6	8	23
			10 to 13 ,,	.	2	3	5	7	10	30
210	35	94	10min.	2	2	4	6	8	12	34
231	38½	102·8	10 ,,	2	3	3	8	10	14	40
276	46	122·7	10 ,,	7	10	12	12	15	20	76

quickly as he likes; the reason for this will now be easily understood, since at such a depth the blood has only twice as much nitrogen in it as it has on the surface, and, therefore, bubbles are unlikely to form. **If,** *however, the diver has been for any considerable time at, say, 180ft.,* and then comes up too quickly, it is almost certain that bubbles will form and cause serious symptoms, such as paralysis of the legs (diver's palsy), severe pains in the joints and muscles, etc. Not only is the air taken up by the blood, but the tissues of the body also get saturated with it. In the case of the blood, the saturation is very quick; it is probable, indeed, that the blood leaving the lungs is always saturated to the existing pressure, but the tissues take up the gas at a much slower rate—a rate which depends on the blood supply. Where this is good, as in the brain and spinal cord, the saturation is quick, but in the fibrous tissues about the joints, etc., saturation is very slow. Those tissues which are saturated quickly also give up their surplus nitrogen quickly, and those which saturate slowly also desaturate slowly."

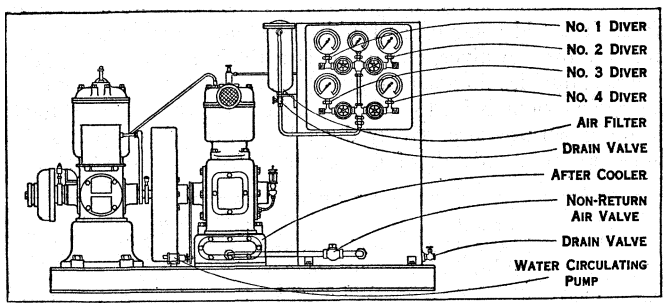

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FIG 8.— OIL-ENGINE DRIVEN AIR COMPRESSING SET. WITH STEEL AIR RECEIVER. FOR SUPPLYING AIR TO 4 DIVERS SIMULTANEOUSLY

The compressed air, after being cooled, is delivered into air receiver, whence it passes to four control valves, to which are connected divers' air tubes

In ascending, the diver is decompressing himself, and it is this gradual decompression that is the most important factor in the prevention of accidents from the formation of bubbles of nitrogen. The dangers are to be avoided by working to the following schedule drawn up by Prof. Haldane, during which there is but little chance of the diver getting dangerously saturated with nitrogen. It is important that the diver descend as fast as his air supply will allow him, for every minute spent in descending is time lost, since his body is becoming saturated.

Compressed **Air** Illness.—Although the rules laid down are calculated completely to prevent compressed air illness, cases do sometimes occur, owing to accidents or mistakes, where the diver comes up too quickly from deep water. In such cases, whether the diver has already shown symptoms of compressed air illness or

On some deep diving operations, however, a Siebe-Gorman Re-compression chamber, as fig. g, is provided, the use of which is a much better and more comfortable method of treatment than sending the diver into deep water again. This chamber is of steel, provided with a bench on which the diver can sit or lie, electric light, telephone, etc. Windows are provided through which the diver can be watched during the process of decompression; a small hand air-lock attached to the chamber allows refreshments, etc., to be passed into him. It is usually found sufficient to raise the pressure in the chamber to 30 lb., but it should never exceed 45 lb. As soon as the diver is relieved of any symptoms, the pressure is allowed to fall at the following rates:—

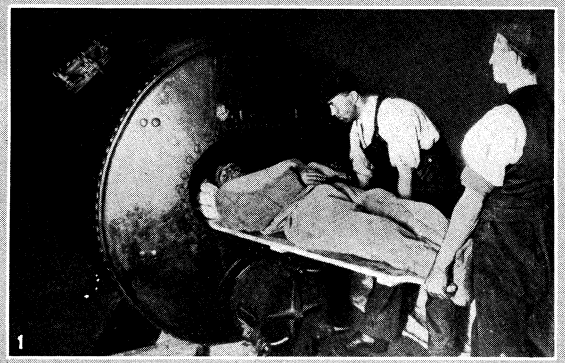
When the pressure in the chamber Is—	Pressure may be allowed to fall at a rate not faster than—
Between 45 lb. and 30 lb.	1 lb. in three minutes.
" 30 " " 15 "	1 " " five "
Below 15 "	1 " " eight "

Helium and Oxygen for Deep **Sea** Diving.—Some years ago the proposal was made by Prof. Elihu Thomson, F.R.S., of Swampscott, Mass., U.S.A., to use helium in place of nitrogen in the atmosphere supplied to divers engaged in deep sea work, and the practical utility of this suggestion has been demonstrated recently by experiments conducted at the Government Bureau of Mines, U.S.A. Helium has a solubility in water nearly 40% less than nitrogen; therefore, during exposure to compressed air, nearly 40% less gas will be dissolved in the watery part of the body. The rate of diffusion of helium is 2·64 times that of nitrogen, its molecular weight being 4 against 28 for nitrogen Helium will thus escape from the lungs much more quickly than nitrogen during decompression. Experiments on animals have so far shown that the safe decomposition time for helium and nitrogen is somewhere about 1 to 3 or 4. To reduce the decompression periods to one-third or one-fourth would be a very great advantage.

Greatest Depths for Useful Work.—The greatest depth at which useful work has been accomplished by divers is 27jft. This was at the salvage of the U.S.A. submarine "F4," sunk off Honolulu, by divers of the United States Navy using the British Admiralty decompression system described in the present article. The Spanish diver, Erostarbe, recovered £9,000 worth of silver bars from a depth of 182ft. Siebe, Gorman & Co.'s chief diver, the late Alexander Lambert, salved £70,000 worth of Spanish gold coin from the wreck of the "Alphonse XII" sunk in 16jft. off Las Palmas. W. Ridyard brought up £50,000 worth of dollars from the "Hamilla Mitchell" lying in 1joft. of water. These are a few examples of treasury recovery notable by reason of the great depths involved. But there have been many cases where far larger sums have been recovered from lesser depths, *e.g.*, the case of the "Laurentic" in 130ft., sunk during the World War, with gold on board to the value of five million pounds sterling, all but £40,000 worth of which was recovered by British naval divers. Then there is the case of the "Oceanic" from which specie, etc., to the value of £700,000 was salved by divers.

The sponge divers of the Mediterranean work at a maximum depth of about 150ft., but they make exceedingly short stays on the bottom, and so, in most cases, avoid risk of pressure troubles. The pearl divers of Australia usually work at about 120ft. Submarine operations on the great majority of harbour, dock and bridge works are conducted at depths of from 40 to Soft. The weighted tools employed by divers differ very little from those used by workmen on *terra firma.* Pneumatic tools, worked by compressed air conveyed from the surface through flexible tubes, are great aids, particularly in rock-blasting work.

Self-contained Diving Apparatus (fig. 10).—The first really practicable self-contained diving apparatus was designed by H A. Fleuss, working in conjunction with Siebe and Gorman, about 50 years ago. The original apparatus enabled a diver to do good work in the flooded Severn tunnel in 1882. The diver on that occasion had to travel nearly a quarter of a mile through the workings-encountering all sorts of obstacles, floating timber, etc., on his journey—to a heading in which he had to close an iron door and a sluice valve. Later, Fleuss and R. H. Davis improved the apparatus considerably. The apparatus supplies a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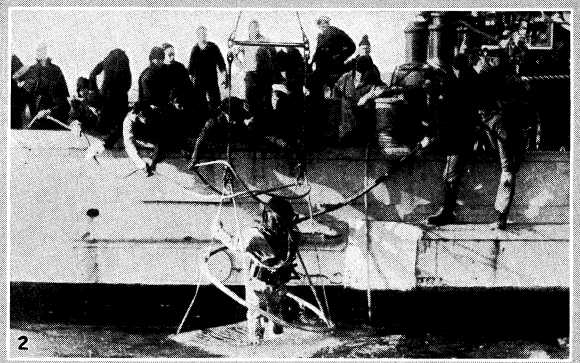
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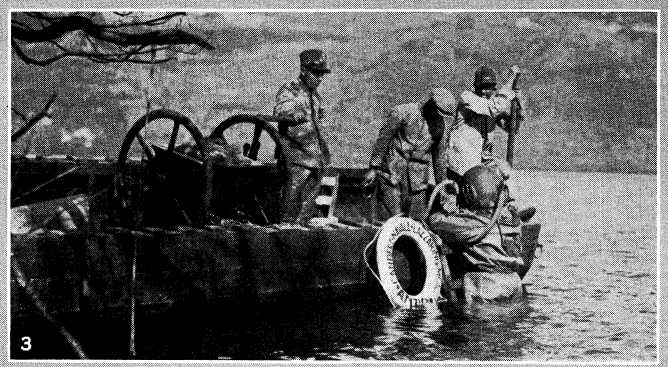
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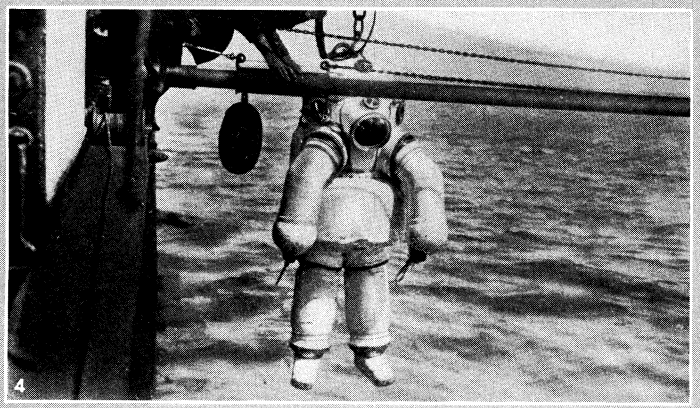
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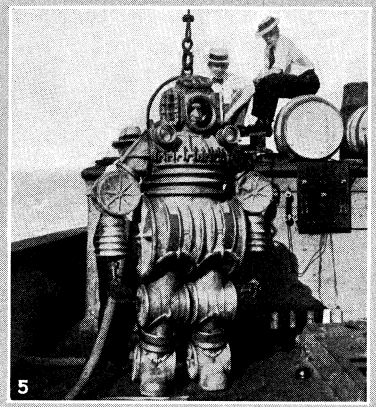
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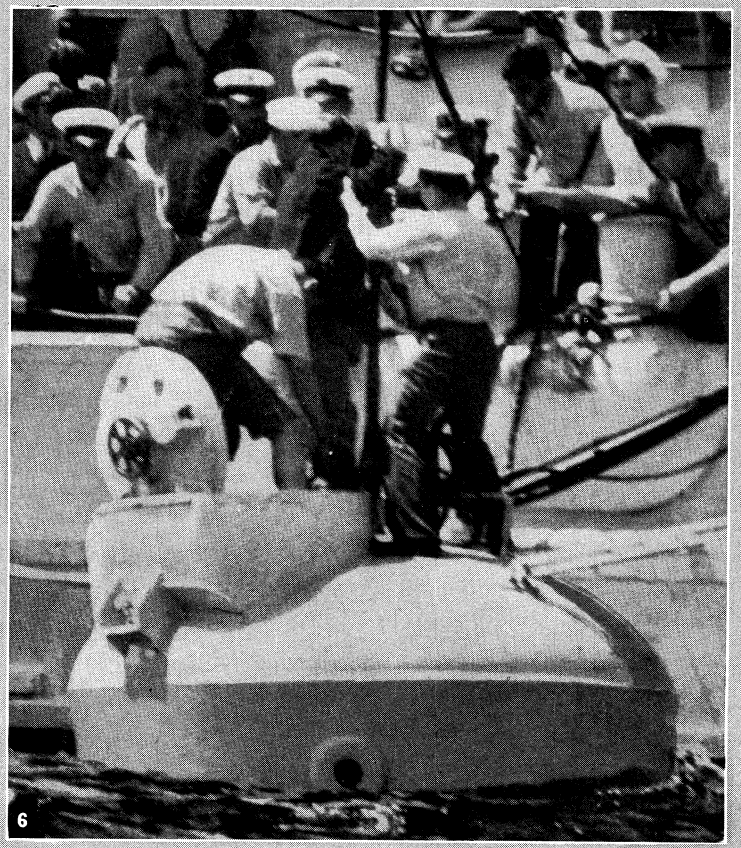
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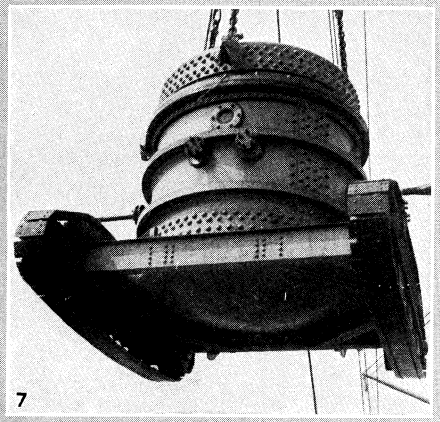
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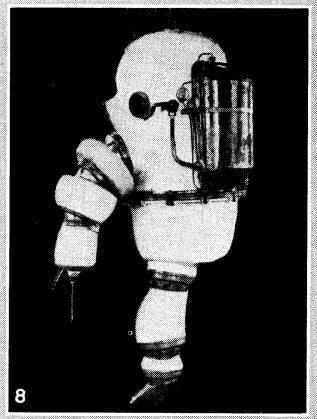
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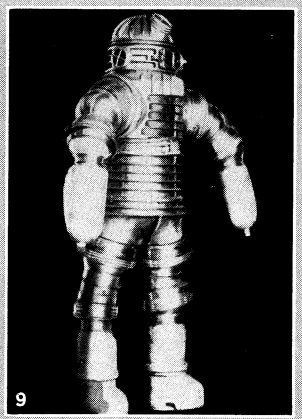
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DIVING APPARATUS FOR ESCUE WORK AND SALVAGING

1. Compressio chamber, for gradual reduction of depth pr su boa "Falcon" to subnarine S-4. 3. Diving in the Lake of Ve , Air pump sh n at lft. 4. Diver in deep-sea diving arm or ei teamer "El be tlhvile." Clamps operated by diver's ands. emoved. Gr ngs shown at sia and top protect glass. llec tric

2. Diver being lowered fr rescue Rome, for remains of Roma galleys. owered from davits in the s rage of Diver in jointed armour; e-piece its on shoulders guide diver work.

Tube at left supplies air from surface. 6. Rescuing survivors of the sunken U.S. submarine "Squalus," in a rescue bell lowered and fastened to the submarine's hatch. 7. Electrically driven submarine tractor, 18 tons. Chamber mounted on caterpillar trucks holds two divers. 8. British type diving armour, side view, showing ball-and-socket joints of arm and leg coverings. 9. British type diving suit. Light weight flanged construction gives strength

factitious, but perfectly respirable air by means of regenerating devices, thus making him independent of the surface. His dress, helmet and boots are of the ordinary patterns. Attached to a leather equipment carried on his back is (1) a cylinder of oxygen and air in certain proportions (it is dangerous to breathe pure oxygen at pressures above one atmosphere plus, hence the dilution); (2) a reducing valve connected to the cylinder, and passing the gas into the helmet through a tube connection at the requisite pressure and volume; (3) a watertight chamber, containing caustic soda, also connected by tube to the helmet. The diver's exhaled air is passed through the caustic soda, which takes up the carbonic acid, and, thus purified, comes back into the helmet where it mixes with the fresh oxygen and air which is constantly passing from the cylinder. This process of regeneration goes on automatically for from 45 minutes to two hours, according to the depth at which the diver may be working. The apparatus can be used at depths down to 150ft.

Recently, Neufeldt and Kuhnke have constructed a diving dress of steel and aluminium alloy, which, they claim, enables the wearer to do the work of a diver in the ordinary (flexible) dress. This diving suit is independent of outside air supply, and is designed to withstand the pressure due to the head of water at which the diver is working. The diver, therefore, breathes air at normal atmospheric pressure, thereby eliminating the effects due to excessive air pressure. Connection with the ship can be maintained by a cable and communication effected by a telephone. A diver equipped with the dress has recently (Aug. 1928) worked on the wreck of the Belgian steamer "Elizabethville," sunk in 1917 off Belle Isle, at a depth of 240 feet.

Diving Bells.—The first designer of the diving bell may have received inspiration from the water spider which makes its home in a bell-shaped chamber of silk, anchored, orifice downwards, by silken threads to water-weeds, etc. The hairs which cover the hinder part of the spider's body are long and hooked at the ends, and have the power of entangling air, so that, when it dives beneath the surface, the insect is partially enveloped in a bubble. The bell when first made is, of course, full of water. To expel the water, the spider disengages the bubble of air inside the bell, and so displaces a little water, the operation being repeated until the water is replaced entirely by air, the latter being re-oxygenated by the same process. Pressure of water increases with its depth. Sink a diving bell to a depth of, say 33ft., and the air inside it will be compressed to about one-half its original volume, and the bell itself will be half filled with water. But keep up a supply of air at a pressure a little above that which is equal to the depth at which the bell is submerged, and you will not only keep the water down to the lower edge of the bell, you will also ventilate it and enable its occupants to work for hours at a stretch.

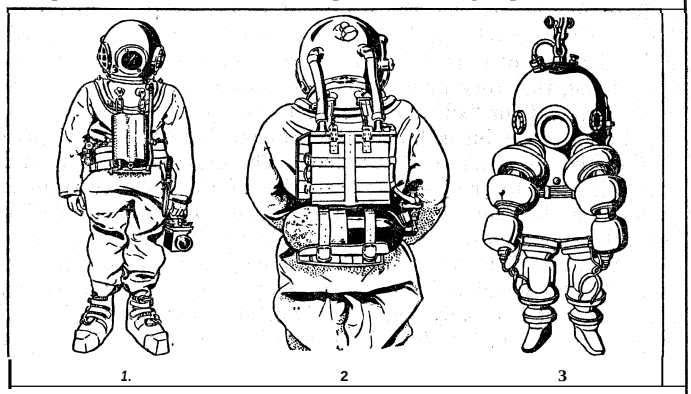

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FIG. 10— FEATURES OF THE SELF-CONTAINED DIVING DRESS, AN APPARATUS WHICH NEEDS NO AIR SUPPLY FROM THE SURFACE

1. Front view, showing emergency oxygen and air cylinder in weighted chamber
2. Back view, showing oxygen and air cylinder, and exhaled-air purifying chamber
3. New German self-contained diving dress, invented by Neufeldt and Kuhnke. Made of cast steel cylinders, it permits diver to explore freely at depth of 40 fathoms (240 feet)

Tradition gives Roger Bacon, in 1250, the credit of being the originator of the diving bell, but actual records are not to be had. Of the records preserved to us, the most trustworthy is the description in the *Philosophical Transactions of the Royal Society*, 1717, of Dr. Edmund Halley's bell, constructed of wood, and supplied with air by means of two closed barrels, with a hole in the bottom, and with a leathern tube, connected at the top, the open end of the tube falling below the bottom of the barrel. The barrels were lowered and raised alternately. When the tubes were taken into the bell, the pressure of water, acting through the hole in the bottom of the barrel, forced the enclosed air into the bell.

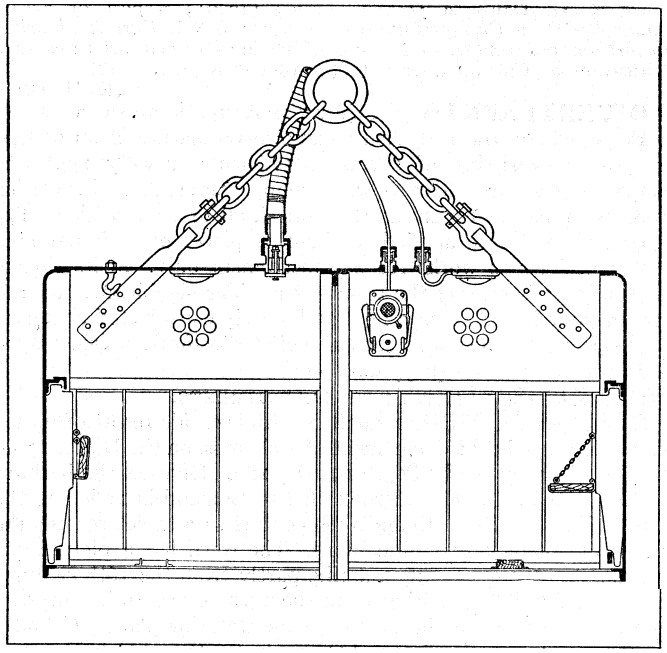

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FIG. 11.— SECTIONAL VIEW OF A DIVING BELL OF THE ORDINARY TYPE Open at the bottom, the water is kept out by compressed air pumped down from the surface. Illustration shows inlet valve, lenses, telephonic apparatus, electric lamps, folding seats, behind which are slabs of cast iron serving as ballast to give the necessary sinking weight to the bell

Fig. 11 illustrates one of several Siebe-Gorman ordinary diving bells, built of steel, as used during the construction of the National Harbour at Dover. Each measured 17ft. long by 10½ft wide by 7ft. high, and weighed 35 tons. It was lighted electrically, and fitted with telephonic apparatus which enabled the bell divers to converse with the engineers and crane and compressor attendants at the surface. Air was supplied to the bell by a steam-driven compressor housed on the gantry which carried the travelling cranes for lowering and raising the bell through the water to a maximum depth of 60ft., and also for lowering the concrete blocks. The air tube for the compressor was connected to a non-return air inlet valve fitted in the crown of the bell. As in the case of the diving dress, an adequate supply of air at the right pressure is maintained to ensure proper ventilation of the bell, the excess escaping at the lower edge of the latter. The bell divers were employed in levelling the sea-bed in readiness to receive the blocks, which weighed 40 tons apiece. Having levelled one section, the bell was moved to the next. The blocks were then lowered, and were placed in position by helmet divers. The bell divers, clad in woollen suits and watertight thigh boots, worked in two-hour to three-hour shifts. The cost of such a bell, with air compressor, telephone and electric lamps, is about £2,000.

The air-lock diving bell comprises a steel working chamber similar to the ordinary diving bell already described, with the addition of a steel shaft attached to the roof. At the upper end of the shaft is an airtight door, and about 8ft. below this is another similar door, the space between the two forming an air-lock. When the men wish to enter the bell, they pass through the first door and close it after them, and then open a valve and let into the lock compressed air from the working chamber till the pressure is equalized; they then open the second door and pass into the main shaft, closing the door after them. Access to the working

chamber is by ladder, secured to the side of the shaft. When returning to the surface, they reverse the operation, opening the lower door, entering the lock and closing the door again; then opening a valve to release the air pressure, when the upper door is opened and the men emerge to atmosphere. Some bells of this type are fitted with two shafts each with its air-lock—one for the passage of the bell men, the other for materials.

See R. H. Davis, *A Diving Manual* (1920); *Report* of *British Admiralty Deep Diving committee* (1907); *U.S.A. Bureau of Mines Report* on possibilities in the use of Welium-Oxygen Mixtures as a Mitigation of Caisson disease (16th Annual Report, 1926).

(R. H. D.)

DIVERTIMENTO (Fr. *Divertissement*), in music, a class of work popular in the 18th century and in the nature of an orchestral suite, consisting of several movements, usually light and simple in character. Mozart wrote many. Serenade and cassation were other names for much the same kind of composition. The same term was also applied to chamber pieces of a similar kind and sometimes to works for one instrument only. In its French form (Divertissement) the term has a wider significance, including pot-pourris, ballets of a light and loosely constructed character (as opposed to the more serious ballet d'action), music played between the acts of a play, and so on.

DIVERTISSEMENT: see DIVERTIMENTO.

DIVES-SUR-MER, a small port and seaside resort of northwestern France in the department of Calvados, on the Dives, 15 m. N.E. of Caen by road. Pop. (1936) 5,183. Dives is the harbour whence William the Conqueror sailed to England in 1066. In the porch of its church (14th and 15th centuries) a tablet records the names of some of his companions. The town has a picturesque inn, adapted from a building dating partly from the 16th century, and market buildings dating from the 14th to the 16th centuries. The coast near Dives has many small watering-places, Cabourg (to the west) and Beuzeval and Houlgate (to the east) being practically united with it. There are large metallurgical works with electric motive power close to the town.

DIVIDE, a term used technically, chiefly in America, for any high ridge forming a water-parting between two valleys. For special senses of the verb "to divide" see DIVISION. In a parliamentary sense, to divide (involving a separation between Aye and No) is to take the opinion of the House by voting on the subject before it.

DIVIDEND, the net profit periodically divided among the proprietors of a joint stock company or corporation in proportion to their respective holdings and as determined by the class of their holdings. From Lat. *dividendum,* a thing to be divided.

Dividend is not interest, although the word dividend is frequently applied to payments of interest; and a failure to pay dividends to shareholders does not, like a failure to pay interest on borrowed money, lay a company open to being declared bankrupt. In bankruptcy a dividend is the proportionate share of the proceeds of the debtor's estate received by a creditor. In England, the Companies Acts provide that no dividend shall be payable except out of the profits arising from the business of the company, but, in the case of companies incorporated by special act of parliament for the construction of railways and other public works which cannot be completed for a considerable time, it is sometimes provided that interest may during construction be paid to the subscribers for shares out of capital. Dividends (excluding occasional distributions in the form of shares) are ordinarily payable in cash.

Preference and Ordinary **Dividends.**—Most companies divide their capital into at least two classes, called "preference" shares and "ordinary" shares, of which the former are entitled out of the profits of the company to a preferential dividend at a fixed rate, and the latter to whatever remains after payment of the preferential dividend and any fixed charges. Before, however, a dividend is paid, a part of the profits is often carried to a "reserve fund." The dividend on preference shares is either "cumulative" or contingent on the profits of each separate year or half year. When cumulative, if the profits of any one year are insufficient to pay it in full, the deficiency has to be made good out of subsequent profits. **A** cumulative preferential dividend is sometimes said to be "guaranteed," and preferential dividends payable by all English companies registered under the Companies Acts 1862 to 1908 are cumulative unless stipulated to be otherwise. There is a growing practice of issuing "deferred" shares which are entitled to no dividends until prior classes of shares receive specified rates of dividend; their speculative character makes them popular and they often stand at high premiums.

Maximum and Sliding Scale Dividends.—Certain British public companies are forbidden by statute to pay dividends in excess of a prescribed maximum rate, but this restriction has been happily modified in some instances, notably in the case of gas companies, by the institution of a sliding scale, under which a gas company may so regulate the price of gas to be charged to consumers that any reduction of an authorized standard price entitles the company to make a proportionate increase of the authorized dividend, and any increase above the standard price involves a proportionate decrease of dividend.

Dividends are usually declared yearly or half-yearly; and before any dividend can be paid it is, as a rule, necessary for the directors to submit to the shareholders, at a general meeting called for the purpose, the accounts of the company, with a report by themselves on its position and their recommendation as to the rate of the dividend. And they have power to pay on account of the dividend for the year, without consulting the shareholders, an "interim dividend," which on ordinary shares is generally at a much lower rate than the final or regular dividend.

Bonus Dividends.—An exceptionally high dividend is often distributed in the shape of a dividend at the usual rate supplemented by an additional dividend or "bonus." Payment of dividends is made by means of cheques sent by post, called "dividend warrants." All dividends are subject to income-tax, and by most companies dividends are paid "less income-tax," in which case the tax is deducted from the amount of dividend payable to each proprietor. When paid without such deduction a dividend is said to be "free of income-tax." In the latter case, however, the company has to make provision for payment of the tax before declaring the dividend, and the amount of its divisible profits and the rate of dividend which it is able to declare are consequently to that extent reduced.

With few exceptions, the prices of securities dealt in on the London Stock Exchange include any accruing dividend not paid up to the date of purchase. At a certain day, after the dividend is declared, the stock or share is dealt in on the Stock Exchange as ex dividend (or "xd"), which means that the current dividend is paid not to the buyer but to the previous holder, and the price of the stock is lower to that extent. The expression "cum dividend" is used to signify that the price of the security dealt in includes a dividend which, in the absence of any stipulation, might be supposed to belong to the seller of the security. On the New York Stock Exchange the invariable practice is to sell stock with the "dividend on" until the company's books are closed, after which it is usually sold "ex dividend." The bonus dividend is designated as an extra dividend; it may be paid in cash or stock. (*See* STOCK EXCHANGE; CUM DIVIDEND.)

DIVIDING ENGINE, an instrument used in engineering and physics for constructing finely divided scales, ruling the diffraction—gratings used in spectroscopy (*q.v.*) and so on. (*See* GRADUATION.)

DIVIDIVI, the native and commercial name for the astringent pods of Caesalpinia coriaria, a leguminous shrub of the subfamily Caesalpinioideae, growing in open, semi-arid regions, especially above tidal flats of the coast from Mexico to northern South America and the West Indies. The plant is between 20 and 30 ft. in height and bears white flowers. The pods are flattened and curl up in drying; they are about $\frac{3}{4}$ in. broad, from 2 to 3 in. long and of a rich brown colour. Dividivi was first brought to Europe from Caracas in 1768. The pods yield a high percentage of tannin of exceptional qualities.

DIVINATION, the process of obtaining knowledge of secret or future things by means of oracles, omens or astrology, from contact with superhuman or divine sources. Divination is practised in all grades of culture. The information is commonly held

to come directly or indirectly from superior, non-human sources. In the Bornean cult of the hawk the divine bird is regarded as knowing the future, or as a mere messenger. Divination is largely employed to discover the cause of death, where it is assumed to be due to magic. In some cases the spirit of the dead man is held to give the information, in others the living magician is the source of the knowledge.

Divinatory methods may be classified as: (a) internal, conditioned by change in the consciousness of the soothsayer; (b) external (a) Internal methods depend on (i.) sensory or (ii.) motor automatisms, or (iii.) mental impressions, for their results. (*i.*) Crystal-gazing is analogous to dreams, except that the vision is voluntarily initiated, though little, if at all, under the control of the scryer. Shell-hearing and similar methods are less common. In these the information is gained by hearing a voice. (*ii.*) The divining rod (*q.v.*) is the best known example of this class. In mediaeval and modern times water-divining or dowsing (*q.v.*) has been largely and successfully used. Similarly a sieve held suspended gives indications by turning; and divination by a suspended ring is found from Europe in the west to China and Japan in the east. The ordeal by the Bible and key is equally popular; the book is suspended by a key tied in with its wards between the leaves and supported on two persons' fingers, and the whole turns round when the name of the guilty person is mentioned. Divination by automatic writing is practised in China. Trance speaking may be found in any stage of culture and in many cases the procedure of the magician or shaman induces a state of auto-hypnotism; at a higher stage these utterances are termed oracles (*q.v.*) and are believed to be the result of inspiration. (*iii.*) Observation shows that by the aid of mental impressions, akin to clairvoyance (*q.v.*), fortunes are told successfully by means of palmistry or by laying the cards; for the same "lie" of the cards may be diversely interpreted to meet different cases. In other cases the impression is involuntary or less consciously sought, as in dreams (*q.v.*), which, however, are sometimes induced for purposes of divination by the process known as incubation or temple sleep. Dreams are sometimes regarded as visits to or from gods or the souls of the dead, sometimes as signs to be interpreted symbolically. (b) In external divination the process is by inference from external facts. The methods are very various. (*i.*) The casting of lots, sortilege, was common in classical antiquity. Similarly dice are thrown for purposes of sortilege; the astragali or knucklebones, used in children's games at the present day, were implements of divination. In Polynesia the coco-nut is spun like a teetotum to discover a thief. In ancient times the poets were often consulted, more especially Virgil, whence the name sortes virgilianae, just as the Bible is used for drawing texts in our own day, especially in Germany. (ii.) In haruspication, or the inspection of entrails, in *scapulomancy* or divination by the speal-bone or shoulder-blade, in divination by footprints in ashes, the diviner must take active steps to secure the conditions necessary to divination. (See also HEPATOSCOPY.) (iii.) In the case of augury and omens (*q.v.*), the behaviour and cries of birds, and meeting with ominous animals, etc., may be voluntarily observed. (iv.) Astrology (*q.v.*) still finds believers among people of good education. (v.) In other cases the tie that binds the subject of divination with the omen-giving object is sympathy. The name of the life-index is given to a tree, animal or other object believed to be united by sympathetic ties to a human being so that the fate of the latter is reflected in the condition of the former. (See the articles AUGURS, ORACLE, ASTROLOGY, OMEN, etc.)

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DIVING: see DIVERS AND DIVING APPARATUS.

DIVINING-ROD. The art of using a divining-rod for discovering something hidden is of immemorial antiquity, and the Roman *virgula* divina, used in taking auguries by means of casting bits of stick, is described by Cicero and Tacitus. The particular form of virgula *furcata,* or forked twig of hazel or willow, described by G. Agricola (De re metallica, 1546), and in Sebastian Munster's Cosmography in the early part of the 16th century, used especially for discovering metallic lodes or water beneath the earth, must be distinguished from the general superstition. The "dowsing" or divining-rod dates from its use by prospectors for minerals in the German (Harz mountains) mining districts in the 15th century. The *Schlagruthe* (striking-rod) or forked twig of the German miners was brought to England by the merchant venturers of Queen Elizabeth's days for those engaged in the Cornish mines. As mining declined in Cornwall its use was transferred to water finding.

In modern times the professional dowser (q.v.) is a "water finder," and there has been a good deal of investigation of his claims to be able to locate underground water, where it is not known to exist, by the use of a forked hazel twig which, twisting in his hands, leads him by its directing power to the place where a boring should be made. A widespread faith exists, based on frequent success, in the dowser's power. Prof. Sir W. F. Barrett was satisfied that the rod twists without any intention or voluntary deception on the part of the dowser, and ascribed the phenomenon to "motor-automatism" on the part of the dowser, a reflex action excited by some stimulus upon his mind, which may be either a subconscious suggestion or an actual impression (obscure in its nature) from an external object or an external mind; both sorts of stimulus are possible, so that the dowser himself may infer that the stimulus is an external object (like water). Like the "homing instinct" of certain birds and animals, the dowser's power lies beneath the level of conscious perception; and the forked twig acts as an index of some material or other mental disturbance within him, which otherwise he could not interpret. Not all dowsers use a rod. Some use a willow rod, or withy, others a hazel twig (the traditional material), others a beech or holly twig, or one from any other tree; others even a piece of wire or watch-spring. The best dowsers have generally been more or less illiterate men, engaged in some humble vocation.

DIVISION, a general term for the action of breaking up a whole into parts (from Lat. dividere, to break up into parts, separate). Thus, in political economy, the phrase "division of labour" implies the assignment to particular workmen of the various portions of a whole piece of work; in mathematics division is the process of finding how many times one number or quantity, the "divisor," is contained in another, the "dividend" (see ARITHMETIC and ALGEBRA); in the musical terminology of the 17th and 18th centuries, the term was used for rapid passages consisting of a few slow notes amplified into a florid passage, *i.e.,* into a larger number of quick ones. The word is used also in concrete senses for the parts into which a thing is divided, *e.g.,* a division of an army, an administrative or electoral division; similarly, a "division" is taken in a legislative body when votes are recorded for and against a proposed measure.

In logic, division is a technical term for the process by which a genus or wider class is differentiated into its sub-classes or species. Thus the genus "animal" may be divided, according to the habitat of the various kinds, into animals which live on land, those which live in water, those which live in the air. Each of these may be subdivided according to whether their constituent members do or do not possess certain other qualities The basis of each division is called the *fundamentum* divisionis. It is clear that there can be no division in respect of those qualities which make the genus what it is. The various species are all alike in the possession of the generic attributes, but differ in other respects; they are "variations on the same theme" (Joseph, Introduction to Logic, 1906); each one has the generic, and also certain peculiar, qualities (*differentiae*), which latter distinguish them from other species of the same genus. The process of division is thus the obverse of classification (*q.v.*); it proceeds from genus to species,

whereas classification begins with the particulars and rises through species to genera. In the exact sciences, and indeed in all argument both practical and theoretical, accurate division is of great importance. It is governed by the following rules. (1) *Division must be exhaustive;* all the members of the genus must find a place in one or other of the species. Rectilinear figures are not correctly divided into triangles and quadrilaterals because there are rectilinear figures which have more than four sides. On the other hand, triangles can be divided into equilateral, isosceles and scalene, since no other kind of triangle can exist. (2) *Division must be exclusive,* that is, each species must be complete in itself and not contain members of another species. No member of a genus must be included in more than one of the species. (3) In every division *there must be but one principle* (*fundamentum divisionis*). The members of a genus may differ from one another in many respects; *e.g.,* books may be divided according to external form into quarto, octavo, etc., or according to binding into calf, cloth, paper-backed and so on. They cannot, however, be divided logically into quarto, paper-backed, novels and remainders. When more than one principle is used at the same time in a division it is called "cross division." (4) *Division must proceed gradually* ("Divisio non facit saltum"); *i.e.,* the genus must be resolved into the next ("proximate") species. To go straight from a *summum genus* to very small species is of no scientific value.

It is to be observed that logical division is concerned exclusively with universals or concepts; division is of genus and species, not of particulars. Two other kinds of division are recognized: *metaphysical division,* the distinction in thought of the various qualities possessed by an individual thing (a piece of lead has weight, colour, etc.), and *physical division* or *partition,* the breaking up of an object into its parts (a watch is thought of as being composed of case, dial, works, etc.). Logical division is closely allied with logical definition (*q.v.*).

In military science, "division" is the term which is given to a higher formation of an army. The infantry division is a permanent formation of all arms, and it is provided with all the necessary means for subsisting, marching, and fighting independently of any other formation. Divisions as we know them to-day were first formed by the French in 1770; but it was not till a hundred years later that they became a permanent part of the army in peace time. At the opening of the World War the French division, which may be taken as typical of European practice, comprised two infantry brigades, each of two 3-battalion regiments, a cavalry squadron, two artillery groups each of three 6-gun batteries, engineer, medical and administrative units, in all 12,000 men and 36 guns. The Prussian army introduced the divisional system at the opening of the Wars of Liberation in 1813, and it was adopted for the whole German army after the war of 1866, and continued in essentials unchanged down to 1914. Other European armies were slower to follow suit, but by the end of the 19th century practically all had done so.

In the British army the division had been the highest tactical and administrative unit throughout all the wars from the Peninsular to the Boer War; but it did not really become a part of the peace-time organization till the period of Lord Haldane's reforms in 1906. At the opening of the World War the British division differed in some important particulars from its continental counterparts, consisting as it did of three infantry brigades, each of four battalions, four artillery brigades, each of three 6-gun batteries, one 60-pdr. battery, three field companies of engineers, three field ambulances, a signal company, and administrative units such as the divisional ammunition column, a supply train and a veterinary section. Numerically it was considerably stronger than the average Continental division.

During the World War in all the belligerent armies the division became the tactical and administrative unit. Various modifications took place in its internal composition: by 1918 the strength of the infantry had been greatly reduced, though the number of machine-guns and automatic weapons had increased; divisional cavalry had disappeared; and the proportion of artillery and administrative units was larger. The majority of the remodelled armies of the post-war period show similar tendencies in the composition of their higher formations. The division tends more and more to become the kernel of peace-time armies. The numerical reduction of the infantry has gone hand in hand with a re-armament which has greatly increased its fire power and its potentialities for attack and defence, including defence against tanks. Divisional cavalry on the other hand has been generally reintroduced; while the lavish artillery allotment necessary for position war has been reduced to an amount considered more suitable for mobile operations. Finally, the mechanization of transport has considerably increased the radius of action of the whole formation.

In the British army, however, these tendencies have perhaps been less marked than elsewhere. The 4-battalion infantry brigades have been retained; the artillery, signal, engineer and medical units remain much as before the war, and no divisional cavalry has been allotted. The great increase in infantry fire power has, however, been fully maintained, and the mechanization of transport has proceeded further than in any other army; so that though the framework of the British division has changed but little in broad outline, it is to-day a far more powerful engine of war than its prototype which took the field in Aug. 1914.

Cavalry divisions were first formed in war in the time of the first Napoleon; but though they became part of the French peace-time organization in 1875, the Germans, in common with the majority of European armies, had few or none in peace, and formed them as required on the outbreak of war. They usually comprised six regiments, organized in two or three brigades, with horse artillery and ancillary units. Since the World War, in which, after the early stages, at any rate in the European theatres, cavalry were rarely able to carry out their normal functions, the general tendency has been to remodel them as light divisions, of which cavalry form only a proportion of the combatant strength; mechanized units, such as armoured cars, motor machine-guns, cyclists, artillery and mechanical transport, have been added to increase mobility and fire power. (*See* ARMY.)

United States Army.—The division is at present the highest tactical and administrative command in the United States army in time of peace. Prior to the World War the regiment was the highest. Provisional manoeuvre divisions were assembled in Texas in 1911 and again in 1913, largely under the influence of conditions on the Mexican border. Theirs, however, was only a transitory existence. The 1928 divisional organization of the army of the United States is a World War development. It preserves on the one hand the designations which have become historic on the battlefields of France and Flanders, and on the other hand embodies the results of World War experience. The actual strength of the army necessitates, however, the maintenance of these divisions in highly skeletonized form. The command consists of two infantry brigades of two regiments each; a field artillery brigade of two regiments, with a total of 48 French 75 mm. guns; one regiment of engineers; a medical regiment; an observation squadron; division trains and special troops, such as military police, tank, signal, ordnance and headquarters companies, complete the organization of an infantry division which is commanded by a major general. The total war strength of this organization is 20,030 officers and enlisted men. In a single column it occupies 28·1 m. road space and requires 72 standard type railway trains for its transportation.

DIVORCE. It is the general rule that marriage is contracted for an indefinite length of time or for life, although even in the latter case it may very frequently be dissolved, for some reason or other, during the lifetime of the partners.

Lower Culture Groups.—Among a few uncivilized peoples marriage is said to be indissoluble or divorce unknown, and among many others divorce is said to be rare or marriage as a rule to last for life; but there are also many tribes in which divorce is reported to be of frequent occurrence or marriage of very short duration. Owing to the defective character of the information it is impossible to say anything definite about the comparative prevalence of lifelong unions and of divorce among the lower races in general, or about the duration of marriage at the different grades of economic culture compared with one another. It is interesting, however, to note the universal ar almost universal

prevalence of lifelong unions among some of the lower hunters and incipient agriculturists, such as the Veddas of Ceylon, the Andamanese, the Orang Mamaq and Orang Akit of Sumatra, and the "pure" tribes of the Malay Peninsula. Somewhat more definite than the information we possess of the actual prevalence of divorce among the simpler peoples are the statements as to the circumstances in which their customs allow it to he practised. Among a large number of tribes the husband is said to be able to dissolve the marriage at will or on the slightest grounds or pretexts, and in the majority of these cases a similar right is granted to the wife. But we are also frequently told that a man must not divorce his wife and a wife not separate from her husband without just or good cause. The most generally recognized ground for divorce is probably adultery on the part of the wife; and among some peoples the wife is said to have a right to divorce an unfaithful husband. A very frequent cause of divorce is barrenness in the wife, while the birth of a child may make marriage indissoluble; and sometimes we are told that the wife can effect divorce if the husband proves impotent. There are a variety of other recognized grounds for divorce more or less frequently found in the savage world. A man may divorce his wife if she is lazy or neglectful; if she suffers from a foul or incurable disease; if she becomes too old; if all her children die; or, of course, if she deserts him The wife. again, may dissolve the marriage if the husband neglects or ill-treats her, if he deserts her or if she has a strong repugnance to him. Among some natives of Eastern Central Africa the wife may divorce a husband who fails to sew her clothes. Among the Shans of Burma, should the husband take to drinking or otherwise misbehave, the wife has the right to turn him adriit and to retain all the goods and money of the partnership.

Early China and Japan.—Among the peoples of ancient civilization the stability of marriage is not less variable than it is among the lower races. The old penal code of China says that if a man repudiates his wife "without her having broken the matrimonial connection by the crime of adultery or otherwise, and without her having furnished him with any of the seven justifying causes of divorce," he shall in every such case be punished with 80 blows. The seven causes in question are: barrenness. lasciviousness, disregard of the husband's parents, talkativeness, thievish propensities, envious and suspicious temper and inveterate infirmity. Yet none of these seven causes will justify a divorce if the wife has mourned three years for the husband's parents, if the family has become rich since the marriage after being poor previously, or if the wife has no parents living to receive her back again. In practice, however, the husband's power of divorce was no doubt greater than it was according to the letter of the law. On the other hand, it does not seem that either law or public opinion justified a wife in deserting her husband or demanding a separation from him. The divorce law of the Japanese Taihō code was substantially the same as that in China, but practically a wife could be divorced at the pleasure of her husband under any slight or flimsy pretext. As in China, the wife had no legal right to demand a divorce from her husband on any ground. This was the case till the year 1873, when a law was enacted which for the first time allowed the wife to bring an action of divorce against the husband; and the new civil code, promulgated in 1896–98, went further in the same direction. Prof. Hozumi, in his commentaries on this code, says that it places husband and wife on an equal footing with regard to the right of divorce; but it does not seem that mere adultery on the part of the husband gives the wife a right to divorce him, although he can divorce an unfaithful wife. Divorces are very frequent in Japan, but since the new code came into force their number has rapidly decreased. In 1897 the proportion of divorces to marriages was 34%, in 1900 it was 18·5%.

Semitic Peoples.—Among Semitic peoples the husband has had, or still has, the legal right of repudiating his wife at will. In Babylonia, according to the Laws of Hammurabi, however, the wife and even a concubine had certain pecuniary guarantees against arbitrary divorce, and she might also herself in certain circumstances claim a divorce, or at least separation. The right of the husband to repudiate his wife at his pleasure is the central thought in the system of Jewish divorce law; and the Rabbis neither did nor could set it aside, although they gradually tempered its severity by numerous restrictive measures. It ceased to exist in practice, and was at last, in the earlier part of the 11th century, formally abolished, whereas the husband retained the right to divorce his wife if a good cause could be shown. On the other hand. the wife has no right to divorce her husband But the Mishnah allowed her to sue for divorce, and if the court decided that she mas entitled to be divorced the husband was forced to give her a bill of divorce, although he was supposed to give it of his own free will and accord At Jewish law the wife may demand a bill of divorce from her husband if he repeatedly ill-treats her, if he is guilty of notorious dissoluteness of morals, if he wastes his property and refuses to support her, if he suffers from some loathsome chronic disease contracted after marriage, if he is physically impotent, and for a few other reasons. For divorce by mutual agreement no specific causes are required. As the ancient Hebrews, so the pagan Arabs permitted the husband to repudiate his wife whenever he pleased, and subsequently this unlimited customary right was crystallized in Mohammed's law. And at Mohammedan, as at Jewish law, the wife can never divorce her husband, although she may take steps leading to the dissolution of her marriage. When she desires 2 divorce, she may obtain from him a release from the marriage contract by giving up either her settled dower or some other property; and when the husband is guilty of conduct that makes the matrimonial life intolerable to the wife or when he fails to fulfil his engagements, she has the right of preferring a complaint before the judge and demanding a divorce by authority of justice. But the facility with which Mohammedan women can effect a dissolution of their marriage is influenced by local custom. So also the frequency of divorce differs considerably in diffcrcnt parts of the Mohammedan world. In some parts it is practised to an extent that is almost without a parallel; whereas among the Mohammeddns of India the husband seldom exercises his right to divorce his wife without any special reason. This may be due to Hindu influence.

Hindu Practice.—With orthodox Hindus marriage is a religious sacrament which cannot be revoked A woman convicted of adultery may be deprived of her status and turned out of her caste, but even in this case divorce in the ordinary sense is an impossibility. The law, however, was not always equally stringent. At present the orthodox Hindu law of divorce is more or less disregarded by certain low castes in the north of India and by many castes, both high and low, in the south. among whom usage has superseded texts; agreeably to such usage the granting of a divorce, or the recognition of a divorce as one properly made, is the duty of the caste.

Early Greeks and Romans.—Among the Greeks and Romans in the early days, as among the Hindus, marriage evidently was a union of great stability, although in later times, contrary to what was the case among the Aryans of India, it became extremely easy and frequent. Among the Greeks of the Homeric age divorce seems to have been almost unknown, but afterwards it became an everyday event in Greece. According to Attic law the husband could repudiate his wife whenever he liked and without stating any motives, while the wife could demand a divorce by appealing to the Archon and stating the motives for her demand. A Roman marriage was perhaps at no time indissoluble, but the specifically patrician kind of marriage, by *confarreatio,* was at any rate very nearly so. The other fcrms of marriage, not being of the same mystical and sacramental character, could be dissolved without difficulty. The husband's legal authority in regard to the dissolution of a marriage with *manus* was absolute, whereas in the old law a wife *in manu* was as little a free party to the act of divorce as a child was a free party to that of emancipation. Yet in practice the husband's right was no doubt more or less checked by public opinion and, as it seems, even by the Censors; it was said that for 500 years no one took advantage of the liberty of divorce. In regard to a "free" marriage. which implied that the wife did not fall under the *manus* of her husband, the rule of divorce was very different: the dissolution of such a marriage

could be brought about either by mutual agreement between both parties or by the will of one party only. The rules of divorce that were recognized in the case of a free marriage were afterwards practically extended to marriages with *manus;* and in the end marriages with *manus* fell into disuse altogether. Towards the close of the Republican era and during the Empire divorce was very frequent among the upper classes; almost all the well-known ladies of the Ciceronian age were divorced at least once.

Celtic and Teutonic Peoples.—In the Celtic law-books, various rules relate to divorce, from which we may draw the conclusion that separation of married couples was by no means an uncommon occurrence. In ancient Ireland it might take place either by mutual consent or as the outcome of legal proceedings; and with reference to the latter kind of separation, one of the Breton law tracts specifies seven different causes for which a married woman may separate from cohabitation without losing her dowry. According to the old customary law of the Teutonic peoples a marriage could be dissolved by agreement between the husband and the woman's kin; and the husband was entitled to repudiate his wife if she was sterile or guilty of conjugal infidelity and perhaps for some other offences. On the other hand the wife had originally no right to dissolve the marriage.

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Divorce (legal) is the dissolution, in whole or in part, of the tie of marriage. In the main the practice in the legal systems of the civilized world is derived from the Roman law and the teachings and canons of the Christian religion. In countries in which the Roman Catholic creed is supreme, subject to certain exceptions indicated later, complete divorce *a vinculo matrimonii* (the bond of marriage) is not legally possible, though the same result may be achieved in rare cases by the ecclesiastical courts declaring that the marriage was a nullity owing to duress or other causes. The partial decree of divorce *a mensa et thoro* (from bed and board), which is still the practice in the Irish Free State and other Roman Catholic countries, and in English law is represented by judicial separation, leaves the parties still married, neither being able to remarry during the lifetime of the other. In the end it was due to the spread of Christianity and the authority of the Church of Rome that marriage came to be regarded not merely as a civil contract but as a sacred bond net lightly to be severed by the spouses or by the State.

How far the Founder of the Christian religion laid down any moral law in regard to divorce has always been a matter of controversy, owing to the form of His declaration that has come down to us, and the different conceptions then existing of the connubial relations, monogamy, so far as a husband was concerned, not having been established. The rule of the Mosaic law was expressed as follows: "When a man hath taken a wife, and married her, and it come to pass that she find no favour in his eyes, because he hath found some uncleanness in her, then let him write her a bill of divorcement, and give it in her hand, and send her out of his house. And when she is departed out of his house, she may go and be another man's wife" (Deut. xxiv. 1–2).

The Pharisees asked Jesus: "Is it lawful for a man to put away his wife for every cause?" Jesus replied: "What God hath joined together let no man put asunder," and also said: "Moses, because of the hardness of your hearts, suffered you to put away your wives; but from the beginning it was not so." Then came the declaration which is the main basis of the canon law: "Whosoever shall put away his wife, except it be for fornication, committeth adultery; and whoso marrieth her which is put away doth commit adultery" (Matt. xix.). Practically the same formula was used in the Sermon on the Mount (Matt. v. 32) and also in Luke xvi. 18, and Mark x. 11–12.

The Roman Church has always interpreted the exception of fornication as applying only to incontinence by the wife before marriage discovered by the husband after marriage, and has treated it, not as just cause for dissolution of marriage, but as invalidating the marriage itself. It will be observed also that right down to the present century incontinence has been regarded as a matrimonial offence only if committed by the wife. In most countries where the civil law allows complete divorce husband and wife are now on an equal footing as to the grounds of divorce. In England the jurisdiction of the divorce court extends to nullity (*q.v.*) jactitation and restitution of conjugal rights *(see* below) and legitimation (*q.v.*).

The Roman Law of Divorce.—The history of divorce took its earliest colour from that conception of the *patria potestas,* or the power of the head of the family over its members, which enters so deeply into the jurisprudence of ancient Rome. The wife was transferred at marriage to the authority of her husband, *in manus,* and consequently became so far subject to him that he could, at his will, renounce his rule over her, and terminate his companionship, subject at least to an adjustment of the pecuniary rights which were disturbed by such action. As early, however, as the time of Romulus, it is said that the State asserted its interest in the permanence of marriage by forbidding the repudiation of wives unless they were guilty of adultery or of drinking wine, on pain of forfeiture of the whole of an offender's property, one-half of which went to the wife, the other to Ceres. But the law of the XII. Tables, in turn, allowed freedom of divorce. At last the *lex Julia de adulteriis,* while recognizing a power of divorce both in the husband and in the wife, imposed on it, in the public interest, serious restrictions and consequences. It required a written bill of divorce *(libellus repudii)* to be given in the presence of seven witnesses, who must be Roman citizens of age, and the divorce must be publicly registered. In this way a wife could divorce a lunatic husband, or the *paterfamilias* of a lunatic wife could divorce her from her husband. The *lex Julia* was followed by a series of acts of legislation extending and modifying its provisions.

In AD. 449 the law of divorce was rendered simpler and more facile by Theodosius and Valentinian.

The modification in the civil law of Rome effected by Justinian under the joint influence of the previous law of Rome and that of Christianity was remarkable. Divorce by mutual consent, hitherto, as we have seen, absolutely free, was prohibited except in three cases: (1) when the husband was impotent; (2) when either husband or wife desired to enter a monastery; and (3) when either of them was in captivity for a certain length of time. At a later period Justinian, under the influence of the Christian idea of marriage, placed a further restriction or even prohibition on divorce by consent by enacting that spouses dissolving a marriage by mutual consent should forfeit all their property, and be confined for life in a monastery, which was to receive one-third of the forfeited property, the remaining two-thirds going to the children of the marriage. The prohibitions of Justinian on divorce by consent were repealed by Justin, his successor.

Justinian further re-enacted, with some modifications, the power of divorce by a husband or wife against the will of the other. Divorce by a wife was allowed in five cases: (1) the husband being party or privy to conspiracy against the State; (2) attempting his wife's life, or failing to disclose to her plots against it; (3) attempting to induce his wife to commit adultery; (4) accusing his wife falsely of adultery; (5) taking a woman to live in the house with his wife, or, after warning, frequenting a house in the same town with any woman other than his wife. A husband was allowed to divorce his wife for any one of seven reasons: (1) failure to disclose to her husband plots against the State; (2)

adultery; (3) attempting or failing to disclose plots against her husband's life; (4) frequenting dinners or balls with other men against her husband's wishes; (5) remaining from home against the wishes of her husband except with her parents; (6) going to the circus, theatre or amphitheatre without the knowledge of, or contrary to the prohibition of, her husband; (7) procuring abortion.

The canon law of Rome was based on two main principles: (1) That there could be no divorce a *vinculo matrimonii,* but only a mensa et thoro, *i.e.,* separation. (2) That no divorce could be had at the will of the parties, but only by the sentence of an ecclesiastical court, The papal canon law allowed a divorce a mensa et *thoro* for six causes: (1) adultery or unnatural offences; (2) impotency; (3) cruelty; (4) infidelity; (5) entering into religion; (6) consanguinity. The church, however, always assumed to itself the right to grant licences for an absolute divorce.

Divorce in England. — In England the law of divorce, being based on the canon law of Rome, was practically unchanged until the Matrimonial Causes Act 1857. Divorce a mensa et thoro could only be granted by the ecclesiastical courts, which were invested with this jurisdiction until 1857. These were the courts of the various dioceses, including that of the archbishop of Canterbury, the court of arches, and that of the archbishop of York, the consistory court of York. An appeal lay to special delegates appointed by the Crown ad koc, until in 1836 the judicial committee of the privy council was given this appellate jurisdiction. Adultery and cruelty were the main grounds for this sort of divorce allowed by the ecclesiastical courts, and the principles acted upon by those courts are still those imposed by statute upon the present courts in regard to judicial separation, except that desertion was added by the 1857 act as a ground for a decree. As regards adultery a mere confession by a spouse of her guilt was not regarded by the canon law as a safe ground for a decree, if uncorroborated, and in the present practice in cases for dissolution of marriage a confession has to be supported by some sort of circumstantial evidence in the English court. In general the principle was accepted, and is still the rule, that if an illicit affection is proved and there are opportunities by association to gratify a guilty passion, then a prima facie case is made out, justifying a decree if there is no defence.

As regards cruelty the definition accepted by the ecclesiastical courts as that of the canon law is the same now. It was accepted by the House of Lords in *Russell* v. Russell (1897, A.C. 395), in which "legal cruelty" was defined as conduct of such a character as to have caused danger to life, limb or health (bodily or mental), or as to give rise to a reasonable apprehension of such danger. Those who wish to read the classic exposition on the subject of legal cruelty should read the judgment of Lord Stowell, one of the greatest English masters of the civil and canon law, in the case of Evans v. Evans (1790, 1. Hagg. Con., 35). Since then there have been innumerable decisions all showing that the court is not bound by any cast-iron rule in its interpretation of what constitutes cruelty within the range of this definition.

Apart from a bare denial the canon law allowed three grounds of answer: (1) *Compensatio criminis,* or the committal by the spouse bringing the charge of the same matrimonial offence, in which case the petitioner could be refused relief; (2) Condonation: the complete forgiveness of the offendingspouse by the other with full knowledge of the facts. Resumption by a husband of marital relations with his wife when he has full knowledge of her adultery is conclusive proof of condonation under the English divorce law, but resumption by a wife of marital relations with a guilty husband, with full knowledge, is not necessarily conclusive proof of condonation on her part. A matrimonial offence even of a different kind revives the former one, even if condoned. Condonation was a bar to relief, and still is. (3) Connivance: this is also a bar to relief, and always was, as it was held that a man could not avail himself of a charge if he did not appear with clean hands. The presumption of law is against connivance, and the intention must be clearly shown for the court to refuse the petitioner relief. The petitioner need not be the active agent in the adultery of the other spouse. He may be guilty of connivance merely by neglect or indifference, though in that case the modern plea under the English statute law would probably come under the head of conduct conducing, which is in some cases hardly distinguishable from connivance, and may equally be held a bar to relief.

Collusion between the parties for the purpose of presenting a false case to the court was also held by the ecclesiastical courts to be a bar to relief, whether it was an agreement to give the appearance of having committed adultery when none had occurred or merely to withhold material facts from the knowledge of the court. In the present law of divorce in England collusion may be held to exist not only when a false case is presented, but also where there is a good case. Thus in a recent suit where the husband made provision for the future of his wife pending divorce proceedings Lord Merrivale, president, though granting a decree, uttered a warning against any transaction pending divorce proceedings which raised a suspicion of collusion. In a more recent case a divorce petition was dismissed in the first place owing to an agreement by which the petitioner received a certain sum in advance in respect of damages from the co-respondent, and his second petition on a later charge was dismissed because by taking such sum he had connived at the further adultery of his wife.

The ecclesiastical courts provided for the pecuniary rights of the wife by granting to her alimony during the progress of a suit, and a proper allowance after its termination in cases in which she was successful. Such payments were dependent on the pecuniary means, or faculties, as they were termed, of the husband, and were subject to subsequent increase or diminution in proper cases. But the ecclesiastical courts did not deal with the custody of the children of the marriage, it being probably considered that that matter could be determined by the' common law rights of the father, or by the intervention of the court of chancery.

As regards suits for divorce any substantial delay might lead to the imputation of acquiescence or even condonation. To that extent, at least, the maxim *vigilantibus* non dormientibus jura *subveniunt* applied. Desertion by either party to a marriage, except as giving rise to a suit for restitution, was not treated as an offence by canon law in England. It formed no ground for a suit for divorce, and constituted no answer to such a suit by way of recrimination. It might indeed deprive a husband of his remedy if it amounted to connivance, or perhaps even if it amounted only to culpable neglect.

Conjugal rights are those rights which a husband and wife have to each other's society. When either party continues to refuse to render these rights to the other, they may be enforced by a suit for the restitution of conjugal rights. Until the grounds of complete divorce were equalized in 1923, the procedure of restitution was mainly used by wives to shorten the statutory period of desertion, non-compliance by the husband with a decree being followed by the wife's petition for divorce on the dual grounds of adultery and desertion.

Jactitation of marriage is a persistent claim by a person of a marriage falsely alleged to have taken place between himself or herself and the complainant, who petitions for a decree enjoining perpetual silence on the person alleging such marriage in regard to it. In these days such a remedy is rarely required, though it was not an uncommon proceeding when "Fleet" and other irregular marriages were frequent and rights to property were involved. The procedure might still be useful for obtaining a declaration as to the validity of a disputed marriage in cases where the procedure under the Legitimacy Declaration Act 1858, now re-enacted in the Supreme Court of Judicature (Consolidation) Act 1925, is not convenient or applicable. The most historic case in which jactitation arose was the duchess of Kingston's case in 1776, reported in the State Trials. The last reported case was in 1922 when the petition was dismissed.

Criminal Conversation. — Up to the Matrimonial Causes Act 1857, a husband could bring an action for damages against his wife's paramour (action for criminal conversation). It was a common law suit, and the damages were estimated according to the loss he was supposed to have suffered by the seduction and loss of his wife. This procedure was abolished by the

1857 act and engrafted upon the new procedure in divorce, by way of a separate prayer for damages against the co-respondent in a petition for dissolution. In theory the damages are assessed on the same principle, though in practice a jury often fixes the amount at a figure calculated to inflict a severe punishment on the co-respondent. If a petitioner for divorce or the respondent (husband) die before the petition comes to trial, the petition is "abated," *i.e.,* abandoned, the matrimonial tie having been dissolved by death. But if it is the respondent wife who dies the husband's prayer for damages against the co-respondent may be pursued to trial.

It was for some time supposed after the Reformation that the sentences of divorce pronounced by the ecclesiastical courts acquired the effect of allowing remarriage, and such divorces were in some cases granted. In Lord Northampton's case in the reign of Edward VI. the delegates pronounced in favour of a second marriage after a divorce a mensa et *thoro*. It was, however, finally decided in *Foljambe's* case, in the 44th year of Elizabeth, that a marriage validly contracted could not be dissolved for any cause. In 1669 a private act of parliament was granted in the case of Lord de Roos, and this was followed by another in the case of the duke of Norfolk in 1692. Such acts were, however, rare until the accession of the House of Hanover, only five acts passing before that period. The jurisdiction thus assumed by parliament to grant absolute divorces was exercised with great care.

The Act **of** 1857.—The Matrimonial Causes Act (which came into operation on Jan. 1, 1858) embodied two main principles: 1. The constitution of a lay court for the administration of all matters connected with divorce. 2. The transfer to that court, with as little change as possible, of the powers exercised in matrimonial matters by (a) the House of Lords, (b) the ecclesiastical courts, (c) the courts of common law.

The functions of the new court, termed "The Court for Divorce and Matrimonial Causes," were practically entrusted to the judge of the court of probate (which was also established in 1857), termed the "Judge Ordinary," who thus in matters of probate and divorce became the representative of the former ecclesiastical jurisdiction. The parties to a suit obtained the right of trial by jury of all disputed questions of fact; and the rules of evidence of the common law courts were made to apply. An appeal to the full court was given in all matters, which the judge ordinary was enabled to hear sitting alone.

1. To this court were transferred all the powers of the ecclesiastical courts with regard to suits for divorce a *mensa* et tlzoro, to which the name was given of suits for "judicial separation," nullity, restitution of conjugal rights, and jactitation of marriage, and in all such proceedings it was expressly enacted (s. 22 [now comprised in ss. 32 and 103 of the Judicature (Consolidation) Act 1925]) that the court should act on principles and rules as nearly as possible conformable to the principles and rules of the ecclesiastical courts. Judicial separation could be obtained by either husband or wife for adultery, or cruelty, or desertion continued for two or more years.

2. There were also transferred to the court powers equivalent to those exercised by the legislature in granting absolute divorce. The husband could obtain a divorce for adultery, the wife could obtain a divorce for adultery coupled with cruelty or desertion for two or more years, and also for incestuous or bigamous adultery, or rape, or unnatural offences. As has been explained above, connivance, condonation or collusion continued to be absolute bars to divorce, and the court was given discretion to refuse relief where the petitioners had been guilty of adultery or conduct conducing to the respondent's adultery or had delayed unreasonably in prosecuting his suit.

This act assigned a new force to desertion. The ecclesiastical law regarded it only as suggestive of connivance or culpable neglect. But the act of 1857 made it (1) a ground of judicial separation if continued for two years, (2) a ground in part of dissolution of marriage if continued for the same period, (3) a bar, in the discretion of the court, to a petition for dissolution, though it was not made a bar to a suit for judicial separation.

S. 32 provided, in case of dissolution, for maintenance of the wife by the husband on principles similar to those recognized by the ecclesiastical courts, and s. 45 for the settlement of the property of a guilty wife on her husband or children. By later acts of 1859 and 1878 provision was made for altering settlements made in view or in consequence of a marriage. The act (s. 35) provides also in all divorce proceedings, and also in those **of** nullity, for provision for the custody, maintenance and education of children by the court. It was made obligatory to join an alleged adulterer in the suit, and damages (s. 33) might be claimed against him, and he might be ordered to pay the cost of the proceedings (s. 34).

The act of 1857 also provided (s. 21) that a wife deserted by her husband might apply to a magistrate in petty sessions and obtain an order which had the effect of protecting her earnings and property, and during the currency of such order of protection a wife was to be in the same position as if she had obtained an order for judicial separation. The effect of this section appears to have been small; but the Summary Jurisdiction (Married Women) Act 1895, now reinforced by the Summary Jurisdiction (Separation and Maintenance) Act 1925, has afforded a cheap and speedy remedy to all classes. The act of 1857 made no provision as to the name to be borne by a wife after a divorce; and this omission led to litigation in the case of a peer's wife, in *Cowley* v. *Cowley* (1901, A.C. 450), in which Lady Cowley was allowed to retain her status.

By the Act of 1860 a very important change was made, having for its object a practical mode of preventing divorces in cases of connivance and collusion or of misconduct of the petitioner. It was provided that a claim of dissolution (a provision afterwards extended to decrees of nullity) should in the first instance be a decree nisi, which should not be made absolute until the expiration of a period then fixed at not less than three, but by subsequent legislation enlarged to not less than six, months. During the interval which elapsed between the decree nisi and such decree being made absolute, power was given to any person to intervene in the suit and show cause why the decree should not be made absolute, by reason of the same having been obtained by collusion, or by reason of material facts not having been brought before the court. At any time before the decree was made absolute, the queen's proctor, if led to suspect that the parties were acting in collusion for the purpose of obtaining a divorce contrary to the justice of the case, might under the direction of the attorney-general intervene and allege such case of collusion. It was established in Sloggett v. Sloggett (1928, 44 The Times L.R., 394) that it was open to the king's proctor by direction of the court to intervene during the progress of a divorce suit before decree *nisi* and to call new evidence, not only when collusion is in question but in regard to other matters.

By an act of 1866 the court was given power to order a guilty husband to make provision for the maintenance of his former wife on the marriage being dissolved, and by an act of 1907 the court was enabled in suitable cases to order the husband to make similar provision when he was the petitioner and she the guilty spouse. From time to time the law of evidence in the divorce court was varied by statute until in 1869 it was enacted that no witness in any proceeding should be asked or be bound to answer any question tending to show that he or she had been guilty of adultery, unless in the same proceeding such witness had given evidence in disproof of alleged adultery.

The Law of Domicile.—No petition for dissolution of marriage can be granted in England unless the husband is domiciled in this country at the commencement of the proceedings. If such domicile is established the court may adjudicate even if the parties are not British subjects, or the marriage was contracted abroad, or at the time of the marriage the parties were not domiciled in England. The wife's domicile is that of her husband. It has been suggested by a series of judicial *obiter* dicta that if a man desert his wife and acquire a domicile abroad the wife may still petition for dissolution of her marriage in the divorce court, but the point has not yet been definitely decided. It has been held, however, that if a woman domiciled in England marry a foreigner domiciled

abroad, and the latter obtains under the law of his domicil a decree of nullity not recognized by English law, she may petition for divorce despite the foreign decree. As regards judicial separation the test of jurisdiction is either residence of both parties, irrespective of domicil or nationality, in England at the time of the institution of the suit, or where the parties are domiciled in England. The English court does not recognize a divorce purporting to be made by a foreign tribunal with reference to persons domiciled in England. This principle was maintained In the prosecution of Earl Russell on a technical charge of bigamy before the House of Lords in 1901, it being held that if a divorce were refused a man in England he would not be relieved from the guilt of re-marrying by securing an American divorce.

Summary Proceedings for Separation. — The legislature has sought to extend the relief afforded by the courts in matrimonial causes by a procedure fairly to be considered within the reach of all classes. In 1895 an act was passed which re-enacted in an improved form the provisions of an act of 1878 of similar effect. By the act of 1895 power was given to a married woman whose husband (1) has been guilty of an aggravated assault upon her within the Offences against the Person Act 1861, or (2) convicted on indictment of an assault on her and sentenced to pay a fine of more than £5 or to imprisonment for more than two months, or (3) shall have deserted her, or (4) been guilty of persistent cruelty to her or wilful neglect to maintain her or her infant children, *and* by *such cruelty or neglect shall have caused her to leave and live aport from him,* to apply to a court of summary jurisdiction and to obtain an order containing all or any of the following provisions: — (1) that the applicant be not forced to cohabit with her husband, (2) that the applicant have the custody of any children under 16 years of age, (3) that the husband pay to her an allowance not exceeding £2 a week. (The words in *italics* have been repealed by the Separation and Maintenance Act 1925, with the result that a wife may now apply to the magistrates notwithstanding that she has not left her home owing to her husband's neglect and cruelty.) The act provides that no married woman guilty of adultery should be granted relief, but with the very important proviso, altering as it does the rule of the common law, that the husband has not conduced or connived at, or by wilful neglect or misconduct conduced to, such adultery.

Recent Developments. — The above is a summary of the law of divorce up to 1910. Since then there have been developments. statutory and otherwise, which may be classified as follows: (1) Matrimonial Causes Act 1923; (2) Poor Persons Rules of litigation; Divorce on Assize; (3) The Decision in *Russell* v. *Russell,* 1924; (4) Extended exercise of the court's discretion; (5) Judicial Proceedings (Regulation of Reports) Act 1926.

The royal commission on divorce and matrimonial causes, after sitting for three years, completed its monumental labours in Nov. 1912, and by a majority report recommended important changes in the substantive law of divorce. The more important recommendations of the majority report were as follows: (a) Hearing of divorce locally by commissioners of the High Court. (b) Powers of magistrates to make orders having the permanent effect of a decree of judicial separation to be abolished, and a simple process in the High Court with that object to be made available; husbands to be entitled to separate orders on the grounds of cruelty, habitual drunkenness, and wilful desertion, equally with wives. (c) Amendment of law so as to place the two sexes on an equal footing as regards the grounds of divorce. (d) New grounds for divorce: (i.) desertion for three years; (ii.) cruelty; (iii.) incurable insanity after five years' confinement; (iv.) habitual drunkenness found incurable after three years from first order of separation; **(v.)** imprisonment under commuted death sentence. (e) Habitual drunkenness as a ground for judicial separation. (f) Provision for overcoming difficulties of jurisdiction as to domicil and residence. (g) (i.) Unsoundness of mind, actual or incipient, at the time of the marriage, if unknown to the petitioner, and (ii.) if a spouse is suffering from a venereal disease unknown to the other, or the wife is pregnant by another man, both at the time of the marriage, to be grounds for nullity. (g) Provision for proceedings in *forma pauperis.* (h) No reports of divorce suits until a case is finished, and divorce judges to forbid or limit reports at their discretion.

In their minority report Dr. Lang (archbishop of York), Sir William Anson, and Sir Lewis Dibdin confined their recommendations to placing the sexes on the same basis as to grounds of divorce, and to accepting the above recommendations as to the ground for nullity, plus that of wilful refusal to consummate the marriage.

By the Matrimonial Causes Act 1923 (sometimes called the Entwhistle Act from the name of its chief sponsor), it was provided that since July 18, 1923, any act of adultery by a husband would entitle his wife to a divorce. This act was repealed but re-embodied in the Judicature (Consolidation) Act 1925. Thus the royal commission's proposal in (c) above was carried into effect, and an immense change made in the law of divorce, in keeping with the spirit of the Sex Disqualification (Removal) Act 1919 (*q.v.*) but in contradistinction to the principle which actuated the divorce statutes of the 19th century. Thus a woman may now divorce her husband for a single act of infidelity. As a consequence of the alteration in the law the number of wives' petitions has increased in a marked degree. Moreover the procedure of restitution of conjugal rights, mostly utilized up to 1923 for the purpose of shortening the statutory period of two years for desertion, has become extremely rare.

By the Administration of Justice Act 1920, provision was made for the local hearing of undefended divorce suits on assize, and of defended Poor Persons' divorce suits, if this venue was suitable In the last year for which statistics are available the number of proceedings commenced in matrimonial causes under the Poor Persons' Rules was 2,150 of which the majority were tried on circuit. This procedure, coupled with the Poor Persons' system, has brought divorce within the range of people whose small means formerly discouraged this resort to the court, and to this extent the recommendations of the divorce commission (a) and (g) have been followed.

By the majority of three law lords to two the House of Lords in *Russell* v. *Russell* (1924, A.C. 687) effected a retrograde movement in the law of evidence by denying to spouses the right of stating on oath anything as to the posaibility of marital access, if such evidence would tend to bastardize a child. The judge of first instance and three lords justices of appeal had admitted the evidence in question, and the majority decision reversed the accustomed practice of the divorce court. The decision has involved undue hardship on poor litigants, but subsequent judgments have reduced its effect to the lowest possible range. If this had been the law before, hundreds of War divorce suits depending on the evidence of the husbands' *simpliciter* as to non-access, in cases where their wives had given birth to children, would have been abortive, owing to the difficulties of securing independent evidence.

Notably since the War, the attitude of the court has changed in several important respects in the direction of greater humanity. Lord Merrivale in his judgment in *Wilson* v. *Wilson* (1920, P. 20) showed that in exercising his discretion in favour of a spouse who had himself been guilty of adultery, such action was not inconsistent with the interests of morality at large. The old rule that a guilty mother was not entitled to access to her children was overcome by the decision of the court of appeal in B. v. B. (1924, p. 174). On the other hand one result of equalizing the grounds of divorce was the marked increase in the number of wives' suits in which the charge was based on a solitary incident at a hotel In March 1928 Lord Merrivale called a halt to this kind of petition by declaring that he would not grant decrees in cases where the real facts seemed to be cloaked by an artificial procedure.

By the Judicial Proceedings (Regulation of Reports) Act 1926, the reporting of matrimonial causes by newspapers was limited to the names, address and occupations of the parties and witnesses, legal submissions, summings-up and judgments, and verdicts of juries. Thus the recommendation of the divorce commission, (h) above, has been dealt with in more drastic fashion than was proposed.

The Matrimonial **Causes Act, 1937.**—This act was promoted

by a private member of parliament, Mr. **A. P.** Herbert, and, after interesting discussions in both houses of parliament, was finally passed in July 1937 to take effect from Jan. 1, 1938. It was largely based upon the recommendations of the royal commission published in 1912. To adultery as grounds for divorce were added desertion for three years, cruelty, and unsoundness of mind regarded, after five years' duration, as incurable. No divorce proceedings could be initiated until three years after the date of marriage; but the courts were given power to reduce this period in cases of exceptional hardship or depravity. A feature of the Act is that it lays no compulsion whatever upon the Church in the matter of re-marriage of divorced persons, leaving the Church free to recognize or not in practice the law of the land.

Divorce in Other Countries. — So far as matrimonial laws are concerned Scotland, Ireland and the British dominions overseas are just as independent of the Engish law as foreign countries.

In *Scotland* marriages may be judicially dissolved for two causes, adultery and wilful desertion. Condonation is a bar to relief as in England, and so are connivance or conduct conducing, pleaded in defence as *lenocinium.* If the petitioning spouse has been guilty of adultery it is no bar to a divorce, though it may be set up by the accused spouse by way of counteraction. Delay in prosecuting the suit has to be taken into account by the court, but is rarely a bar to relief. Collusion is also guarded against, the lord advocate being equipped with much the same powers as the king's proctor in England. As regards an action for dissolution on the ground of desertion, the petitioner must prove that the desertion has been wilful from the beginning, and has continued for four years. In such a case it is a good answer that the petitioner has been guilty of adultery. Actions for judicial separation may be raised for adultery or cruelty, and since 1908 the sheriff has had jurisdiction in judicial separation.

In *Ireland* there is no absolute divorce, but the courts may grant divorce *a mensa et thoro,* and a petitioner may secure a complete dissolution by act of parliament. Both Northern Ireland and the Irish Free State have had freedom to legislate in this matter since 1922, but have made no statutory change.

In *Canada* though divorce is a matter exclusively within the control of the Dominion parliament that body has not seen fit to pass any such act, with the result that there is no complete divorce in the provinces of Alberta, Manitoba, Ontario, Quebec and Saskatchewan, but as the other four provinces, British Columbia, New Brunswick, Nova Scotia, and Prince Edward Island, each had jurisdiction in divorce before the federating act of 1867 was passed, they still retain this jurisdiction. The Dominion parliament can pass special acts of divorce in individual cases, as was done in England prior to the act of 1857. There is no absolute divorce in *Newfoundland.*

In the Commonwealth of *Australia* the grounds of complete divorce vary according to the State, but, generally, they are wider than in England, including conduct which would only justify a judicial separation in England.

In ***New Zealand*** the grounds of absolute divorce are (1) adultery; (2) wilful desertion for five years; (3) habitual drunkenness for four years coupled with cruelty or desertion by the husband and neglect of household duties by the wife; (4) commuted life sentence or sentence of seven years, penal servitude; (5) incurable lunacy for at least ten years.

In the Union of *South Africa* the Roman-Dutch Law is in operation for the most part, the grounds of divorce being (1) adultery or unnatural offences; (2) malicious desertion; (3) lifelong imprisonment.

As regards European countries there is no complete divorce where the Church of Rome still preserves its ancient powers and influence.

In *Italy* a husband may secure a divorce *a mensa et thoro* on the ground of his wife's adultery, and the wife is entitled to the same decree if her husband keeps a concubine in such a way as to constitute a grave indignity to his wife, or if he voluntarily deserts her or fails to make a home for her, or is guilty of violence, threats or cruelty endangering her safety or health, or if he is sentenced for a grave crime. The Italian courts do not recognize foreign divorce decrees relating to Italian subjects. In *Spain* and *Portugal* the law is practically the same as in Italy.

In *Germany* complete divorce is allowed on the grounds of adultery, an attempt by one spouse to kill the other, desertion for a year, bigamy, incest and certain gross crimes, insanity for three years, dishonest or immoral conduct. If the innocent spouse prosecutes, the spouse guilty of adultery may be sent to prison for not more than six months. A husband may forbid his divorced wife to use his name. Judicial separation is granted on the same grounds, but either party may later apply to have the decree made into a complete divorce.

In *Austria* the grounds for complete divorce are adultery, conviction for a crime for which the penalty could be five years' imprisonment, malicious desertion, cruelty or conduct endangering life or health and invincible aversion. A judicial separation is allowed in the same grounds, and also by mutual consent. In *Hungary* the law is very similar.

Dissolution of marriage by mutual consent is allowed in several European countries. Thus in *Belgium* this course is permitted, subject to the approval of the court. The other grounds of complete divorce in Belgium are the adultery of the wife, the adultery of the husband only if he has brought a concubine to the home, cruelty and conviction for infamous offence. The law on separation was modified by a law of March 20, 1927. There has to be an interval of ten months before remarriage. In *Switzerland* also the marriage may be dissolved by mutual consent on grounds deemed sufficient by the court; specific grounds are cruelty or dishonourable treatment, wilful desertion for three years, incurable insanity or mental disease of three years' duration, and in cases of gross antagonism a couple may be granted a trial separation for two years, followed by a divorce if there is no reconciliation.

In *Sweden* a divorce is granted after the expiry of a year from the date of a judicial separation allowed on the ground of aversion, if there has been no reconciliation; other grounds of divorce are adultery, six years' absence by one spouse without news, insanity for three years, conduct endangering life and imprisonment for life. These are judicial grounds, but a divorce may also be pronounced by means of the royal prerogative against a person who has been the subject of a sentence for a grave crime, or on proof of violence, insobriety or prodigality. In *Norway* and *Denmark* the grounds are very similar, and in the former country a royal decree of divorce may be obtained by mutual request after three years of separation. In *Holland* judicial separation is allowed on the usual grounds of the canon law, and complete divorce can be secured for each of the following grounds: adultery, wilful desertion for five years, unnatural offences, life imprisonment and absence for ten years. The court sits *in camera.*

In *Russia* under the present code of the Soviets complete divorce is obtainable either by mutual consent, or on the application of husband or wife subject to the approval of the court. The decree does not become absolute until after the time for appeal has expired. Under the imperial law the grounds for divorce used to be adultery, bigamy, impotence at the time of marriage, absence of one spouse without any news for five years. exile to Siberia and loss of civil rights. In *Japan* a complete divorce is allowed by mutual consent with notice to the registrar, and also on the respective grounds of the wife's adultery, the husband's cruelty or desertion or his being sentenced for a grave offence, or three years' absence without knowledge.

Under the *Jewish* laws there is no distinction between nullity and divorce, the grounds of divorce being bigamy, breach of the law of affinity, the wife's adultery, the husband's leprosy or vice or neglect, the wife's refusal of marital rights for a year or by her cursing her father-in-law in her husband's presence; a divorce may also be obtained by mutual consent. Jews in most countries however are bound by the national laws.

In *France* the law of divorce has had a chequered history. Before the Revolution the Roman canon law prevailed, marriage was considered indissoluble, and only divorce a *mensa et thoro,* known as *la séparation d'habitation,* was permitted; though it would appear that in the earliest age of the monarchy divorce a *vinculo matrimonii* was allowed. But the Revolution swept away

marriage among the institutions which it overwhelmed, and by the law of Sept. 20, 1792, so great facility was given for divorce *a vinculo matrimonii* as practically to terminate the obligations of marriage. A reaction came with the Code Napoléon, yet even under that system of law divorce was fairly easy. On the restoration of the monarchy in 1816 divorce *a vinculo* was abolished.

Divorce was re-enacted by a law of July 27, 1884, the provisions of which were simplified by laws of 1886 and 1907. But a wide departure was made by these laws from the terms of the Code Napoléon. Divorce by consent was not permitted, and the following became the causes for which divorce was allowed: (1) Adultery by either party to the marriage at the suit of the other, without, in the case of adultery by the husband, the aggravation of introduction of the concubine into the home required by the Code; (2) violence (*excès*) or cruelty (*sévices*); (3) *injures* gmves, acts reflecting on honour or reputation, and such things as unjustifiable refusal of marital rights or habitual drunkenness, and (4) *peine afflictive* et *infamante,* a legal punishment involving corporal confinement and moral degradation.

In addition to its recognition of full divorce, the French law recognizes *séparation* de corps. The grounds are the same as those for a divorce; and if a *séparation* de corps has existed for three years, it may be turned into a divorce upon the application of either party to the court.

On a divorce both parties are at liberty to remarry. The husband could remarry at once; but the wife (art. 296 of the Code) was only allowed to remarry after an interval of ten months By the act of 1907, this article was abolished, and the wife allowed to remarry as soon as the judgment or decree granting the divorce has been entered, providing 300 days have elapsed. Under the law of March 26, 1924, art. 295 was amended in favour of greater, but not complete, freedom of remarriage of the parties divorced, not still in a state of wedlock. The publication of divorce proceedings in the press is forbidden under heavy penalties. After a divorce the wife may not continue to use the name of her divorced husband. An appeal may be brought against a decree of divorce within two months; and a decree made on appeal is subject to revision by the court of cassation within two months. A decree must be transcribed in the Register of Civil Status before it becomes absolute. (Cf. Woodland v. Woodland, 44 The Times L.R. 495.) (ST. H.; C. Mo.)

UNITED STATES

According to American practice, divorce is the termination by proper legal authority, sometimes legislatively but usually judicially, of a marriage which up to the time of the decree was legal and binding. It is to be distinguished from a decree of nullity of marriage, which is simply a legal determination that no legal marriage has ever existed between the two parties. It is also to be distinguished from a decree of separation, which permits or commands the parties to live apart, but does not completely and for all purposes sever the marriage tie. The matrimonial law of England, as at the time of the Declaration of Independence, forms part of the common law of the United States. But as no ecclesiastical courts have ever existed there, the law must be considered to have been inoperative.

Upon the subject of divorce in the United States and foreign countries a careful investigation was made by the former American Department of Labour, its report covering the years 1867–86; further reports for the period 1887–1906 have been published by the Federal Census Bureau. The number of divorces was in 1886 over 25,000, and in 1906 was over 72,000, about double the number reported for that year from the rest of the Christian world. The number in 1916 was over 112,000, and in 1926 nearly 181,000, indicating an increase, 1906–16, of 56% and 1916–26 of 61%, about four times as rapid as the increase of population. The number of divorces annually to each 100,000 people has increased as follows: 1867, 27; 1877, 34; 1887, 47; 1897, 62; 1906, 86; 1916, 113; 1926, 154.

The several States differ in divorce-rate, from South Carolina, with no provision for legal divorce, to Oregon, where the rate is more than twice and Nevada where it is more than eight times the average for the country. In general the rate is about the same in the North as in the South, but greater in the Central States than in the Eastern, and in the Western than in the Central. The several State groups had in 1926 the following divorce rates per 100,000 married persons: Middle Atlantic (New York, New Jersey and Pennsylvania) 147; New England, 227; South Atlantic, 249; East South Central, 425; West North Central, 426; East North Central, 459; Mountain, 543; West South Central, 654; Pacific, 656; being an average for the United States of 378, and showing that all six central and western groups had rates above the average. Although the divorce-rate in the United States has increased rapidly and steadily, in 60 years, distinct tendencies are traceable in different regions. In the North Atlantic group the rate rose by 165%, in the North Central by 352%, in the Western by 400%, but in the South Atlantic by 1,090%, and in the South Central by 1,340%. This very rapid increase in the South was largely due to the spread of divorce among the emancipated negroes.

Grounds of Divorce.—Each State determines for itself the causes for which divorce may be granted, and no general statement is therefore possible. The cause pleaded is seldom an index to the motives which caused the suit to be brought. This is determined by the character of the law rather than by the state of mind of the parties; and so far as the individuals are concerned, the ground alleged is thus a cloak rather than a clue or revelation. Still those causes which have been enacted into law by the various State legislatures do indicate the pleas which have been endorsed by the social judgment of the respective communities. In the United States exclusive of Alaska and the recent insular accessions there are 49 different jurisdictions in the matter of divorce. Six out of every seven allow divorce for desertion, adultery or cruelty; and of the 179,397 divorces reported with their causes in 1926 nearly 80% were granted for some one of these three causes, viz., 39% for cruelty, 32% for desertion and 9% for adultery. Probably nearly 7% more were for some combination of these causes. Three other grounds for divorce are admitted as legal in many or most American States, viz., imprisonment in 39, habitual drunkenness in 38 and neglect to provide in 22. About 98% of American divorces are granted on some one or more of these six grounds. In general the legislation on the subject of the causes allowed for divorce is most restrictive in the States on the Atlantic coast, from New York to South Carolina inclusive, and is least so in the Western States. The slight expense of obtaining a divorce in many of the States, and the lack of publicity which is given to the suit, are also important reasons for the great number of decrees issued. The importance of the former consideration is reflected in the fact that the divorce-rate for the United States as a whole shows clearly, in its fluctuations, the influences of good and bad times. When times are good and the income of the working and industrial classes likely to be assured, the divorce-rate rises. In periods of industrial depression it falls, fluctuating thus in the same way and probably for the same reason that the marriage-rate in industrial communities fluctuates. In two-thirds of the divorce suits the wife is the plaintiff, and the proportion has risen slightly in the 40 years. In the Northern States the percentage issued to wives (1887–1906) was 71, while in the Southern States it was only 56. But where both parties desire a decree, and each has a legal ground to urge, a jury will usually listen more favourably to a woman's suit.

Divorce is probably especially frequent among the native population of the United States, and among these probably more common in the city than in the country. This statement cannot be established absolutely, since statistics afford no means of distinguishing the native from the foreign-born applicants. It is, however, the most obvious reason for explaining the fact that, while in Europe the city divorce-rate is from three to five times as great as that of the surrounding country, the difference in the United States between the two regions is very much less. In other words, the great number of foreigners in American cities probably tends to obscure by a low divorce-rate the high rate of the native population. Divorce is certainly more common in the

New England States than in any others on the Atlantic coast north of Florida, and it is not unlikely that wherever the New England families have gone divorce is more frequent than elsewhere. For example, it is much more common in the northern counties of Ohio settled largely from New England than in the southern counties settled largely from the Middle Atlantic States.

There are two statements frequently made regarding divorce in the United States which do not find warrant in the statistics on the subject. The first is that the real motive for divorce with one or both parties is the desire for marriage to a third person. The second is, that a very large proportion of divorces are granted to persons who move from one jurisdiction to another in order to avail themselves of lax divorce laws. On the first point the American statistics are practically silent, since, in issuing a marriage licence to parties one or both of whom have been previously divorced, no record is ordinarily made of the fact. In Connecticut, however, for a number of years this information was required; and, if the statements were trustworthy, the number of persons remarrying each year was about one-third the total number of persons divorcing, which is probably a rate not widely different from that of widows and widowers of the same age. Foreign figures for Switzerland, Holland and Berlin indicate that in those regions the proportion of the divorced who remarry speedily is about the same as that of wido s and widowers. What statistical evidence there is on the subject therefore tends to discredit this popular opinion. The evidence on the second point is more nearly conclusive, and has gone far towards decreasing the demand for a constitutional amendment allowing a federal marriage and divorce law. About four-fifths of all the divorces granted in the United States were issued to parties who were married in the State in which the decree of divorce was later made; and when from the remaining one-fifth are deducted those in which the parties migrated for other reasons thdn a desire to obtain an easy divorce, the remainder would constitute a very small, almost a negligible, fraction of the total number.

Social Results. — It is difficult, perhaps impossible, to say how far the frequency of divorce in the United States has been or is a social injury; or to what extent it has weakened or undermined the ideal of marriage as a lifelong union. The prevalence of divorce in the United States among the native population, in urban communities, among the New England element, in the middle classes of society, and among those of the Protestant faith, indicates how closely this social phenomenon is interlaced with much that is characteristic and valuable in American civilization. In this respect, too, the United States perhaps represents the later stage of a tendency which has been at work in Europe at least since the Reformation. Certainly the divorce-rate is increasing in nearly every civilized country. Decrees of nullity of marriage and decrees of separation not absolutely terminating the marriage relation are relatively far less prevalent than they were in the mediaeval and early modern period, and many persons who under former conditions would have obtained relief from unsatisfactory unions through one or the other of these avenues now resort to divorce. The increasing proportion of the community who have an income sufficient to pay the requisite legal fees is also a factor of great importance. The belief in the family as an institution ordained of God, decreed to continue "till death us do part," and in its relations typifying and perpetuating many holy religious ideas, probably became weakened in the United States during the 19th century, along with a weakening of other religious conceptions; and it is yet to be determined whether a substitute for these ideas can be developed under the guidance of the motive of social utility or individual desire. In this respect the United States is, as Gladstone once wrote, a *tribus praerogativa*, but we need not too readily despond of the outcome.

The great source of American statistical infonnation is the governmental report of over 1,000 pages, *A Report on Marriage and Divorce in the United States 1867 to 1886, including an Appendix relating to Marriage and Divorce in Certain Countries of Europe*, by Carroll D. Wright, commissioner of labour; together with the further report for 1887 to 1906. The statistics contained in the former volume have been analysed and interpreted in W. F. Willcox, *The Divorce Problem. A Study in Statistics* (1891, 1897) Further interpretations are contained in an article in the *Political Science Quarterly* for March *1893*, entitled "A Study in Vital Statistics." The best legal treatise is probably Bishop on *Marriage, Divorce and Judicial Separation See* also *J. P.* Lichtenberger, *Divorce: A Study in Social Causation* (1909); Walker Gwynne, *Divorce in America under State and Church* (1925); and E. R. Mowrer, *Family Disorganization* (1927). (W. F. W.)

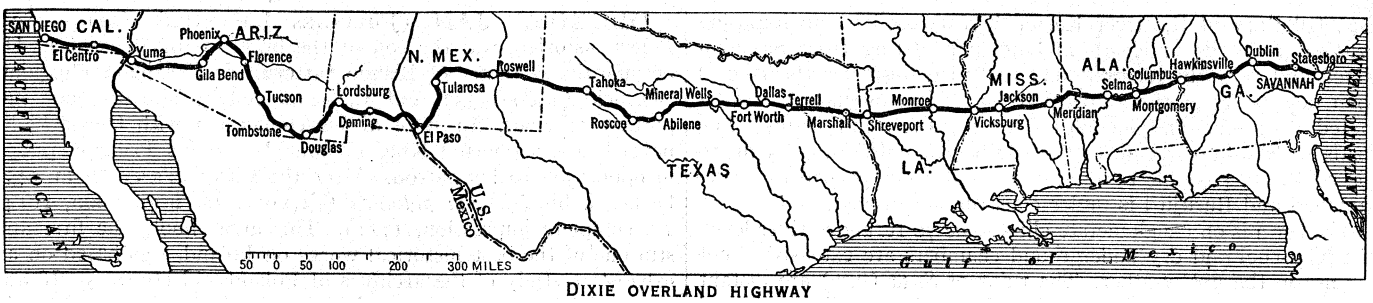
DIWANIYEH, a town in Iraq in 31° 58' N. and 4j° E. about 40 m. below Hilla on the Euphrates, here crossed by a floating bridge, and on the Baghdad-Basra railway. The town is a frontier post on the edge of the desert, and is a strategic military point.

DIX, DOROTHEA LYNDE (1802–1887), American philanthropist, was born at Hampden (Me.), April 4, 1802. About 1821 she opened a school in Boston. From 1824 to 1830 she wrote books of devotion and stories for children. Her *Conversations on Common Things* (1824) had reached its 60th edition by 1869. In 1841 she became interested in the condition of gaols and almshouses, investigating especially the treatment of the pauper insane. Her memorial to the State legislature resulted in improved treatment of the insane, and she then extended her work into many other States. By 1847 she had visited 18 State penitentiaries, 300 county gaols and houses of correction, and over 500 almshouses. Her labours resulted in the establishment of many insane asylums, and in the founding of many additional gaols and almshouses conducted on a reformed plan. In 1854 she became interested in the condition of the insane in Scotland, and her report opened the way for sweeping reforms. She extended her work into the Channel islands, and then to France, Italy, Austria, Greece, Turkey, Russia, Sweden, Norway, Denmark, Holland, Belgium and a part of Germany. Her work resulted in the establishment of two asylums for the insane in Japan. She was superintendent of women nurses during the Civil War; and her labours on behalf of defectives were continued after the war. She died at Trenton (N.J.), July 17, 1887.

See Francis Tiffany, *Life of Dorothea Lynde Dix* (Boston, 1892).

DIX, JOHN ADAMS (1798–1879), American soldier and political leader, was born at Boscawen, N.H., on July 24, 1798. He studied at Phillips Exeter academy and at the College of Montreal, and as a boy took part in the War of 1812. In July 1828, having attained the rank of captain, he resigned from the army, and for two years practised law at Cooperstown, N.Y. He soon became prominent as one of the leaders of the Democratic Party in the State and for many years was a member of the so-called "Albany regency" (*q.v.*), a group of Democrats who between about 1820 and 1850 exercised a virtual control over their party in New York. In 1833–39 he was secretary of State and superintendent of schools in New York, and in this capacity made valuable reports concerning the public schools of the State, and a report (1836) which led to the publication of the *Natural History of the State of New York* (1842–66). From 1845 to 1849 he was a United States senator from New York. In May 1860 he became postmaster of New York city, and from January until March 1861 he was secretary of the Treasury of the United States, in which capacity he issued (Jan. 29, 1861) to a revenue officer at New Orleans a famous order containing the words, "If any one attempts to haul down the American flag, shoot him on the spot." He was appointed major-general of volunteers in June 1861, and during the Civil War commanded various departments until July, 1865. He was minister to France in 1866–69, and in 1872 was elected by the Republicans governor of New York, but was defeated two years later. He had great energy and administrative ability and served as president of important railways. He died in New York city on April 21, 1879. Among his publications are *A Winter in Madeira and a Summer in Spain and Florence* (1850), and *Speeches and Occasional Addresses* (1864). He wrote English versions of the *Dies irae* and the *Stabat mater.*

His son, MORGAN DIX (1827–1908), graduated at Columbia in 1848 and at the General Theological seminary in 1852, and was ordained deacon (1852) and priest (1853) in the Protestant Episcopal Church. In 1855–59 he was assistant minister, and in 1859–62 assistant rector, of Trinity Church, New York city, of which he was rector from 1862 until his death. He published sermons and lectures; *A History of the Parish of Trinity Church,*

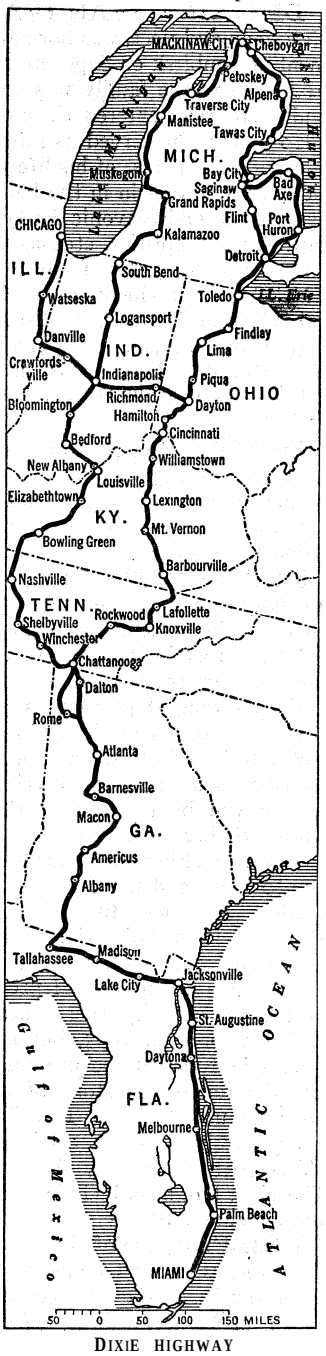


DIXIE OVERLAND HIGHWAY

New York City (1898–1905); and a biography of his father, *Memoirs of John Adams Dix* (1883).

DIXIE, a popular name given to the Southern States of the United States which lie south of the Mason and Dixon line. There are various reasons given for the name, one of the most plausible being that it had its origin in money issued by a bank in New Orleans before the Civil War On the back of the ten dollar bills was printed the French word *Dix,* with other lettering in French, hence the South, particularly Louisiana, became known as the land of Dixies and thereupon Dixie land It was about this time that Daniel Emmett, Negro minstrel and song writer, while looking out on the cold dreary streets of New York and wishing he were in Dixie, picked up his violin and composed that rollicking song, which has been called the national anthem of the South, "Away down South in Dixie."

DIXIE HIGHWAY, a former American thoroughfare from Lake Michigan and Lake Huron to Tallahassee, Jacksonville and Miami, Fla. A branch running through Nashville, Tenn., was called the "Dixie B Line." Paved or improved throughout, it had a length of 3,989 mi., 1,930 mi. in its western and 2,169 mi. in its eastern division. The Dixie highway represented one of the earliest attempts in the United States at modern long-distance road improvement and comprised in its course the scenic charm of the Great Lakes, the Appalachian mountains and the shores of the Gulf of Mexico and the Atlantic ocean.



DIXIE HIGHWAY

DIXON, GEORGE (*c.* 1755–1800), English navigator. He served under Capt. Cook in his third expedition, and after his return became a captain in the royal navy. In the autumn of 1785 he sailed in the "Queen Charlotte," in the service of the King George's Sound Company of London, to explore the shores of the present British Columbia, with the special object of developing the fur trade. His chief discoveries were those of Queen Charlotte's islands and sound (the latter only partial), Port Mulgrave, Norfolk bay and Dixon's Entrance and archipelago. He disposed of his cargo in China and returned in 1788, and published *A Voyage round the World, but more particularly to tfze North-West Coast of America* (1799), the bulk of which consists of descriptive letters by William Beresford, his supercargo His own contribution to the work included valuable charts and appendices He is usually identified with the author of *The Navigator's Assistant* (1791), who was teacher of navigation at Gosport. It is believed that he died *c.* 1800

DIXON, HENRY HALL (1822–1870), English sporting writer over the *nom de plume* "The Druid," was born at Warwick Bridge, Cumberland, and educated at Rugby and at Trinity college, Cambridge, where he graduated in 1846 Three of his novels, *Post and Paddock* (1856), *Silk and Scarlet* (1859), and *Scott and Sebright* (1862) appeared in the *Sporting Magazine* He also published a legal compendium entitled *The Law of the Farm* (1858); *Field and Fern* (1865), giving an account of the herds and flocks of Scotland; and *Saddle and Sirloin* (1870), treating in the same manner those of England

See Hon. Francis Lawley, *Life* and *Times of "The Druid"* (1895).

DIXON, RICHARD WATSON (1833–1900), English poet and divine, son of Dr. James Dixon, a Wesleyan minister, was born on May 5, 1833. He was educated at King Edward's school, Birmingham, and on proceeding to Pembroke college, Oxford, became one of the famous "Birmingham group" there who shared with William Morris and Burne-Jones in the pre-Raphaelite movement. He became minor canon and honorary librarian of Carlisle in 1868, and honorary canon in 1874; he was proctor in convocation (1890–94), and received the honorary degree of D D. from Oxford in 1899 He died at Warkworth, of which parish he was vicar, on Jan. 23, 1900. His principal work is *History of the Church of England from the Abolition of the Roman Jurisdiction* (1878–1902). At the time of his death he had completed six volumes, covering the period 1529 to 1570, two of which were published posthumously

Dixon's ***Selected Poems*** were published in 1909 with a memoir of the author by Robert Bridges.

DIXON, a city of northern Illinois, U S A , on the Rock river and the Lincoln highway, 98m W of Chicago; the county seat of Lee county It is served by the Chicago and North Western and the Illinois Central railways.

The population mas 8,191 in 1920 (91% native white), and was 10,671 in 1940 by the federal census Dixon is the centre of a rich farming region, and has a number of manufacturing industries, for which the river supplies power

It was laid out in 1835 by John Dixon (1784–1876), the first white settler in the county, and was chartered as a city in 1859. In 1832, at the close of the Black Hawk War, Jefferson Davis, Zachary Taylor and Abraham Lincoln were comrades in the old block-house chat stood near the northern end of the present bridge across the river

DIZFUL, a town and district in the province of Khuzistan, Persia, in 32° 25′ N., and 48° 35′ E , anciently known as Andamish It is 6jo ft above sea-level on the left bank of the Ab-i-

Diz, tributary of the river Karun, here crossed by an imposing bridge 430 yards in length in large part dating from Sasanian times and recently repaired under British auspices, the central span now being of the suspension type. The population is estimated at 15,000 and includes Persians, Lurs and Arabs. The roads to Shushtar. 35 m. to the south-east and Ahwaz 85 m. to the south are passable t y motor cars and a motor road to Khurramabad and Burujird is under construction (1928).

The town is on conglomerate cliffs some 70 ft. above river level, in which cool and dry underground chambers are extensively cut for use in the hot weather. The ruins of *Susa* (*q.v.*) are distant about 1 j m. to the south-west. The industries peculiar to Dizful are the preparation of icdigo, the dyeing of cloths and the making of felts. It is the principal southern market town of the nomad population of Luristan. Indigo was first introduced here in the early 19th century, but has since been almost entirely displaced by imported dyes. Dizful reed pens are celebrated in the East and extensively exported. The streets are narrow and crooked and the sanitary conditions bad. In the river bed above the bridge are several flour mills worked by water power. Several canals take off below the bridge and irrigate some 20,000 acres on either bank, but a far greater area was once served by similar canals and could be again fertilized if the dam, on which the original bridge stood, were reconstructed.

DJAKOVO (DAKOVO), a city of Croatia-Slavonia, Yugoslavia, occupied by Italy in April, 1941, after the axis invasion of the Balkans. Pop. 7,987. Djakovo is a Roman Catholic Episcopal see. Bishop Strossmayer (1815–1905), did much to foster the sense of racial kinship among the Yugoslavs, and the town became a centre of religious and political activity. The cathedral, a basilica with a central dome and two lofty spires, was founded in 1866. Its style is Romanesque, chosen by Strossmayer as symbolical of the position of his country, midway between east and west. Djakovo has a thriving trade in agricultural produce. Many Roman remains have been discovered.

For a full description of the cathedral, in Serbo-Croatian and French, *see* the illustrated folio *Stolna Crkva Djakovu,* published by the South Slavonic Academy, 1900.

DJEMAL PASHA, AHMED (1861–1922), Turkish politician, was born at Constantinople on May 1, 1861. He entered the army, and later became a member of the Committee of Union and Progress. He was appointed military governor of Adana (1908), governor-general of Baghdad (1911) and commanded a division during the Balkan wars. In 1913 he commanded the I. Army Corps, and was made Minister of Public Works. In 1914 he became Minister of Marine; in the same year he took over the II. Army, and was afterwards sent to Syria in command of the IV. Army. Owing to dissensions with Enver Pasha and von Falkenhayn he returned to Constantinople in 1917, where he retained the portfolio of the Marine until the Armistice. On the downfall of the Ministry in Oct. 1918 Djemal, with other members of the Committee of Union and Progress, sought refuge in Germany and Switzerland. Later he visited Russia, and thence proceeded to Afghanistan, where he exercised a powerful influence. He was assassinated at Tiflis on July 22, 1922. Djemal did much to awaken the spirit of nationalism in the Mohammedan countries of central Asia.

His writings include a volume in French, *Le Carnet de route du Colonel Djemal Bey,* and works in Turkish on Plevna and the Crimean Campaign. Another work, *Memories of a Turkish Statesman, 1913–19* (1922) appeared in English and in German.

D LINES, in spectroscopy (*q.v.*), the pair of lines, characteristic of sodium, in the yellow region of the spectrum. Their separation is too small to be detected with a spectroscope of low resolving power, hence to Fraunhofer (*q.v.*) they appeared as a single line This line was the fourth prominent absorption line in the sun's spectrum, starting from the red end, and he accordingly designated it by the letter D. It was subsequently resolved into two components D_1 and D_2 corresponding to wave-lengths 5895.93 and 5895.97 Å.U. (10^{-8} cm.) respectively. An emission line appearing in the chromosphere, D_3 λ 5875.62, has since been discovered. This line is due to helium.

DLUGOSZ, JAN (JOHANNES LONGINUS) (1415–1480), Polish historian, was the son of the burgrave of Bozeznica. He became the secretary of Bishop (afterwards Cardinal) Zbygniew Olesnicki (1389–1455), and was employed by him on many important missions. In spite of his connection with Olesnicki he nevertheless supported King Casimir IV. in his Prussian policy in opposition to his patron. After the Cardinal's death in 1455 he began his *Historia polonica* (13 vols., 1st impression, 1614; 1st complete impression, 1711). This great book, the first and still one of the best historical works on Poland, was based on an exhaustive study of the archives of Poland and Hungary. It was completed in 1479. Dlugosz became archbishop of Lemberg in 1478 He died on May 19, 1480, at Piatek.

See Semkowicz, *Critical Considerations of the Polish Works of Dlugosz* (Cracow, 1874); Michael Bobrzynski and Stanislaw Smolka, *Life of Dlugosz and his Position in Literature* (Cracow, 1893); both of these are in Polish.

DMITRIEV, IVAN IVANOVICH (1760–1837), Russian statesman and poet, was born at his father's estate in the Government of Simbirsk on Sept. 20, 1760. In consequence of the revolt of Pugachev the family was compelled to flee to St. Petersburg, and there Ivan entered the army. During the four years from 1810 to 1814 he served as minister of justice under the emperor Alexander. The rest of his life was devoted to literature. He took sides with Karamsin in the battle for a natural Russian language against the Old Slavonic Party. His poems include songs, odes, satires, tales, epistles, etc., as well as the fables—partly original and partly translated from Fontaine, Florian and Arnault—on which his fame chiefly rests. He also wrote a short dramatico-epic poem on Yermak, the Cossack conqueror of Siberia.

His writings occupy three volumes in the first five editions; in the sixth (St. Petersburg, 1823) there are only two. His memoirs, to which he devoted the last years of his life, were published at Moscow in 1866.

DMITRIEVSK, a town in the Stalin district of the Ukrainian S.S.R. long. 38° 48′ E. lat. 47° 56′ N. In 1897 it was a village with a population of 512, but in 1917 its coal mines were developed and metal and chemical industries established. Its population is 51,436.

DNEPROPETROVSK, formerly Ekaterinoslav, a town in a county of the same name, in the Ukrainian S.S.R. It is situated on the right bank of the Dnieper river above the rapids in 48° 21′ N. and 35° 4′ E., alt. 210 ft. In 1927 under American direction, the construction of a ferro-concrete dam, with sluices and docks allowing ships to pass, and turbines for generating electricity was commenced. The proximity of manganese, nitre, coal and iron deposits to the station, and of the Zaporozhny aluminum industry is a great commercial asset. Pressure on the railway system will be relieved by the opening of river transport for wheat, timber, coal, iron and other heavy products. The town has iron-smelting, and metal industries employing more than 50,000 men, and there are also breweries, flour-mills and other smaller industries. In 1895 it became the centre of numerous Franco-Belgian industrial enterprises, and its population has increased from 18,881 in 1861 to 500,662 in 1939. It is a trading centre for the agricultural products of the district. On the site of the present city there formerly stood the Polish castle of Koindak, built in 163 j, but it was destroyed by the Cossacks. Potemkin founded the city in 1786, and Catherine II. in 1787 laid the foundation stone of its cathedral, which however, was not built until 1830–5. Paul I. changed the name of the city to Novo Rossiysk, but its original name was restored in 1802. The oldest part of the city lies very low and is subject to floods The civic buildings include a mining academy, an archaeological museum and a library.

DNIEPER, one of the most important rivers of Europe (the *Borysthenes* of the Greeks, *Danapris* of the Romans, *Uzi* or *Uzu* of the Turks, *Eksi* of the Tartars, *Elice* of Visconti's map [1381], *Lerene* of Contarini [1437], *Luosen* of Baptista of Genoa [1514], and *Lussem* in the same century). It belongs entirely to Russia, and rises in the Smolensk province, in a swampy district (alt. 930 ft.) at the foot of the Valdai hills, not far from the sources

of the Volga and the Dvina, in 55° 52' N. and 33" 41' E. Its length is about 1,410 m. and it drains an area of 202,140 sq.m. In the first part of its course, which may be said to end at Dorogobuzh, it flows through an undulating country of Carboniferous formation; in the second it passes west to Orsha and south through the White Russian S.S.R. to the Ukrainian S.S.R., where it passes south through the fertile plain of Chernigov and Kiev, and then south-east across the rocky steppe to Dnepropetrovsk (Ekaterinoslav). About 45 m. south of this town it has to force its way across the same granitic offshoot of the Carpathian mountains which interrupts the course of the Dniester and the Bug, and for a distance of about 25 m. rapid succeeds rapid. The fall of the river in that distance is 1jj ft. The Dnieper, having got clear of the rocks, continues south-west through the grassy plains of Kherson and Taurida, and enters the Black sea by a considerable estuary in 46° 30' N. and 32° 20' E. with the town of Kherson on its right bank. On this ramifying *liman,* into which the Bug also pours its waters, stands Nikolaiev. Navigation extends as far up as Dorogobuzh, where the depth is about 12 ft., and rafts are floated down from the higher reaches. The banks are generally high, more particularly the left bank. About the town of Smolensk the breadth is 455 ft., at the confluence of the Pripet 1,400, and in some parts of the Dnepropetrovsk district more than $1\frac{1}{4}$ m. In the course above the rapids the channel varies very greatly in nature and depth, and it is not infrequently interrupted by shallows. The rapids form a serious obstacle to navigation; it is only for a few weeks when the river is in flood that they are passable, and even then the venture is not without risk and can be undertaken only with the assistance of special pilots. As early as 1732 an attempt was made to improve the channel. A canal, which ultimately proved too small for use, was constructed at Nenasitets in 1780 at private expense; blastings were carried out in 1798 and 1799 at various parts; in 1805 a canal was formed at Kaindatski, and the channel straightened at Sursk; by 1807 a new canal was completed at Nenasitets; in 1833 a passage was cleared through the Staro-Kaindatski rapid; and in the period 1843 to 1853 numerous ameliorations were effected. The result has been not only to diminish greatly the dangers of the natural channel, but also to furnish a series of artificial canals by which vessels can make their way when the river is low. A ferro-concrete dam was constructed in 1927 across the falls, under American direction, with sluices and docks for letting ships pass, and a station and turbines for the production of electric power. Of the tributaries of the Dnieper the following are navigable—the Berezina and the Pripet from the right, and the Sozh and the Desna from the left. By means of the Dnieper-Bug (King's) canal, and the Berezina and Oginski canals, this river has water connection with the Baltic sea. In the estuary the fisheries give employment to large numbers of people. At Kiev the river is free from ice on an average for 234 days in the year, at Dnepropetrovsk 270 and at Kherson 277.

DNIESTER, a river of south-eastern Europe belonging to the basin of the Black sea. It rises on the northern slope of the Carpathian mountains in Poland. and for 150 miles from Zaleszczyky to Karmassy, where it forms a broad estuary as it flows into the Black sea, is the boundary between Rumanian Bessarabia and the Ukrainian S.S.R. During the 1918 Russo-Rumanian retreat, all the bridges across the Dniester were destroyed, and as diplomatic relations between Rumania and the U S.S R. have not been opened (1928) these bridges have not been re-built, and no traffic is allowed up and down the river. Both banks of the river are watched by armed guards and trade across or along it has completely ceased. The Dniester drains an area of 29,670 sq m. It is excessively meandering, and the current in most parts even during low water is decidedly rapid as compared with Russian rivers generally, the mean rate being calculated at $1\frac{7}{11}$ m. per hour. The average width of the channel is from 500 to 750 ft., but in some places it attains as much as 1,400 ft.; the depth is various and changeable. The navigable portion of the river is interrupted by a granitic spur from the Carpathians which gives rise to the Yampol rapids. For ordinary river craft the passage of these rapids is rendered possible, but not free from danger, by a natural channel on the left side, and by a larger and deeper artificial channel on the right, for steamboats they form an insuperable barrier. The river falls into the sea by several arms, passing through a shallow lagoon, a few miles south west of Odessa. There are two periodical floods—the earlier and larger caused by the breaking up of the ice, and occurring in the latter part of February or in March; and the latter due to the melting of the snows in the Carpathians, and taking place about June. The spring flood raises the level of the water 20 ft., and towards the mouth of the river submerges the gardens and vineyards of the adjacent country. In some years the general state of the water is so low that navigation is possible only for three or four weeks, while in other years it is so high that navigation continues without interruption; but considerable improvements were effected before the World War at government expense. In consequence the traffic increased; the Dniester used to tap regions of great productiveness, especially in cereals and timber. Steamboat traffic was introduced in the lower reaches in 1840. The fisheries of the lower course and of the estuary are of considerable importance; and these, together with those of the lakes which are formed by the inundations, furnish a valuable addition to the diet of the people in the shape of carp, pike, tench, salmon, sturgeon and eels. Its tributaries are numerous, but not of individual importance.

DO, in music, the first of the sol-fa syllables, or sound names for the notes of the scale, this syllable having been substituted, as being more sonorous, for *Ut,* which was originally the first of these syllables—*ut,* re, *mi,* etc.—as chosen in the 11th century by Guido d'Arezzo when he devised his system of solmization. Hence in the Tonic Sol-fa system, based on what is called the "movable *do,*" **do** is the tonic of whatever key may be employed, whereas in the systems employing the "fixed do" it is invariably C.

BOAB, a name appiied in India, according to its derivation (do, two, and ab, river), to the stretch of country lying between any two rivers, as the Bari Doab between the Sutlej and the Ravi, the Rechna Doab between the Ravi and the Chenab, the Jech Doab between the Chenab and Jhelum, and the Sind Sagar Doab between the Jheium and the Indus, but frequently employed, without any distinctive adjunct, as the proper name for the region between the Ganges and its great tributary the Jumna.

DOBBIE, SIR JAMES JOHNSTONE (1852–1924), British chemist, was born at Glasgow on Aug. 4, 1852, and educated at Edinburgh, Glasgow and Leipzig. At Glasgow he became closely associated with Ramsay's work, and they collaborated in a series of papers on the cinchona alkaloids (Trans. *Chem. Soc.,* 1878–1879). He held various posts at University college, Bangor (1884), the Royal Scottish Museum (1903–1909), and the Government Laboratory in London, becoming Government chemist (1911–1920) when the laboratory was created a separate department. He was a Fellow of the Royal Society, and was knighted in 1915. He died on the Ayrshire coast on June 19, 1924.

At Bangor where he helped to establish an agricultural department, Dobbie collaborated with Dr. A. Lauder, and they succeeded in isolating three of the five alkaloids of *Corydalis* cava. As Government chemist he used the absorption spectra method of studying the constitution of organic compounds (with W. N. Hartly, J. J. Fox and others). After the World War he applied the absorption spectra methods to gases. The results of his researches were published in a series of papers from 1893–1921.

DOBBS FERRY, a village of Westchester county, New York, on the east bank of the Hudson river, opposite the northern end of the Palisades, 20 mi. N. of New York city. It is served by the New York Central railroad. The population was 5,883 in 1940. The Masters' corporation, St. Christopher's school, Missionary Sisters of the Sacred Heart are operated as private girls' schools there, together with the Children's Village. The principal industry is the printing plant of the Methodist Book concern, employing 600 workers. It is a typical commuters' neighbourhood. with fine country homes. In 1775 Jeremiah Dobbs, a Swede (probably from Delaware) began operating a skiff ferry there, which was kept up by his family for a century. During the Revolution fortifications were erected, and the village was a rendezvous for the British army after the battle of White Plains and for an American division in Jan. 1777. Washington's army encamped

near by on July 4, 1781, and started thence for Yorktowh the following month. In the Van Brugh Livingston house, on May 6, 1783, Washington and Governor Clinton met General Sir Guy Carleton to negotiate for the evacuation of the posts still held by the British. The village was incorporated in 1873, as Greenburgh, but the original name was soon resumed.

DOBELL, BERTRAM (1842–1914), English bookseller and man of letters, the discoverer of the poet Thomas Traherne, was born at Battle, Sussex, the son of a tailor; he died at Hampstead on Dec. 14, 1914. The father moved to London, and there fell ill; the son became an errand-boy and began to collect old books from the stalls. In 1869 he set up business as a bookseller on a capital of £10, and in 1887 moved to Charing Cross road, where his shop became famous and his catalogues interesting for their literary gossip. Dobell met James Thomson in 1876, and helped him from that time to his death; in 1895 he edited the *Poetical Works* of his friend, with a memoir. His literary work also included the publication of much useful work on Shelley and Charles Lamb. After his death some volumes of his verse containing some admirable sonnets were issued by his son. But his reputation rests chiefly on the identification of Thomas Traherne, whose *Poetical Works* he edited in 1903. For the story of that identification *see* TRAHERNE, THOMAS.

See S. Bradbury, *Bertram Dobell* (1909).

DOBELL, SYDNEY THOMPSON (1824–1874), English poet and critic, was born at Cranbrook, Kent. His father was a wine merchant, his mother a daughter of Samuel Thompson (1766–1837), a London political reformer. The family moved to Cheltenham when Dobell was 12 years old. He was educated privately, and never attended either school or university. He refers to this in some lines on Cheltenham college in imitation of Chaucer, written in his 18th year. An acquaintance with Mr. (subsequently Sir James) Stansfeld and with the Birmingham preacher-politician, George Dawson (1821–76), which afterwards led to the foundation of the Society of the Friends of Italy, fed the young enthusiast's ardour for the Liberalism of the day. Meanwhile, Dobell wrote a number of minor poems, instinct with a passionate desire for political reform. *The Roman* appeared in 1850, under the *nom de plume* of "Sydney Yendys." His second long poem, *Balder,* appeared in 1854. The three following years were spent in Scotland. Perhaps his closest friend at this time was Alexander Smith, in company with whom he published, in 1855, a number of sonnets on the Crimean War, which were followed by a volume on *England in Time of War.* He died on Aug. 22, 1874.

As a poet Dobell belongs to the "spasmodic school," as it was named by Prof. Aytoun, who parodied its style in *Firmilian.* The epithet, however, was first applied by Carlyle to Byron. The school includes George Gilfillan, Philip James Bailey, John Stanyan Bigg (1826-65), Dobell, Alexander Smith, and according to some critics, Gerald Massey. It was characterized by an under-current of discontent with the mystery of existence, by vain effort, unrewarded struggle, sceptical unrest, and an uneasy straining after the unattainable. It thus faithfully reflected a certain phase of 19th century thought.

The standard edition of his *Poems* (1875) includes a memoir by Prof. Nichol, who also edited a collection of his prose writings under the title *Thoughts on Art, Philosophy and Religion (1870).*

DOBELN, a town of Germany, in the *Land* of Saxony, on the (Freiberg) Mulde, two arms of which embrace the town as an island, 35 mi. S.E. from Leipzig by rail, and at the iunction of lines to Dresden, Chemnitz, Riesa and Oschatz. Pop. (1939) 25,048. The Nikolai-kirche, dating in its present form from 1485, a mediaeval town hall, a former Benedictine nunnery and a monument to Luther are notable. The industries includewool-spinning, iron-founding, carriage, agricultural implement, and metal-printing and stamping work.

DOBERAN, a town and watering-place in the *Land* of Mecklenburg, Germany, lying about 2 mi. from the shores of the Baltic and 7 W. of Rostock by rail. Population 5,570. Besides the ruins of a Cistercian abbey founded by Pribislaus, prince of Mecklenburg, in 1173, and secularized in 1552, it possesses an Evangelical Gothic church of the 14th century, one of the finest in north Germany, a palace, a theatre, an exchange and a concert hall. Owing to its delightful situation amid beech forests and to its chalybeate waters, Doberan has become a favourite summer resort. In 1793 Duke Frederick Francis caused the first seaside watering-place in Germany to be established on the neighbouring coast, 4 m. distant, at the spot where the Heiligen-Damm, a great bank of rocks about 1,000 ft. broad and 15 ft. high, stretches out into the sea and forms an excellent bathing ground.

DÖBEREINER, JOHANN WOLFGANG (1780–1849), German chemist, was born near Hof in Bavaria on Dec. 15, 1780. After studying pharmacy at Miinchberg, he started a chemical manufactory in 1803, and in 1810 was appointed professor of chemistry, pharmacy and technology at Jena, where he died on March 24, 1849. The Royal Society's *Catalogue* enumerates 171 papers by him on various chemical topics, but he is best known for his experiments on platinum in a minute state of division and on the oxidation products of alcohol. He studied the formation of aldehyde from alcohol by various methods, also obtaining its crystalline compound with ammonia, and he was the discoverer of furfural. An early observation of the diffusion of gases was recorded by him in 1823 when he noticed the escape of hydrogen from a cracked jar, attributing it to the capillary action of fissures. His works included treatises on pneumatic chemistry (1821–25) and the chemistry of fermentation (1822).

A correspondence which he carried on with Goethe and Charles August, grand-duke of Saxe-Weimar, was collected and published at Weimar by Schade in 1856.

DÖBLIN, ALFRED (1878–), was born at Stettin on Aug. 10, 1878. After studying in Berlin and Freiburg, he settled in Berlin as a practising doctor. His principal works are *Der schwarze Vorhang* (written 1902–03; pub. 1919); *Die drei Sprünge des Wang-lun* (a romance of China, 1916); *Wallenstein* (historical novel, 1919) and *Berge, Meere, Giganten* (a tale of primitive life, 1924). In these works he combines an epic force of expression with an extremely vivid narrative style. Less important are *Wadzek's Kamtpf mit der Dampfturbine* (1918); *Der deutsche Maskenball* (essays, 1921); *Reise in Polen* (an appreciative travel book, 1926); *Manas* (poem, 1927); *Das Ich über die Natur* (1928).

In 1928 Doblin was elected a member of the German Academy of letters.

DÖBRENTEI, GABOR (GABRIEL) (1786–1851), Hungarian philologist and antiquary. was born at Nagyszollos. He completed his studies at the Universities of Wittenberg and Leipzig. and became a tutor in Transylvania. In 1820 Dobrentei settled at Budapest, where he held various official posts, and there he spent the rest of his life. His great work is the *Ancient Monuments of the Magyar Language* (*Régi Magyar Nyelvemlékek,* 1838 *seq.*), the editing of which was entrusted to him by the Hungarian Academy.

Döbrentei was one of the organizers, under the presidency of Count Teleki, of the Hungarian Academy.

He died at his country house, near Budapest, on March 28, 1851.

DOBRICI (or BAZARGIC), capital of the department of Caliacra, southern Dobruja, Rumania. Population 29,938. Dobrici is the centre of a postal district, and has a large annual fair for cattle, horses and sheep.

The small ports of Balcik and Cavarna are situated some 15 m. away, on the Black sea. The population of the district is very mixed, including Turks, Bulgars, Circassians and Tatars. Gagauz and many gypsies.

DOBRIZHOFFER, MARTIN (1717–1791), Austrian Roman Catholic missionary, was born at Gratz, in Styria. He joined the Jesuits in 1736, and in 1749 proceeded to Paraguay, where for 18 years he worked among the Guaranis and the Abipones. Returning to Europe on the expulsion of the Jesuits from South America, he settled at Vienna, obtained the friendship of Maria Theresa, and composed the history of his mission

entitled *Historia de Abiponibus, Equestri Bellicosaque Paraguariae Natione,* etc., 3 vols. (Vienna, 1783). In 1822 there appeared in London an anonymous translation really by Sara Coleridge. Dobrizhoffer died on July 17, 1791.

DOBROVSKY, JOSEPH (1753–1829), Hungarian philologist, was born of Bohemian parentage at Gjermet, near Raab, Hungary, and studied at Prague. In 1772 he joined the Jesuits at Briinn; but on the dissolution of the order in 1773 returned to Prague to study theology, and became tutor in the family of Count Nostitz. In 1792 he was commissioned by the Bohemian Academy of Sciences to visit Stockholm, Abo, Petersburg and Moscow in search of the manuscripts which had been scattered by the Thirty Years' War; and on his return he accompanied Count Nostitz to Switzerland and Italy. Dobrovsky was the real founder of modern Slavonic studies, and the originator of the revival of Czech as a literary language. His grammar and dictionary provided the basis for modern Czech philology, and modern Czech speech. *(See* CZECH LANGUAGE: CZECH LITERATURE.)

The following is a list of his more important works, *Fragmentum Pragense evangelii S. Marci, vulgo autographi* (1778); *Scriptores rerum Bohemicarum* (a vols., 1783); *Geschichte der bohm. Sprache und altern Literatur* (1792); *Die Bildsamkeit der slaw. Sprache* (1799); *Institutiones linguae slavicae dialecti veteris* (1822); *Entwurf zu einem allgemeinen Etymologikon der slaw. Sprachen* (1813); and a critical edition of Jordanes, *De rebus Geticis,* for Pertz's *Monumenta Germaniae historica. See* Palacky, *J. Dobrowskys Leben und gelehrtes Wirken (1833).*

DOBRUJA (DOBROGEA), a region of southeast Rumania and northeast Bulgaria, bounded north and west by the Danube, east by the Black sea, and south by Bulgaria. Its area is 23,262 sq.km., the population (1937) approximately 900,000. It comprises the four districts of Tulcea, Constanţa, Durostor and Bazargic. It consists of low mountains, fens and sandy steppes, wind-swept and drought-ridden, but remarkably fertile when the lack of irrigation is considered. Its main port, Constanţa, is Rumania's principal seaport, connected by a pipe line with the Rumanian oil-fields.

HISTORY

The district was known to the Greeks in the 6th century B.C. and included the Greek colonies of Istros, Tomi and Dionysopolis. In the 5th and 4th centuries B.C. invading Scythians subjugated and later submerged the Thracian population, whence the later names of Scythia Minor and Scythia Pontica. The Romans first invaded it 75–72 B.C., definitely subjecting it in A.D. 46. They and their successors the Byzantine emperors Romanized the population and erected walls for its defence; but it was repeatedly overrun by Goths, Alans and Huns.

In A.D. 678 Asparuch, Khan of the Bulgarians, settled with his horde, by permission of the Byzantine empire, near the present Nicoliţel; but soon repudiated his allegiance and founded the first Bulgarian empire, which included the Dobruja, with its mixed population of Slavs, Bulgars and the remnants of the old Roman colonies. It was recovered for Byzantium in 1018, but in 1186 reverted to the second Bulgarian empire, established by the alliance of Bulgars, Vlachs and Cumans. Magyars, Petchenegs and Cumans had repeatedly ravaged it, the two last named settling there in such numbers that it was known as Petchengia. In the 13th century the Tatars frequently raided it. With the decline of the Bulgarian empire, one Dobrotitich, a condottiere of Wallachian origin, founded here an independent, or at least semi-autonomous depotate; the name Dobruja derives either from Dobrotitich or from the Topruch Tatars. In 1390 it passed under the suzerainty of Mircea-Voda, Voivode of Wallachia; but after his several capitulations to the Turks (1391, 1393, finally in 1411) it came under Turkish domination for nearly 500 years. These years brought a further ethnical change, numbers of Turks, Tatars and Circassians being settled in the steppes.

The Treaty of Berlin (July 13, 1878) assigned the Dobruja to Rumania, in compensation for Bessarabia, annexed by Russia. The Treaty of Bucharest (Aug. 10, 1913) advanced the frontier 30m. southward, the two districts of Bazargic and Durostor being ceded to Rumania by Bulgaria. The Central Powers annexed the entire province under the Treaty of Bucharest (May 7, 1918); the southern half was ceded immediately to Bulgaria, the northern administered provisionally by the Central Powers in condominium, while Rumania was allowed to retain the port of Constanţa (Kustenje) as an outlet to the Black sea. The Treaty of Neuilly (Nov. 27, 1919), restored the 1913 frontier, leaving the entire province to Rumania. The treaty of Crayova in Sept. 1940, restored southern Dobruja to Bulgaria. The territory ceded was about 7,600 sq.km. or a third of the whole area (population, 350,000), made up largely of the districts of Durostor and Bazargic. This fertile quadrilateral contains the important port of Silistra on the Danube and of Balchich on the Black sea. The territory ceded was occupied by Bulgarian troops on Sept. 20. The Rumanians living in the region were to be exchanged for Bulgarians living in the northern Dobruja. Thus the frontier of 1912 was restored. (N. L. F.; H. KO.)

DOBŠINÁ, a small town of central Slovakia in the Triassic limestone "karst" zone of the Carpathians near the Gollnitz valley. Founded by German miners in the 14th century as a result of the wealth of the surrounding mountains in iron, cobalt, copper and mercury, it is now mainly famous for the existence about 3¾ m. N.W. of the town of a cavern containing an icefield, nearly 2 acres in area, with which are associated remarkable and beautiful formations.

DOBSON, FRANK (1887–), British sculptor, was born in London on Nov. 18, 1887. He received his early training with the sculptor W. Reynolds-Stephens, and later obtained a scholarship at Hospitalfield, Arbroath, New Brunswick. After further study in the City and Guilds Schools at Kennington, London, he lived in Cornwall and worked with the granite cutters. He was thus technically well equipped for a sculptor's career. His early works, both in painting and sculpture—few of which now exist—show definitely the attraction of the first Post-Impressionist exhibition held in London in 1909. After war service he exhibited his first important work in stone "The Concertina Man" (1919), which was followed in 1921 by "Two Heads" in red Mansfield stone and the more complex Portland stone group "The Man Child." In 1923 he competed unsuccessfully for the Welsh National Memorial at Cardiff with his recumbent figure, "Cambria." To the next two years belong the white marble figure of a woman (1924), the seated nude "Susanna" and "Morning" (1925). His portraits include the bronze bust of the Earl of Oxford and Asquith (1921), the polished brass head of Osbert Sitwell (1923) and the plaster head of a young girl (1925)—the two last named in the National Gallery of British Art—the bronze half-length of Lydia Lopokova (1924) and heads of L. H. Myers (1925), Robert McAlmond and Robin Sinclair. He was a founder of the X Group, and in 1923 became president of the London Group.

See Roger Fry in *The Burlington Magazine,* vol. *46,* p. 171 (1925); Clive Bell in *The Architectural Review,* vol. 59. p. 41 (1926).

DOBSON, HENRY AUSTIN (1840–1921), English poet and man of letters, was born at Plymouth and educated at Beaumaris, Coventry, and the Strasbourg gymnase. In Dec. 1856 he entered the board of trade, and from 1884 to 1901, when he retired, was a principal clerk in the marine department of that office. In 1873 he collected the poems which had appeared in various periodicals in a volume entitled *Vignettes in Rhyme.* In 1875 appeared *At the Sign of the Lyre,* which contained "The Ladies of St. James's," "The Old Sedan Chair," "My Books," and the delightful "Fables of Literature and Art." The book has the flavour of the 18th century which Dobson loved so well, and of which he has left exquisite pictures in prose as well as in verse. Dobson led the movement in the late '70s for the introduction of French forms, the ballade, the triolet, and the rondeau, forms which he used in his *Proverbs in Porcelain* (1877). *Vignettes in Rhyme* and *Proverbs in Porcelain,* combined in one volume, were printed in the United States as *Vignettes in Rhyme* (1880), and with some additions as *Old World Idylls* (1883) in England. After 1885 Dobson was engaged principally upon critical and biographical prose. His biographies of *Fielding* (1883), *Bewick* (1884), *Steele* (1886), *Goldsmith* (1888), *Walpole* (1890), *Hogarth* (1879–98), *Samuel Richardson* (1902), and *Fanny Burney* (1903) are studies marked

alike by assiduous research, sympathetic presentation and sound criticism. Dobson always added something, and often a great deal, to our positive knowledge of the subject in question, his work as a critic never being solely aesthetic. *Four Frenchwomen* (1890), the three series of Eighteenth-Century Vignettes (1892–94–96), and *The Paladin* of Philanthropy (1899), contain unquestionably his most delicate prose work. In 1901 he collected his hitherto unpublished poems in a volume entitled *Carmina Votiva.*

See Alban Dobson, Austin Dobson, Some Notes (1928).

DOBSON, WILLIAM (1610–1646), English portrait and historical painter, was born in London. Excellent examples of Dobson's portraits are to be seen at Blenheim, Chatsworth, and other country seats throughout England, and there are several examples at Hampton Court and in the National Portrait Gallery, London, including a very fine portrait of Endymion Porter. The head in the '(Decollation of St. John the Baptist' at Wilton is said to be a portrait of Prince Rupert.

See Collins Baker, *Lely* and *the* Stuart Portrait Painters (1912).

DOBSON-FLY, the name given to large flies of the genus Corydalis, allied to the alder-fly (*q.v.*), and inhabiting North and South America and northern India. The males are remarkable for their large jaws. Scientifically, dobson-flies are placed in the family *Sialidae,* order Neuroptera (*q.v.*). The larvae are aquatic.

DOCETAE, a name applied to those thinkers in the early Christian Church who held that Christ, during his life, had not a real or natural, but only an apparent (δοκεῖν, to appear) or phantom body. The name is first used by Theodoret (*Ep.* 82) as a general description, and by Hippolytus (*Philosophumena,* viii. 8–11), Clement of Alexandria and others, as the name of a distinct sect. It must, however, be regarded as a type of Christology. The origin of the heresy is to be sought in Greek, Alexandrine and Oriental speculations about the imperfection or rather the essential impurity of matter. Traces of a Jewish Docetism are to be found in Philo; and in the Christian form it is generally supposed to be combated in the Johannine Epistles (I. ii. 22, iv. 2, v. 6, 20; II. 7) and more formally in the epistles of Ignatius (*Ad* Trall. 9 f., *Ad Smyrn.* 2, 4, *Ad Ephes.* 7; cf. Polycarp, Ad Phil. 7). It differed much in its complexion according to the points of view adopted by the different authors. Among the Gnostics and Manichaeans it existed in its most developed type, and in a milder form is to be found even in the writings of the orthodox teachers.

The more thoroughgoing Docetae assumed the position that Christ was born without any participation of matter; and that all the acts and sufferings of his human life, including the crucifixion, were only apparent. They denied, accordingly, the resurrection and the ascent into heaven. To this class belonged Dositheus, Saturninus, Cerdo, Marcion and their followers, the Ophites, Manichaeans and others. Marcion, for example, regarded the body of Christ merely as an "umbra," a "phantasma." His denial (due to his abhorrence of the world) that Jesus was born or subjected to human development, is in striking contrast to the value which he sets on Christ's death on the cross. The other, or milder school of Docetae, attributed to Christ an ethereal and heavenly instead of a truly human body. Amongst these were Valentinus, Bardesanes, Basilides, Tatian and their followers. They varied considerably in their estimation of the share which this body had in the real actions and sufferings of Christ. Docetism springs from the same roots as Gnosticism (*q.v.*).

DOCHMIAC [Gr. δοχμή, "a hand's breadth"], a form of verse, consisting of *dochmii* or pentasyllabic feet (usually ∪ – – ∪ –), in English, "rĕbēl, slāves, rĕbēl."

'DOCK, in botany, the name applied to the plants constituting a section of the genus *Rumex,* family Polygonaceae. They are biennial or perennial herbs with a stout rootstock, and glabrous linear-lanceolate or oblong-lanceolate leaves with a rounded, obtuse or hollowed base and a more or less wavy or crisped margin The flowers are arranged in more or less crowded whorls the whole forming a panicle; they are generally perfect, with six sepals, six stamens and a three-sided ovary bearing three styles with much-divided stigmas The fruit is a triangular nut enveloped in the three enlarged leathery inner sepals, one or all of which bear a tubercle. In the common or broad-leaved dock, *Rumex* obtusifolius, the flower-stem is erect, branching, and 18 in. to 3 ft. high, with large radical leaves, heart-shaped at the base, and more or less blunt; the other leaves are more pointed, and have shorter stalks. The whorls are many-flowered, close to the stem and mostly leafless. The flowers appear from June to August. In autumn the whole plant may become of a bright red colour. It is a troublesome weed, common by roadsides and in waste places, fields and pastures, where it is often accidentally introduced with clover and grass seeds. The great water dock, *R. hydrolapathum,* is a tall-growing species. Other British species are R. *crispus;* R. conglomeratus, the root of which has been employed in dyeing; R. *sanguineus* (bloody dock, or bloodwort); R. *pulcher* (fiddle dock), with fiddle-shaped leaves; *R. maritimus.* The naturalized species, R. *alpinus,* or "monk's rhubarb," was early cultivated in Great Britain, and was accounted an excellent remedy for ague.

Some 30 or more species occur in North America, widely distributed in the United States and Canada, about one-third of which are naturalized from the Old World. The roots of the canaigre (*R. hymenosepalus*), native to the south-western United States and Mexico, have been used for tanning.

The fleshy, solid part of an animal's tail is also known as "dock" (cf, Icel. docke, stumpy tail; Ger. *Docke,* bundle, skein). The verb "to dock," especially in reference to horses and dogs, is used of the shortening of an animal's tail by severing one or more of the vertebrae. The English Kennel Club (Rules, 1927) disqualifies from prize-winning dogs whose tails have been docked, with the exception of varieties of terriers, spaniels, etc., and such other breeds as may be determined by the committee.

The prisoners' dock, a railed-in enclosure in which prisoners are placed during trial, is apparently derived from Flem *dok,* pen or hutch. It occurs in 1610 as "bail-dock," a room at the Old Bailey left open at the top.

DOCKET, in law, a brief summary of a case, or a memorandum of legal decisions; also the alphabetical list of cases down for trial, or of suits pending. Such cases are said to be "on the docket." In commerce a docket is a warrant from the custom-house, stating that the duty on goods entered has been paid, or the label fastened to goods, showing their destination, value, etc., and, generally. any endorsement on the back of a document, briefly stating its contents.

DOCKS. The principal function of a commercial port is to provide means whereby cargoes may be discharged from and loaded into vessels frequenting it for the purpose. The transfer of goods may be from ship to quay warehouses and other storage places; or to wagons on the quays; or to river and canal craft lying alongside the ship; and vice versa. The facilities provided must be in sheltered positions and suitable appliances are necessary for the convenient and expeditious handling of cargoes. A basin constructed for these purposes, surrounded by quay walls, is known as a dock. The term is specially applied to basins, at places with a large range of tide, usually more than 15ft., in which the water is maintained at a fairly uniform level by gates, which are closed when the tide begins to fall as at the docks of Liverpool. England. and Havre, France. (The word "dock" should, strictly speaking, be applied only to wet-docks closed by gates, and to dry-docks and floating docks used for the repair of vessels. It is. however, commonly and popularly employed in a wider sense and is so used in this article.) Sometimes, however, at both river and sea-coast ports with lesser range of tide such as Glasgow, Hamburg, Rouen, Southampton and New York, dock gates are dispensed with, and open basins and river quays serve for the accommodation of vessels. In tideless seas, such as the Mediterranean, the rivers are usually barred by deltas at their outlets, like the Rhone and Tiber, and thus rendered inaccessible. Ports have often been established on the coasts of such seas by constructing open basins protected by breakwaters, as at Marseilles. Genoa and Naples. Open basins, however, are precisely the same as closed docks, except for the absence of dock gates.

The accommodation for shipping in basins in river ports is so

frequently supplemented by river quays, that closed docks, open basins and river quays and wharves are all naturally included in the general consideration of dock works. The present article therefore comprehends brief descriptions of wet-docks and basins and their approaches; locks and entrances; quay walls, piers and wharves; dry docks and slipways; dock and lock gates and caissons; the equipment and machinery of docks; and the methods of handling cargo in them. Reference is made to Naval docks but

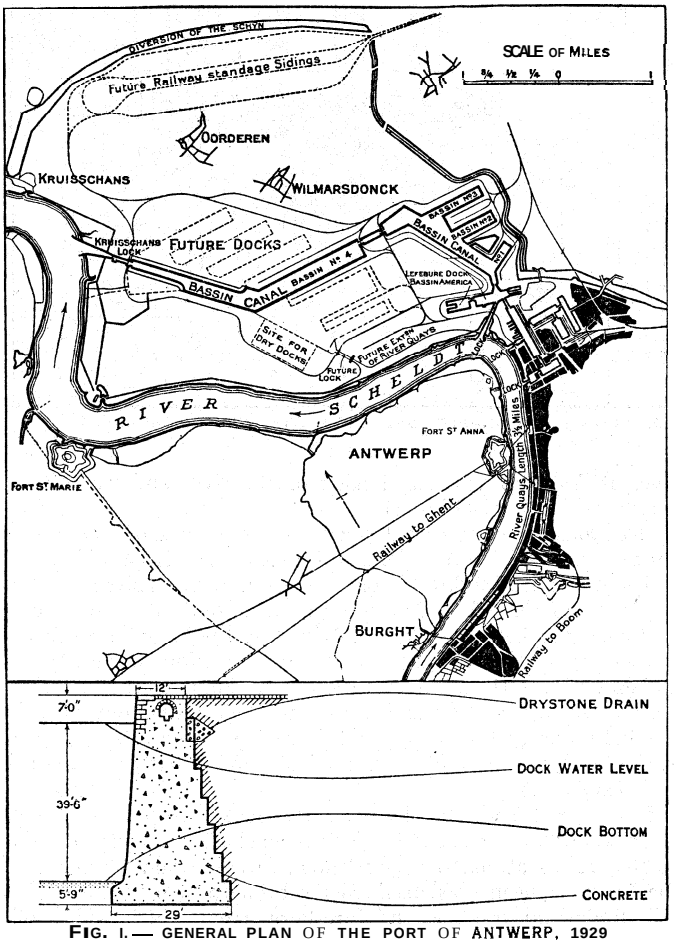


FIG. 1.— GENERAL PLAN OF THE PORT OF ANTWERP, 1929

The docks, opened in 1928, extend from Kruisschans to the old docks at Antwerp higher up the river.* The inset is a typical cross-section of the quay walls in the Bassin Canal and other new docks at Antwerp

for these *see* the article DOCKYARDS AND NAVAL BASES. *See* also HARBOURS; BREAKWATER; RIVER AND RIVER ENGINEERING; JETTY; CANALS AND CANALIZED RIVERS; PORT OPERATION.

Early Dock Construction.—Some account of ancient harbour works will be found in the article HARBOURS. The earliest quays or wharves in the Port of London were probably the "hithes" of Saxon times. These were small cuts formed in the bank of the river, their sides being protected by rude piling. The word is still preserved in place names, such as Queenhithe. Dowgate dock and Puddle dock were ancient hithes but the word dock was not used in the sense of a closed dock until the 15th century.

There are records in 1434 of an elementary form of dry-dock at Southampton which seems to have been a narrow embayment in which a ship was placed at high tide and then, as the tide fell, enclosed by a temporary wall of clay, timber and brushwood built across the mouth. The first permanent dry dock, with primitive gates staunched with clay, was built at Portsmouth in 1496. This dock was large enough to take in the "Sovereign," the biggest warship of the time. Later the dock was enlarged and in 1523, the "Henri Grace à Dieu" of 1,000 tons was docked in it. In the Port of London no dry docks, other than those of the ly temporary kind, were constructed until the middle of the century when there were dry docks with gates at Deptford, wall and Woolwich, as well as at Chatham. One such was made at Bristol as early as 1626 and remained in use until 1687; and in 1656 a larger dry dock was built at Portsmouth.

Open tidal basins formed by excavating in the banks of a river, such as the Thames, and surrounded by wharves or primitive timber faced quays, had been in use since the 11th century, and these were sometimes known as docks. But the first closed wet dock was one at Blackwall, which is mentioned by Pepys in 1661; and at Dunkirli a wet dock of 49 acres with closing gates was made in 1686. An Act of Parliament was obtained in 1696 for the building of the Howland dock at Rotherhithe on the Thames, which was later absorbed in the Surrey Commercial docks.

The earliest wet dock at Liverpool, the Old Dock, was built about 1708–10—the exact date is uncertain—and was the pioneer of the great series of docks since constructed in the river Mersey. Bristol followed with a wet dock, begun in 1712; but at that port, the "Trench," an artificial cut forming a new channel for the river Frome into the Avon, with quays and wharves along its bank, was made as far back as 1247. This cut became the harbour of Bristol and from its quay Cabot sailed in 1497, on the voyage which resulted in his discovery of the mainland of North America. (For details of early history see *The Development of Harbour and Dock Engineering*, Sir C. R. S. Kirkpatrick's Vernon-Harcourt Lecture, Inst. C.E. 1926; and Bélidor's *Architecture Hydraulique*, Paris, 1737–53.)

It was not until the beginning of the 19th century that the era of systematic dock construction began which kept pace with the steady development of shipbuilding and maritime transport throughout the past century, and still continues to do so.

Dimensions **of** Shipping.— In designing new port works, it is essential to look forward to the possible future requirements of vessels. The necessity for such forethought is shown by the progressive increase in the size, not only of the largest ocean liners but, also, of cargo carrying ships. The "City of Rome," launched in 1881, was 560ft. long, 52½ft. beam and had a maximum draught of 27½ft.; the "Campania" and "Lucania," of 1893, measured 600 by 65ft. At the close of the 19th century a cargo vessel of over 500ft. in length did not exist: the limiting draught of the Suez canal was 27½ft., and the largest merchant ship afloat, excepting those in the Atlantic trade, was 530 by 61ft. and 28ft. draught.

The period of 15 years which preceded the World War was marked by great advances. In 1910 the largest merchant ship afloat was the "Mauretania" of 30,696 gross tons, 762ft. long and 88ft. beam; but, excluding transatlantic liners, the largest cargo carrying ship did not exceed 13,000 tons. In 1914 merchant ships far exceeding the dimensions of the "Mauretania" were either afloat or building. Harbour authorities, not only of those ports which accommodated the great transatlantic liners but in many other parts of the world, were engaged in increasing their facilities to serve shipping of far larger dimensions than any which had hitherto used their navigable waters. During the war period harbour development throughout the world was arrested and confined. in the main, to works of a belligerent nature.

Until 1930 no ships of greater dimensions than the largest of those building in 1914 were laid down. The dimensions of the "Majestic" (ex "Bismarck"), laid down before the war but not completed until 1921, were 56,551 gross tons, 915·5ft. length, 100·1 ft. beam, and maximum draught 38.9 feet. The "Leviathan" (ex "Vaterland") has been loaded to 41ft. draught. The "Queen Mary" laid down in 1930, but not completed until 1936 was the first ship to exceed 1,000ft. in length (over all) and was followed by the "Normandie," completed in 1935, and the "Queen Elizabeth." These vessels slightly exceed the "Queen Mary" in tonnage and dimensions, the "Queen Elizabeth" being of about 84,000 gross tons. In 1899 the largest general cargo vessel afloat had a gross tonnage of under 8,000 and was 470ft. in length. In 1928 cargo ships over 600ft. long and of 18,000 to 20,000 tons gross were in service, in 1939 there were no less than 82 vessels entered in Lloyd's Register whose gross tonnage exceeded 20.000; 496 ships within the range of 10,000–20,000 tons were in regular service.

Depth of Water.—The deepening and widening of the Suez canal in recent years has enabled ships of the largest class to trade with eastern ports. By 1928 it mas practicable for ships draw-

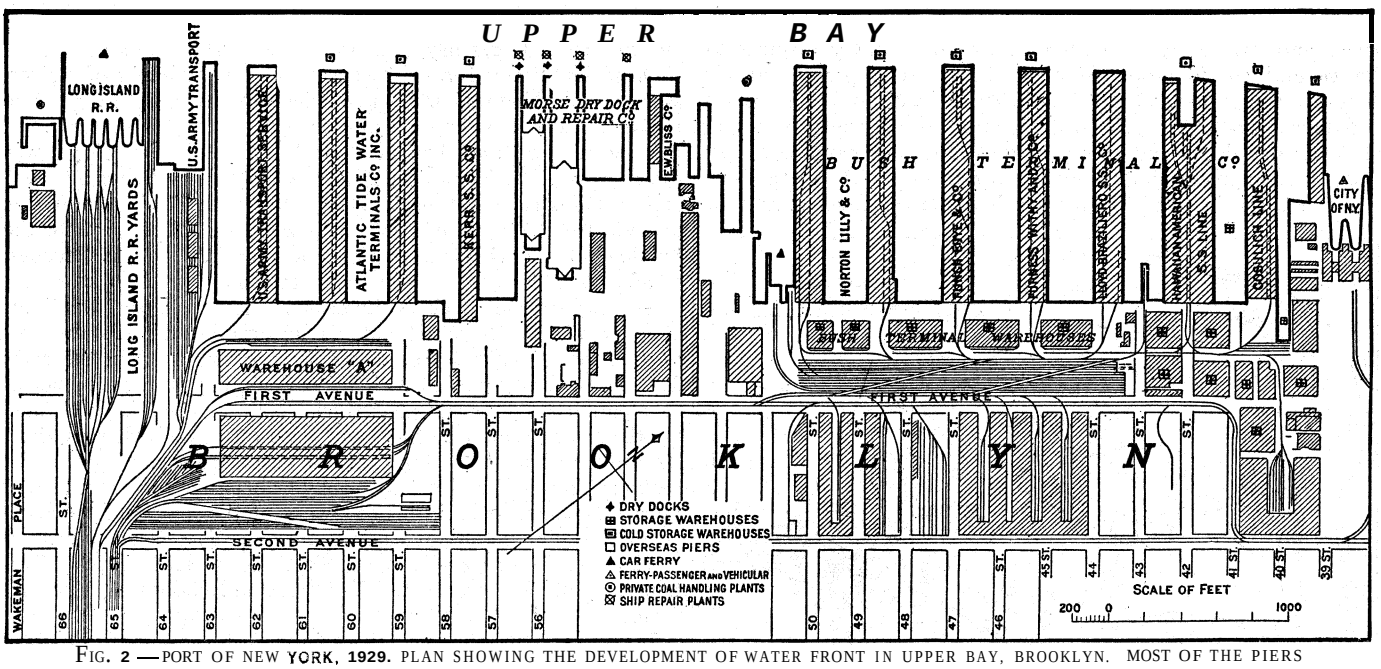


FIG. 2 — PORT OF NEW YORK, 1929. PLAN SHOWING THE DEVELOPMENT OF WATER FRONT IN UPPER BAY, BROOKLYN. MOST OF THE PIERS ARE OPEN PILED STRUCTURES WITH 30 FT. DEPTH OF WATER AT LOW TIDE

ing 33ft. to pass through it. Further improvements in progress in 1940 were to provide for a draught of 35ft. and there is no reasonable limitation to the capacity of the canal. The more important ports of the Far East have been developed concurrently. The opening in 1914 of the Panama canal, having a navigable depth of 40ft., has also had an important bearing on the development of harbours in the Far East and on the Pacific coast of America. Work was begun in 1940 on the construction of a third and larger set of locks in the Panama canal. The internal dimensions of these locks will be approximately 1,200ft. length, 135ft. width and 45ft. depth of water. The general result is that, whereas in 1900 a navigable depth of 30ft. was considered ample, at least 3jft. is now regarded as essential in harbours of the first class and, in special cases, including the ports used by transatlantic liners. depths exceeding 40ft. and even up to 45ft. are required.

Effect of Depth on Cost of Works.—The cost of constructing port works in general shows an increase approximately proportional to the ratios of the cubes of the draughts of the largest ships for which they are designed. (*See* L. H. Savile, 13th International Congress of Navigation, London, 1923.) It is thus obvious that the problem of providing port accommodation for shipping of the largest class is one of considerable importance from the point of view of finance, and may become one of balance between the relative economy of ships of large draught and cargo capacity, and the capital cost of port construction.

Sites for Docks.—Low-lying land adjoining a tidal river or estuary frequently provides suitable sites for docks. The position, being more or less inland, is sheltered; the low level reduces the excavation required for forming the docks, and enables the excavated materials to be utilized in raising the ground at the sides for quays; and the river furnishes a sheltered approach channel. Notable instances are the docks of the ports of London, Liverpool, South Wales, Southampton, Hull, Belfast, St. Nazaire, Rotterdam, Antwerp and Hamburg. Sometimes docks are partially formed on foreshores reclaimed from estuaries, as at Hull, Grimsby, Cardiff, Rosyth Dockyard, Liverpool, Leith and Havre; while at Bristol, a curved portion of the river Avon was appropriated for a dock, and a straight cut made for the river. By carrying docks across sharp bends of tidal rivers, upper and lower entrances can be provided; and of this the London, Surrey Commercial, West India, and Victoria and Albert docks are examples on the Thames, and Chatham dockyard on the Medway. The enlargement of the port of Antwerp is another instance. A series of enclosed docks, extending from Kruisschans, on the Scheldt 7m. below the city, to the old dock system higher up the river at Antwerp, cuts off a bend of the river and was opened for traffic in 1927. (Fig. 1.)

Occasionally, when a tidal river has a shallow entrance, docks, formed on its foreshore adjoining the sea-coast, are provided with a sheltered entrance direct from the sea as in the Havre docks at the outlet of the Seine. Many old ports were first established on sandy coasts where a creek, maintained by the influx and efflux of the tide from low-lying spaces near the shore, afforded some shelter and an outlet to the sea across the beach. Some of these, such as Calais, Dunkirk and Ostend, have had their access improved by parallel jetties and dredging; and docks have been readily formed in the low-lying land only separated by sand dunes from the sea. (*See* HARBOURS.)

In sheltered places on the sea-coast, docks are sometimes constructed on low-lying land bordering the shore, with direct access to the sea, as at Barrow, Hartlepool, Swansea and Bombay. In the Mediterranean open basins have been formed in the sea, by establishing quays along the foreshore, from which wide, solid jetties, lined with quay walls, are carried into the sea at intervals at right angles to the shore. Such basins are sheltered by an outlying breakwater parallel to the coast, and are reached at each end through the openings left between the projecting jetties and the breakwater, as at Marseilles and Trieste, and at the extensions at Genoa (*see* HARBOURS). In some of these ports additional accommodation has been obtained by constructing wide quays along the inner face of the breakwater (*q.v.*). Where, however, the basins are formed within the partial protection of a bay, as in the old ports of Genoa and Naples, the requisite additional shelter has been provided by converging breakwaters across the opening of the bay, and an entrance to the port is left between the breakwaters.

The two deep arms of the sea at New York, known as the Hudson and East rivers, are so protected by Staten Island and Long Island that it has been only necessary to form open basins by projecting jetties or piers into them from the west and east shores of Manhattan island, and from the New Jersey and Brooklyn shores, at intervals, to provide adequate accommodation for Atlantic liners and the sea-going trade of New York. Somewhat similar conditions obtain in many of the great natural harbours in other parts of the world, as, for instance, in Sydney harbour and at San Francisco.

Dock Extensions. — In designing dock works, it is expedien to make provision, as far as possible, for future extensions as trade of the port increases. Generally this can be effected a side tidal rivers and estuaries by utilizing sites lower don

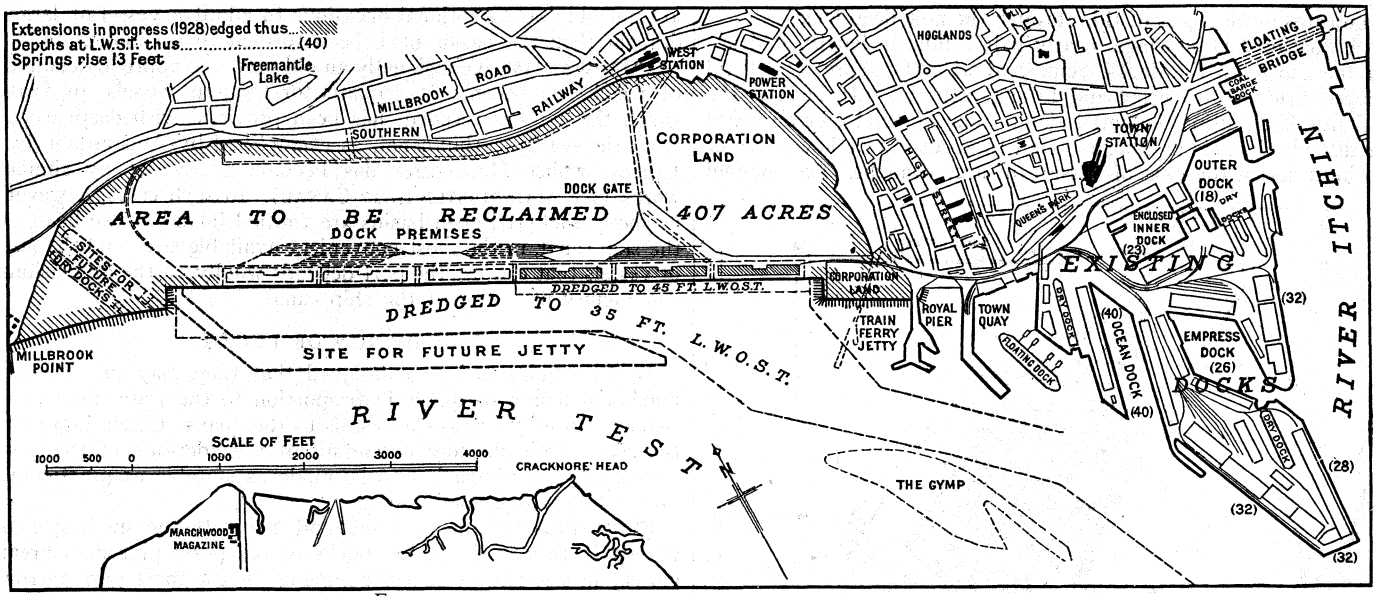


FIG. 8.— DIAGRAM SHOWING THE PLAN OF SOUTHAMPTON DOCKS, 1928

river, or reclaiming unoccupied foreshores of an estuary, as adopted for extensions of the ports of Liverpool, Hull and Havre. At ports on the sea-coast of tideless seas, it is only necessary to extend the outlying breakwater parallel to the shore line, and form additional basins under its shelter, as at Marseilles and Genoa (for plans *see* HARBOURS). Quays also along rivers furnish valuable opportunities of extending the accommodation of ports. Ports, however, established inland, like Manchester, though extremely serviceable in converting an inland city into a seaport, are at the disadvantage of having to acquire very valuable land for any extensions that may be required; but, nevertheless, some compensation is afforded by the complete shelter in which the extensions can be carried out, when compared with Liverpool, where the additions to the docks can only be effected by costly reclamation works along the foreshore to the north, in increasingly exposed situations.

Venice being situated upon an island of limited area in a lagoon has secured the extension of its dock facilities by the construction of an entirely new port on the adjoining mainland. New York, in view of the congestion of traffic at the piers in the upper areas of the harbour, is developing large districts such as Staten island and Jamaica bay nearer the sea entrance.

APPROACH CHANNELS

The accessibility of a port depends upon several factors, such as the depth of its approach channel, which also determines the depth of the docks or basins to which it leads, for it is useless to give a depth to a dock much in excess of the depth down to which there is a prospect of carrying the channel by which it is reached. The great augmentation, however, in the power and capacity of modern dredgers, and especially of suction dredgers not only in sand but also in soft clay, together with the increasing draught of vessels, has resulted in a considerable increase being made in the available depth of rivers and channels leading to docks.

It is therefore necessary to make due allowance for the possibility of a reasonable improvement in determining the depth to be given to a new dock. On the other hand, there is a limit to the deepening of an approach channel, depending upon its length, the local conditions as regards silting, and the resources and prospects of trade of the port, for every addition to the depth generally involves a corresponding increase in the cost of maintenance.

In Tidal Ports.—At tidal ports the maximum available depth for vessels should be reckoned from high water of the lowest neap ides, as the standard which is certain to be reached at high tide. `e period during which docks can be entered at each tide depends the nature of the approach channel, the extent of the tidal and the manner in which the entrance to the docks is effected. Thus, where the tidal range is very large, as in the Severn estuary, the approach channels to some of the South Wales ports are nearly dry at low water of spring tides. It would be impracticable to make these ports accessible near low tide, except for small craft, whereas at high water, even of neap tides, vessels of large draught can enter the docks. Nevertheless, in recent years, it has become increasingly important to provide in tidal ports channels of sufficient depth to permit the access of large ships to the closed docks at all states of the tide and this has been effected at many ports such as Liverpool, London and Havre.

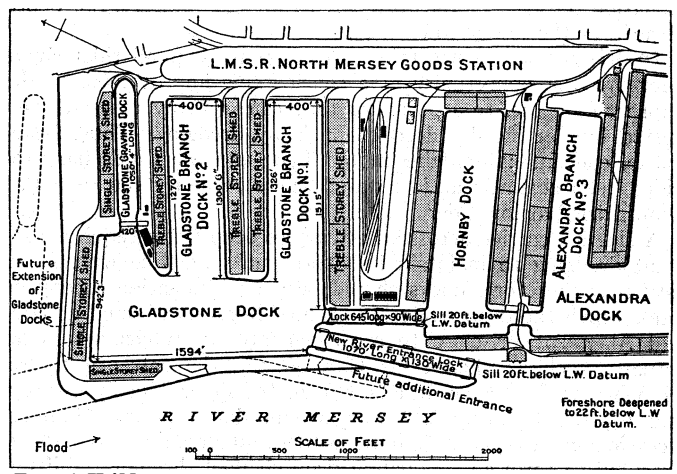


FIG. 4.—PLAN OF NORTHERN END OF DOCKS SYSTEM AT LIVERPOOL INCLUDING THE GLADSTONE DOCK OPENED IN 1927

Liverpool.—In the Mersey, with a rise of 31ft. at equinoctial spring tides, the deep channel between Liverpool and Birkenhead and into the outer estuary of the river in Liverpool bay is maintained by the powerful tidal scour resulting from the filling and emptying of the large inner estuary. Access to the river has been rendered possible, at any state of the tide (except in the case of the largest vessels at and near low water) by dredging a channel through the Mersey bar; minimum depth in bar channels is about 27ft. at mean low water spring tides (*see* RIVER AND RIVER ENGINEERING; HARBOURS) but the docks, with the exception of those communicating with the new Gladstone dock, cannot be entered by large vessels till the water has risen above half-tide level, and the gates are closed directly after high water. Vessels of light draught are, however, able to pass in and out of the older docks from about 3 hours before to 3 hours after high water by using the locks. The opening of the Gladstone dock in 1927 allows ships of moderate size to enter it and the docks with which it com-

municates at all states of tide through the new deep lock.

A floating landing-stage, nearly half a mile in length, in front of the centre of the docks, connected with the shore by several hinged bridges and rising and falling with the tide, enables the Atlantic liners using the port to come alongside and take on board or disembark their passengers at all times except at low water of spring tides in the case of vessels of large draught. The channel

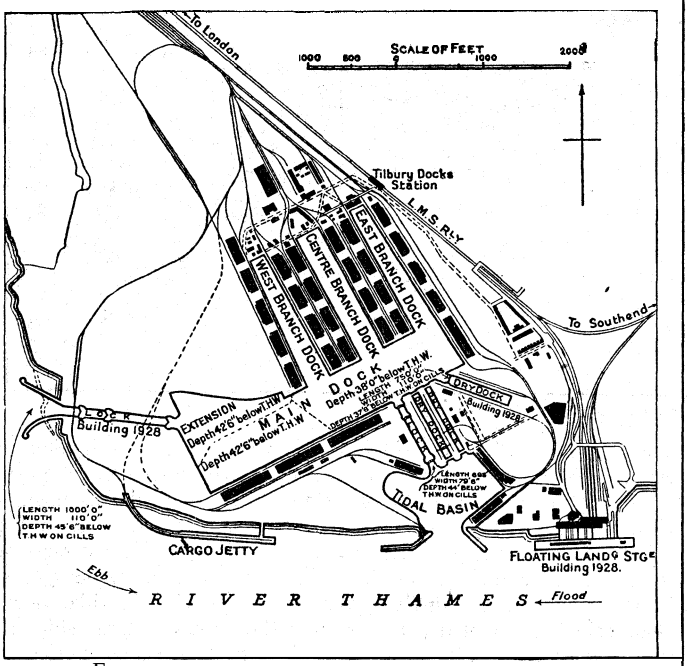


FIG. 5.—TILBURY DOCKS. THE PORT OF LONDON, 1929

alongside the part of the stage used by large vessels has a depth of 32ft. at the lowest low water.

In Rivers and Estuaries.— Comparatively small tidal rivers offer the best opportunity of a considerable improvement in the approach channel to a port; for they can in many cases be converted into artificially deep channels by dredging. Thus, systematic, continuous dredging in the Tyne and the Clyde has provided deep channels at low water where formerly the river bed almost dried at low tide.

A channel carried across an estuary to deep water requires constant dredging to maintain its depth. In large tidal rivers and estuaries, therefore, docks should be placed alongside a concave bank which the deep navigable channel hugs, as effected at Hull and Antwerp; or close to a permanently deep channel in an estuary, such as chosen for Garston and the entrance to the Manchester ship canal at Eastham in the inner Mersey estuary, and for the Grimsby and Immingham docks in the Humber. Occasionally, extensive training works and dredging have to be executed to form an adequately deep channel through a shifting estuary and shallow river, as, for instance, on the Weser to Bremerhaven and Bremen; on the Seine to Honfleur and Rouen; and on the Tees to Middlesborough and Stockton (see RIVER AND RIVER ENGINEERING).

Southampton.— Southampton possesses the very rare combination of advantages of a well-sheltered and fairly deep estuary, a rise of only 13ft. at spring tides, a double high water, and a position at the head of Southampton Water at the confluence of two rivers; so that, with a moderate amount of dredging and the construction of quays, some with a depth of 45ft. in front of them at low water, it is possible for vessels of the largest draught to come alongside or leave the quays at any state of the tide. This circumstance has enabled Southampton to attract many of the Atlantic steamships formerly running to Liverpool.

In Tideless Seas.—Ports on tideless seas have to be placed where deep water approaches the shore and, if possible, where there is an absence of littoral drift. The basins of such ports are always accessible for vessels of the draught they provide for, but they require most efficient protection and, unlike tidal ports, they are not able on exceptional occasions to admit a vessel of larger draught than the basins have been formed to accommodate.

Inland Ports.—Occasionally an old port, the approach channel of which has become inadequate for modern vessels, or from which the sea has receded, has been provided with deep access from the sea by a ship-canal, as exemplified by Amsterdam and Bruges; whilst Manchester has become a sea-port by similar works (see MANCHESTER SHIP CANAL). In such cases, however, perfectly sheltered open basins are formed inland at the head of the ship canal, in the most convenient available site; and the size of vessels that can use the port depends wholly on the dimensions and facility of access of the ship canal.

THE DESIGN OF DOCKS

Docks require to be so designed that they may provide the maximum length of quays in proportion to the water area consistent with easy access for vessels to the quays. Often, however, the space available does not admit of the adoption of the best forms, and the design has to be made as suitable as practicable under the existing conditions.

Planning.— On this account, and owing to the small size of vessels in former times, the docks of old ports present a great variety in size and arrangement, being for the most part narrow and small, forming a sort of string of docks communicating with one another, and provided with locks or entrances at suitable points for their common use. Such conditions are noticeable in the older London and Liverpool docks.

Where the conditions of site permit, the ideal plan for a commercial dock comprises an ample vestibule or turning basin and a series of wide parallel piers or quays with intervening water spaces or branch docks arranged like the teeth of a comb, but inclined slightly towards the approach channel. Vestibule planning has been embodied in the lay-out of many large modern docks including those of Manchester, Dunkirk, Hull and the open basins at Glasgow. It is also the characteristic feature of mohern ports in tideless seas enclosed by protection works as at Marseilles.

Liverpool.— The later Liverpool docks at the northern end of the series, including the Gladstone dock (fig. 4) have been constructed on the vestibule plan with branches. Some of the older docks adjoining them to the south have been remodelled so as to form series of branch docks opening into vestibule docks alongside the river wall. The Gladstone dock includes a vestibule or turning dock, a graving dock, also usable as a wet dock, two branch docks and a large deep water lock giving access from the river. The water area is 58¼ acres and the quayage about 3m. in

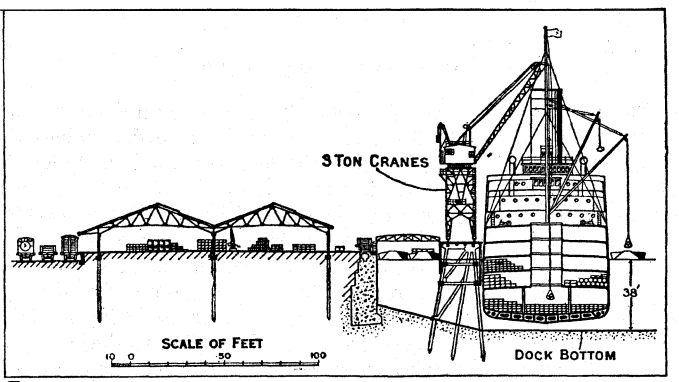


FIG. 6.— CROSS SECTION OF SOUTH QUAY AND ISLAND JETTIES OF KING GEORGE V. DOCK. LONDON, OPENED IN 1921

length. A lock between the adjoining Hornby dock and the new dock makes it possible for ships to enter and leave some of the older docks by way of the deep river lock.

Port of London.— Though narrow timber jetties were introduced long ago in some of the wider London docks for increasing the quay space, no definite planning arrangement was adopted in building the large Victoria and Albert docks between 1850 and 1880. The Victoria dock was made wide, with solid jetties provided with warehouses projecting from the northern quay thereby affording accommodation for vessels lying end on

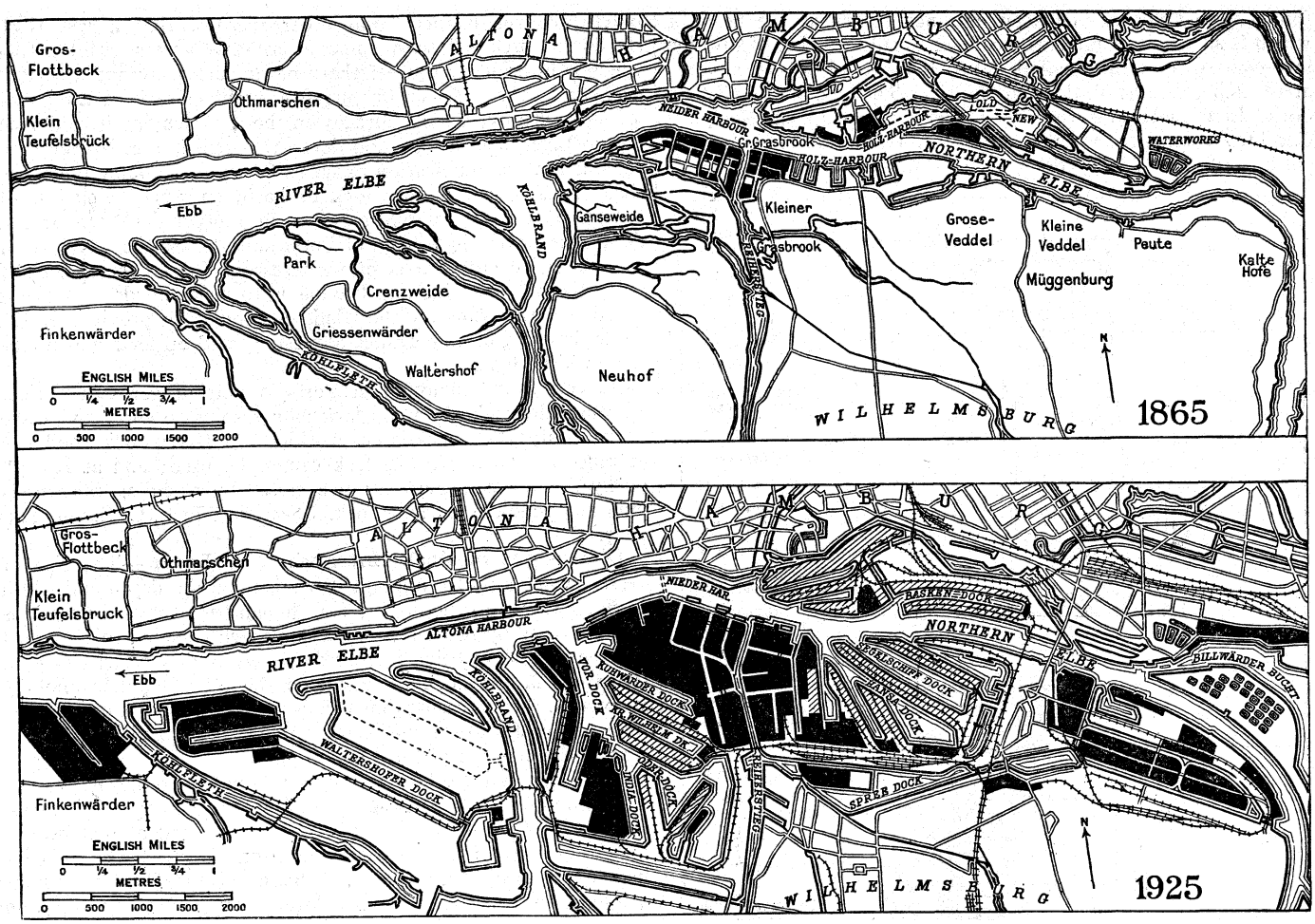


FIG. 7.— PORT OF HAMBURG IN 1865 AND 1925 THE BLACK AND CROSS-HATCHED AREAS ARE COVERED WITH PORT BUILDINGS, THE BLACK AREAS BEING OCCUPIED BY THE PORT OF HAMBURG AUTHORITY

north quay. The Albert dock was given about half the width but made much longer, so that vessels lie alongside the north and south quays in a long line, stretching across the remainder of the wide river bend, in order to obtain a second entrance in a lower reach of the river. Between 1937 and 1940 the Victoria Dock was completely remodelled and deepened, a continuous quay wall taking the place of the old jetties. *(See* Jl Inst. C.E., Jan. 1939).

The Tilbury docks east of London (1886) consist of a series of branch docks separated by wide, solid quays. and opening straight into a vestibule dock in which vessels can turn on entering or leaving. An extension of the main dock at its western end to form a larger branch dock was made in 1912–17, adding about 17ac. to the previously existing 54¾ac. of dock water area. *(See* Proc. Inst C.E. 1923.) A further enlargement 1926–29 provides an additional entrance higher up the river, and a water area sufficient for turning the largest ships.

The latest of the docks in the port of London, the King George V. dock opened in 1921 *(see* Proc. Inst. C.E., ccxvi., 1923) occupies a site lying between the river and the Royal Albert dock with which it is connected by a communication passage. It has a separate entrance from the river by means of a deep lock. The wet dock has an area of about 64 acres and is constructed on the single water-area plan without branches. The two long quays which form its sides are not parallel, the width between them at the entrance end being sufficient to allow of ships turning. An interesting feature of the design is the provision of 7 reinforced concrete island jetties arranged in a line parallel with the south quay-wall with a barge passage between the jetties and the quay (fig. 6). Cranes on the jetties work the ship's cargo either into barges or to the quay as may be required. This system was introduced with the object of affording better facilities for lighter-borne traffic which forms a large proportion of the trade of the port of London.

Tidal and Half-tide Basins.—Tidal basins, as they are termed, were interposed in many old docks between the entrance locks or tidal gates and the dock proper, with the object of facilitating the passage of vessels out of and into the docks before and after high water. This is effected by lowering the water in the basin to meet the rising tide and opening the outer gates directly a level has been formed. The outgoing vessels which have collected in the basin, when level with the dock water, are then passed successively through the outer gates. The incoming vessels are next brought into the basin, the outer gates are closed, and the water in the basin raised to the level in the dock, when the vessels are admitted to the latter. This arrangement, which in effect serves the purpose of a large lock, is still in use at a few of the older docks in the Port of London and also at the Bute and Roath docks at Cardiff, and at Sunderland and other docks. The locks, where they exist, are used (as locks) only for the smaller vessels leaving early or coming in late on the tide.

The large half-tide locks at many of the Liverpool docks serve a similar purpose as tidal basins, but, being much larger, the gates are closed at high water to prevent the lowering of the water level in the dock, and to avoid closing them against a strong issuing current. All entrances on the Mersey have duplicate pairs of gates in case of any accident occurring to one pair. This practice has been followed at some other ports

The so-called tidal basins outside the locks at Tilbury and Barry *(see* Proc. Inst. C.E., ci., 1890) are open water spaces provided to give a sheltered approach to the lock or entrance with comparatively deep water available at or near low water for vessels waiting to enter.

Dock Entrance Channels and **Locks.**—The more modern practice in planning the approach to a large wet dock is to form a

funnel-shaped channel between entrance jetties at the head of which is situated a large entrance lock usually capable of division into two parts by intermediate gates. This plan has been adopted at the King George V. dock in the river Thames; the Gladstone dock, Liverpool; and for the modern entrances at Newport, Cardiff, Avonmouth, Immingham and other docks. The modern entrance at the Tilbury docks is also of this type. When large

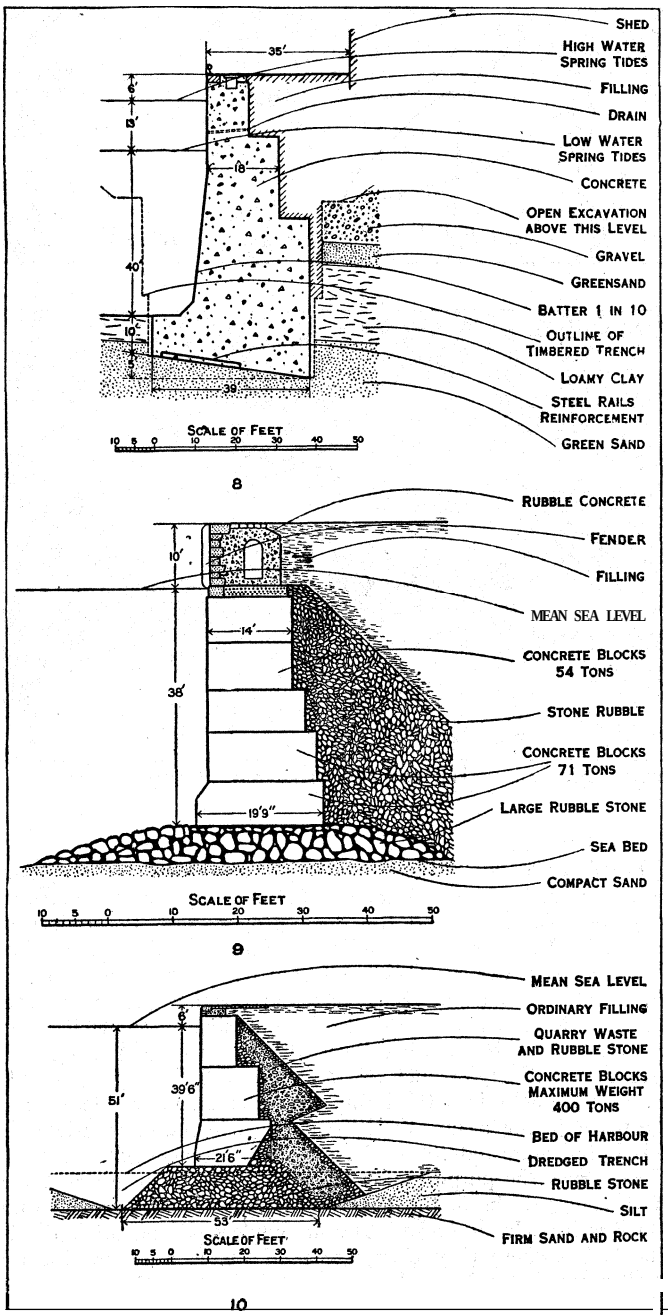


FIG. 8.— SOUTHAMPTON-OCEAN DOCK. SECTION OF QUAY WALL BUILT IN THE DRY IN TIMBERED TRENCH. FIG. 9. GENOA—VITTORIO EMANUELE III BASIN QUAY WALLS OF SUPERIMPOSED CONCRETE BLOCKS. WITHOUT LONGITUDINAL BONDING. CONSTRUCTED ON RUBBLE MOUND FOUNDATIONS IN DEEP WATER. FIG. 10. QUAY WALLS, 1927, AT MUSTAPHA BASIN. ALGIERS

lock entrances are constructed in a river whose current is at times swift it is now the practice to align the lock and entrance channel at a small angle with the direction of the current, and not at right angles to the river, in order to avoid the necessity of large ships getting athwart the tide in entering or leaving the dock. The latest Liverpool, Tilbury and Antwerp entrances are planned in this way.

Emergency Entrances. — It is desirable, although not always practicable for financial and other reasons, that a wet dock should be provided with some alternative access besides that which is in ordinary use. If there be no such provision a serious accident to the one lock or entrance might close it to traffic for a time and prevent ships already in the dock leaving it. In most of the Liverpool and London docks this risk is met by the construction of communication passages between adjoining docks, so that, in the event of any lock or basin entrance being out of operation, some alternative entrance in another dock can be utilized. Moreover, in busy and important docks, the building of an alternative entrance is often necessary for traffic reasons if delay to ships entering and leaving is to be avoided. It may be noted that the plans for the Gladstone wet dock provide for the future building of an entrance alongside the deep lock, and of the same width (fig. 4).

At Havre and many other ports, a pair of gates in a tidal entrance alongside the main lock allows ships to enter and leave at high water if the lock is not working. At Barry dock, the basin entrance is available if the lock cannot be used; and at Rosyth dockyard an emergency entrance closed by a sliding caisson, is built alongside the entrance lock. (See Proc. Inst., C. E. vol. 223, 1927.)

Dimensions of Dock Entrances and Locks. — The size of vessels which a port can admit depends upon the depth and width of the entrance to the docks; for, though the access of vessels is also governed by the depth of the approach channel, this channel is often capable of being further deepened by dredging. The solid structures of the dock entrance, on the other hand, cannot be adapted to the increasing dimensions of vessels except by troublesome and costly works sometimes amounting to reconstruction as carried out at some of the London docks.

The width and depth of access to wet docks are in one way of more importance than the length of locks: for gate entrances, and also locks if both pairs of gates are opened at high water, impose no limitation as regards length on ships entering or leaving. (The terms "entrance" and "gate entrance," used without qualification in connection with a wet dock, commonly imply an entrance closed by a single pair of gates or by a caisson as distinct from a lock.) This factor is of importance in the working of some old docks whose locks are of limited length but of ample width. It is, however, usual in modern dock construction to make a lock amply long enough for any ship whose beam or draught is not too large for the limiting dimensions of its entrance.

Open basins are generally given an ample width of entrance and river quays are also always accessible to the longest and broadest ships which can navigate the channel leading to them. In a tidal port or river, however, the available depth in the berths has to be reckoned from the lowest low water of spring tides, instead of from the lowest high water of neap tides, if the vessels in the open basins and alongside river quays have to be always afloat.

Many years ago the Canada lock (1857) at Liverpool, the Alfred lock at Birkenhead, the Ramsden lock and entrance at Barrow-in-Furness, and the Eure entrance at Havre, were all given a width of about 100 ft. This was no doubt done with the view of admitting the paddle steamers of large overall width in use at the time. With these exceptions the widest lock entrance in the world, until the beginning of the present century, was at the Alexandra dock, Hull, opened in 1885, which was made 85ft., the length being 550ft. The wide entrances to the deepened Brunswick dock and the Sandon dock at Liverpool, completed in 1906, were made 100ft. wide, with sills more than 30ft. below high water of low neap tides. The Gladstone graving dock, which is also usable as a wet dock, opened in 1913, has an entrance 120 ft. in width. The latest addition to the Liverpool docks, the Gladstone wet dock, has a lock 1070×130ft. internally.

The depths of the sills of locks and entrances at large ports have increased in much the same ratio as their other dimensions. Thus, in the port of London, the old lock of the Albert dock, opened in 1880, has a depth of 26½ft. at high water of neap tides and 10ft. at low water of spring tides: the Tilbury lock (1886) has corresponding depths of 393 and 23½ft. over the outer and intermediate sills, but 6ft. less over the inner sill. All the sills

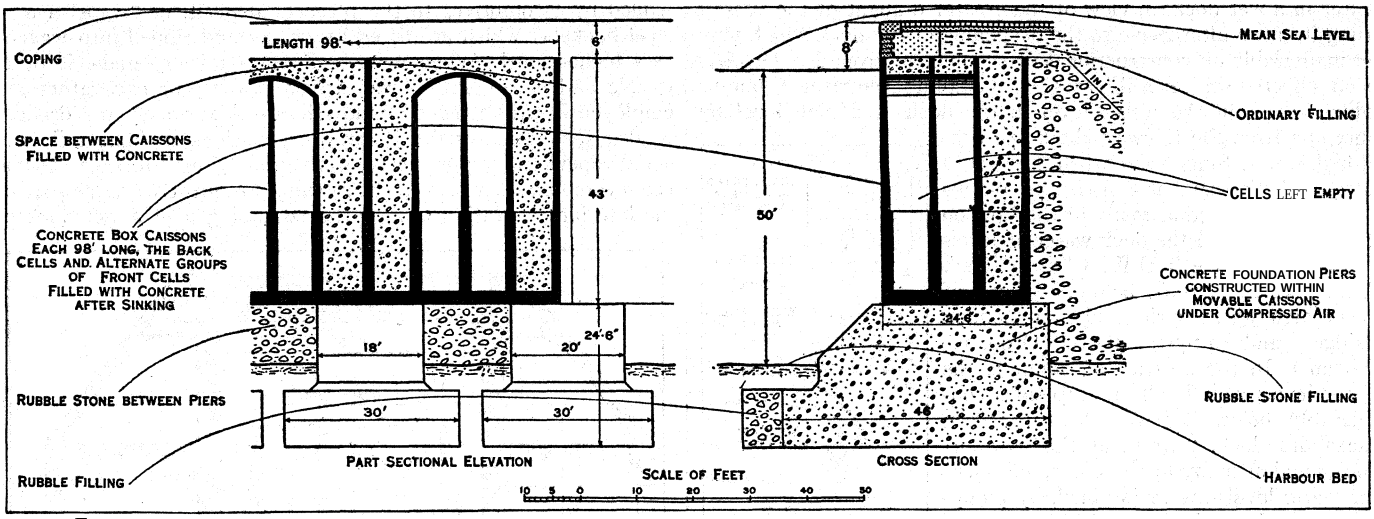


FIG. 11.—PRESIDENT WILSON BASIN. MARSEILLES. QUAY WALL OF CONCRETE CAISSONS ON DISCONTINUOUS CONCRETE FOUNDATIONS IN DEEP WATER

of the King George V. lock are 41½ft., and those of the new Tilbury lock are 41ft. below the level of high water neap tides.

The following table shows the dimensions of some of the largest locks in use or building in 1940:

TABLE I.—*Dimensions of Modern Docks and Locks*

Port	Name	Date of opening	Depth in dock at min. water level	Locks: Depth on outer sill: eaps	Locks: Depth on outer sill: L. Spgs	Locks: Available: Length	Locks: Available: idth
			ft.	ft.	ft.	ft.	ft.
Cardiff .	Q. Alexandra	1907	40	32	5	850	90
Avonmouth	Royal Edward	1908	39	36	4	875	100
Swansea .	King's Dock	1909	29	32½	11½	875	90
Havre .	Florida lock	1909	40	35	17	855	98½
Hull .	King George	1914	32	37	21½	750	85
Newport, Monmouth	Alexandra South	1914	33	35	7	1000	100
Bombay .	Alexandra	1914	36¼	38¼	29¼	750	100
Rosyth .	Dockyard lock	1915	38	50	37½	850	108*
" .	Emergency entrance	1916	..	38½	26	..	123*
London .	K. George V.	1921	38	41½	25	800†	100
Liverpool .	Gladstone	1927	43	42¾	22	1070	130
Antwerp .	Kruisschans	1927	39%	47	34	885	114
Tilbury .	New lock	1929	383	41	24½	1000	110
Calcutta .	King George	1929	36	33 about	23	700	90
North Sea-Amsterdam Canal .	Ymuiden lock	1930	..	51	46	1312	164
Bremerhaven	Northern	1931	36	47½	36	1220	147½
Dunkirk .	New lock	(Building 1940)	44¼	43%	27%	918	131

*At level of H.W.N.T.
†Can be increased to 910ft. if necessary by use of caisson at inner end.

The only other locks in the world having usable dimensions of 1,000×100ft. or more are those of the Panama and Kiel canals respectively 1,000×110ft. and 1,083×147⅔ft. and the No. 2 combined dry dock and lock at Bremerhaven. (*See* CANALS AND CANALIZED RIVERS.)

Open Wharves and Quays.—Where the range of tide is moderate, closed docks, if they exist, or open basins are usefully supplemented by quays or wharves in the river or harbour in positions where the shelter is sufficient for vessels to lie alongside in safety and the currents are not too strong to make this impracticable. Generally a range of 14 or 15ft. at spring tides is the limit above which it becomes more convenient to provide closed docks. On the river Tyne, where the range is 14½ft., the open water quays and coal staiths about equal the closed dock accommodation in extent. On the Clyde, with a tidal range of from 10 to 13ft., and at Hamburg (fig. 7), with a range of 7ft., there are no closed wet docks. Pit Antwerp, a port possessing a very large closed dock system, and having a tidal rise of 15ft., a long line of quays has been constructed along the right bank of the Scheldt at which large ocean-going ships are berthed. Even in the Thames, with a spring range of 21ft., deep water jetties and wharves have been built in the river.

On the Atlantic and Pacific coasts of North America, where the tidal range, except in the Bay of Fundy, is generally small and most of the larger ports are in situations possessing ample natural protection, accommodation is provided for shipping at long piers or jetties projecting from the shore into deep water. Many of these piers, or "docks" as they are termed in New York, have berths upwards of 1,000ft. in length with 30 to 45ft. depth at low water. Timber and reinforced concrete piles are commonly employed for these structures, but sometimes cylinders are used in place of piles for carrying the superstructure of the jetty. The same type of construction has become usual in the natural harbours of Australia and New Zealand where, except in the northern parts of Australia, the tidal range is also small.

The following table (II.) gives particulars of the depth at low water alongside typical deep water tidal quays built since 1910.

TABLE 11.—*Tidal Quays*

Port	Date of completion	Low water spring tide depth
		ft.
London. Tilbury Jetty	1921	30
Southampton. Open basins	1912	40
" Western Quays . . .	1933–34	45
Tyne. River quay, N. Shields . . .	1928	30
Glasgow. King George V. Dock . . .	1931	32
Halifax. Open basins	1919	45
Sydney, New York, Vancouver. Openpiers	..	40 to 45
Havre. Tidal quay.	1918	40
" North quay	1928	48
Marseilles. President Wilson basin . .	1919	39½
Genoa. Victor-Emmanuel basin . . .	1927	36
Naples. Masaniello quays .	1926	33
Singapore. Naval dockyard	1935	40
Cherbourg. Quai de France	1933	46

Pumping for Impounding in Wet Docks.—It is sometimes desirable to make provision for increasing the minimum depth of

water in a wet dock, in view of the greater draught of the vessels using it, as an alternative to the deepening of the dock which may be inadvisable on constructional or economical grounds. This has been effected in several cases by installing centrifugal pumps which maintain the water level in the dock at a high level by pumping from the tideway about the time of high water Since 1909, when the Port of London Authority was constituted, pumps have been installed at many of the London docks to maintain the dock water at levels 1½ to 3½ft above T H W (Trinity High Water, which is 1·5ft. below the level of mean high water spring tides at London Bridge, and 12 gft above Ordnance Datum) In the absence of pumping the water levels would fall at neap tides considerably below T H W. At the Queen Alexandra dock, Cardiff, at the Newport docks, and at many of the Liverpool docks the water levels are maintained, by pumping, at or about the level of high water of spring tides The British Admiralty practice is to utilize the pumping plant, which is installed for unwatering dry docks, for raising water levels of wet docks when necessary.

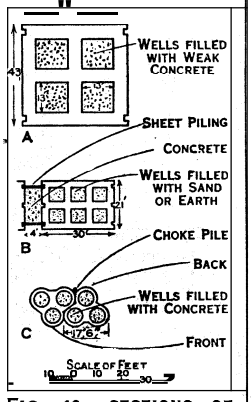


FIG. 12.—SECTIONS OF TYPICAL WELL MONOLITHS A. Rosyth, 1910; B. Clyde, Rothesay Dock, 1901–7; C. Clyde, Queens Dock, 1877.

THE CONSTRUCTION OF DOCKS

Up to the last quarter of the 19th century masonry construction was adopted for the large majority of dock works such as quay walls and locks, and hydraulic limes to a limited extent took the place now occupied by Portland cement. The use of Portland cement concrete for all kinds of port construction is now almost universal, and its cheapness in comparison with the cost of dressed stone in the large majority of situations has restricted the employment of the latter to such purposes as copings and sills, altar courses in dry docks, etc. As an example of this change in practice, the Rosyth dockyard (1909–18) may be mentioned Practically all British naval docks built prior to 1905 are faced throughout, or at any rate on all important surfaces, with dressed stone, usually granite. In the case of Rosyth, however, the quay and dock walls are built of and faced with concrete, dressed granite being used only for copings, quoins, sills and similar work

Reinforced concrete has been used in building jetties, wharves and other dock works since about 1895, and its employment is extending In a considerable measure it has superseded timber in the building of openwork jetties and wharves, particularly in

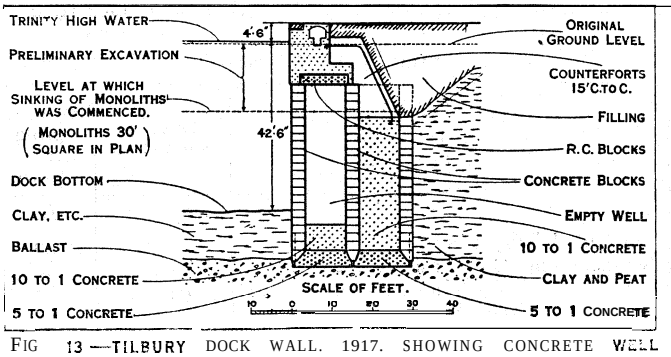


FIG 13.—TILBURY DOCK WALL. 1917. SHOWING CONCRETE WELL MONOLITH

waters where marine borers such as the Teredo (*q.v.*) and *Limnoria* are present. Rapid setting aluminous cement came into use on the continent of Europe about 1920, and its employment in the United Kingdom became rapidly extended; but its suitability for use in sea water had not been fully tested by the lapse of time. Pozzuolana and trass cements (see CEMENT) are largely employed on the continent of Europe, usually in combination with Portland cement.

Excavations for Docks.—When a dock has to be made on land the excavation is performed by men filling wagons, which are hauled by locomotives to the place of deposit, or "skips" (large steel buckets) which are lifted by cranes and tipped into wagons at a higher level. When, however, the conditions make it practicable and economical power driven navvies or excavators are employed in preference to hand labour. A form of land dredger is also sometimes used for large excavations in light soil, and aerial ropeways, dragline excavators and various forms of electric conveyors find their uses in excavation. Frequently a large part of the interior excavation (called the "dumping") of a wet dock or

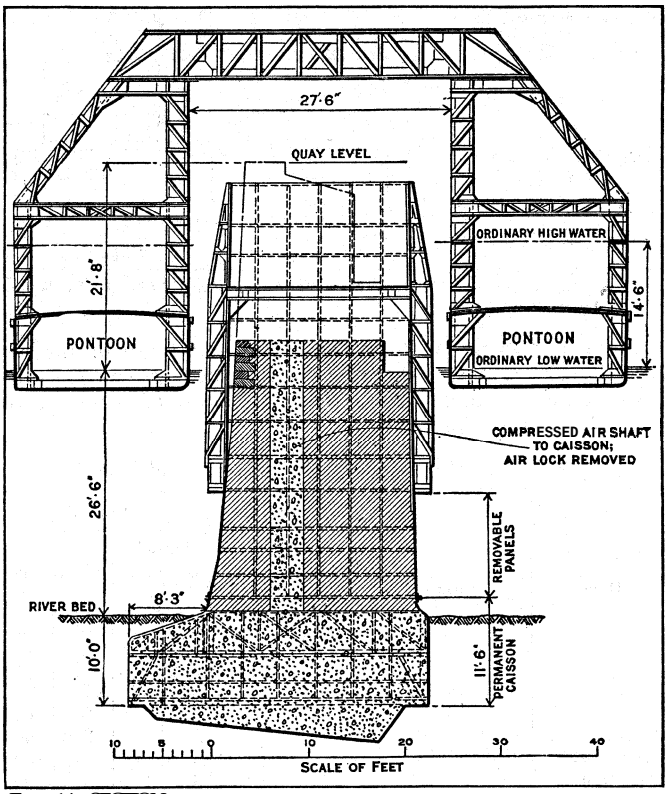


FIG. 14.—SECTION OF QUAY WALL IN THE RIVER SCHELDT. ANTWERP. 1903. FOUNDED ON CAISSONS SUNK BY COMPRESSED AIR

basin is left to be dredged away by floating dredgers after the walls of the dock have been completed and water has been admitted to the area.

When the standing water level in the soil is reached, the water has to be removed from the excavation by pumps drawing from sumps sunk down below the foundations in suitable positions so that the lowest portions of the dock walls and other structures may be built out of water. A method of draining the working area first adopted in Holland and Belgium and successfully applied in the construction of the King George V. dry-dock at Southampton (1931–33) where the pressure of artesian water in sandy beds beneath the foundations was relieved by pumping from wells, is to sink filter wells at intervals round the dock area outside the lines of the permanent works. The suction pipes in the wells, nhich are sunk to a depth below the deepest foundation, are connected up to one or more pumps which, working continuously, lower the standing water level in the ground to be excavated to the required amount.

In many cases of dock building a cofferdam has to be constructed cutting off the entrance works from the river or harbour water. This cofferdam is removed when the works built within it have been completed. When a dock is to be constructed, partially or wholly, on reclaimed land, a reclamation bank for enclosing the site and excluding the tide may be necessary, as in the construction of the King's Dock, Swansea. In some cases, however, the wall forming the outer boundary of the dock has been built by sinking concrete monoliths from temporary staging erected on the foreshore or sea bed. This plan was adopted to a partial extent in building the enclosing wall of the Rosyth Dockyard

basin (1909–15).

Dock Walls.—Docks and open basins are generally surrounded by upright walls retaining the quays alongside which vessels lie for discharging and taking in cargoes. In some cases the dock sides are, either wholly or in part, formed by stone pitched and even natural soil slopes over which openwork wharves of timber or reinforced concrete are built out to the toe of the under water

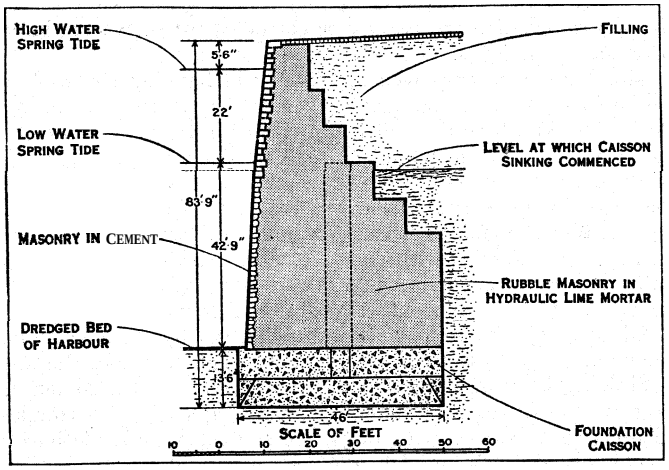


FIG. 15.—SECTION OF THE TIDAL QUAY AT HAVRE. BUILT 1915–23
Foundations were constructed within permanent caissons each 141 feet long, and the upper part of the caisson removed

slope. The solid upright wall, is, however, the usual practice in large and deep modern docks.

The nature of the strata to be excavated and on which the walls are to be founded is ascertained by trial borings and, when practicable, by sinking trial pits. The nature of the foundation has an important bearing on the design of the wall and its method of construction. Ordinarily, hard clay (such as boulder clay), compact gravel and sand, as well as most rocks form excellent foundations. It is, in these cases, usually unnecessary to carry the base of the wall more than a few feet below the dock bottom. In less satisfactory ground, however, such as slippery clay and alluvial material, and sand charged with water, the foundations may have to be carried down to a considerable depth and the base width increased. Timber bearing piles are sometimes driven to form a

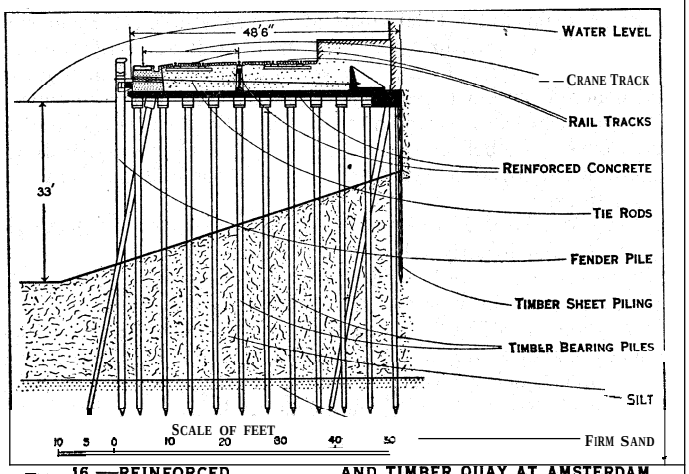


FIG. 16.—REINFORCED CONCRETE AND TIMBER QUAY AT AMSTERDAM

foundation for a wall. In other cases a trench has been dredged in the soft material along the line of wall and filled with ballast or stone or even coarse sand to provide a sound foundation.

The walls round a dock serve as retaining walls; and, though they have the support of the water in front of them when the docks are in use, they have, when built and before the water is admitted, to sustain the full pressure of the filling at the back, as well as any surcharge due to erections on the quay. The completion of the filling behind the wall is on this account sometimes deferred until after the dock is filled with water.

The thickness of solid dock walls is increased downwards to support the pressure which increases with the depth. This pressure depends on the nature and angle of repose or natural slope of the ground and filling material behind the wall. But the pressure is often increased by the accumulation of water at the back, which with fine silty material, is liable to exert a sort of fluid pressure against the wall proportionate to the density of the mixture of silt and water. The increase of thickness towards the base used formerly to be effected by a batter on the face, as well as by stepping the back. The vertical form now given to the sides of ships necessitates, however, a corresponding vertical, or nearly vertical, face for the wall.

The height of a dock wall above the dock bottom depends upon the minimum depth of water always available for vessels, and the rise of the tide. In tideless sea-ports and inland ports removed from tidal influence, the height is represented by the minimum depth of water plus a margin of from 6 to 10ft. from the water level to the quay surface. At tidal ports, however, an addition has to be made equal to the difference in height between

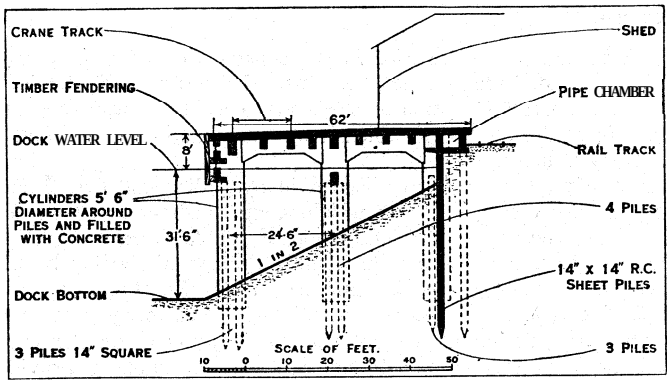


FIG. 17.—CROSS SECTION OF REINFORCED CONCRETE QUAY ON PILES AND CYLINDERS, VICTORIA DOCK, LONDON, BUILT 1925

the highest and lowest water levels in the dock or in the open basin as the case may be. At some ports, *e.g.*, Montreal, provision against river floods, etc., necessitates especially high coping levels.

Under normal conditions, a solid or gravity dock wall should be given a width at a height halfway between dock-bottom and quay level, not less than $\frac{1}{3}$ of its height above dock bottom, and a width of about half this height at dock bottom. Conditions, however, are so largely governed by the nature of the strata that every case has to be dealt with on its merits.

Dock walls are constructed of masonry, brickwork or concrete, or of concrete with a facing of masonry or brick. The bulk of recent dock wall building has been in concrete and, when suitable materials are available at or near the site of the works, concrete construction is usually cheaper than any other form. Where no extraordinary difficulty is to be apprehended the foundations for dock walls, below the level at which open excavation is practicable and economical, are excavated in a trench. The trench is lined with timbering for the support of the sides during excavation and, in bad ground and very deep trenches, timber sheet-piling or interlocked steel sheet piles are driven to form the sides. Examples of dock walls built in trenches are shown in figs. 6 and 8.

The walls of open basins are often constructed in the dry precisely like dock walls as in the case of some of the basins at Glasgow. They differ only from dock walls in being exposed to variations in the pressure at the back resulting from the lowering of the water-level in front. This feature is, indeed, shared to some extent by the walls round closed docks where the difference in the high water levels of springs and neaps is considerable. The walls, however, round basins in tideless seas, such as Marseilles, occasionally those inside harbours and docks, and especially quay walls along rivers, have to be constructed under water. If mass concrete walls are to be built in the dry some form of cofferdam is necessary when the site is covered by water and steel sheet piling is now commonly employed for the purpose of enclosing the area to be excavated.

Concrete Block Walls.—The simple expedient was adopted

long ago of constructing the quay walls, lining the basins formed in the sea at Marseilles, by depositing tiers of large concrete blocks on a rubble foundation, one on top of the other, till they reached sea level, and then building a solid masonry wall out of water on the top. This practice has been widely followed, particularly in Mediterranean ports (fig. 9) and the size of blocks employed has progressively increased. As far back as 1871, blocks

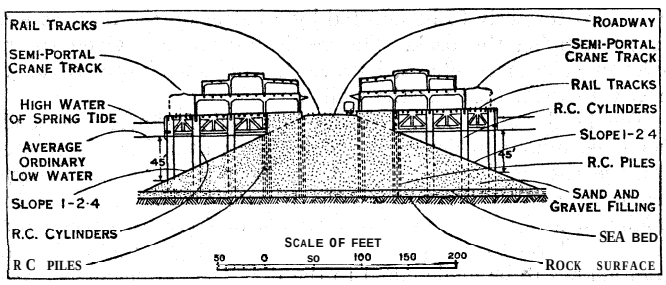


FIG. 18.— CROSS SECTION OF OUTER BERTHS. BALLANTYNE PIER, VANCOUVER

weighing 360 tons were used in the construction of a quay wall in the port of Dublin (see *Proc.* Inst. C E., 1876). Each block formed a complete section of the lower part of the wall and was lifted from the staging on which it was made and deposited under water by a floating derrick.

Recently quay walls have been built by Italian and French engineers with concrete blocks weighing up to about 400 tons set one above the other on a foundation of rubble or on a prepared rock bed (fig. 10). Both cellular and "cyclopean" (solid) blocks have been employed for this purpose. (See also BREAKWATER.)

Sloping blocks (see BREAKWATER) were used many years ago in the construction of a quay wall at Marmagoa, on the west coast of India, erected on a foundation layer of rubble, to provide against unequal settlement on the soft bottom. The system has often been employed since. Recent examples are the quay walls of Valparaiso and Kilindini (Mombassa) harbours.

Reinforced Concrete **Caissons.**—Since about 1905 reinforced concrete caissons with closed bottoms have been frequently used in the construction of quay walls (fig. 11). The caissons are constructed on shore, in a dry dock or in some position from which they can be launched into the water or lifted by a goliath crane and put afloat. When floated they are towed to the required position and sunk on a prepared bed of rubble stone or concrete. The cells of the caissons are then filled, usually with concrete, but in some cases stone or sand filling is used in the rear cells. Notable examples are the more recent quay walls at Marseilles In some cases caissons have been sunk on a prepared and levelled natural bottom, as at Heligoland and Dublin. Reinforced concrete caissons have also been used for quay wall construction at Rotterdam, where, in one case, the soft alluvial material on the site of the wall was dredged away down to a firm stratum of sand and the trench thus formed was filled with sand upon which, after it had been consolidated, the caissons, 138ft.x37ft. in plan, were founded. The depth of water in the berths in front of the wall is 33ft. at low water.

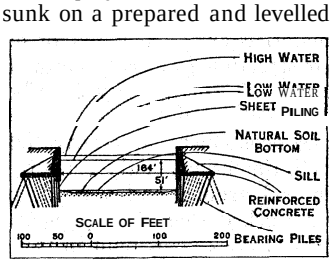


FIG. 19.—CROSS SECTION OF LOCK CHAMBER. YMUIDEN LOCK AT ENTRANCE TO AMSTERDAM SHIP CANAL

Well Monoliths.— It is sometimes necessary, even in positions where the whole of the dock walls are constructed in ground above water level or within an enclosing embankment or cofferdam, to have recourse to monolith sinking on account of the treacherous nature of the strata to be passed through. Monolith foundations are derived from the ancient Indian system of well sinking. They are built up generally on steel framed "curbs" provided with a cutting edge and gradually sunk by excavating inside, usually by grabbing. (See also CAISSON.)

Cylindrical well foundations were used for the construction of quay walls in the Clyde about 1870. Originally built of brick, but in later work of concrete, single cylinders were first employed placed side by side. Subsequently monoliths with three wells planned like a trefoil (fig. 12) were introduced on the Clyde and afterwards at other ports. Still later, monoliths rectangular in plan came into general use and some of these have as many as six wells. The rectangular multiple well monolith possesses the advantage over other forms in that any tendency to tilt from the vertical position can usually be corrected by excavating in one or other of the wells.

Monoliths were employed at Tilbury in building the walls of the main dock extension (fig. 13) and at Calcutta for the new docks (1928) where the soil is alluvial of a very soft character. At Rosyth some of the monoliths sunk for forming the outer walls of the dock were carried down to a depth of 121ft. below the coping before a sound foundation was reached (see *Proc.* Inst. C.E. 1927). When monoliths have been sunk to the required level the well spaces are sealed with concrete. In some cases the wells are entirely filled with concrete, in others sand filling is used above the concrete seal at the bottom. At Tilbury, Karachi and Southampton (1933–34), the front wells are only partially filled to reduce the intensity of pressure on the foundations at the toe of the wall.

Sinking by Compressed Air.— Compressed air has sometimes been used in sinking well monoliths, and frequently in bottomless caissons (*q.v.*) for carrying down the subaqueous foundations of quay walls, through alluvial deposits, to a solid stratum. About 1880 the building of a long line of river quays, extending out into the Scheldt, was commenced at Antwerp with the object of regulating the width of the river simultaneously with the provision of deep-water quays. The wall was built, out of water, on the flat tops of a series of wrought iron caissons, 82ft. long and 29½ft. wide, constructed on shore. These were floated out, one by one, between two barges and gradually lowered as the wall was built up inside a plate iron enclosure erected round the roof of the caisson. Each caisson was eventually sunk by aid of compressed air through the bed of the river to a compact stratum. An extension of the wall carried out in a somewhat similar manner was completed in 1903 (fig. 14).

A dry dock and quay walls constructed in the old harbour at Genoa about 1888, were founded under water in a similar manner by the aid of compressed air. Part of the Broomielaw quay at Glasgow was reconstructed about 1902 on steel caissons carried down by means of compressed air from 54 to 70ft. below quay level. A deep water tidal quay at Havre was built upon steel caissons about 141ft. long and 45ft. wide sunk by compressed air through about 57ft. of soil. The wall was constructed of masonry and concrete within temporary caissons raised upon the tops of the permanent caissons which terminate at the level of the dredged berth over 40ft. below low water (fig. 15). Compressed air has also been employed at Marseilles (fig. 11) for building quay wall foundations.

Quay Walls of Timber Crib Work.— In some North American ports, particularly where firm under water foundations are obtainable, walls have been built up to low water level of timber crib work, sunk in a previously dredged trench or on to a hard bottom, and then filled with rubble stone. Above low water mass concrete or masonry walls are raised in the dry on the crib foundation. Such quay walls are still being built at Montreal, St. John (N.B.), in some of the ports of the Great Lakes and at other places.

Quay Walls, Wharves and Piers on Piled Foundations.— In many cases where soft strata extend to considerable depths, river and basin quays have been constructed by building a comparatively light wall upon a series of bearing and raking piles driven into, and if possible through, the soft alluvium. Thus the older quay walls at Rouen were built upon bearing piles carried down through the alluvial bed of the river to the chalk. The lower portion of the wall was built of concrete and brickwork within water-tight timber caissons resting on the piles at a depth of 8 to 10ft. below low water.

The pier and wharf walls in the port of New York and other North American harbours are frequently built on bearing and

raking piles. These are some cases where the soft silt into which piles have been driven is so deep that no firm stratum could be reached and the supporting power of the piles has been increased by tipping large quantities of stone rubble and gravel around them before and after they were driven.

Many of the basin and quay walls at Bremen, Hamburg and other German ports are also built on bearing and raking piles, the wall being begun a few feet below low water. At Rotterdam timber piling in combination with fascine work was used for many of the older quay walls.

Reinforced concrete piles have been used in substitution of timber piles to an increasing extent since about 1900 for foundation piling under solid superstructure walls, but in waters where marine borers are not present as, for instance, at Amsterdam and Hamburg, timber is still employed and has a long life in positions where it is always submerged. Reinforced concrete is also widely used for building the superstructures of wharves (figs. 16–17) as well as for the piles on which they are built. At Madras piles 25in. square and over 7jft. in length were employed in building a deep water wharf completed in 1928. Substantial piers and wharves have been built by driving clusters of reinforced concrete piles inside cylinders of that material sunk below the dredged level of the berth. The spaces between the piles and the surrounding cylinders are filled in solid with concrete. In some cases cylinder foundations are sunk without piles. An example of this construction applied to the typical North American wide pier or jetty is seen in the Ballantyne pier at Vancouver (fig. 18), completed in 1923. It is 1,200ft. long, 341ft. wide, with a depth of water in the berths of 45ft. at low water. The hearting of the pier is formed of sand and gravel filling; the outer rows of columns are 7ft. diameter reinforced concrete cylinders and the inner rows clusters of piles. Economy in construction is sometimes obtained by forming sloping sides to part of a dock or river frontage in place of vertical quay walls. Jetties or open wharves of timber or reinforced concrete can be carried out across the slope, as at many coal-shipping ports; and the length of the slope projection into the dock is sometimes reduced by substituting sheet piling for a portion of the slope at the toe or at the upper part.

A type of open-work quay wall much used in Dutch and Scandinavian ports is shown in fig. 16. The example shown is built on timber piles, but in some cases reinforced concrete piles are used.

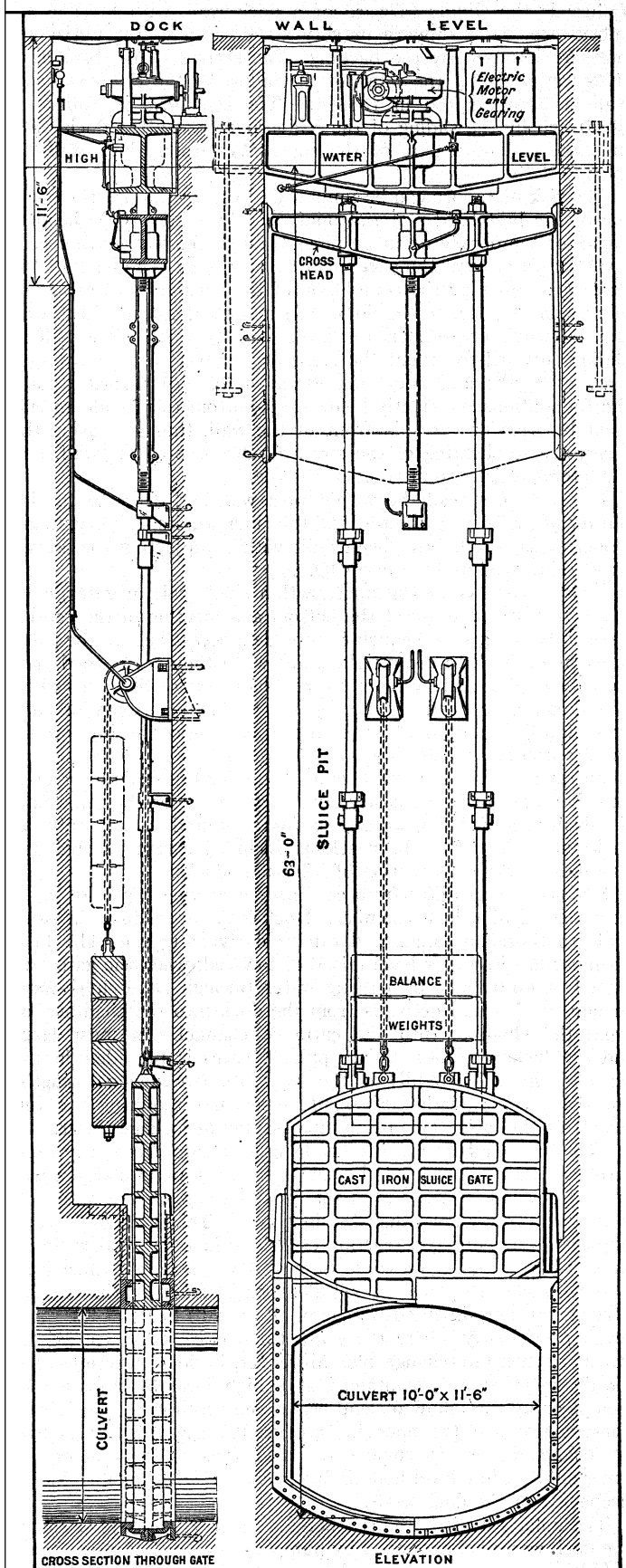
The Tilbury river jetty (fig. 5), completed in 1921, is an example of a cargo wharf in tidal waters where the spring tide range is 21ft. The design of this jetty is hardly typical as it is intended to deal with special conditions of part-cargo traffic.

In tropical ports materials for concrete construction, as well as skilled labour, are occasionally difficult to obtain and the use of timber for wharf construction may be unsuitable on account of the ravages of marine borers. These conditions exist, for instance, in some ports of East and West Africa and in them open work wharves and jetties have been built of mild steel completely fabricated in European or American works and sent overseas ready for erection. Screw piles are frequently used where the foundations are suitable, and timber is employed for the decking.

Reinforced concrete in wharves and jetties is liable to damage by vessels, and such damage is often more difficult and costly to repair than timber construction in similar positions. It is, therefore, important to provide substantial timber fendering on the face of such works.

Failure of **Dock** Walls.—Dock walls, especially before the admission of water into the dock, constitute high retaining walls. not infrequently founded upon soft or slippery strata, and backed up with excavated materials into which water is liable to percolate. Furthermore, when water is admitted to the dock there is always present the possibility of a large part of the mass of the wall being partially waterborne owing to the upward pressure of water under the base of the wall reducing the weight of the wall acting vertically. Thus dock walls may be exposed under unfavourable circumstances to the danger of failure (see Proc. Inst. C.E. cxxi., cxcv. and ccxiii.).

A dock wall founded on a soft bottom is liable to settle down at its toe, where the intensity of pressure is greatest, and to fall



BY COURTESY OF MESSRS. GLENFIELD AND KENNEDY, LTD.

FIG. 20.— SLUICE GATE AT CONGELLA DRY DOCK (DURBAN) OPERATED BY A 25 HORSE-POWER ELECTRIC MOTOR. THE TOTAL WATER PRESSURE ON THE SLUICE DOOR (EITHER SIDE) IS 170 TONS

forward. It is found, however, that the most common form of failure is the sliding forward of a dock wall, with little or no subsidence, on a slippery or silty stratum under the horizontal pressure imposed by the backing. The second of these alternatives was probably the cause of the failure of the Empress basin wall at Southampton in 1888–89 The last form of failure is illustrated by the sliding of the Kidderpur (Calcutta) dock walls in 1890, and of a part of the south West-India dock walls in 1870.

The risk of failure can be minimized by: (a) the use for backing of the best hard material unaffected by water; (b) the provision of temporary drainage pipes through the wall during construction to prevent the accumulation of water at the back of the wall; (c) deferring the completion of the backing until after the admission of water to the dock; (d) making the base of the wall slope downwards towards the back, thereby forcing the wall in sliding forward to mount the slope or to push forward a larger mass of earth; and, most important of all, (e) carrying down the foundations sufficiently below dock-bottom to provide an efficient buttress of earth in front of the wall, thus increasing the resistance to shearing of the strata at the base of the wall, and the lateral resistance in front of the toe.

In order to spread the weight of a wall and decrease the intensity of pressure at the toe. and thus increase its stability, many modern quay walls have been built with a projecting toe, sometimes reinforced by steel bars (fig. 8).

Gate Entrances. — Entrances with a single pair of gates, closing against a raised sill at the bottom and meeting in the centre, have to be made long enough to provide a recess behind the gates in each side wall to receive the gates when they are opened, and to form an abutment in front to bear the thrust of the gates when closed against a head of water in the dock. A masonry or concrete floor is laid on the bottom in continuation of the sill, serving as an apron against erosion.

Entrances have the advantage of occupying less room than locks and they are much less costly; but they are under the important disadvantage of being accessible for a limited period only on each tide. They have been seldom included except as auxiliary passages, in the construction of large new docks.

Locks. — Locks differ from entrances in having a pair of gates at each end of a lock chamber. Dock locks are similar in principle to those on canals and canalized rivers (*q.v.*). The lock chamber has its water level raised or lowered, when the gates are closed at both ends, by passing water through large sluice-ways or culverts in the side walls from the dock into the chamber, or from the chamber into the entrance channel. In most large modern locks an intermediate pair of gates is provided in the chamber in order to divide the lock into two unequal lengths for the accommodation of small vessels not requiring the full length of the lock. This results in a saving of lockage water.

The inner and outer sills of dock locks are frequently constructed at the same level; but at some ports, particularly where the tidal range is large, as in the Bristol Channel, the outer sill is laid at a lower level than the inner one. This effects an economy in the cost of construction especially in large modern locks designed to admit a vessel at or near low water, in which case it is necessary to place the sill at a considerable depth. On the other hand there is an advantage in all the sills being at the same level, particularly where there are three pairs of gates, as the gates are then interchangeable. Moreover, in docks where the enclosed water is not maintained at a high level by impounding pumps or by the inflow of land water, the depth in the dock, and consequently over the inner sill, is reduced at neap tides by the loss of lockage water. In some cases, also. the construction of the inner sill at a low level is desirable in view of the possible future deepening of the dock itself.

The inner sill of the King George V. lock (London), although the dock water is impounded by pumping at a level of $2\frac{1}{2}$ ft. above T.H.W., was constructed at the same level as the outer sill and about 10ft. deeper than the general surface of the dock bottom. The impounding at the King George V. dock is consequent on its being connected by a passage with the Albert dock. where the necessary increase in depth had been effected by this means. The Gladstone (Liverpool) lock sills are also all at the same level but. in this case, the level of the dock bottom is approximately the same as that of the sills and no provision is made for impounding. On the other hand, the inner sill at Rosyth is laid at dock bottom level or $13\frac{1}{3}$ ft. above the outer sill. The sills of intermediate gates are always placed at the same level as the outer sills.

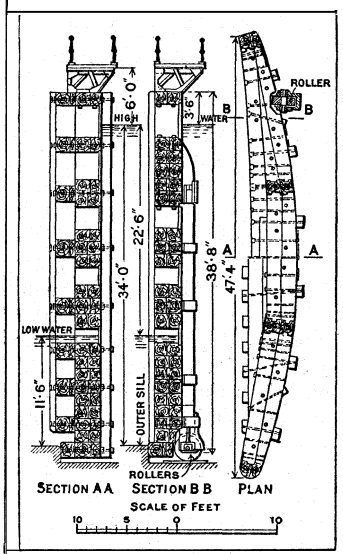


FIG. 21.—TIMBER DOCK GATES. ALEXANDRA DOCK. HULL

The foundations for the sills, side walls and invert or floor of a lock are generally constructed under shelter of a cofferdam across the entrance channel, and the excavations are kept dry by pumping. Under sills and the adjacent walls the foundations are usually carried down to a lower level than the rest and, if possible, to an impervious stratum, to prevent infiltration of water under them owing to the water pressure on the upper sides of the gates. Sometimes permanent sheet piling is driven across the lock site under the sills, and occasionally under the side walls also, to cut off the flow of water.

The sills, projecting about 2 or $2\frac{1}{2}$ ft. above the gate floor, and the hollow quoins are almost always constructed of granite, carefully dressed to a smooth and true surface. The hollow quoin is the vertical concave recess formed in the wall, in which the heelpost of the gate turns, and is exposed to considerable wear. Other parts of the lock structure are ordinarily built of concrete except the coping courses which also are frequently of granite.

The side walls of a lock chamber are very similar in construction to dock walls; but they are strengthened against the loss of water pressure in front of them, when the water is lowered in the chamber, by the floor or "invert" of the lock, usually built of concrete and sometimes constructed in the form of an inverted arch. This invert prevents any forward movement of a sidewall, the toe of which abuts against it. In some cases too it acts as an inverted arch and assists to resist any upward hydrostatic pressure under the floor when the lock water is run down. The side walls alongside the gates also abut against a thick level gate floor and apron and, moreover, are widened to provide space for the culverts, sluice pits and gate machinery.

A feature in the design of all modern locks and entrances, including those of dry docks, is the rectangular form of the entrance, approximating to the shape of the midship section of modern steamships. Most old entrances were constructed with inverted arch floors, the depth being greater in the centre than at the sides.

In situations where a lock has to be built in waterlogged alluvial strata of a soft nature it is sometimes necessary to sink concrete well monoliths in constructing the foundations: this has been done in building the locks at the King George dock, Calcutta and Tilbury (1928). Large caissons were employed for constructing, under compressed air, the foundations of the gate chambers, lock heads and portions of the side walls and floor of the Florida lock at Havre; *V. The Engineer*, 1908, *et* seq. A large lock at New Orleans, built in fine quicksand, is supported on 24,000 piles (see CANALS AND CASALIZED RIVERS.)

The entrance lock at Ymuiden, opened in 1930, is the largest in the world (see Table 1). It is a remarkable structure of reinforced concrete resting on piles of the same material. The lock has a floor of reinforced concrete under and near the caisson sills but in the main chamber the natural bed is left uncovered between the side walls the foundations of which are, however, sheet piled (fig. 19). The lock was built on fine waterlogged sand, the excavations being kept dry by rneans of the ring-well system of pumping In a few other instances, including one of the large locks at

Bremerhaven, an artificial floor has been dispensed with except at the ends of the lock chamber.

DOCK GATES, CAISSONS, ETC.

Sluice **Valves, etc.**—Valves or sluice gates in various forms are used for controlling the water levels in locks and docks. Valves were formerly, in some cases, built into the gates, but, as the volume of water to be dealt with grew larger it became usual to build culverts with controliing gates in the side walls of the lock or entrance. Gate sluices are, however, still used in some docks for the purpose of sluicing silt deposits from the sill apron. An oid form of sluice gate or "paddle," still largely employed, is constructed of timber, usually greenheart, and is raised and lowered over the culvert mouth in the sluice chamber by hand power or hydraulic gear. Cast iron gates faced with gun-metal and working against cast iron frames are often employed and these are usually operated by hydraulic or electric machines. A double faced sluice gate at the Congella dry dock, Durban, is illustrated in fig. 20 Balanced cylindrical sluice valves, in which the water flows between the bottom edge of a steel cylinder and its annular seating when the cylinder is raised, are used in some cases. Roller gate sluices of the Stoney pattern are frequently employed in large culverts as at the locks of the Panama canal; and "butterfly" or balanced flap sluice valves turning about a horizontal axis are occasionally used in culverts of moderate dimensions. Cylindrical and "butterfly" valves both possess the advantage, in that they are balanced, or in equilibrium so far as water pressure is concerned, of eliminating friction at the meeting surfaces. In roller sluices the friction is reduced to insignificant dimensions. All dock sluices operated by electric motors or hydraulic rams should be fitted with means for hand working when necessary Stop paddles for emergency use are often provided in secondary sluice pits

Dock Gates.—The entrances and locks at wet docks, and the entrances at dry docks are closed by either gates or caissons. Gates were formerly built of timber, greenheart being used very generally for that purpose in England. Until about 1915 practically all the gates at Liverpool were so constructed, even for such wide openings as 100ft. at the Canada lock. The difficulty of obtaining very large greenheart timbers, its high cost since the war, and the convenience and economy of steel construction have resulted in the almost universal use of mild steel for gate building. During the second half of the last century many gates were built of wrought iron until the general adoption of mild steel for structural purposes superseded it. In steel gates the heel post, *i.e.*, the vertical closing piece at the hinge end, the mitre post at the meeting end, and the sill piece or "clapping sill" which closes against the fixed sill of the gate chamber, are all usually built of greenheart or faced with it.

Wooden gates consist of a series of horizontal framed beams, made thicker and placed closer together towards the bottom to resist the water-pressure which increases with the depth. The beams are framed and fastened to the heel post and mitre post at the ends and there are usually intermediate uprights. On the inner face watertight planking is fixed (fig. 21).

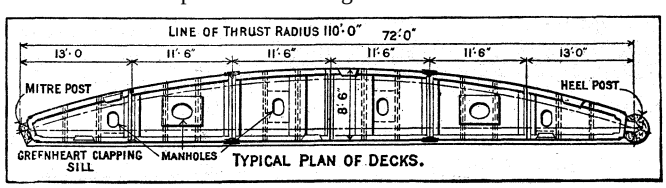


FIG 22A — ENTRANCE GATES OF GLADSTONE DOCK, LIVERPOOL

Steel gates have generally an outer as well as an inner skin of plating braced vertically and horizontally by steel plate ribs and girders. Steel gates have the important advantage over those built of timber in that they can be made with buoyancy chambers which relieve the gate anchorage at the head of the heel post of a great part of the horizontal stress, due to the weight of the gate, and the pivot support, at its foot, of all weight except so much as is necessary to prevent the gate floating out of its seating They are thus much easier to move in the water than wooden gates. On the other hand the latter are less likely to be seriously damaged if run into by a vessel. All anchorages and supports of a steel gate should, however, be made strong enough to sustain its weight in the event of the buoyancy chambers becoming waterlogged.

The adoption of the semi-buoyant type of steel gate, now generally employed in modern docks, has made it possible to dispense with the roller and roller path under the gate near the mitre post formerly provided to sustain the weight. These were always a source of trouble and anxiety and their use is now practically abandoned in new construction. The buoyancy of the gate is maintained at a practically constant value by constructing the watertight air or buoyancy chamber in the lower part of the gate, all the chambers formed by the skin plating above the watertight compartments being open on the outside face to the free flow of the tide. Thus, so long as the buoyancy chambers are submerged, the unbalanced weight remains practically unchanged whatever the depth of water may be. In this way the unfloated weight of the gate can be reduced to a few tons.

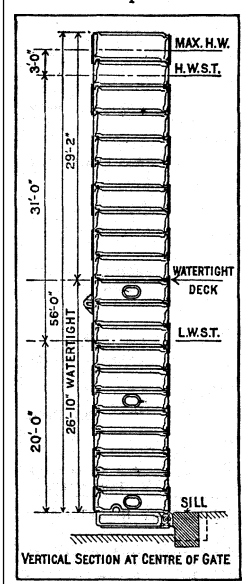


FIG. 22B.—VERTICAL SECTION OF ENTRANCE GATES, GLADSTONE DOCK

Formerly dock gates were sometimes made segmental in plan on both faces with the inner faces forming a continuous circular arc. It is now usual to make gates with perfectly straight faces on the sill side, the pressure or inside faces being either curved or polygonal. Fig. 22 illustrates one of the Gladstone lock gates with curved inner face which weighs 496 tons. The width of a gate leaf at its centre is usually made about $\frac{1}{8}$ of its length.

The pressures produced by a head of water against gates when closed depend not only on the form of the gates but also upon the projection given to the mitre of the sill in proportion to the width of the opening. This projection is called the "rise" of the gate and is usually about $\frac{1}{5}$ (more or less) the width of the opening. In straight gates, the stresses consist: first, of a transverse stress due to the water pressure against the gate; and, secondly, of a compressive stress along the gate, resulting from the pressure of the other gate against its meeting post. This pressure varies inversely with the rise. Though an increase in the rise reduces this stress, it increases the length of the gate and the transverse stress, and also the length of the chamber. By curving the gates, the transverse stress is reduced and the longitudinal compressive stress is augmented, till at last, when the gates form a horizontal segmental arch, the stresses become wholly compressive. The straight fronted and curved or straight backed gate now usually adopted is a compromise mainly dictated by practical considerations. Gates are, however, always designed so that the horizontal line of thrust falls within the skin plating.

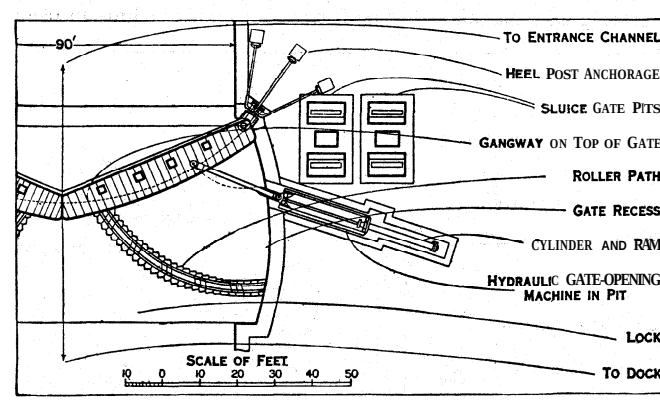


FIG. 23.— HALFPLAN OF GATES OF 90 FT. ENTRANCE LOCK AT CARDIFF DOCKS, SHOWING ROLLER PATH AND GATE OPENING MACHINE

Storm gates, pointing in the reverse direction to the impounding gates and placed outside them, are occasionally employed in entrances which are subjected at times to extraordinarily high tides, floods or strong wave action. Strut gates are auxiliary hinged and framed shores, housed at the back of the gate recess. They can be swung into position at the back of the impounding gates to support them against the pressure of waves at or about high

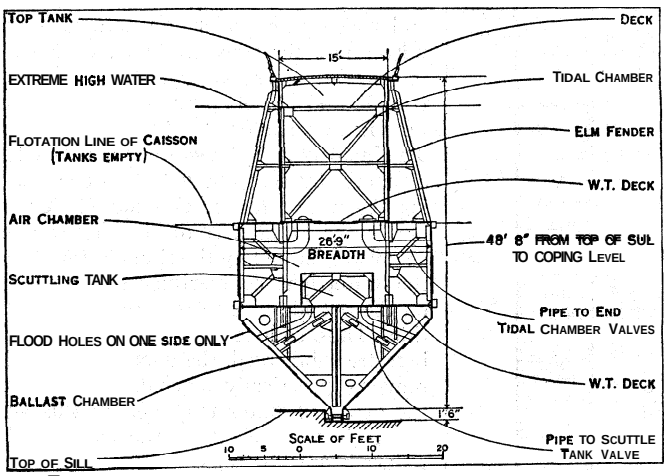


FIG. 24.— FLOATING CAISSON FOR EMERGENCY USE AT ROSYTH

water in exposed situations. Single leaf semi-buoyant gates, hinged on a horizontal axis below the level of the sill, have been used in some dry dock entrances. The gate is lowered into the water to open the entrance until it lies flat on a platform or apron outside and below the level of the sill. The train-ferry dock at Dover, opened in 1936, is provided with horizontally-hinged gates. As this is a wet dock and is designed to maintain the water surface inside the gates at a level which may be either higher or lower than the tidal water outside, there are two gates. one behind the other, capable of being lowered in opposite directions.

Gate Machinery.— The old practice was to attach two chains to each gate, hauled by hand winches or some form of power machine. Direct acting hydraulic rams, placed in covered pits just below the coping level of the lock, were first introduced about 1889 at the Barry docks. This system, in an improved form (fig. 23), has been widely adopted, particularly in Great Britain, and is still in general use. On the continent of Europe and in America electric power has been generally employed in recent years for operating gate machinery. One form of electric machine in use on the Panama canal consists of a large horizontal spur wheel linked, at one point on its circumference, to the gate by a connecting rod and rotated by an electric motor through gearing. In opening the gate the spur wheel turns through about a half circle. Another type used both in America and on the continent of Europe employs a connecting rod in the form of a rack which is engaged by worm gearing driven by an electric motor. In all these cases the operating machinery is placed in pits at the side of the lock.

Dock Caissons.—Caissons for closing the entrances of wet docks, dry docks and locks are constructed with buoyancy and ballast tanks so that, by means of valves and a pump or ejector fitted in the caisson, the weight of the contained water ballast can be varied at will for the purpose of floating or sinking the caisson or adjusting the unbalanced weight. Caissons are fitted with greenheart sill pieces and meeting faces which close against the granite faced sills and stops provided in the dock or lock entrance. They are of three general types: (a) floating caissons

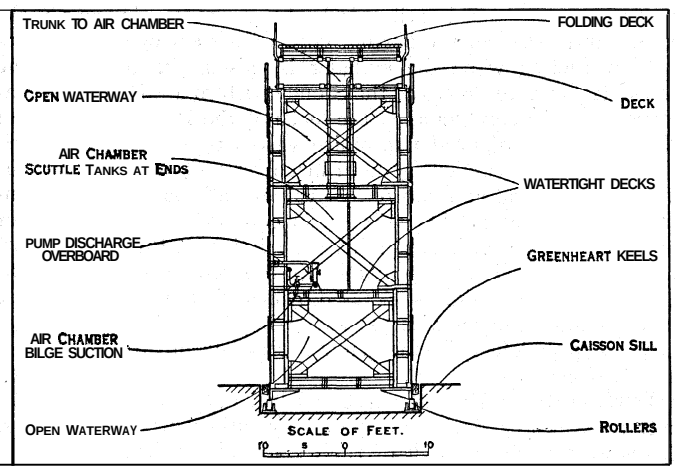


FIG. 25.— CROSS SECTION OF ROLLING CAISSON AT OUTER SILL, CONGELLA DRY DOCK, DURBAN

which are either ship form or rectangular and are moved without guides or rollers; (b) sliding caissons, provided with greenheart or other keel pieces which rest on sliding ways of smooth granite over which the caisson is drawn; and (c) rolling caissons, having wheels fixed to the under side on which they travel over rails laid on the floor of the entrance. In some cases the wheels or rollers are attached to the floor and the rails to the caisson.

The second and third types require a long recess or "camber"

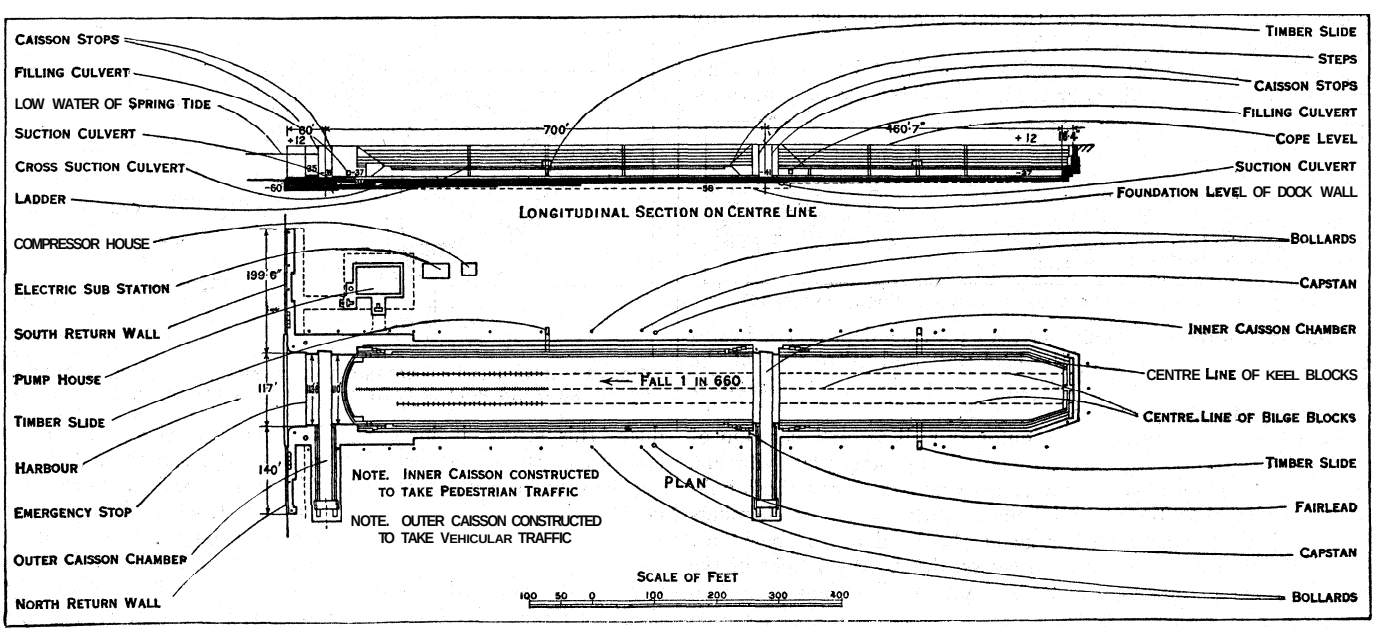
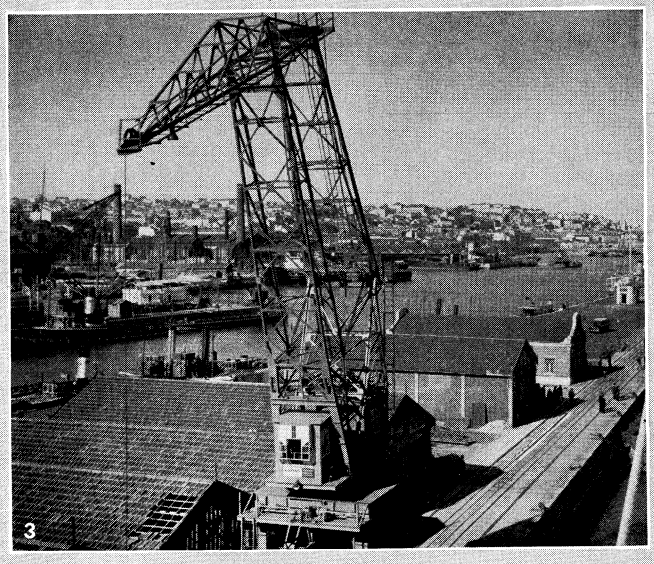
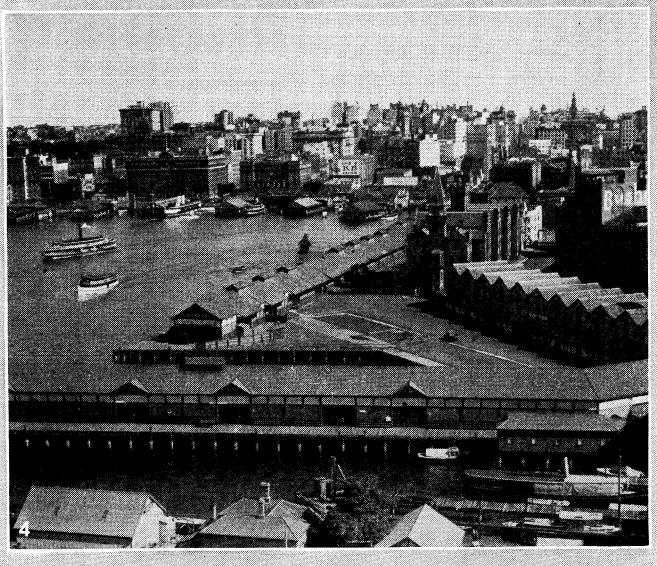
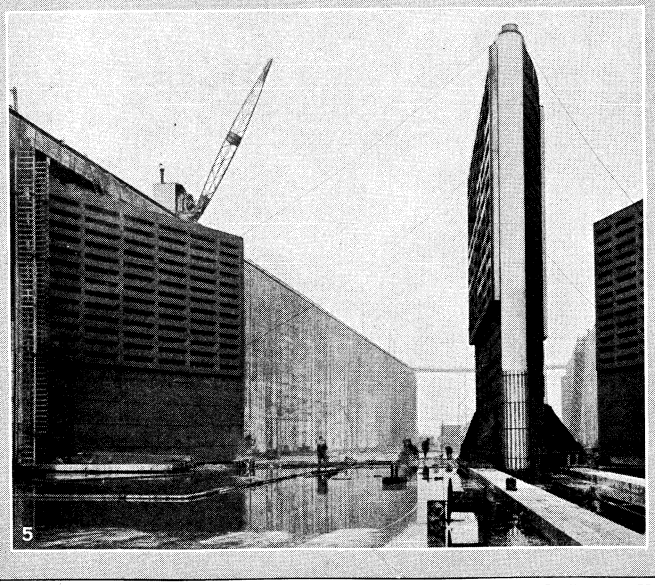


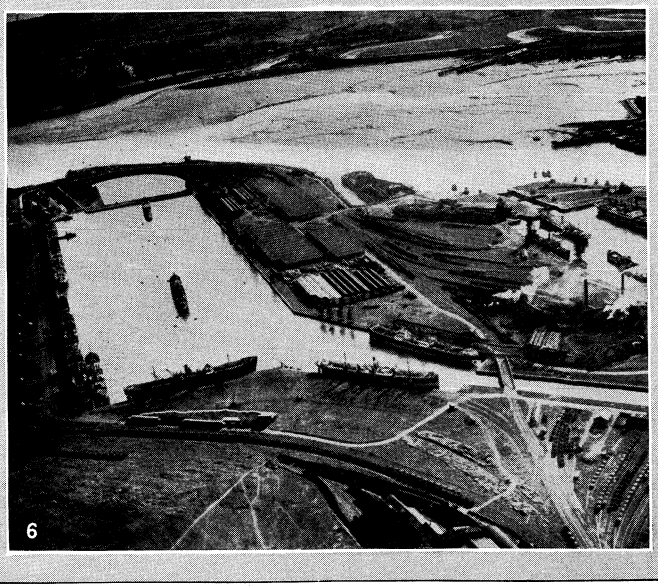
FIG. 26.— PLAN AND LONGITUDINAL SECTION OF CONOELLA DRY DOCK. DURBAN, 1925

DOCKS









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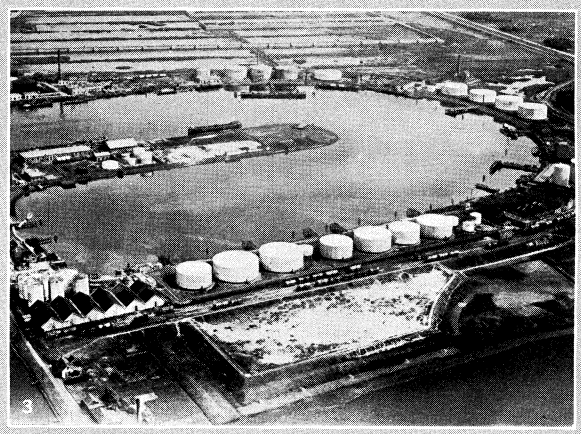
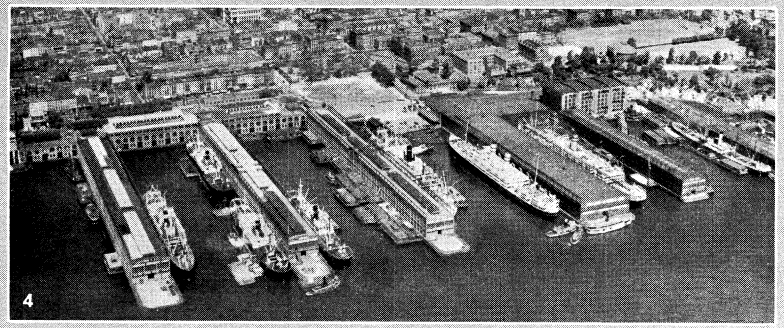
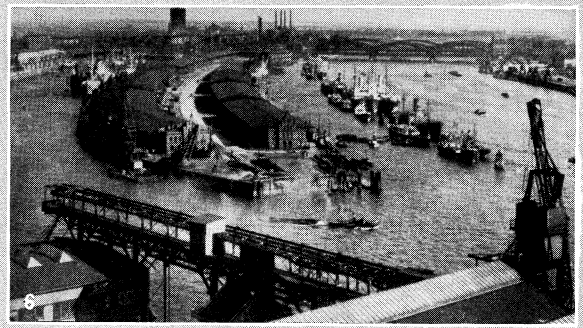
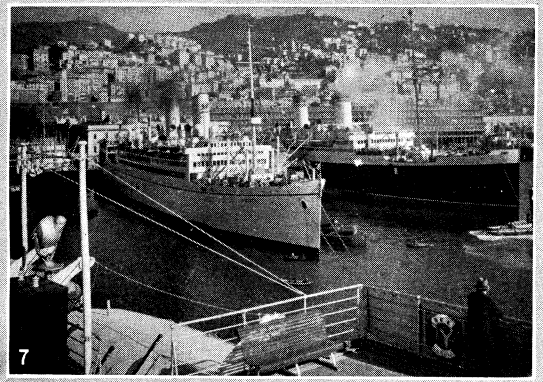
EUROPEAN, AMERICAN AND AUSTRALIAN DOCKS

1. Tilbury docks on the Thames below London
2. Marseilles docks, showing the southern basins looking north
3. The docks of Lisbon, on the Tagus river near the Atlantic
4. The quays at Sydney, Australia
5. Gladstone dock, Liverpool, lock gate 58 feet in height in course of erection
6. Docks at Cardiff, Wales









BY COURTESY OF (1) COMPAGNIE AÉRIENNE FRANÇAISE, (2) THE GREAT WESTERN RAILWAY, (3) K. L. M. HOLLAND, (4) THE U.S. AIR CORPS, (5) THE FAIRCHILD AERIAL SURVEYS; PHOTOGRAPHS, (6) EWING GALLOWAY, (7, 8) BURTON HOLMES FROM EWING GALLOWAY, (9) AEROFILMS, LTD.

DOCKS AT EUROPEAN AND AMERICAN PORTS

1. Docks at Algiers, showing breakwater in foreground. 2. Newport (Mon.), England, Alexandra South Dock, showing fixed hydraulic coaling hoists. 3. Petroleum Dock, Amsterdam, with safety gates at entrance on left. 4. Aerial view of Hudson River piers at Hoboken, New Jersey. 5. Aerial view of New York Harbour, showing East River piers. 6. Partial view of the docks at Hamburg, Germany, with the Elbe bridge in the background. These docks were severely damaged by air raids in World War II. 7. Docks of Genoa, Italy's principal seaport. 8. Cranes unloading a ship at the docks of London, heavily bombed in World War II. 9. Liverpool, England: view of Canada basin, lock and dock

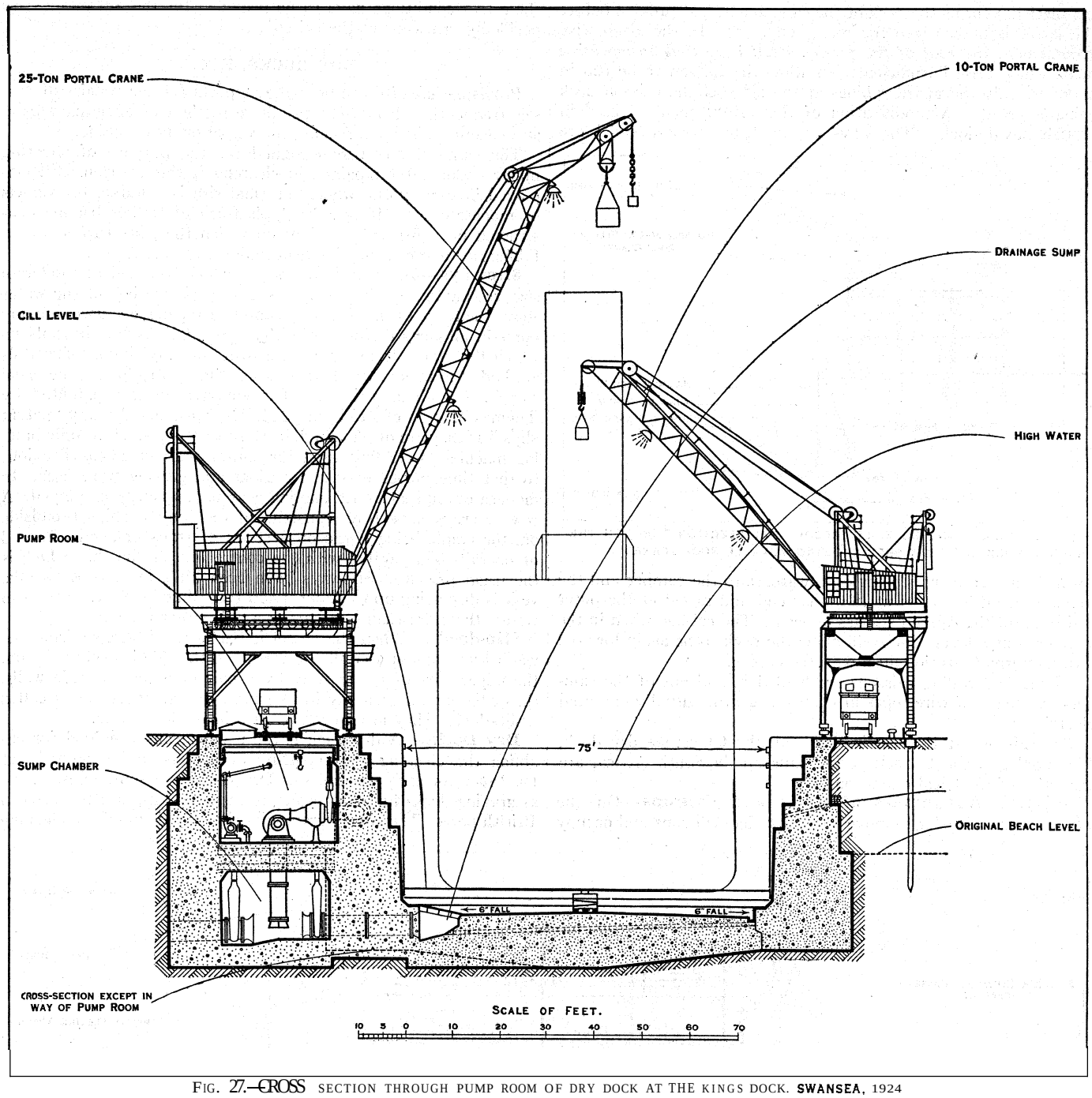


FIG. 27.—CROSS SECTION THROUGH PUMP ROOM OF DRY DOCK AT THE KINGS DOCK. SWANSEA, 1924

to be formed in the side of the entrance into which the caisson may be withdrawn when the passage is to be opened. In a few cases, *e.g.*, a dry dock at Dundee, floating caissons have been hinged at one end and arranged to swing out into a recess in the dock wall. Floating caissons are in use for closing many dry docks. They are often provided at wet docks for emergency use (fig. 24). A rolling caisson was used at the Garvel dry dock, Greenock, in 1874. Qthers are at the entrance lock of the Bruges ship canal, the Congella dry dock, Durban (1925) (fig. 25); the Kruisschans lock, Antwerp (1927); and the Ymuiden lock (1930). The caissons which close the combined lock and dry dock at St. Nazaire (1932) and the new locks at Bremerhaven (1931) and Dunkirk (building 1940), are supported on a submerged roller carriage at one end and slung at the camber end from an overhead roller carriage travelling on the side walls of the camber chamber.

For closing large dry docks sliding caissons have been adopted in many recent instances (see Table III.). They are employed less frequently in the case of wet docks and locks, but of this use there are, however, important examples. Thus, most of the recent naval wet dock entrances in Great Britain, including Rosyth and Portsmouth, are closed by sliding caissons as is also the 140ft. entrance, made in 1917, at Cammell Laird & Co.'s fitting out dock at Tranmere on the Mersey. Among commercial docks they are in use at Bremen and Bremerhaven, and at the Ramsden dock, Barrow. A recent example is the Calcutta lock (completed, 1929).

A floating caisson is occasionally made to draw back into a camber and in this form differs but slightly from a sliding caisson. The large dry dock at Havre (1927) is closed by a caisson of this type. Sliding or rolling caissons, although more costly than simple floating caissons, are more easily and rapidly moved.

In situations where it is necessary to provide for carrying a road or railway over a sliding or rolling caisson, one or other of two methods is usually adopted for effecting this. In the first the camber is covered by a fixed roof carrying the rail tracks, and a lower-

ing platform forms the deck of the caisson and is depressed before the latter is hauled into the recess (fig. 25). In the alternative arrangement the roof of the camber itself is carried on elevating jacks which raise it sufficiently to allow the caisson to be run in under it, only the guard railings at the sides of the caisson deck being lowered. A modification of this arrangement is used in British naval docks. The ways on which the caisson slides are

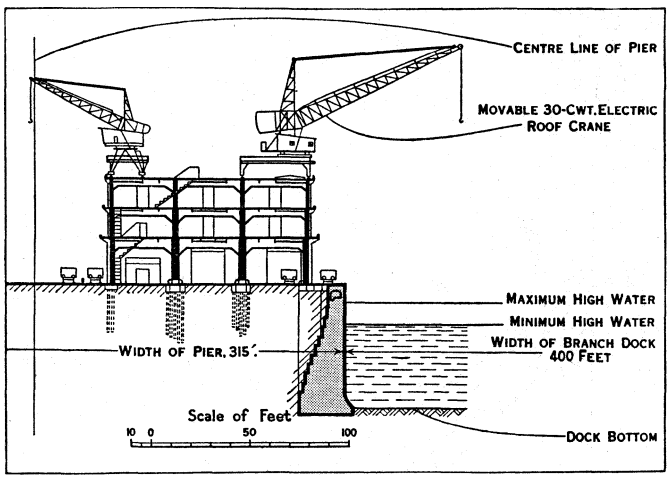


FIG. 28.— GLADSTONE DOCK. LIVERPOOL. HALF SECTION THROUGH THE BRANCH DOCK AND QUAY SHED SHOWING MOVABLE ROOF CRANES

formed on a gradient sloping downwards into the camber and the movable deck is hinged at the inner end and raised at the outer end to allow the caisson to pass under it. The caisson when in the camber is at a level which will allow the deck to be again lowered into its normal position flush with the coping.

Sliding and rolling caissons are hauled in and out of the cambers by means of wire ropes or chains or gearing usually operated electrically.

The caissons at Rosyth, in Scotland, the Gladstone dry dock, Liverpool and the Congella dock, Durban, in South Africa, are examples of electrical operation.

Relative Advantages of Gates and Caissons.--On the whole gates are easier to move and work than caissons and occupy less time in opening and closing. They necessitate a longer lock or entrance passage than caissons because of the space required for the gate recesses; but, on the other hand, a sliding or rolling caisson requires a long camber at the side of the entrance. Caissons are somewhat more costly than gates, but they can conveniently be made to afford accommodation for rail and road traffic across an entrance and thus obviate the necessity of a swing bridge in some cases. Moreover, they can be constructed to take water pressure on both sides, thus doing the work of two pairs of gates. An instance of this is the lock at Ymuiden. Where these two conditions have to be provided for the advantages are decidedly in favour of the caisson.

DRY DOCKS, ETC.

Provision has often to be made at ports for the repairs of vessels frequenting them. The primitive method of effecting repairs and cleaning was by careening the vessel or by beaching.

The simplest structure designed for the purpose of effecting minor under-water repairs and cleaning is the gridiron, still employed in some ports, where the tidal rise is suitable, for vessels of moderate size. It is a level platform of timber beams, constructed on a firm foundation, on which the ship settles with a falling tide and can then be inspected at low water.

Slipways.— Inclined slipways, up which a vessel of moderate size, resting in a cradle on wheels, can be drawn out of the water above the reach of the tide for cleaning or repairs, are used in many ports in all parts of the world. The foundations for the rails on which the cradle travels must be firm and unyielding. The rails are laid at gradients which vary from 1 in 15 to 1 in 25, the usual slope being about 1 in 20. The contrivance was patented by Thomas Morton of Leith, in 1818. He constructed many "patent slips," as they are often called, in European ports. Hydraulic hauling machines were first used for slipways about 1850. Previous to that time horses or steam engines and gearing were used. In modern examples electric hauling gear is frequently employed. A few slipways have been constructed to haul up ships broadside on, the cradle being borne on a series of transverse rails instead of on rails laid parallel with the centre line of the ship which is the usual practice. Slipways have been built in Europe to take vessels displacing up to about 4,500 tons; but in North American waters there are examples having a still larger capacity.

Slip-docks.— When the vessel is partially withdrawn from the water by means of a cradle on ways and the tide is excluded from the upper part of the slipway by a pair of gates and side walls, thus effecting an economy in its length, the arrangement is called a slip-dock. They are, however, rare in modern ports.

Dry Docks.—A dry dock is the usual means provided for enabling the cleaning and repairing of vessels to be carried out (v. supra for early examples). Dry docks are sometimes known as graving docks but the former term is now more often used in British ports. The word "graving" originally denoted the cleaning

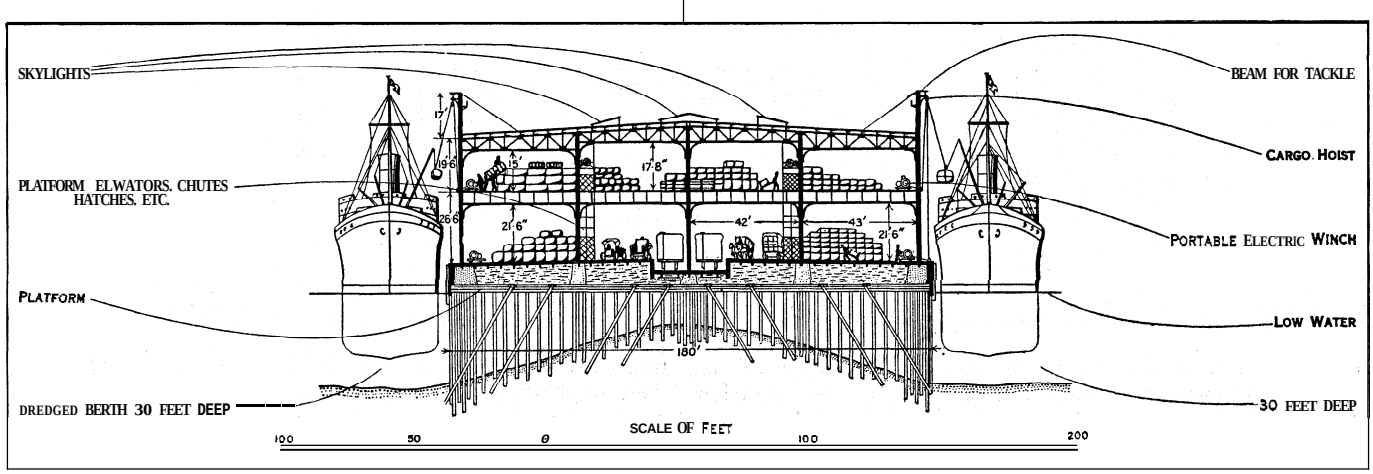


FIG. 29.— PLAN OF CARGO PIER, PHILADELPHIA, U.S.A. (1915), A TYPICAL PIER IN ATLANTIC PORTS OF THE U.S.A., SHOWING ARRANGEMENTS FOR "BURTONING" CARGO

of a ship's bottom by scraping or burning, and coating with tar.

A dry dock is a narrow basin, closed by gates or by a caisson, in which a vessel may be placed and from which the water may be pumped or let out, leaving the vessel dry and supported on blocks. A dry dock is sometimes used, especially in naval dockyards, for building ships. Many old dry docks were built of timber, and there are several such still in use in the port of London. In the United States timber dry docks are in common use even for large vessels. The typical modern dry dock, however, consists of concrete side walls, resembling those of a lock, but

stepped back towards the top, with a substantial concrete floor upon which the keel blocks, and sometimes bilge blocks also, rest (figs. 26 and 27). The floor usually has a slight fall from back to front, and from the centre to the sides, to facilitate drainage.

Dry docks should, for preierence, be founded on a solid impervious stratum, but this is not always possible. It is often impracticable to obviate the presence under the dock bottom of water which may exert a hydrostatic upward pressure when the dock is pumped out. Such conditions are usually met in one or other of two ways. The floor may be made comparatively thin with vents formed in it or low down in the side walls to relieve the pressure of the water which is allowed to leak into the dock and is dealt with by drainage pumps. The alternative is to make the dock floor and walls of sufficient weight and dimensions to resist the maximum pressure due to saturation of the surrounding soil. That is to say, the floor must act as an inverted arch and the whole body of the dock when empty must be of sufficient weight to resist the tendency to flotation. In bad ground and when the floor is thin, bearing piles are often driven under the dock floor in way of the keel blocks, and, in some cases, under the whole of the floor and side walls also. In any case the floor must be of sufficient strength to bear the weight of the heaviest ship which the dock can take in, concentrated on the lines of the supporting blocks. Thus far very few dry docks have been built of reinforced concrete, forming a rigid box, usually supported on piling.

A dry dock at Havre (see table III.), opened in 1927, is of particular interest on account of the method adopted for its construction on a deep stratum of sand and silt. The entire dock structure was built in and upon a huge steel caisson framework 1,132 x 197ft. which was floated into position over the site of the dock, previously dredged to the required depth, and there sunk in place. The caisson was constructed on levelled ground within a containing embankment and portions of the floor and side walls were built in it before it was floated out to the permanent site.

The stepped courses provided in the upper parts of the side walls of a dry dock are called "altars" and are used for the support of side shorks between them and the ship. Culverts, controlled by sluice gates (fig. 20), are built in the side walls of the entrance for flooding the dock when it is necessary to let a ship out. Centrifugal pumps—usually electrically driven in modern docks—are employed for pumping out the dock and maintaining effective drainage. The water flows to the pump sump chamber and from the pumps to the outside of the dry dock through culverts. (See figs. 26 and 27). In many old docks, in positions where the tidal range is suitable, water is run out as the tide falls; but in modern practice it is customary to provide for pumping out the whole of the water in about 3 hours—more or less.

In ports where the tidal rise is considerable and there are wet docks, it is preferable, when practicable, to construct a dry dock with its entrance from within the wet dock and not from the tideway. There are many advantages attending this arrangement: still water for manoeuvring the ship; availability for use at all states of the tide; and comparative freedom from siltation may be instanced. In situations where a dry dock is entered from tidal water of considerable range, it is desirable to provide for holding up the water inside the dock above the level of the falling tide in order that ample time shall always be available for shoring and other dock operations.

Equipment of Dry Docks.—The machinery employed at dry docks for working gates, caissons, sluices and capstans is generally on the same lines as for entrance locks. It is necessary, however, to equip a dry dock, in addition to the pumps already referred to, with powerful cranes, travelling along the dock side, to deal with the heavy lifts sometimes necessary in effecting ship repairs (see fig. 27). As an example of such provision the Trafalgar dry dock at Southampton has an electric travelling portal crane lifting 50 tons at a radius of 87ft. Most of the modern dry docks thus far constructed are also well equipped for working electric and compressed air tools.

Examples of Dry Docks.—The following table (III.) gives particulars of some typical large modern dry docks:—

TABLE 111.—Dry Docks

Port, name and date of opening	Available			Method of closing
	Length	Breadth	Depth over sills or blocks at H. W. O. S. T. or maximum dock level	
	ft.	ft.	ft.	
London, Tilbury, 1929	750	110	376	Floating ship-type caisson
Rosyth, H. M. Dockyard, 1915	890	105	40	Sliding caisson
Bombay, Hughes, 1914	1000	100	36¼	Floating calsson
Liverpool, Gladstone, 1913	1050	120	436	Sliding caisson
Boston, U.S.A., Navy, 1920	1170	120	43	Floating ship-type caisson
Esquimalt (Victoria), 1926	1150	125	40	do.
St. John (N. B.), 1923	1165	125	42	do.
Durban, Congella, 1925	1150	110	41	Rolling calsson
Havre, 1927	1023	125	52½	Floating box caisson
Panama Canal, Balboa, 1916	1044	110	41½	Gates
Singapore, King George VI., 1937	1000	130	44	Sliding caisson
Southampton, King George V. dock, 1933	1200	135	48½	Sliding calsson
St. Nazaire (combined lock and dry dock), 1932	1148	164	43½	Rolling caisson
Genoa (No. 4 dock), 1940	919	131	423	Floating caisson

Floating Docks.—Floating dry docks are used in some situations where there is no site available for an ordinary dry dock or where special conditions render the floating structure more convenient or economical. They possess the advantage of mobility and, during the World War, large floating docks were moved from ports where they were not urgently needed to places such as the Tyne and Cromarty firth where they could be more usefully employed. It is only necessary to find a sheltered site, with a sufficient depth of water, for conducting the operations of a floating dock. But, although a floating dock may be self-contained with workshops in its walls, or be served by a separate floating workshop, experience shows that to obtain the full advantage it is advisable to have an establishment on shore. This tends to restrict the choice of site. Furthermore, a floating dock can often be built and placed in service in a fraction of the time which would be necessary to construct an ordinary dry dock. The largest floating dock in the world (1940) is that at Southampton completed in 1924. It has an overall length of 860ft.; clear inside width of 130⅔ft.; and a total lifting power of 60,000 tons. The dock can be submerged to take in ships drawing 38ft., and the berth where it is moored is dredged to a depth of 61ft. at L W.O S T. It has docked some of the largest ships afloat (see *Proc.*, Inst.C.E. 192j).

Unfortunately the dredging of such deep pits below the general level of the harbour bed as are required in some situations for a floating dock of very large dimensions is sometimes followed by rapid silting and this has occurred at Southampton where redredging has been necessary at intervals of less than 2 years.

Another large floating dock of 50,000 tons lifting capacity was built on the Tyne in 1927–28 for the Singapore naval base. (See also section in this article Floating ***Docks.)***

NAVAL DOCKS

The dockyard at Rosyth, on the north side of the Firth of Forth, is the most modern example of naval dock construction in Great Britain. The works had been commenced in 1909 and,

although a large part of the accommodation was made available for the fleet by the summer of 1915, construction continued until 1921. The dockyard occupies a site on the foreshore of the Firth above the Forth bridge and comprises a closed basin or dock of 56½ac., an entrance lock, three dry docks, and tidal basins and in addition, there is a tidal entrance to the basin 115ft. wide at sill level (see Proc., Inst. C.E. 1927).

To meet the growing needs of the navy new locks and a dry dock with dimensions practically identical with those at Rosyth, were constructed at Portsmouth shortly before the war of 1914–18.

In the years following the war, many of the locks, dry docks and basin entrances at the naval dockyards of Devonport, Portsmouth and Chatham were enlarged. The naval base at Singapore, begun in 1928 and in its main features completed in 1938, includes over 6,000 lin.ft. of deep-water quayage in a tidal basin most of which has a depth of water alongside the walls of 40ft. at low water. The dry dock (see Table III.) has an entrance width of 130 feet. The dockyard also comprises a floating-dock and power stations, together with all the workshops, etc., necessary in a naval repair base. Occupying a site on the southern shore of the Johore Strait, it cost upwards of £11,000,000 excluding fortificationsand air defences.

THE EQUIPMENT OF DOCKS

Railways and Roads.—In order to deal expeditiously with the cargoes and goods brought into and despatched from docks, numerous sidings communicating with the railways of the district are arranged along the quays. In ports where a large railway traffic is dealt with it is necessary to provide, within or near the dock area, marshalling yards and standage sidings if congestion of traffic on the quays is to be avoided.

The "lay-out" of the railways in a dock area calls for much skill and ingenuity, both in planning and in the arrangement of gradients, to secure economical and rapid working. Moreover, in busy ports of modern construction it is usual to provide at least three lines of rails on those quays where goods are worked direct from ship to railway truck, or vice versa, and not through transit sheds. This arrangement allows two roads to be used for standing wagons while one is a running road. The growth of motor road transport has made it necessary to afford liberal accommodation for heavy lorries both on quays and at the side of transit sheds and warehouses, and the provision of adequate road access has become a matter of primary importance. The tendency in all modern dock construction is, in fact, to provide much wider quay spaces than was formerly the practice. Even in the port of New York where the old long, narrow pier is the characteristic feature of the quay accommodation, wide piers are now being built.

Warehouses, etc.—The arrangement and nature of store and transit sheds, warehouses, etc., varies at every port, depending largely on the local trade and traffic conditions. At Liverpool three-storey sheds with roof cranes have been built at the new Gladstone docks (fig. 28). At the Manchester docks there are large quay-side warehouses of five floors and in some North American ports transit sheds with as many as 8 and 9 floors. Where double sided piers and quays are constructed, widths of from 300 to over 500ft. are usual in order to provide ample space for sheds and warehouses which frequently have rail and road tracks on both sides. A typical example of such construction in northern Pacific ports is the Ballantyne pier at Vancouver (fig. 18). The piers at New York and in some of the other Atlantic ports of the United States are, however, usually built without open quay spaces on the water fronts. Often the transit sheds cover practically the whole surface, and roadways and rail tracks, when provided, are constructed inside the building. Piers with open quay-side spaces and rail tracks are, however, becoming more common in the Atlantic ports.

Appliances for Special Trades.—Elaborate and costly plants for loading, discharging and storing special classes of cargo have been established at ports in all parts of the world where such cargoes are dealt with in large quantities. Among them may be instanced coal, grain, ores and oil in bulk; and chilled meat and fruit. With the exception of coal all these classes of traffic may be said to be modern developments of transport, at any rate in regard to the working of bulk cargoes. The bulk shipment of wheat at such ports as Montreal, New York, Vancouver and Port Arthur has necessitated the building of vast granaries (*q.v.*) and elevators, some of them holding over 110,000 tons and capable of loading into ships at a rate of 3,000 tons per hour. For the discharge of grain pneumatic and bucket elevators and electric conveyors and large storage warehouses, the working of which is almost entirely automatic, are provided at many ports. Floating pneumatic elevators for discharging grain from ships into lighters or to shore granaries are largely employed. Appliances for the shipment and discharge of ores have been developed to a high standard of efficiency in some of the ports of the United States. Both in America and in European ports grabs and transporters are used for discharging ore cargoes. Mechanical handling is employed at docks where chilled and frozen meat is imported on a large scale, as in the port of London. Electric conveyors, runways and hoists carry the carcasses from the ship to the cold rooms in large stores at or near the quays with a minimum of manual labour (see REFRIGERATION AND ITS APPLICATION).

Oil Export and Import.—The transport of oil in bulk (see PETROLEUM) is a product of the 20th century. At all ports where tank steamers discharge, the oil berths are isolated and the arrangements for storage on shore must be such as to minimize the risk of fire and its spreading. The sea transport of petroleum in barrels is on a very small scale compared with bulk cargoes. The latter are loaded by being pumped from large storage tanks to the ship through mains.

Ports such as Los Angeles in California, Corpus Christi in Texas and Abadan in the Persian Gulf have been created since the beginning of the century for the shipment of bulk oil cargoes. Los Angeles has been made, as a port, since the opening of the Panama canal, and the bulk of its seaborne trade of over 21 million tons annually is the export of oil. According to official statistics it is the second port of the United States in point of tonnage.

Continuous quayage being unnecessary, the berths at which tankers load and discharge are usually alongside isolated jetties or dolphins connected with the shore by light piled structures on which the pipe mains are carried. Provision for the bunkering of ships using oil fuel is made at many ports, special oil jetties being set apart for this purpose.

In ports such as London, situated at a considerable distance from the mouth of a tidal river, oil berths are usually isolated in the lower reaches seaward of the dock areas. In some ports, however, this is not possible and at Stanlow, near Ellesmere, on the Manchester ship canal, a special petroleum dock, provided with a floating isolating gate or boom across the entrance, has been constructed with the object of preventing the flow of oil beyond the limits of the dock. Similar provision is made in other ports, *e.g.* at Amsterdam.

Coal Shipping Ports.—At docks whose principal export trade is coal, the arrangement of quays and berths is planned with special reference to the running of coal wagons to and from the shipping points. (For bunkering of ships see BUNKERING OF SHIPS.) In the ports of north-east. England high level coal "staiths" are much used, mainly on account of the high elevation of the ground in the neighbourhood of the shipping berths, as, for instance, on the river Tyne. At many high-level staiths such as those at Dunston on the Tyne and at Blyth, which are built parallel to the river bank, trains of wagons are brought on to the staith and discharged successively by means of shoots into vessels lying alongside. In situations where the elevation of the surrounding ground is insufficient to provide for gravity discharge from staiths to the hatchways of large modern vessels, hydraulic hoists (electric hoists are sometimes used in American and continental ports, but in Great Britain hydraulic hoists are very generally employed) are often provided, as in the docks of South Wales and Scotland as well as at north-east coast ports. Wagons are brought to the shipping points at quay level, or over a graded gantry structure raised sufficiently high above the quay t o avoid obstruction of the quay space,

The coal hoist is contained in a steel latticework tower erected on the dock side. The tower may be either fixed in position or capable of limited movement along the quay so as to suit the position of a ship's hatchway. The loaded wagon is raised on a cradle or platform to the required height for the discharge of the coal through adjustable steel shoots into the ship's hold. In some ports the practice is for wagons to discharge through bottom doors; in others the wagons are fitted with end doors and are tipped on a cradle in the hoist. The running of wagons to and from the staith or hoist is, wherever possible, assisted by suitable grading of the tracks. Empty wagons are sometimes run off from the hoist at a higher level than the loaded wagon roads and run by gravity to the empty sidings. Electric and hydraulic capstans are also used for working the wagons at shipping places.

Electric conveyors are much used in the shipment of coal, in some cases raising it from quay-level, as at Hull and Manchester. They are also used at some coal staiths in order to increase the height of the point of delivery of the coal. In this way they are employed at Dunston and other Tyne shipping places. Some of the modern coal shipping appliances in British ports, as at Newport, are capable of loading coal into a ship at the rate of 850 tons per hour and at elevations of over 75ft. above high water.

In a few English ports, including Liverpool and Cardiff, some coal is shipped by means of cranes lifting wagons or containers and emptying them over the ship's hatchway. At Goole *(see* CANALS AND CANALIZED RIVERS) small compartment boats containing coal are raised by hoists and discharged into the waiting ships.

The wharf or jetty on which the coaling staith or hoist is erected is frequently constructed over and in front of a stone pitched slope in order to avoid the necessity of building a continuous deep uater wall. This plan has been adopted at Swansea. Barry Dock, Newport and at many of the Tyne staiths. At the King's dock, Swansea, and at the King George dock, Hull, some of the coaling jetties are arranged en echelon; thus, in effect, increasing the length of available berthing space by permitting one vessel partially to overlap that of another in the adjoining berth.

Up to about 1910 the use in the United Kingdom of high capacity coal wagons carrying 20 tons was uncommon, the usual maximum load being 10 tons. The large wagon is, however, steadily replacing the older, uneconomical, small wagon at coal shipping ports. Practically all coal hoists, conveyors and other coal shipping appliances constructed in Great Britain since 1918 have been designed for the 20-ton wagon and a few wagons of 40-ton capacity are in use. Appliances to minimize the breakage of coal in falling from the shoot into the ship's hold, are commonly used at ports where grades, the value of which is seriously deteriorated by breakage, are shipped.

In America railway freight cars are of much larger capacity than in Europe and coal cars carrying up to 120 tons are in use. The shipment of coal is effected both by hoists and conveyor belts as in the United Kingdom, but the tipping arrangements provided for the cars are on a much larger scale; and it is customary to discharge them by means of revolving "tipplers" or "dumpers" into large hoppers whence the coal is delivered to the ship, either direct or over conveyor belts, through shoots as required. The large hoppers serve as reservoirs to equalize the rate of supply. In some cases the coal is dumped from railroad cars on the low level into very large pier cars which are raised by hoists and are tipped over hoppers at a high level. **A** coal shipping installation on the belt system, put into service at Baltimore in 1918 by the Baltimore and Ohio Railway, employs self-trimming loaders which shoot the coal at high velocity in any desired direction between decks. Somewhat similar mechanical trimmers are in daily use at the several other coal ports of the American continent.

By these means, in conjunction with highly developed arrangements for dumping cars and belt feeding, the rate of shipment of coal has been largely augmented. The Baltimore pier is double-sided, 700ft. long and has four main coal loading towers. Over 40.000 tons have been loaded at it in one day. The use of the American type of large coal cars and mechanical trimming enables ships to be loaded with coal at some of the best equipped U. S. A. ports more rapidly than in British ports where the time rate for a complete cargo does not often exceed 600 tons per hour and is usually less on account of delays in trimming the coal between decks. The best American shipping plants have, in this respect, an advantage of at least 50% over the Tyne and South Wales ports.

Power for Dock Machinery, **etc.**—Though different sources of power are sometimes made use of at different parts of the same port, it is generally most convenient to work the various installations by one form of power from a central station. This applies in particular to installations of dock-side cranes. The adaptability and flexibility of electric power has led to its general adoption, and its use for cranes and other mechanical appliances at docks has become almost universal. Even at numerous other important ports where hydraulic power is available at the docks, electric appliances are now being installed side by side with hydraulic equipment.

Hydraulic power for dock appliances is more commonly used in Great Britain than in American ports and on the continent of Europe. It possesses undoubted advantages for operating gate-opening machinery, large sluices, coal hoists, capstans, swing bridges and some other forms of dock equipment.

Appliances for Loading and Unloading Ships.—In addition to the provision of high speed electric cranes or cargo hoists on quays and wharves in most European and North American ports, the equipment of warehouses and transit sheds with electric "run about" and overhead cranes, runways, loaders, conveyors and hoists is becoming general.

In the Far East, however, even at ports handling a large volume of trade, this equipment is not general and cargo is still generally discharged by means of ships' derricks and dealt with on shore by manual labour. Again, in some ports, notably those of London, Rotterdam and Amsterdam, a large proportion of the cargoes is loaded or discharged overside from or into lighters and barges, and at Rotterdam sea-going ships lying at moorings in the river or basins frequently take in or discharge the whole of their cargo from or to large Rhine river barges without going alongside a quay.

The rapid loading and discharge of ships, thus enabling a quick "turn round" of the ship to be made, is of the utmost importance both to the ship owner and the dock authority. The capital sum represented by a modern cargo ship and a dock berth is very large, and if the average time of loading or discharge of a ship can be reduced from, say 4 to 2 days, by the installation of appropriate mechanical appliances, the revenue earning capacity of the berth is increased theoretically by 100%, and that of the ship in proportion to the reduction effected in the time required for the voyage.

' At quays working general cargo in busy ports a liberal but not extravagant provision of cranes is one for every 100 or 120 feet of quay. The traffic capacity of docks varies within very wide limits and depends largely on the nature of the principal exports and imports and on seasonal variations of traffic. In a well equipped port through which a large volume of mixed traffic passes, it is not too much to aim at a traffic intensity of 300 tons of cargo per foot of quay per annum. During the last 18 months of the war of 1914–18 the ports in northern France operated by the British army passed an import tonnage of well over 1 ton per day per foot of quay frontage.

Cranes.—Dockside cranes for general cargo purposes are frequently of the portal type, travelling on rails laid upon the quay with space between the legs (which carry the crane platform) for railway wagons to pass under. In some docks where warehouses are near to the face of the dock wall, travelling cranes of semi-portal type are employed: one pair of the crane legs travels on rails laid near the quay edge and the other pair on elevated rails fixed to the wall of the building. As a result this leaves nearly the whole quay space free for the passage of transport.

Cargo cranes must be raised high enough above the quay sur-

face to enable their jibs to command the hatchways of ships rising high above the water level. For general purposes cranes of 1½-, 3- and 5-ton lifting capacity are most commonly used, but for special purposes much more powerful travelling cranes are provided. Floating and fixed cranes of great capacity are employed for dealing with exceptional loads. Some floating cranes lifting 250 tons are in use and at least one fixed crane, that at the Philadelphia navy yard, is capable of lifting 350 tons.

Some modern dockside warehouses have been equipped with electric cranes travelling on the flat roof of the building and arranged to work cargo to and from the several floors of the warehouse through hatchways formed in them and in the roof as at the Gladstone docks, Liverpool.

In New York and some other ports of the United States, particularly on the Atlantic coast, quay-side cranes are in use to a limited extent only. The bulk of the working of general cargo is effected by a process called "Burtoning." This consists of the joint working of the load by means of a ship's derrick and a fixed cargo mast or hoist attached to the wall of the pier shed which is built out close to the water front.

Electric current for dockside cranes is taken either from conductors in conduits laid below the quay surface or fixed to the walls of quay-side buildings, or by means of flexible cables from plug boxes at points on the quay. (*See* also CRANES.)

Brief modern surveys of cargo handling at ports are the *Vernon-Harcourt Lectures,* Inst.C.E., 1928; H. A. Reed's *Cargo Handling;* and N. G. Gedye's *The Mechanical Handling of Coal at Ports* (1931).

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PIERS, WHARVES, AND DOCKS OF THE UNITED STATES

Waterborne commerce of the U S., which exceeds 500,000,000 short tons annually, is handled at ports on the Atlantic, Gulf, and Pacific coasts and on the Great Lakes, and at terminals on the rivers, canals, and connecting channels. A detailed description of port and harbour facilities at the principal ports of the United States is contained in Government publications called *Port Series,* which are prepared jointly by the Board of Engineers for Rivers and Harbors War Department, and the Division of Research, United States Maritime Commission. The piers wharves, and docks at typical United States ports, each having a combined foreign and domestic commerce exceeding 15,000,000 tons annually, are described in the following paragraphs:

The Port of New York.—New York, the most important seaport of the United States and among the foremost of the world, is on the Atlantic coast at the mouth of the Hudson river. The water front of the port of New York is extensively developed along the Hudson and East rivers, the Harlem river, Newtown creek, Gowanus bay and canal, and Upper New York bay. The west side of Arthur Kill, the Kill van Kull, and the Passaic river have also a considerable number of water terminal facilities. The port has a total of approximately 1,900 water terminal facilities, including piers, bulkhead wharves, ferry slips and railroad-car ferry transfer bridges.

The Hudson river on the New York side is the most intensely developed water front in the port area, being devoted almost entirely to shipping, with no large industrial sites. A great part of the passenger and express freight business of the port is handled in this section. The large express liners of the European trade, with turn-arounds as short as two days, cause considerable congestion on the marginal ways and on piers. The greater part of the Hudson river water front on the New Jersey side is devoted to railroad use. The East river has terminal facilities used in the West Indies and Mexican passenger and freight trade and in the coastwise trade It is the centre of the fish and shellfish business of the harbour. The Brooklyn navy yard, with four dry docks and extensive shipbuilding and repair facilities, is located on the Long Island side of East river. A large number of industries, including oil and sugar refineries, are established in this section Passenger and freight steamship lines from all ports of the world use the Long Island terminals. The city of New York has provided 12 piers, known as the Stapleton piers, which are modern in every respect. Five of these piers are included within the area occupied by the Foreign Trade zone. Other portions of the port of New York, such as the Kill van Kull, Passaic river. and Upper New York bay, have terminal facilities for the needs of oil companies, refineries, copper refining works, lumber yards, coal yards, and chemical, fertilizer, and asphalt plants and various other commercial establishments The State of New York has eight modern barge terminals conveniently located for shippers using the State Barge Canal system. The piers and wharves of the port are in general owned or used under lease by operators.

The Port of Boston.—Boston, Mass., is on the North Atlantic coast of the United States. There are 223 commercial piers or wharves in Boston harbour, providing 26 mi. of berthing space. The piers are mainly of open-pile construction and many have rail connections. Practically all of the terminals fronting on the main ship channel are in close proximity to storage warehouses, both cold and dry, which greatly facilitates the transfer of cargo. The water front of Boston harbour proper comprises 28 piers and wharves, with a total berthing space of nearly 20,000 linear feet. Eight of its more important terminals afford facilities for handling cargoes of the inland waterway carriers, and six are used in the foreign and coastwise trade. Many of the wharves have rail facilities.

At East Boston, five terminals are used for handling miscellaneous cargo in foreign and coastwise trade and six provide for the transfer of coal. There are also wharves and piers for handling lumber and fish and for marine repair activities. Chelsea creek. a branch of the harbour, is used primarily for the handling of petroleum products, several large oil plants having been established along this waterway. Among the 18 wharves on Mystic river one, owned by a railroad, consists of a large coal-handling plant having six steam travelling tower cranes and in the rear of the wharf a steam travelling bridge crane. The United States Navy yard, comprising 11 piers, is situated on the Charlestown water front. This section of the harbour has various commercial wharves used for handling miscellaneous cargo in foreign anc coastwise trade, and is equipped for handling grain. At South Boston the Commonwealth of Massachusetts has provided severa piers, one of which, constructed of steel and concrete is equippec with cargo beams and electric winches for thr handling of cargo

The Port of Philadelphia.— The water front of the port of Philadelphia, which is on the Delaware river 100mi. from the Atlantic ocean, covers a distance of 38mi. on the west side of the river between Hog island on the south and Poquessing creek on the north, and on both sides of the Schuylkill river, a tributary stream.

Within this area are 191 piers, wharves, and bulkheads, excluding those of the Navy yard, with a total berthing capacity of about 159,000 linear feet.

The wharfage facilities at the port vary from simple timber bulkheads with solid earth fill to the large piers constructed of timber piles supporting timber or concrete relieving platforms, at low water, which in turn carry timber or concrete retaining walls and solid fill. The ownership of terminal facilities at the port is divided as follows: city owned, 34; United States, 7; the several railroads own or control 66; while the remainder, or 84, are privately owned or operated. Of the total number, 39 facilities are open to all water carriers on equal terms and 152 are used for the private purposes of their occupants. Over one-half of the facilities have rail connections.

The Port of Baltimore.— At the port of Baltimore, which is on the middle Atlantic coast near the head of Chesapeake bay, there are 289 piers, wharves, and bulkheads having a combined berthing capacity of 211,000 linear feet. Facilities are available for accommodating all classes of vessels from the smallest to ships of 35-foot draught.

Practically all of the terminals used for general cargo shipping in overseas, coastwise, and bay traffic are on the Northwest branch of the Patapsco river, and within convenient access to the centre of the city. Piers for overseas traffic are generally of open-pile and timber construction, while a few have timber bearing platforms on timber piles to low water, covered by concrete retaining walls and earth fill.

Rail service is generally available, either on the aprons or within and in the rear of the transit sheds. Overseas freight is usually handled by means of cargo beams on transit sheds and ships' gear, though in some instances gantry cranes and other mechanical devices are utilized. Some of the large industrial plants, together with their terminals, are located in outlying sections of the water front, principally at Sparrows Point, at Fairfield, and on Curtis bay.

Ports in the Hampton Roads Area.— Norfolk, Portsmouth, Newport News, Hampton, and Old Point Comfort comprise the principal ports in the Hampton Roads area, which is on the middle Atlantic coast, at the entrance to Chesapeake bay. These ports have a combined total of 293 piers and wharves, with space of 175,000 linear feet for berthing vessels and transit shed areas of 4,458,000 square feet. Of this number the several railroads entering these ports own 74 facilities with 72,500 linear feet of berthing space. The United States own 28 piers and wharves with 27,000 linear feet of berthing space, steamship lines own 7 piers and wharves, the municipalities own 24, and private corporations and individuals own 159.

At Norfolk and Berkley, Va., there are 176 terminals having a combined berthing space of 107,000 linear feet. Privately owned terminals are used for shipbuilding and ship repair, by fertilizer plants, by sea food packing plants, and for the handling of petroleum products and farm produce. Portsmouth, including Pinners Point and West Norfolk, has a total of 54 piers, wharves, and docks with a total berthing space of 33,000 linear feet, owned by railroad companies, the United States, the municipality, and private concerns. There are 41 piers, wharves, and docks in Newport News.

The Port of Los Angeles.—Los Angeles harbour, Calif., is on the west coast of the United States. It consists of an outer harbour and an inner harbour, with a total water frontage of 25½mi., 55% of which is improved. Approximately 95% of the wharves, sheds, and port facilities open to the public are owned by the city of Los Angeles.

Of total wharfage, the city owns 44,582ft., three-fourths of which is of timber deck construction supported by creosoted timber piles, and the remainder is of composite concrete and timber construction, or has concrete decks supported by reinforced concrete piles. Private wharfage totals 21,900ft., nearly all of which is of timber construction. The city owns and operates 22 one-story and 2 two-story transit sheds totalling 16,000ft. in length.

All facilities are easily accessible by motor trucks over well-paved highways, and the majority are served by a belt line railroad which connects with the main railroad system and the electric interurban railway serving the port.

The Port of New Orleans.— New Orleans, La., is situated on both banks of the Mississippi river, 110mi. from the Gulf of Mexico. There are 100 piers, wharves, or docks at the port, practically all of which lie on the east bank of the Mississippi river. They are parallel to the river bank and form a continuous quay for a distance of approximately 10 miles.

Of the port facilities, 25 are used for handling general cargo in foreign trade. Various wharves are used for receiving molasses in bulk, for handling fuel oil, coal, cotton, and tropical fruit, or for miscellaneous and private purposes. The public wharves, which are controlled by a local port commission, cover 62% of the improved water front. These wharves are generally of open pile with timber and concrete deck construction, and the greater portion of the wharf area is covered by transit sheds of steel framework with corrugated metal walls. The aprons extending along the front of the wharves average from 20 to 30ft. in width. In the rear of the transit sheds a roadway built at car floor level furnishes a platform over which cargo is conveyed to the various rail lines either directly or by means of a public belt railroad.

Port Arthur.— The city of Port Arthur, Texas, is on Sabine lake at the head of Port Arthur canal, 20mi. from the Gulf of Mexico. The port has 11 wharves, all are of creosoted pile and timber construction except one which is of concrete. Five are used almost exclusively for handling petroleum products and the remainder is used for handling coal, lumber, general merchandise, grain, and cotton. A case oil dock, 600ft. long, has sheds constructed of concrete and tile, with two movable link-belt conveyors and gravity spiral chutes for loading cases directly into ships. One of the wharves used for handling fuel oil and products is of concrete construction, 3,000ft. long, with a depth alongside of 32 feet. At a terminal located at Sabine Pass, oil for storage is obtained by inland pipe lines and by vessels, and is loaded into tankers through pipe lines located on the wharf

The Port of Beaumont.— The harbour of Beaumont, Texas, which extends along the Neches river, 50mi. from the gulf, has 12 terminal facilities, and in addition the Neches river below Beaumont has nine facilities. The principal terminal development at the port is the municipal enterprise which comes under the jurisdiction of the local port commission. It has a total berthing space of 2,900ft. and handles practically all of the general shipping of the port. The terminal is made up of several wharves; some are of pile and timber construction, while others are of concrete bulkhead construction. There are transit sheds served by surface tracks on the wharf proper and additional tracks immediately in the rear of the sheds.

A terminal used for handling cargo oil and petroleum products, and as a fuel oil bunkering station, has a wharf 1,500ft. long of concrete quay wall construction. Terminal facilities below Beaumont harbour are all owned and operated by oil companies and are used principally for the receipt and shipment of crude and refined oil, and petroleum products.

The Port of Houston.— The port of Houston, Texas, is at the head of the Houston Ship channel, a deep-draught waterway extending 50mi. inland from the Gulf of Mexico. The port has 48 wharves, bulkheads and moorings used for commercial purposes, which provide berthing space for 58 seagoing vessels, 18 at the public wharves and 40 at private plants. Of the total number of terminals 19 are used for the handling of general merchandise and cotton, 14 for oil, and the remainder for steel, grain, bulk freight, miscellaneous commodities, and private purposes.

The principal terminal facilities are located at the turning basin within the city of Houston. Surrounding the basin are 13 public wharves, nine of which are of reinforced concrete construc-

tion and four of pile and timber, all but two having transit sheds and modern mechanical handling equipment. A public belt railroad with track scales serves all these facilities.

Below the turning basin the city of Houston has public wharves which are used for handling bulk cargoes of grain, coal, ore, sulphur, and oils. Additional terminals, operated by private corporations, are located along the ship channel and handle a considerable volume of the business of the port, especially in the shipping of cotton. A number of oil docks for the loading or discharge of tank vessels and barges or bunkering of vessels exist along the upper 2 j-mile reach of the ship channel.

The Port of Duluth-Superior.—Duluth-Superior harbour, Minnesota and Wisconsin, is a Great Lakes port at the head of Lake Superior. Terminal facilities at the port include 98 wharves. Of this number 10 are used for general merchandise, 21 for handling coal, 11 for handling grain, seven for handling ore, and four for sand and gravel. The remainder provide for the handling of forest products, rails, structural steel, salt, lime, cement, and other products, or for miscellaneous or private purposes. There are eight railroads and two switching lines connecting with the water terminals. Eight package freight wharves are railroad terminals and two are owned by individual companies, the latter having cold storage facilities for perishable goods.

The first ore-shipping docks on the Great Lakes were built in the early '70s, and the present docks in Duluth-Superior have been developed since then. The facilities for handling ore are most extensive. The total length of the seven ore docks, which are of modern concrete and steel construction, is 15,000ft., and the total storage capacity is over 800.000 tons. One of these modern ore docks is 2,438 ft. long, has a structural steel frame, and contains four tracks with necessary trestle approach. It is 84ft. high and has 384 pockets arranged in pairs. Operation is by electricity throughout. There are 21 coal docks at this port, all equipped with efficient mechanical means for handling coal. At the most modern docks, the unloading, stocking, repairing, reclaiming, and loading operations are performed with the electrically operated man-trolley type of travelling bridge crane.

The Port of Toledo.—The city of Toledo, situated at the mouth of the Maumee river at the westerly extremity of Lake Erie, is one of the most important bulk commodity ports of the Great Lakes. It has 46 piers, wharves, and docks operated mainly for the receipt of ore, for the shipment of coal, and for handling sand, gravel, grain, oil, and fish. A publicly owned wharf, leased as a general cargo and terminal warehouse, has mechanical handling facilities consisting of electric conveyors, and steam and electric cranes. Railroad companies own a number of wharves, many of which have modern equipment for the expeditious handling of cargo. One wharf, 900ft. long, is constructed of wooden piles with riprap fill. Privately owned wharves are used for handling iron ore, coal, oil, grain, cement, automobiles, and package freight. (J. L. S.)

FLOATING DOCKS

A floating dock is a steel, iron or timber floating construction designed to raise ships out of the water, that their under-water portions may be inspected and, if need be, painted or repaired. The earliest known form was evolved by an English captain during the reign of Peter the Great in the harbour of Cronstadt. His ship being in need of repairs, and no facilities being available, he bought an old hulk which he gutted completely, and fitted with a watertight gate at the stern. He then berthed his ship inside the hollow shell thus formed and, after closing the gate, pumped out the water remaining inside. He was thus able to repair his own ship in the dry. This type of dock continued in use for the next 150 years, and is known as a "camel" dock, from the name of the Cronstadt hulk.

The first obvious improvement was to construct a dock specially for the purpose instead of utilizing a hulk. A dock of essentially this type was built by Christopher Watson in 1785 at Rotherhithe. The useful life of timber docks is surprisingly long. An engraving of this dock was made, dated 1829, or no less than 44 years after the dock was built, and it is not known how many years of life the dock had after it was first built and used.

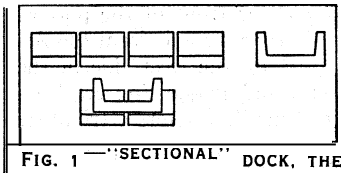

FIG. 1.—"SECTIONAL" DOCK, THE EARLIEST OF THE SELF-DOCKING TYPE. MADE UP OF INDIVIDUAL SECTIONS. CHAINED TOGETHER

The next step in the evolution of the modern floating dock was to make the walls and bottom hollow, and thus buoyant. As early as 1809 a patent was taken out for a hollow iron dock, but there the matter rested for many years. The first hollow docks were constructed of timber in the United States, the earliest of any note being that in the navy yard at Portsmouth, Maine, which was built in 1848. These early timber docks suffered from the fact that they would not readily sink low enough to allow a ship to enter them. The walls therefore were fitted with a deck inside them above the normal water line forming chambers into which water could be pumped in addition to the amount which could flow in by gravity, thus overcoming the natural buoyancy of the timber. This drawback ceased to exist when iron was substituted for wood in the construction of the hull, but the same system of pumping water into the walls was followed for some years.

In 1866 iron docks began to be freely built from the designs of George Banks Rennie, James Campbell and others, which were worked at Cartagena, Saigon, Callao, Bermuda and other places. The most notable of these was Campbell's dock at Bermuda, then and for many years the largest floating dock in the world. It had a length of 381ft. and a lifting power of 10.000 tons, and was in use up to the year 1905. In addition to the buoyancy due to the fact that the structure of the dock was hollow, further lifting power was obtained by means of gates, which could be put in place at each end when the ship was partly lifted, water being pumped out from the space between them exactly as was done in the very earliest type of floating dock.

In 1876 a new problem in docking ships was presented by the construction of Admiral Popoff's circular ironclads in the Black sea. The diameter of the largest of these was 120ft., and no dock in the world had a width of entrance enough to admit a vessel of such beam. This problem was solved by Clark and Standfield, who devised a floating dock with only one side, the loss of stability entailed by the absence of the other side being compensated for by a floating outrigger attached to the dock by two sets of hinged parallel arms This was called a "depositing" dock. The pontoon or horizontal portion of the dock, upon which the ship rested, instead of being a continuous platform, consisted of a series of fingers with a space of jft. between them, each finger being 72ft. long. By detaching some of these from the wall of the dock and attaching them to the ends of others, a platform 144ft. wide could be made, and upon this the circular ironclads were lifted. A staging had been built along the shore, with the spacing of the grids corresponding to the distance between the fingers of the dock, so that by towing the dock with the ship on it sideways to the staging the fingers and the grids were interlaced. If then the dock was lowered, the ship mas deposited on the staging, and the dock was free to be towed away to lift another ship and deposit it on a further length of staging. Examples of these depositing docks are still to be found at Nicolaieff, Vladivostok, Barcelona and Kobe. The dock at Kobe was built principally for dealing with immense monoliths of reinforced concrete. which were built on the staging, lifted off by the dock, and towed away to the site of the quay wall, where they were sunk in position, thus allowing the quay wall to be built of blocks weighing upwards of 6.000 tons. An outcome of the depositing dock was the "off-shore." This is also a single-sided dock, but the pontoon is a continuous structure, and the floating outrigger is replaced by braced vertical columns on shore. Many of these docks have been built, most of them being very rapid in operation.

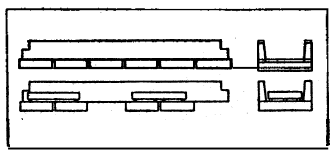

FIG. 2.—SECTIONAL PONTOON DOCK WHICH HAS THE WALLS, DOCK AND PONTOON CONTINUOUS. THUS LESSENING POSSIBILITY OF BREAKAGE

The most common type of floating dock is the double-sided dock, of which there are many kinds distinguished by the means

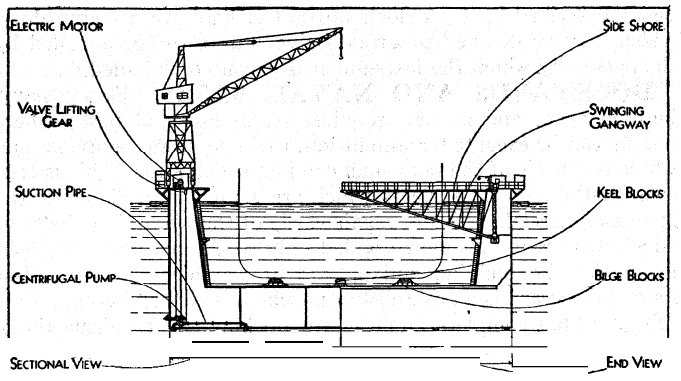

FIG. 3.—END AND SECTIONAL VIEWS OF THE SOUTHAMPTON DOCK. SHOWING MACHINERY, BOOMS, ONE OF TWO CRANES AND GANGWAYS

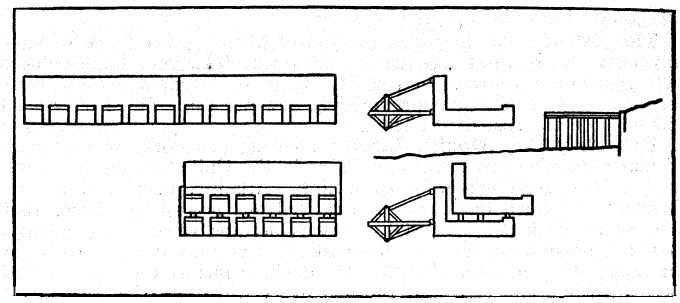

FIG. 4.— DEPOSITING DOCK OR "SECTIONAL BOX," THE STRONGEST TYPE OF DOCK. ABLE TO WITHSTAND GREAT FORCE AND STRAIN BY MEANS OF THE BOLTED AND RIVETED JOINTS WHICH JOIN THE SECTIONS

employed to arrange them for self-docking. It is obvious that a floating iron or steel structure must from time to time be got out of the water for repainting if its life is to be prolonged. As a rule a floating dock is too wide to go into any other dock, even if such be available, so all but the very smallest are designed to be able to lift each portion of themselves out of the water in turn.

Self-docking Docks.—The earliest of the self-docking docks was the "sectional." In this case the dock was built of a number of separate and independent sections which were held together generally by chains, the length of each section being such that it could be turned sideways and lifted by two other sections. This system has the drawback that it has no longitudinal strength, and the risk of straining the ship by uneven pumping is considerable. Accidents have occurred due to the breaking of the connections between the different sections.

A much better form, generally known by the name of its inventor as the "Rennie" or "sectional pontoon" dock, has the walls continuous, thus forming a stiff girder the whole length of the dock, and the pontoon divided up as in the case of the "sectional" dock, the joint between the walls and pontoons being horizontal. This type of dock has been built to take ships up to 25,000 tons, but it is better adapted for smaller sizes, more particularly if they have to be towed across the ocean to their final destination.

The strongest and at the same time the lightest form of self-docking dock is known as the "sectional box." This was evolved also by Clark and Standfield, and is the type used by them for the 60,000-ton dock at Southampton, which was built to take the largest Atlantic liners as well as battleships. It is similar to the "sectional" dock, but the sections are attached together all round their complete profile by bolted joints below the water line and riveted joints with butt covers above it. Thus the dock forms one continuous whole, with very great longitudinal strength to withstand the stresses set up in the structure during the operation of docking a ship, or the much greater stresses which may occur during an ocean voyage. When it is required to self-dock, the joints between the sections are unmade, and the sections successively lifted upon the rest of the dock.

The self-docking of a single-sided dock is very simple. There is a transverse joint at the centre of its length which when unmade enables one half to be lifted, so to speak, onto the lap of the other.

General **Description.**—A typical modern floating dock may be said to be a large rectangular hollow steel trough. The principal functions of the vertical sides of the trough, which form the walls of the dock, are to give stability to the dock when it is being worked without a ship on it, to contain the machinery required to lift the ship, to form platforms from which to berth the ship, and to give longitudinal strength. The horizontal portion of the trough, or pontoon, forms the platform upon which the ship rests, and provides the buoyancy which lifts the ship out of the water. The pontoon is extensively subdivided by watertight bulkheads to ensure stability, and the walls are also divided, but to a lesser extent.

The underlying principle upon which the working of a floating dock depends is that if, say, a ton is removed from a floating structure, that structure exerts an upward pressure of one ton. The main machinery of a floating dock, therefore, consists of a number of centrifugal pumps placed as low down as possible in the pontoon, and worked by steam, electric or other prime movers, situated on the top of the walls; and it is the throwing out of the water by these pumps which causes the ship gradually to emerge from the sea. In order that the ship may be kept level, each subdivision of the dock has separate suction pipes and valves, all the rods actuating the valves being brought together in the valve-house.

Fig. 3 represents two views of the Southampton floating dock, one seen from the end and the other as the dock would appear if cut in two. The arrangement of the machinery can be clearly seen in the left-hand view. In the motor house on the top deck is shown an electric motor, which by means of a vertical shaft drives a centrifugal pump seated on a cast-iron pipe running the full length of the dock. Branching from this pipe are other pipes leading to different watertight compartments. The water flowing through these branch pipes is, as shown in the drawing, regulated by a valve, the rod actuating this being carried nearly to the top of the wall, where it is attached to a pneumatic press by which it is worked. The admission of air to these presses is electrically controlled from the valve-house. In the Southampton dock there are 56 of these compartment valves, and 14 electrically driven pumps. On the top of one of the motor houses is the valve-house, from which all the machinery of the dock—valves and motors—is operated, so that the dockmaster can perform the whole operation of lifting a ship without leaving his post. The side-shores are shown touching the sides of the vessel; they consist of lattice girders which can be moved in and out electrically, and are geared together across the dock. When they are pushed home as shown in the drawing it is known that the ship is accurately in the centre of the dock. In order to lift materials on and off the dock or ship, there is an electrically driven travelling crane on the top of each wall, only one being shown in the drawing for the sake of clearness. This dock is moored to the shore by means of a series of booms hinged at each end, attached at intervals to the back of the dock and to dolphins respectively, end-long movement being prevented by fore and aft chain cables. The top of one of these booms is decked and fitted with hand-rails, to serve as a means of communication between the shore and deck of the dock.

The following operations are performed in lifting of a ship on a floating dock:—(I) Water is admitted to the interior of the dock until it is sufficiently deeply sunk to allow the ship to be brought in; (2) the ship is brought in and centred; (3) water is pumped out of the dock until it is bearing firmly on the keel of the ship; (4) the bilge-blocks or side supports are put in place under the bottom of the ship to keep her steady; (5) water is pumped out of the dock until the deck is above sea level.

The life of a floating dock depends very largely upon the amount of care which is bestowed upon it, but in general a life of from 40 to 50 years may be looked for.

Floating docks are constructed of all sizes according to the requirements of the port where they are to be worked; from 300 tons lifting power up to 60,000 tons were the limits in 1928, but if ships increase in size there is no physical or economic reason why floating docks should not do likewise. At the beginning of 1928 nine floating docks were in existence capable of lifting ships

of 30,000 tons and upwards.

The cost of a floating dock per ton of lifting power tends to vary inversely as the total capacity of the dock. The very largest docks will cost about £6–10s. per ton of ship to be lifted, whereas a dock of 1,000 tons will cost approximately £22 per ton. These figures do not include the cost of dredging. (S. F. S.)

Floating **Dry Docks, U.S.A.** Floating dry docks present particular advantages to naval operations in the United States and territories. The great extent of coast lines—Atlantic, Pacific, Gulf, and insular—on which operations are carried out necessitates docks that can be conveniently located for vessels needing repairs. Frequently, it is not possible or desirable to construct a graving dock in a distant harbour. Also, it is possible that the docking facilities are not needed permanently. The ease and rapidity with which floating dry docks can be constructed, the ability to transfer them from port to port, and their adaptability to localities where graving docks cannot be constructed give them an importance that cannot be disregarded.

American experience with floating dry docks began in 1816 when a patent was granted to J. Adamson. This Adamson dock consisted simply of a float with vertical sides. Such docks were built of wood and in one piece until 1837 when J. Thomas began building them in sections. The Thomas patent shows the first conception of distinctly separate sponsons and coupling logs, which are the essential features of a sectional dry dock. Side wings were added by W. Thomas in 1854. These wings made the dock independent of guides on the shore, and produced the general appearance of the floating dry dock that is kno n today.

Although floating docks had been in use since J. Adamson obtained his patent, it was not until 1899 that construction was started on the first large dock for the U.S. Navy. This dock was built by the Maryland Steel Company at Sparrows Point, Md.. for the Naval Station at Algiers, Louisiana. The overall length is 52jft. and the breadth between fenders on walls is 100 feet. The lifting capacity is 15,000 tons when the deck is 2ft. out of water, and 18,000 tons when the deck is awash. The maximum draught of vessels that can be handled by the dock is 30 feet. Upon completion of the structure, it was towed to Algiers, La., where acceptance tests were made.

An outstanding example of the movability of floating docks occurred in the transport of the dry dock "Dewey" to its home station. The "Dewey," completed by the Maryland Steel Company at Sparrows Point, Md., in 1905, is jooft. long with a breadth between fenders on walls of 100 feet It is capable of handling vessels of 30ft. draught and has a total lifting capacity of 16,000 tons, with 2ft. free-board. Upon completion of acceptance tests, in 1906 the dock was towed across the Atlantic ocean, through the Mediterranean sea, Suez canal, Red sea, Indian ocean, and South China sea to its home station at Olongapo, Subig bay, Philippine islands. The total time required for the journey was 150 days.

Floating dry docks are common equipment for shipbuilders' yards. One of the earlier large docks was constructed in 1915 by the Bethlehem Shipbuilding Corporation at Sparrows Point, Maryland. The dock is 480ft. long with 90ft. between fenders on walls and has a lifting capacity of 20,000 tons. This same company, in 1920, had a fleet of four floating docks at the Potrero Works on the Pacific coast.

Sizes and capacities of these docks were:

No. 2 270ft. long, 66ft. inside width, 2,000 ton capacity;
No. 3 301ft. long, 68ft. inside width, 2,500 ton capacity;
No. 4 450ft. long, Soft. inside width, 6,500 ton capacity;
No. 5 420ft. long, 90ft. inside width, 12,000 ton capacity;

A typical modern floating dry dock is that of the Todd Seattle Drydocks, Inc., which went into operation about 1937. This new 16,000 ton dock is equipped with dual control stations which permit the operator to raise or lower any section of the dock from a commanding position on the wharf, or from a control house located on one side of the wharf out of the way of cranes and locomotives.

The new dock is 531ft. long and 128ft. wide, with a width of 85ft. at the coping. It is comprised of five equal sections, each of which is a complete dry dock.

Each unit is constructed of northwest fir timber. The interior is arranged with a set of three watertight compartments on each side. Each compartment has a pump to discharge the water, while flooding of compartments is controlled by valves.

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DOCK WARRANT, in law, a document by which the owner of a marine or river dock certifies that the holder is entitled to goods imported and warehoused in the docks. In the Factors Act 1889, it is included in the phrase "document of title" and is defined as any document or writing, being evidence of the title of any person therein named . . . to the property in any goods or merchandise lying in any warehouse or wharf and signed or certified by the person having the custody of the goods. It passes by indorsement and delivery, and transfers the absolute right to the goods described in it. A dock warrant is liable to a stamp duty, which may be denoted by an adhesive stamp, to be cancelled by the person by whom the instrument is executed or issued.

DOCKYARDS AND NAVAL BASES. Every navy, both in peace and in war, requires dockyards and bases where repairs can be executed, ammunition, fuel and stores supplied, and where the needs of the personnel can be provided for. This is true also for the mercantile fleets which are served impartially by the great commercial ports and repair yards of the world, but the term "dockyard" is usually now applied only to the national establishments for the building and upkeep of warships. In its fullest sense a dockyard is an establishment which builds and equips warships, and has complete facilities for docking and repairing them. It supplies and perhaps manufactures armaments and ammunition, provides general and victualling stores and fuel and also contains training, medical and other establishments for the service of the personnel. It is however, only the few large home dockyards in each country which are so completely equipped, and even in these only a small proportion of warships are now actually built. Government dockyards are now mainly used for fitting out and commissioning new ships and for the upkeep of the fleets. In most countries, private firms manufacture guns and armour, engines and boilers and often carry the building of ships to the final stages before delivering them to the Government establishments for completion. Other dockyards (*e.g.,* Malta) have no special facilities for building ships but are very completely equipped for the maintenance of a large fleet. Others again, though maintaining the status of dockyards, are capable only of minor repairs and of supplying stores, ammunition and fuel; these smaller establishments are really fortified naval bases or fuelling stations (*q.v.*).

Every Government dockyard is a naval base, but the converse is not true. A modern fleet must have a base from which to operate: and the first requirements of a base are a safe harbour for the auxiliary craft attendant upon the fleet, and a protected fleet anchorage where the ships can, without molestation, replenish with fuel, stores and ammunition and give rest and recreation to the crews. Every dockyard or naval base must be defended by sufficient fixed and mobile local defences to protect it from attack by submarines or torpedo craft, from predatory raids by a few cruisers and from attack from the air. The security of any dockyard or base, however, must depend, ultimately, upon the ability of the fleet which it serves to maintain the command of the sea.

Great Britain.— Until the beginning of the 16th century England had no regular establishment for the Navy and possessed neither arsenals nor dockyards. The fleet was composed of a few "King's ships" supplemented by ships provided by the seaport towns. These towns were charged with the maintenance of the fighting ships when they were laid up and there are evidences of dockyards, or of something answering thereto. at the Cinque Ports as early as the 13th century. In 1238 the keepers of the King's galleys were ordered to build a house at Winchelsea for the safe custody of the vessels. In 1243 the Sheriff of Sussex was ordered to enlarge a house at Rye in which the King's galleys were kept and ten years later the bailiffs of Rye and Winchelsea were ordered to repair these buildings. As the fighting ships developed from the galley to the larger sailing ships there appear to have been depots for both ships and stores maintained at Southampton and Portsmouth, and Henry VII., who laid the foundations of Britain's sea power, built the first dry dock at the latter place in 1495. Henry VIII., in 1509, purchased land at Woolwich and Deptford upon which the building of the first royal dockyards was started and in 1540 the Royal Dockyard at Portsmouth was founded around the site of the dry dock of Henry VII. Queen Elizabeth started the dockyards at Chatham and Sheerness and both were considerably extended by Charles II. after the Restoration. Plymouth, although its ships played so great a part in Elizabethan times, did not become a royal dockyard until 1689, when William III. commenced the Plymouth dock at Devonport. The small dockyard at Pembroke was founded in 1814 and was followed by the establishment at Haulbowline (Queenstown)

Until 1832 the royal dockyards remained under the control of the Navy Board. which had been founded in 1546 by King Henry

VIII. The Admiralty were responsible only for the fleet at sea and this dual control of the Navy had many disadvantages. It led to extravagance and allowed mismanagement and corruption which, several times in the history of the country, came near to bringing about national disaster. With the Reform Bill in 1832, the Admiralty and the Navy Office were amalgamated and the present system of dockyard administration came into being. During the 19th century a gradual change came over the dockyards with the transition from sail to steam and many additions were made to meet the needs of the modern fleet. The most important improvements at any one period were brought about by the Naval Works Act of 1895, which sanctioned a large number of new works. Defensive harbours were commenced at Portland, Dover and Gibraltar and also dockyard extensions at the latter place. At Devonport dockyard the great Keyham extension was started and new works were put in hand at Hongkong and Simon's Town. At the same time the building of naval barracks at the three home ports began, together with new hospitals at Chatham, Haslar and Haulbowline and colleges at Dartmouth and Keyham.

The growing German menace in the North sea, in the opening years of the present century, compelled the Admiralty to seek a new base on the east coast, farther north and easier of approach than Chatham. In 1903 the Government approved the creation of a new naval dockyard at Rosyth on the Firth of Forth. The outbreak of the World War found this base far from complete and the defence of the anchorage against submarines, in common with other naval anchorages, had been almost entirely neglected. The work was pressed on and before the end of the war, a very fine dockyard had been completed. Its 'facilities were such that the biggest ships of the Grand Fleet could be docked and refitted there whilst a large fleet could lie in safety behind boom defences.

In 1914 Great Britain possessed large dockyards at Portsmouth, Plymouth, Chatham and Malta, as well as the uncompleted works at Rosyth, at all of which the largest ships could be docked. Smaller establishments existed, in home waters, at Sheerness, Portland, Haulbowline and Pembroke. At Gibraltar, Hongkong, Bermuda, Simon's Town (Cape of Good Hope) and Sydney (N.S.W.) were dockyards of old standing with dry docks for the largest ships and there were minor establishments at Ascension, Wei-Hai-Wei, Colombo, Bombay and Calcutta, the two last mentioned belonging to the Indian Government. Yet, with all this array of permanent dockyards, the World War made necessary the establishment of other naval bases. Scapa Flow became the main base of the Grand Fleet equipped only for storing, ammunitioning and "running repairs." Cromarty Firth became the second base of the fleet and with the aid of a large floating dock was able to complete the repairs of the biggest ships badly damaged in battle. Harwich, Dover and Immingham acted as bases for light forces and Mudros, Alexandria and other places became bases during particular operations. With the surrender of the German fleet and the changes brought about by post war conditions, Rosyth lost its importance. The great dockyard was reduced to a condition of care and maintenance and so remains. In the interests of economy and the general reduction of armaments the dockyards at Haulbowline and Pembroke were closed down and a reduction in establishment was made at other places.

The result of the World War brought about a re-orientation in British sea power and the growth in the size of capital ships has necessitated the provision of a base in the Far East, capable of maintaining a modern fleet. Hongkong, the only base in those waters for British naval forces, is quite inadequate and, moreover, under the Washington Treaty, no additions or improvements can be made there. The agreement, however, prescribed certain exact limits which definitely excluded Singapore from any prohibitions. That port has been selected for the new dockyard because it lies upon the flank of the sea route to Australia and New Zealand, while behind it are the waters of the Indian ocean and the great British possessions that lie around them. Singapore threatens no one, for it is as far from Japan as Gibraltar is from New York and it is very nearly antipodal to the latter place. But it ensures that, if need be, a battle fleet with all its attendant auxiliaries can be moved into such a position as to afford security to that part of the British empire that lies east of Suez. Without such a base there would be a grave risk in sending heavy ships so far from docking and repairing facilities, for Malta, the nearest large dockyard, is 6,000m. from Singapore. The importance of this dockyard to the sea security of the empire is perhaps not yet fully understood in England, but in Australia and New Zealand and the British possessions in the Far East its necessity is fully appreciated. The work of creating it was put in hand in 1923, checked for a year in 1924 and restarted in the following year. The estimated cost of the new base is £9,000,000.

Dockyard Administration. — The system under which British dockyards are administered is uniform for all, whether the yards are large or small, at home or abroad. The control of all dockyards is vested in the controller of the navy (the third sea lord). At the Admiralty, working under the controller are the director of naval construction, by whom all ships are designed, and the engineering, ordnance, torpedo, electrical and other technical departments, each responsible for the design of its own material. The director of dockyards, also working under the controller, is the Admiralty official under whose instructions the work in the dockyards goes on, involving the control of an army of artisans and labourers and the keeping of costing accounts. Instructions emanate from the Admiralty, the details are left to the dockyard officials and in practice there is considerable decentralization.

Each dockyard is under the charge of an admiral or a captain superintendent, according to its size. His deputy as a rule acts as King's harbour master and is responsible for the berthing and moving of ships in the port. The chief dockyard officers are the constructive manager, the engineer manager, the naval store officer, the electrical engineer, whose names explain their duties, the civil engineer, in charge of all buildings, docks, basins, etc., the cashier, expense accounts officer and medical officers. Technical matters regarding guns and torpedoes are supervised by the captains of the local gunnery and torpedo schools. There being close personal communication between responsible officers, rapid decisions can be taken in matters arising between the departments as the work progresses and operations are thus conducted with ease and efficiency.

France. — The French coast is divided into five arrondissements having the headquarters at the naval ports of Cherbourg, Brest, Toulon, Lorient and Rochefort. All these are building and fitting-out yards. Corsica has naval bases at Ajaccio, Porto Vecchio and Bonifacio. On the African coast there are docking facilities at Algiers and fortified bases at Oran and Bizerta. There are naval establishments at Saigon and Hai-phong in the Far East and at Diego Suarez in Madagascar. There is a gun foundry at Ruelle: steel works at Guerigny, where anchors, cables and armour plates are made: machinery works are at Indret, an island in the River Loire, and there are many private shipbuilding establishments.

In each arrondissement the vice-admiral, who is the naval prefect, is the representative of the minister of marine and has full direction and command of the arsenal. He is commander-in-chief and governor designate in time of war, but his authority does not extend to ships belonging to organized squadrons. The naval prefect is assisted by a rear-admiral as chief of the staff whose special functions are the efficiency of the personnel of the fleet, whilst the "major-general," who is usually another rear-admiral, is concerned with the material. There are also directors of stores, of naval construction, of the medical service, of naval ordnance and of works as well as of the submarine defences which include torpedoes, mines and torpedo-boats. The prefect directs the operation of the whole dockyard and port and is responsible for the efficiency of ships there in reserve.

Germany. — In the first years of the present century, during the expansion of the German fleet, two great modern dockyards were built at Wilhelmshaven on the North sea and at Kiel in the Baltic with a ship canal connecting the two. Smaller establishments were maintained at Cuxhaven, Bremerhaven, Flensburg, Swinemünde, Danzig and at Kiaochow in the Far East. The last-named two were lost to Germany as the result of the World War, and with the disappearance of the German fleet as an important one, all the dockyards have been much reduced.

The chief official at each German dockyard is the superintendent, who is a rear-admiral or captain directly responsible to the naval secretary of State. Under the superintendent's orders are the captain of the fleet reserve, the directors of ordnance, torpedoes, navigation, naval construction, engineering and harbour works, besides other officers. Considerable progress is being made in the re-organization of the German Navy, within the limits of the Versailles Treaty. Important private shipyards exist at Elbing in East Prussia, at Bredow, near Stettin, at Bremen and at Hamburg, which though primarily commercial are all capable of building warships.

Italy. — The Italian Navy is particularly well equipped with modern dockyards. The chief establishment is at Spezia, where there are four large docks and two large building slips in a very completely equipped dockyard. At Naples there are small dry docks with building slips at the subsidiary establishment at Castellamare, across the bay. Taranto and Venice both possess large docks and building slips. A small naval base exists at Maddalena in Sardinia and, as the result of the World War, the valuable Austrian dockyards at Trieste and Pola became Italian property. The Italian Government has no gun or torpedo factories, most of the ordnance being made by the Armstrong firm at Pozzuoli and torpedoes by Schwarzkopf at Venice, whilst armour plates are supplied by the important steel works at Terni. Machinery is supplied by private firms of which there are large numbers.

Japan. — The first dockyard was established in Japan in 1866 at Yokosuka, and this still remains the principal establishment in the country. At first, French naval constructors and engineers were employed but, in 1875, the Japanese took the administration into their own hands. At that time the largest ship that could be constructed in Japan was 5,000 tons, but the dockyard expanded rapidly and is now able to build and dock the largest and most modern ships. Until after the close of the Russo-Japanese War, in 1905, all the important ships of the Japanese fleet were built in Great Britain, France, Germany or the United States. In that year a large first-class cruiser was launched at the new dockyard at Kure and since then the Japanese have only gone abroad for the first ship of each new type. These have been copied in their own establishments, which are thoroughly equipped for producing ships and material second to none, in spite of the fact that a large proportion of the raw material has to come from abroad. Besides Yokosuka, there are now large modern dockyards at Kure, where an armour plate factory has been established; at Sasebo and at Maizuru. Ryojun (Port Arthur) became Japanese after the war with Russia, and there are other naval establishments at Masampo, Takeshiki (Tsushima Is.), Ōminato and at Bako in the Pescadores. Docking facilities for large ships also exist at Tokyo, Yokohama and Uraga.

Soviet Russia. — Of the present state of the Russian dockyards very little is known. Before the break up of Russia, important dockyards existed at Kronstadt and Petrograd and at Nikolayev in the Black sea, with lesser establishments at Archangel, Sevastopol, Batum, Baku, Vladivostock, Reval, Libau and Sveaborg. The World War removed the last-named three from Russian possession and the naval effectiveness of the remainder is now probably negligible. Ordnance and steel works exist at Obukhov and Putilov but their output is at present unimportant.

Spain. — The Spanish dockyards at Ferrol, Cartagena and Cadiz are old establishments which, of recent years, have not kept pace with the times. The fleet is, however, now being steadily modernized and will, in the not far distant future, become a factor in the balance of sea power amongst the States with a Mediterranean littoral. At both Ferrol and Cartagena there are large dry docks. The larger ships are built at Ferrol, Cartagena dealing only with torpedo craft and gunboats; both dockyards are being brought up to date. The dockyard at La Carraca (Cadiz) has four dry docks but no building slips and is used chiefly as a base for gunboats and torpedo craft. There is a small naval establishment at Port Mahon in the Balearic Islands and considerable commercial building and repair yards belonging to private firms at Barcelona, Gijon, Santander and Bilbao.

Minor Naval Powers. — Naval dockyards are maintained by all the Powers who possess fleets, but those in European waters which have not been mentioned above are of secondary importance and are only capable of serving the small navies that they maintain. In South America, although the dockyards themselves are small, the largest capital ships can be docked at Buenos Aires and Puerto Belgrano in Argentina, at Rio de Janeiro in Brazil and at Talcuhuano in Chile. (S. T. H. W.)

UNITED STATES

The shore establishments under control of the navy department are known as navy yards and naval stations. The navy yards are equipped with dry-docks, and shops for general repairs and alterations to vessels of the fleet. They are also provided with building ways for the construction of new vessels. Each yard is equipped for the manufacture of certain equipment used in the naval service and has a supply department for supplying stores and equipment to vessels in active commission and for outfitting new vessels. There are several important naval stations established for special purposes.

Navy Yards. — There are nine navy yards within and two navy yards without the continental limits of the United States. Those in the United States on the Atlantic coast are situated at Portsmouth, N.H. (Kittery, Me.); Boston, Mass.; New York (Brooklyn), N.Y.; Philadelphia. Pa.; Washington, D.C.; Norfolk (Portsmouth), Va.; and Charleston, S.C. Those on the Pacific coast are situated at Bremerton, Wash., and Mare Island, Calif. The two yards outside the United States are Pearl Harbor, Hawaii, and Cavite, P.I. The latter yard includes Olongapo where the Dewey dry dock is located.

Naval Stations are at Key West, Fla., Guantanamo Bay, Cuba, W.I. and Guam, Marianas Islands. Two inoperative stations are at New Orleans, La. and Culebra, an island east of Puerto Rico.

Submarine Bases are at New London, Conn; Coco Solo, Canal Zone and Pearl Harbor, Hawaii. Two inoperative stations are located at Norfolk, Va. and Key West, Fla. These bases are fitted with small machine shops and barracks for officers and enlisted men, and bear the same relation to submarines as a mother ship. The station at New London has a school for the instruction of officers and enlisted men in submarine work.

Naval Operating Bases are at Norfolk, Va.; Balboa, Canal Zone; San Diego, Calif.; San Francisco, Calif. Men-of-war can operate and be maintained from these centres in time of peace or war, and they afford anchorage space for a large number of vessels.

Naval Air Stations are at Alameda, Calif.; Anacostia, D.C.; Cape May, N.J.; Coco Solo, Canal Zone; Jacksonville, Fla.; Miami, Fla.; Kanoehe, Hawaii; Kodiak, Alaska; Lakehurst, N.J.; Midway Island; Norfolk, Va.; Pearl Harbor, Hawaii; Pensacola, Fla.; San Diego, Calif.; San Juan, P.R.; San Pedro, Calif.; Seattle, Wash.; Sitka, Alaska; Tongue Point, Ore. These stations are fitted with machine shops and landing fields for the general repair and the operations of shore base aircraft. Beside the above stations there are maintained a number of reserve aviation bases and aviation facilities for the purpose of training personnel and servicing aircraft from other bases.

Training Stations, for newly enlisted men. are at Newport, R.I.; Hampton Roads, Va.; San Diego, Calif.; and Great Lakes, Ill.

Naval Hospitals are maintained at all major navy yards, naval stations and where there are other naval activities.

Other Special Stations are: the Naval War college at Newport, for the instruction of officers; Naval academy at Annapolis. Md., for the training and education of midshipmen prior to commissioning as officers; Engineering Experimental station at Annapolis, Md.; and Experimental Laboratory at Bellevue, D.C., ior experimental work in engineering; Aircraft factory, Philadelphia, Pa., for building and testing of aircraft; Torpedo stations at Newport, R.I., Alexandria, Va., and Keyport, Wash., for building, repairing and testing of torpedoes, and torpedo parts; Naval Gun factory, Washington, D.C., for construction of naval ordnance;

Naval Ordnance plant, South Charleston, W.Va., for the manufacture of armour and gun forgings; powder factory, Indian Head, Md., for the manufacture of powder; Naval Proving ground, Dahlgren, Va., for testing of naval ordnance; Naval Mine depot, Yorktown, Va., for the storage of mines and explosives; Helium plant, Fort Worth, Texas, for the production of helium gas used in lighter-than-air craft; Naval observatory, Washington, D.C., for the purpose of furnishing astronomical data and nautical instruments to naval vessels and aircraft and furnishing time signals. Fueling depots have been established at Melville, R.I.; Yorktown, Va.; La Playa, Calif.; Tiburon, California.

The officer ordered to command a navy yard or naval station is the commandant. He is usually a rear admiral and is the representative of the navy department in all matters within the limits of his command and is responsible for business transacted therein. The principal aids to the commandant are the captain of the yard and the manager. The captain of the yard, who is next in succession to command, has general charge of the water-front, yard craft and ships moored there, the police force, fire department and other purely military activities as distinct from industrial activities. The manager is the officer in charge of the industrial activities, including the labour force, productive shops and offices. He is directly responsible to the commandant for all industrial work performed at the yard. Under the manager are the inside superintendent, outside superintendent, plant superintendent and accounting superintendent. The other yard heads of departments are known as supply officer, public works officer, medical officer.

With few exceptions, the entire working force of the yards and stations is employed under the rules of the civil service. All are graded under a uniform efficiency-marking system. The employment is continuous as long as funds and work are available. Upon decrease of funds or work the force is reduced by discharging those having lowest efficiency ratings. Veterans are given a preference in case of discharge when their efficiency rating is good or better. The wages are, by law, required to be based upon the wages paid for corresponding trades in the vicinity of the local yards and stations. The wage scale is revised each year by a local wage board and a departmental wage board. In addition to all national and executive order holidays, each yard employee is granted 30 days' leave each year with full pay. Eight hours constitute a day's work and employees are paid 50% additional for all overtime and holiday work. Overtime is only authorized in case of extraordinary emergencies when necessary to save life or Government property.

The nature and extent of repair work necessary upon naval vessels is submitted by commanding officers to the commandant of the yard who approves those that can be accomplished with the funds allotted by the various bureaus of the navy department. Alterations must be approved by the department and funds allotted before being undertaken by yards.

Navy yards are permitted to do work for other Government departments when such work does not interfere with naval work. They are not permitted to compete with private plants for private work and can only undertake private work with departmental approval when such work is in the nature of an emergency and can not be performed by any private plants in the vicinity.

The department has under its control 64 radio stations and 57 radio compass stations. The radio stations are for naval communications and do not compete with private stations. The compass stations are available to merchant as well as naval vessels, upon request direct to station, furnishing bearings and position.

(Y. S. W.)

DOCTOR (Lat. for "teacher"), the title conferred by the highest university degree. Originally there were only two degrees, those of bachelor and master, and the title doctor was given to certain masters as a merely honorary appellation. At Bologna it seems to have been conferred in the faculty of law as early as the 12th century. Paris conferred the degree in the faculty of divinity, according to Antony Wood, some time after 1150. In England it was introduced in the 13th century; and both in England and on the Continent it was long confined to the faculties of law and divinity. It was not until the 14th century that the doctor's degree began to be conferred in medicine. The tendency since has been to extend it to all faculties in French and English universities; while in Germany, in the faculty of arts, it has replaced the old title of *magister*.

Doctors of *the Church* are certain saints whose doctrinal writings have obtained, by the universal consent of the Church or by papal decree, a special authority. In the case of the great schoolmen a characteristic qualification was added to the title doctor; *e.g.*, "angelicus" (Aquinas), "mellifluus" (Bernard). The doctors of the Church are: for the East, SS. Athanasius, Gregory of Nazianzus, Basil the Great, John Chrysostom; for the West, SS. Hilary, Ambrose, Jerome, Augustine, Gregory the Great, Anselm, Bernard, Bonaventura and Thomas Aquinas. To these St. Alphonso dei Liguori was added by Pope Pius IX.

DOCTORS' COMMONS, the name formerly applied to a society of ecclesiastical lawyers in London, forming a distinct profession for the practice of the civil and canon laws. Some members of the profession purchased in 1567 a site near St. Paul's, on which at their own expense they erected houses (destroyed in the Great Fire, but rebuilt in 1672) for the residence of the judges and advocates, and proper buildings for holding the ecclesiastical and admiralty courts. In 1768 a royal charter was obtained by virtue of which the then members of the society and their successors were incorporated under the name and title of "The College of Doctors of Law exercent in the Ecclesiastical and Admiralty Courts." The college consisted of a president (the dean of Arches for the time being) and of those doctors of law of the Universities of Oxford or Cambridge, who had been admitted advocates in pursuance of the rescript of the archbishop of Canterbury, and elected fellows in the manner prescribed by the charter. There were also attached to the college 34 proctors, whose duties were analogous to those of solicitors. The judges of the archiepiscopal courts were always selected from this college. By the Court of Probate Act, 1857, the college was empowered to sell its real and personal estate and to surrender its charter, and it was enacted that on such surrender the college should be dissolved and its property distributed among the members. The college was accordingly dissolved, and the various ecclesiastical courts which sat at Doctors' Commons are now open to the whole bar.

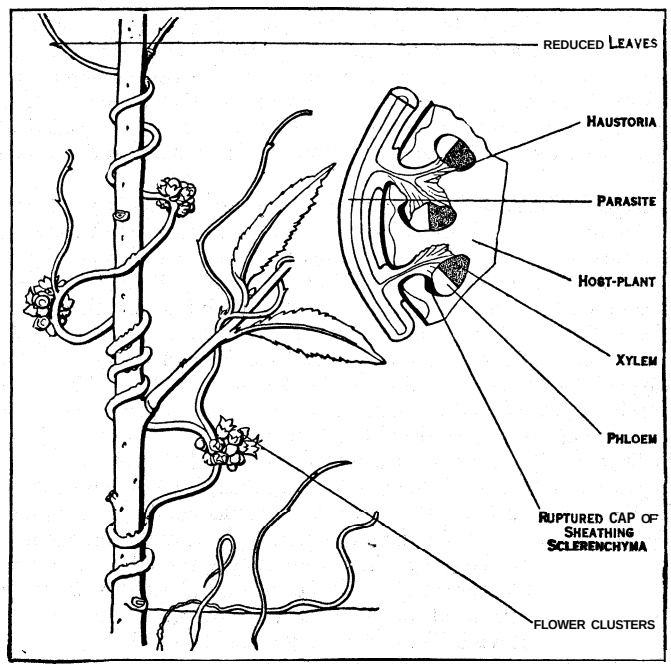
DOCTRINAIRES, the name given to the leaders of the moderate and constitutional Royalists in France after the second restoration of Louis XVIII. in 1815. In 1816 the *Nain jaune réfugié*, a French paper published at Brussels by Bonapartist and Liberal exiles, began to speak of Royer-Collard as the "doctrinaire." The "doctrinaires" was a popular name for a religious order founded in 1592 by César de Bus. The nickname for M. Royer-Collard was well chosen, for he made it his business to preach a doctrine and an orthodoxy. The rapid extension of the name to his colleagues proves that it had more than a personal application. The duc de Richelieu and M. de Serre had been Royalist émigrés; MM. Royer-Collard himself, Lainé, and Maine de Biran had sat in the revolutionary assemblies; Pasquier Beugnot, de Barante, Cuvier, Mounier, Guizot, and Decazes had been imperial officials; but they were closely united by political principle, and all were noted for the dialectical rigidity of their arguments. Their ideal was a king who frankly accepted the results of the Revolution, and who governed in a liberal spirit, with the advice of a chamber elected by a very limited constituency. Their views were set forth by Guizot in 1816 in his treatise Du gouvernement *représentatif* et de *l'état* actuel de la France. The history of the Doctrinaires as a separate political party began in 1816 and ended in 1830. In 1816 they obtained the co-operation of Louis XVIII., who had been frightened by the violence of the reactionary majority in the chamber of 1815. In 1830 they were destroyed by Charles X. when he took the reactionary prince de Polignac as his minister and entered on the conflict with Liberalism which ended in his overthrow. During the revolution of 1830 the Doctrinaires became absorbed in the Orleanists. (See FRANCE: History.) The word "doctrinaire" has become naturalized in English as applied, in a slightly contemptuous sense, to a theorist, as distinguished from a practical man

DOCUMENT, strictly, in law, that which can serve as evidence or proof, and is written or printed, or has an inscription or any significance that can be "read"; thus a picture, authenticated photograph, seal or the like would furnish "documentary evidence." More generally the word is used for written or printed papers that provide information or evidence on a subject. (See DIPLOMATIC; and EVIDENCE.)

DODD, WILLIAM (1729–1777), English divine, was born at Bourne, Lincs., in May 1729. He was admitted a sizar of Clare hall, Cambridge, in 1745, and took the degree of B.A. in 1750, being 15th wrangler. He entered the church, received rapid preferment, and was also tutor to Philip Stanhope, earl of Chesterfield. An effort by his wife to bribe the wife of the lord chancellor drove him from England for some time. He returned in 1776, and, being in financial straits, forged a bond for £4,200 on his former pupil, Lord Chesterfield. He was sentenced to death, and was executed at Tyburn on June 27, 1777. Samuel Johnson was very zealous in pleading for a pardon, and a petition from the City of London received 23,000 signatures. Dr. Dodd wrote one or two comedies and a popular book, the Beauties of Shakespeare (1752). A list of his 55 writings and an account of the writer is included in the *Thoughts* in *Prison*, a poem written in prison before his execution.

See P. Fitzgerald, ***A Famous Forgery (1865).***

DODDER, the popular name of the annual, rootless, leafless, twining, parasitic plants forming the genus Cuscuta, formerly regarded as representing a distinct family Cuscutaceae, but now included in the Convolvulaceae. The genus contains nearly 100 species and is widely distributed in the temperate and warmer parts of the earth. The slender thread-like stem is white, yellow, or red in colour, bears no leaves, and in the seedling stage attaches itself by suckers to the stem or leaves of some other



BY COURTESY OF MESSRS. GUSTAV FISCHER, FROM STRASBURGER, "LEHRBUCH DER BOTANIK"

DODDER (CUSCUTA EUROPAEA). A PARASITIC PLANT ON A WILLOW **TWIG**
In the small figure is seen a transverse section of the host-plant, showing the contact of the dodder with the tissues of the host, which it finally destroys

plant round which it twines and from which it derives its nourishment. It bears clusters of small flowers with a four- or five-toothed calyx, a cup-shaped corolla with four or five stamens inserted on its tube, and sometimes a ring of scales below the stamens; the two-celled ovary becomes when ripe a capsule splitting by a ring just above the base. The seeds are angular and contain a thread-like spirally coiled embryo which bears no cotyledons. On coming in contact with the living stem of some other plant the seedling dodder throws out a sucker, which penetrates the host, its tissues establishing organic union with the tissues of the host. By this means water is drawn from the wood and nutriment from the bast of the host. The dodder then soon ceases to have any connection with the ground. As it grows, it throws out fresh suckers, establishing itself very firmly on the host-plant. After making a few turns round one shoot the dodder finds its way to another, and thus it continues twining and branching till it resembles "fine, closely-tangled, wet catgut." The injury done to flax, clover, hop and bean crops by species of dodder is often very great. C. *europaea,* the greater dodder (see fig.) is parasitic on nettles, thistles, vetches and the hop; C. *epilinum,* on flax; *C. epithymum,* on furze, ling and thyme. *C. trifolii,* the clover dodder, is probably a sub-species of the last mentioned.

In the United States and Canada about 30 species occur, a few of which have been naturalized from the Old World. Among the native species are the love-vine (C. Gronovii), common on herbs and low shrubs in the Eastern States and adjacent Canada; the glomerate dodder (C. paradoxa), which forms dense ropes of flowers on tall herbs in the Central States; and the marsh dodder (C. *salina*), abundant in salt marshes of the Pacific coast, forming golden patches on various saline herbs.

DODDS, ALFRED AMÉDEE (1842–1922), French general, was born at St. Louis, Senegal, on Feb. 6, 1842, of Anglo-French origin. He was educated at Carcassonne and at St. Cyr, and in 1864 joined the marine infantry as a sub-lieutenant. He served as a company commander in the Franco-German War, was taken prisoner at Sedan but escaped, and took part in the campaigns of the Loire and of the east. In 1872 he was sent to west Africa, and except when on active service in Cochin-China (1878) and Tong-king (1883), he remained on duty in Senegal for the next 20 years, taking a prominent part in the operations which brought the countries of the upper Senegal and Upper Niger under French rule. He led the expeditions against the Boal and Kayor (1889), the Serreres (1890) and the Futa (1891), and from 1888 to 1891 was colonel commanding the troops in Senegal. At the close of 1891 he returned to France to command the eighth marine infantry at Toulon. In April 1892 Dodds was selected to command the expeditionary force in Dahomey; he occupied Abomey, the hostile capital, in November, and in a second campaign (1894) he completed the subjugation of the country. He was then appointed inspector-general of the marine infantry, and after a tour of the French colonies was given the command of the XX (Colonial) Army corps, becoming inspector-general of colonial troops. From 1904 to 1914 he was a member of the Conseil Supérieur de Guerre. He died in Paris on July 18, 1922.

DODECAHEDRON: see SOLIDS, GEOMETRIC.

DODECANESE (twelve islands), in the Aegean sea are near the coast of Asia Minor, inhabited by Greeks, and formed before the Italian occupation part of the Ottoman empire. The term first appears in the 9th century and was used in the middle ages for the Cyclades. After the Italian occupation it was applied to "the 13 southern Sporades," consisting of the 13 (not 12) islands of Rhodes, Cos, Kalymnos, Leros, Nisyros, Tēlos, Symē, Khalkē, Astypalaia, Karpathos, Kasos, Patmos and Lipsos. The two first and the last were not included in the mediaeval "dodecanese," which, however, comprised Nikaria and Castellorizo. Turkish firmans from 1652 to 1833 conferred or confirmed their fiscal privileges, and local Greek authorities collected a lump annual sum as tribute to the Porte. These privileges, despite occasional infringements in 1869, 1886 and 1893, continued down to the Turkish Revolution. The Young Turks, in 1909, abolished them, but in 1912, when the islands ceased to belong to Turkey, this decision had not yet been carried out. In that year the Italians, then at war with Turkey and meeting with difficulties in Libya, occupied the 13 islands after a single battle at Psinthos in Rhodes, in which they were aided by the islanders, believing in the promises of General Ameglio and Admiral Presbitero, that "autonomy" would follow the abolition of Turkish rule. Indeed. an Insular assembly met at Patmos, and proclaimed the "Autonomous State of the Aegean" with its own flag. The first Treaty of Lausanne, in Oct. 1912, pledged Italy to evacuate the islands as soon as the Turks had evacuated Libya.

Signor Giolitti, when premier, sincerely repudiated the idea of "annexing territories of Greek nationality" and Sir Edward

Grey, in 1913, declared that their fate "interested all the Great Powers." Nevertheless, the 8th article of the secret Treaty of London of 1915, which secured Italy's entrance into World War I, gave her full sovereignty over the islands. A convention was, however, made between M. Venizelos and Senator Tittoni (then foreign minister) on July 29, 1919, which was to have simultaneous effect with the subsequent Treaty of Sèvres, and which ceded 12 of the islands to Greece, and provided that Rhodes, the thirteenth, should have "a wide local autonomy." A further treaty was signed on Aug. 10, 1920, by M. Venizelos and Count Bonin at Sèvres. It confirmed the above, and added that Rhodes should, 15 years later, become Greek also if Great Britain should have ceded Cyprus to Greece, and a Rhodian plebiscite, held under the supervision of the League of Nations, should have decided for union. Meanwhile Italy pledged herself to give to the islands within two months a "wide local autonomy." In 1922, however, Senator Tittoni's successor, Count Sforza, denounced these agreements on the ground that circumstances had changed, and the fall of M. Venizelos strengthened the determination of the Italians to remain, despite Lord Curzon's stiff note of Oct. 15, 1922, intimating that the cession of Jubaland by Great Britain to Italy was conditional upon the Italian settlement of the question of the Dodecanese nith Greece. This position, however, was abandoned by Ramsay MacDonald. Meanwhile the Treaty of Sèvres formally assigned the Dodecanese to Italy, which by article 15 of the second Treaty of Lausanne not only obtained the recognition by Turkey of her full sovereignty over "the 13 islands," but also the ratification of her occupation (during World War I) of Castellorizo.

The metropolitan of Rhodes was expelled in 1921, and, after an exile of three years, was allowed to return and remain only on condition that he sever his connection with the Oecumenical patriarch. The Italian plan was to create an autocephalous church for the Dodecanese on the mistaken precedent of Cyprus, which nas ecclesiastically autocephalous many centuries before the British occupation. The death of the patriarch, however, prevented the execution of this arrangement, which would have been uncanonical without his consent and contrary to the example of Protestant England in the Ionian Islands and of Catholic Austria in Bosnia and Hercegovina. Another regulation in 1925 compelled all inhabitants of the Dodecanese to take Italian nationality, although, with the exceptions of the Muslims and Jews in Xhodes, they are all practically of Greek race. The fortification of Leros as a naval base and the establishment of a university at Rhodes pointed to the permanence of the Italian occupation, which was the chief obstacle to Graeco-Italian friendship. The islands, with the exception of the sponge-fishing industry of Kalymnos and Symē, have small economic value, and the prohibition of sponge-fishing off the north coast of Africa by the Italians in 1916, later withdrawn, not only injured the islands economically but also diminished their population. only about 80,000, by emigration.

The islands, officially known as Isole Italiane dell' Egeo, are under a governor who resides in Rhodes and is subordinated to the ministry of foreign affairs. Under him serve the regent of Cos and the delegates of Leros, Kalymnos, Symē, Karpathos and Castelrosso. The area of the islands is 1,035 sqmi.; the population on April 21, 1936, amounted to 140,848, of whom 85% were Greek. The capital is Rhodes, with 27,466 inhabitants. The fourteen islands, with their Greek and Italian names, their area and population figures in 1936, are: Rhodes (Rodi) 545 sqmi., pop. 61,886; Cos (Coo) 111 sq mi., pop. 19,731 (capital of same name, 9,852); Kalymnos (Calino) 49 sq.mi., pop. 15,247 Leros (Lero) 28 sq.mi., pop. 13,657; Karpathos (Scarpanto) 118 sq.mi., pop. 7,770; Symē (Simi) 25 sq.mi., pop. 6,195; Nisyros (Nisiro) 18 sq.mi., pop. 3,391; Patmos (Patmo) 22 sq.mi., pop. 3,184; Castelrosso (Castellorizo) 4 sq.mi., pop. 2,238; Astppalaia (Stampalia) 44 sq.mi., pop. 2,006; Kasos (Caso) 27 sq.mi., pop. 1,890; Khalkē (Calchi) 12 sq mi., pop. 1,461; Tēlos (Piscopi) 25 sq.mi., pop. 1,215; Lipsos (Lisso) 7 sq.mi., pop. 977.

The main islands are fertile and famous for their vineyards, their olives and tobacco. Some of the smaller islands are famous for their sponge-fishing. The commerce ordinarily is conducted mainly with Italy, Egypt and Turkey. The development of trade can be seen from the following table in thousands of lire:

	1930	1934	1938
Imports	88,000	56,000	157,421
Exports	17,000	18,000	21,851

The budget for 1938–39 amounted to 32,000,000 lire. The islands were connected by air with Italy and Greece, and by steamship with Italy, Egypt, Syria and Turkey. There are no railroads on the islands; but good motor roads were built by the Italian government, which also tried to promote tourist traffic and the establishment of resorts on Rhodes. A number of representative official buildings were built in the typical fascist style, but behind this façade the life of the native population remained unchanged in its Greek traditions.

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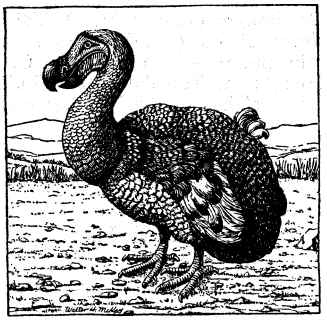
DODGE CITY, a city of south-western Kansas, U.S.A., on the Arkansas river, at an altitude of 2,478 ft; the county seat of Ford county. It is on federal highways 50S and 154, and is served by the Rock Island and the Santa Fe rail ays. The population in 1930 was 10,059; in 1940 by federal census 8,487. It has railroad shops, flour-mills, a dressed poultry plant and creameries, and is the supply centre for a large agricultural and stock-raising area. The meridian separating "central" from "mountain" time passes through the city. Dodge City was settled about 1872 and incorporated in 1875. It was a famous frontier town on the old Santa Fe trail, the rendezvous of picturesque characters, the centre of important freighting lines and headquarters of the cattle business. At the peak, in 1884, herds aggregating 8,000,000 head of cattle passed through from Texas, in charge of 3.000 men. There were immense herds of buffalo in this region. Hunting parties often killed 250 in a day, and the first trains often had to wait hours while a herd crossed the track. The first winter after the Santa Fe came through, 200,000 buffalo hides were shipped from Dodge City. At some stations in the vicinity shipments of buffalo bones in 1875 averaged a car load. a day. On the river 5 mi. E. of the city is old Ft. Dodge, an important frontier garrison, now the State home for disabled volunteer soldiers.

DODGSON, CHARLES LUTWIDGE ("LEWIS CARROLL") (1832–1898), English mathematician and author, son of the Rev. Charles Dodgson, vicar of Daresbury, Cheshire, was born in that village. The literary life of "Lewis Carroll" became familiar to a wide circle of readers, but the private life of Charles Lutwidge Dodgson was retired and practically uneventful. After four years at Rugby, Dodgson matriculated at Christ Church, Oxford, in May 1850. He took a first class in the final mathematical school in 1854, and the following year was appointed mathematical lecturer at Christ Church, a post he continued to fill till 1881. His earliest publications, beginning with *A Syllabus of Plane Algebraical Geometry* (1860), and *Tlze Formulae of Plane Trigonometry* (1861), were exclusively mathematical; but late in the year 1865 he published, under the pseudonym of "Lewis Carroll," *Alice's Adventures in Wonderland*, which has become an English classic. It was an open secret that the original of "Alice" was a daughter of Dean Liddell. *Alice* was followed (in the "Lewis Carroll" series) by *Phantasmagoria* (1869); *Through the Looking-Glass* (1871); *The Hunting of the Snark* (1876); *Rhyme and Reason* (1883); A *Tangled Tale* (1885); and *Sylvie and Bruno* (in two parts, 1889 and 1893). He wrote skits on Oxford subjects from time to time. *The Dynamics of a Particle* was aritten on the occasion of the contest between Gladstone and Mr. Gathorne Hardy (afterwards earl of Cranbrook); and *Tlze New Belfry* in ridicule of the erection put up at Christ Church for the bells that were removed from the cathedral tower. While "Lewis Carroll" was delighting children of all ages, C. L. Dodgson periodically published mathematical works—An *Elementary Treatise on Determinants* (1867); *Euclid, Book V., proved Algebraically* (1874); *Euclid and his Modern Rivals* (1879), the work on which his reputation as a mathematician largely rests; and *Curiosa Mathematica* (1888). Though the fact of his authorship of the "Alice" books was well known, he invariably stated, when occasion called for such a pronouncement, that "Mr. Dodgson neither claimed nor acknowledged any connection with the books not published under his name." His memory is appro-

priately kept green by a cot in the Children's Hospital, Great Ormond street, London, which was endowed perpetually by a public subscription. The beautifully written ms. of *Alice in Wonderland* was sold by Dean Liddell's daughter in April 1928 for £15,400.

See S. D. Collingwood, *Life and Letters of Lewis Carroll* (1898).

DODO, a large bird formerly inhabiting the island of Mauritius, but now extinct—the *Didus ineptus* of Linnaeus. The Dutch called them *Walgvögels, i.e.,* nauseous birds, because no cooking made them palatable. A compendious bibliography of notices of the bird up to the year 1848, will be found in the classical work, *The Dodo and its Kindred,* by H. E. Strickland and A. G. Melville (London, 1848), and the list was continued by G. R. von Frauenfeld *Neu aufgefundene Abbildung des Dronte* (Wien, 1868) for 20 years later. The last evidence we have of the dodo's existence is furnished by a journal kept by Beni. Harry and now in the British Museum (mss. *Addit.* 3,668, 11 D). This shows its survival till 1681, but the writer's sole remark upon it is that its "flesh is very hard." Professor Reinhardt was the first to suggest the affinity of the dodo to the pigeons (Columbidae) and Sir R. Owen's examination of the material discovered in a mud pool by G. Clark in 1865 confirmed this.



FROM WILLIAM SCLATTER, "THE IBIS"

DODO (DIDUS INEPTUS)

Native to Mauritius, the Dodo was exterminated about 1681. It was nearly the size of a swan, and flightless, living in the island forests

In 1889 Th. Sauzier, acting for the Government of Mauritius, sent a great number of bones from the same swamp to Sir Edward Newton. From these the first correctly restored and properly mounted skeleton was prepared and sent to Paris, to be forwarded to the museum of Mauritius. Good specimens are in the British Museum, at Paris and at Cambridge, England.

The huge blackish bill of the dodo terminated in a large, horny hook; the cheeks were partly bare, the stout, short legs yellow. The plumage was dark ash-coloured, with whitish breast and tail, yellowish white wings (incapable of flight). The short tail formed a curly tuft.

The dodo inhabited forests and laid one large white egg on a mass of grass. Man and the hogs and other animals he imported effected its extermination.

The nearest ally of the dodo was the solitaire (*q.v.*) of Rodriguez, also now extinct.

DODONA, in Epirus, the seat of the most ancient and venerable of all Hellenic sanctuaries. Its ruins are at Dramisos, near Tsacharovista. Though the Greeks of the south looked on the inhabitants of Epirus as barbarians nevertheless for Dodona they maintained a certain reverence. Its temple was dedicated to Zeus, and connected with it was an oracle which would seem to date from early times; for the method of gathering responses was by listening to the rustling of an old oak tree: perhaps a remnant of very ancient tree-worship. Sometimes, however, auguries were taken from doves in the branches, the murmur of a fountain, or the clanging of brazen caldrons hung round the tree or temple. Croesus proposed to this oracle his well-known question; Lysander sought from it sanction for his ambitions; Athens frequently appealed to its authority. But the most frequent votaries were the Acarnanians and Aetolians, with the Boeotians, who claimed a special connection with the district.

Dodona is spoken of in the *Iliad* as the abode of Selli who sleep on the ground and wash not their feet, and the *Odyssey* has an imaginary visit of Odysseus to the oracle. A Hesiodic fragment describes Dodonaea or Hellopia as a district full of cornfields, of herds and flocks and of shepherds, where is built on an extremity (*ha' ἐσχατίῃ*) Dodona, where Zeus dwells in the stem of an oak (*φηγός*). The priestesses were called doves (*πέλειαι*) and Herodotus tells a story which he learned at Egyptian Thebes, that the oracle of Dodona was founded by an Egyptian priestess who was carried away by the Phoenicians, out says that the local legend substitutes a black dove, in which he tries to find a rational meaning. In historical times there was worshipped, together with Zeus, a consort named Dione *(see* further ZEUS; ORACLE; DIONE).

The ruins, a theatre, town walls and other buildings were identified by Wordsworth in 1832, and excavated by Constantin Carapanos after 1875. The topographical and architectural results are disappointing; either the site always retained its simplicity, or else its buildings have been very completely destroyed.

South of the hill, on which are the town walls east of the theatre, and towards the eastern end of a plateau about 200 yd. long and 50 yd. wide are the remains of the temple of Zeus; pronaos, cella and opisthodomus, about 130 ft. by 80 ft. over all. Some lower drums of internal columns of the cella still rest on their foundations. No trace of external colonnade was found. It had been converted into a church. In and around it were found statuettes and decorative bronzes, many bearing dedications to Zeus Naïus and Dione, many small tablets of lead which contained questions put to the oracle.

Below the terrace was a precinct, flanked with porticoes over 100 yd. in length and breadth, of irregular shape. One of the buildings on the south-western side contained a pedestal or altar, and is described by Carapanos as a temple of Aphrodite. In front of the porticoes are rows of pedestals, which once bore statues and other dedications. At the southern corner is a gate, flanked with two towers, between which are placed two coarse limestone drums. If these belong to the original gateway, it must have been of a very rough character.

The smaller antiquities are now in the National Museum in Athens. Among the dedications are weapons dedicated by King Pyrrhus from the spoils of the Romans.

The temple of Dodona was destroyed by the Aetolians in 219 B.C., but the oracle survived to the times of Pausanias and the emperor Julian.

See C. Wordsworth, *Greece* (1839), p. 247; Constantin Carapanos, *Dodone et ses ruines* (Paris, 1878). For the oracle inscriptions, *see* E. S. Roberts in *Journal of Hellenic Studies,* vol. i., p. 228.

DODS, MARCUS (1834–1909), Scottish divine and biblical scholar, was born at Belford, Northumberland, on April 11, 1834. He studied at Edinburgh and was licensed in 1858. In 1864 he became minister of Renfield Free Church, Glasgow, where he worked for 25 years and in 1889 was appointed professor of New Testament exegesis in New college, Edinburgh, of which he became principal on the death of Dr. Rainy in 1907. He died in Edinburgh on April 26, 1909. His views on inspiration brought on him a charge of unorthodoxy which was preferred against him by the General Assembly in 1890, a year after his election to the professorship; the charge was soon dropped by a large majority, and in 1891 he received the honorary degree of D.D. from Edinburgh university. He edited Lange's *Life of Christ* in English (Edinburgh, 1864, 6 vols.), Augustine's works (1872–76), and, with Dr. Alexander Whyte, Clark's "Handbooks for Bible Classes" series. In the Expositor's Bible series he edited Genesis and I Corinthians, and he was also a contributor to the ninth edition of the *Encyclopædia Britannica* and Hastings' *Dictionary of the Bible.*

Among other important works are: *The Epistle to the Seven Churches* (1865); *Israel's Iron Age* (1874); *Mohammed, Buddha and Christ* (1877); *Handbook on Haggai, Zechariah and Malachi* (1879); *The Gospel according to St. John* (1897), in the Expositor's Greek Testament; *The Bible, its Origin and Nature* (1904). *See* his *Early Letters* (1910) and *Later Letters* (1911).

DODSLEY, ROBERT (1703–1764), English bookseller and miscellaneous writer, was born near Mansfield, Nottinghamshire, where his father was master of the free school. He is said to have been apprenticed to a stocking-weaver in Mansfield, from whom he ran away, taking service as a footman. In 1729 Dodsley published his first work, *Servitude, a Poem . . . written by a Footman,* with a preface and postscript ascribed to Daniel Defoe; and a collection of short poems, *A Muse in Livery, or the Footman's Miscellany,* was published by subscription in 1732, Dodsley's patrons comprising many persons of high rank. This was followed by a satirical farce called *The Toyshop* (Covent Garden, 1735).

With the help of his friends—Pope lent him £100—Dodsley set up as a publisher at the "Tully's Head" in Pall Mall in 1735. One of his first publications was Dr. Johnson's *London,* for which he gave 10 guineas in 1738. He published many of Johnson's works, and he suggested and helped to finance the *English Dictionary.* Pope also made over to Dodsley his interest in his letters. In 1738 the publication of Paul Whitehead's *Manners,* voted scandalous by the lords, led to a short imprisonment. Dodsleg also founded several literary periodicals: *The Museum* (1746–67, 3 vols.); *The Preceptor containing a general course of education* (1748, 2 vols.), with an introduction by Dr. Johnson; *The World* (1753–56, 4 vols.); and *The Annual Register,* founded in 1758 with Edmund Burke as editor. Dodsley is, however, best known as the editor of two collections: *Select Collection of Old Plays* (12 vols., 1744; and edition with notes by Isaac Reed, 12 vols., 1780; 4th edition, by W. C. Hazlitt, 1874–76, 15 vols.); and *A Collection of Poems by Several Hands* (1748, 3 vols.), which passed through many editions. In 1737 his *King and the Miller of Mansfield,* a "dramatic tale" of King Henry II, was produced at Drury Lane; the sequel, *Sir John Cockle at Court,* a farce, appeared in 1738. In 1745 he published a collection of his dramatic works, and some poems which had been issued separately, in one volume under the modest title of *Trifles;* and this was followed by other poems and plays. His tragedy of *Cleone* (1758) had *a* long run at Covent Garden, 2.000 copies being sold on the day of publication and it passed through four editions within the year. In 1759 Dodsley retired, leaving the conduct of the business to his brother James (1724–97), with whom he had been many years in partnership. He died at Durham while on a visit to his friend, the Rev. Joseph Spence.

Dodsley's poems are reprinted with a memoir in A. Chalmers's *Works of English Poets,* vol. xv (1810). *See* also Charles Knight, *Shadows of the Old Booksellers* (1865) pp. 189–216; E. Solly, in *The Bibliographer,* v (1884) *pp.* 57–61; Austin Dobson, "At Tully's Head" in *Eighteenth Century Vignettes* (2nd series, 1894); R. Straus, *Robert Dodsley, Poet, Publisher and Playwright* (1910).

DODSWORTH, ROGER (1585–1654), English antiquary, was born near Oswaldkirk, Yorkshire, the son of Matthew Dodsworth, registrar of York cathedral. He collected a vast store of materials for a history of Yorkshire, a *Monasticon Anglicanum,* and an English baronage. The second of these was published with considerable additions by Sir William Dugdale (2 vols.. 1655 and 1661). The mss. were left to Thomas, third Lord Fairfax, who by his will bequeathed them (160 volumes in all) to the Bodleian library at Oxford. Portions have been printed by the Yorkshire Archaeological society (*Dodsworth's Yorkshire Notes,* 1884) and the Chetham society (copies of Lancashlre post-mortem inquisitions, 1875–1876).

DODWELL, HENRY (1641–1711), scholar, theologian and controversial writer, was born at Dublin. He became a fellow of Trinity college, Dublin, but having conscientious objections to taking orders he relinquished his fellowship in 1666. In 1688 he was elected Camden professor of history at Oxford, but in 1691 was deprived of his professorship for refusing to take the oath of allegiance to William and Mary. He retired to Shottesbrooke to study chronology and ecclesiastical polity.

His chief works on classical chronology are: *A Discourse concerning Sanchoniathon's Phoenician History* (1681); *Annales Thucydidei* el *Xenophontei* (1702); *Chronologia Graeco-Romana pro hypothesibus Dion. Halicarnassei* (1692); *Annales Velleiani, Quintilianei, Statiani* (1698); and a larger treatise entitled *De veteribus Graecorum Romanorumque Cyclis* (1701).

DOG. Although the word "dog" is believed to have been originally applied to a particular English breed, it is now used in a general sense to connote all the domesticated varieties of the zoological genus *Canis,* of which the wolf (*Canis lupus*) and the northern jackal (*Canis aureus*) of Europe and Asia are familiar wild species. The accepted zoological name is *Canis familiaris.*

Origin and Antiquity.— The time that prehistoric man first domesticated a wild canine to serve as his hunting aid or cave guardian is unknown. The aboriginal peoples of Switzerland and Ireland used dogs for hunting and undoubtedly ate dog flesh long before they learned to till the soil. Cave drawings of the palaeolithic era include hunting scenes in which the rough form of a canine appears alongside the huntsmen. One of these drawings is estimated to be 50,000 yrs. old.

The question which naturally arises relative to such old drawings is whether the canines pictured can rightfully be called dogs. They undoubtedly were wild animals, probably wolves, which were taken into the caveman's abode as cubs and nourished by bones and entrails of the animals eaten by the family. The domesticated canine probably learned that it was easier to procure food by accompanying the huntsman than by chasing and killing its own prey, thus becoming a hunting assistant and probably a guardian of its master.

The most commonly accepted theory of canine development is that the wolf was the main progenitor, with subsequent crossings with other wild canines such as the Eskimo and the dingo. It is unlikely that the jackal was a contributor to the strain in view of the fact that the jackal's dental structure is different from that of the dog, whereas the teeth of the wolf are identical in every detail with those of the dog.

From the investigations of caves, middens and lake dwellings, it is known that Europeans of the new stone age possessed a wolf-like breed of dogs; and a similar breed has been traced through the successive ages of bronze and iron. But accurate information of the external form of domesticated dogs prior to historic times is not available. From the oldest records supplied by Chaldean and Egyptian monuments, it is manifest that several distinct varieties had been developed 4.000–5,000 yrs. ago. Slender dogs of the greyhound type, and a short-legged breed of a terrier type are depicted in Egypt; and the Assyrians of about 600 B.C. had mastiff-like hounds.

The early Greeks and Romans had dogs and mentioned them often in their literature. The Romans' canine classifications were similar to our modern groups. Both made distinctions between those which hunted by scent and those which hunted by sight, just as we divide hounds from hunting breeds. The Romans also had *Canes villatici* (housedogs) and *Canes pastorales* (sheep dogs) which compare to modern working dogs.

MODERN BREEDS OF DOGS

There are five main classes of dogs in addition to a miscellaneous sixth group. This division is based on the uses of the dogs—sporting dogs for hunting by air scent; hounds for hunting primarily by ground scent; terriers which hunt by going to earth; working dogs to serve as guards, guides, and herders; toy dogs to serve as companions; and the miscellaneous or non-sporting group of dogs for a great variety of uses. This general classification applies to modern dogs all over the world. In 1943 there were 112 breeds in these 6 groups recognized in the United States.

The Sporting Group.—(Wire-haired pointing griffon, pointer, German short-haired pointer, Chesapeake Bay retriever, curly-coated retriever, flat-coated retriever, golden retriever, Labrador retriever, English setter, Gordon setter, Irish setter, American water spaniel, Brittany spaniel, clumber spaniel, cocker spaniel, cocker spaniel [English type], English springer spaniel, field spaniel, Irish water spaniel, Sussex spaniel, Welsh springer spaniel and Weimaraner).

The dogs in this group serve as hunters' assistants, mainly as finders and retrievers of small furbearers and fowl. The spaniels are the largest class of hunting breeds. The Irish were among the first users of spaniels, and the name indicates that they probably procured their original stock from Spain. The word spaniel was first printed in the Irish laws of 17 A.D. in a statement that water spaniels had been given as tribute to the king. Three hundred years later, during the period when Wales was overrun by the Irish, spaniels are mentioned in Welsh statutes.

English literature of the 14th century mentions "spanyells," and they were used in falconry during the 16th century, probably to retrieve game killed or injured by the falcons. From the reign of Henry VIII there are records of payments made to "Robin, the King's spaniel keeper."

The spaniel family is divided into those breeds which hunt and retrieve, those which retrieve only and toy spaniels which do not hunt (see *Toy Dogs,* below). Most of the sporting spaniels, in-

cluding the cocker, springer and clumber, range the hunting ground just ahead of the gunner. Their task is to range back and forth over terrain selected by the hunter, but always close enough to the gunner that the charge from his shotgun can kill the game which the dogs flush. Thus the spaniel may be as close as 20 yds. to the hunter, rarely more than 75 yds. away. The reason that spaniels must hunt close is that they give no warning upon finding game, as do the pointing dogs, but immediately rout the game from cover. A well-trained spaniel of this type hunts until he finds game, flushes the game, then immediately sits. For such a dog to chase flushed game is a serious hunting fault. If the game is killed, the spaniel is ordered to find the dead bird or animal and return it to the gunner. Hunting spaniels of this type are trained to flush both furred and feathered game. They also can be trained to retrieve waterfowl from a hunting blind, the springer spaniel being especially adaptable for this work.

The Irish water spaniel, despite its name, is usually classed with the retrievers rather than the spaniels. It competes with the Labrador, Chesapeake Bay and other retrievers in usage.

A second group of gun dogs includes the pointers and setters, which hunt upland game birds by pointing. Unlike the spaniels, which hunt close to the gunner, the pointing breeds range far ahead of the huntsman — often out of sight. When they scent game they do not immediately flush the birds into the air, but stand immobile within a few feet of the game, their sensitive noses pointing toward the single bird or covey. They remain in this position until the hunter flushes and shoots the birds. A well-trained pointing dog will hold such a point for a minute to two hours, stand staunchly while the game is shot and wait for the hunter's command to find and retrieve the killed game.

Pointing dogs are of comparatively recent origin, their development paralleling the development of sporting firearms Wing shooting came into popularity during the first decade of the 18th century, and from that period the rise of the "bird dogs" was marked. The dogs of the pointing group include the German short-haired pointer, the pointer, English setter, Irish setter, Gordon setter and Weimaraner.

Most of the pointing breeds were developed in the British Isles. The first of record were those used in England about 1650 for pointing hares. The English setter probably was developed from crosses of the Spanish pointer, the large water spaniel and the springer spaniel; and there is evidence that a distinct breed of the English setter type was used as early as 1582. It was not until about 1825, however, that the breed came into real prominence through the English sportsman, Edward Laverack, whose breeding practices standardized the appearance of the English setter.

The Gordon setter often is called the black and tan setter because of its coat colours. The breed never has approached the English or Irish setter or the pointer in popularity.

The mahogany-red Irish setter, as distinguished from an earlier red and white breed, first appeared in Ireland early in the 19th century. In addition to being one of the most handsome of all breeds, the Irish setter is a capable field dog.

The retriever breeds are hunting specialists. Their job in the field is that of finding game which has been killed or wounded by the hunter and returning that game to their masters. During the hunting of upland game, retrievers often are worked with spaniels. The spaniels quarter the ground and "spring" the game while the retrievers are kept at the hunter's side. When game is downed the retrievers are sent out to do their specialized job.

The most common use of retrievers is in the hunting of waterfowl. In this type of sport the retrievers remain in the shooting blind until birds are killed, when they are ordered after the downed game. They retrieve equally well on land or water, being strong swimmers. The most popular retriever breeds are the Labrador, Chesapeake Bay, and golden retrievers and the Irish water spaniel. Other breeds used in this hunting work are the curly-coated and flat-coated retrievers.

The Hound Group. — (Afghan hound, bassethound, beagle. bloodhound, borzoi. dachshund, Scottish deerhound, American foxhound, English foxhound, greyhound, harrier, Norwegian elkhound, otterhound, saluki, whippet and Irish wolfhound).

Most of the dogs of this group were developed for sporting uses, primarily to trail game by ground scents. The exceptions to this rule are the Irish wolfhound, borzoi and Scottish deerhound, all of which hunt large game primarily by sight.

The typical breeds of the hound group are powerfully built dogs with strong legs, long heads and muzzles, pendulous ears and pendulous upper lips or "flews." There was at least one hound type, called the St. Hubert, in France before the Conquest; and there are good reasons for the belief that English breeds of the present day are traceable to the importation of these dogs by King William I. From them were derived the talbot and the old English staghound, both now extinct, and the bloodhound which still survives. The bloodhound, which exhibits the hound characteristics of the head in the most exaggerated form, has the keenest scent of all dogs but is heavily built and lacking in speed. For these reasons the bloodhound has been weaned away from its original use as a sporting dog and now is used as a police aid in the trailing of criminals and lost persons.

There seem to have been other breeds in England in the middle ages known as the southern and northern hounds, and in addition there mas a large hound used for trailing deer and smaller hounds, principally harriers and beagles, used for hares. Harriers and beagles are miniature foxhounds in appearance, the beagle being the smallest of the true hounds.

The English country gentlemen of the middle ages were the prime developers of hound breeds, and the development of the breeds paralleled the hunting fancies of the times. Staghunting and hare hunting were popular long before fox hunting became the vogue; thus harriers and beagles, which were followed on foot, are older breeds than the foxhound. The latter breed probably was developed by crossing one of the old English hounds of the bloodhound type with the greyhound to give speed in the pursuit of the fox in open country.

In the United States, the two most popular hounds are the beagle and the dachshund. Basically they are hunting dogs, and the beagle's popularity is due to its ownership by thousands of rural sportsmen for the hunting of rabbits. Single beagles commonly are used for this type of hunting, but they may be hunted in braces or in packs.

Short-legged and long-bodied hounds of the dachshund type were recorded in carvings in Egyptian monuments of the 15th century B.C.; and there is evidence that Englishmen, as well as Germans and Italians, had a similar breed used in hunting during the 15th and 16th centuries, but it was in Germany that the breed was standardized in its modern conformation. The dachshund's popularity in the United States springs from the fact that it is a small, intelligent and friendly house pet. The breed is only occasionally used for hunting. Another of the hound breeds, the greyhound, is distinguished as one of the oldest of all established dog types.

The Working Group. — (Alaskan Malamute, Belgian sheep dog, Bernese Mountain dog, Bouvier de Flandre, boxer, briard, bull-mastiff, collie [rough], collie [smooth], Doberman pinscher. Eskimo, German shepherd, great Dane, Great Pyrenees, komondor, Kuvasz, mastiff, Newfoundland, old English sheep dog, puli, Rottweiler, Samoyede, schnauzer [giant], Shetland sheep dog, Siberian husky, St. Bernard, Welsh corgi [Cardigan] and Welsh corgi [Pembroke]).

There is no doubt that the dogs of the working group have the greatest utilitarian value of all the modern canine classifications. Except in rare cases they are not used in sporting capacities. Instead, they work as police aids, draft animals, herders of livestock and guides for the blind.

In the police group are the boxer, Doberman pinscher, Rottweiler, German shepherd, great Dane, and giant schnauzer, all of which are commonly trained to serve as sentry aids and guard dogs. In addition, the Airedale and standard schnauzer from the terrier group are similarly trained, and the bloodhound from the hound group serves often as a police aid for trailing duty. Thus all of these breeds may be considered "police dogs," a term often

mistakenly used to denote the German shepherd.

Other breeds in the working division were developed as farmers' aids. This group includes the collie, puli, old English sheep dog, Shetland sheep dog, Belgian sheep dog, German shepherd and the corgi, all of which are herders. The Norwegian elkhound, from the hound group, also is used for herding duties. Almost every nation has its dog breed used for herding purposes. Thus we have the collie from Scotland, the puli from Hungary, the corgi from Wales and other imported breeds. The dog most commonly used on U.S. farms for herding work is an unrecognized breed unofficially called the American shepherd, English shepherd or border collie. It is a collie type, but has a shorter muzzle and smaller body, and usually is black and white in colour

Sure-footed draft animals also are included in the utilitarian group of working dogs. Arctic explorations would have been impossible but for the Eskimo and Alaskan Malamutes which pulled long sleds filled with necessary foods and supplies. Draft dogs also are commonly used in Belgium and the Netherlands.

A further sub-classification of working dogs are the "rescue breeds"—the St. Bernard and Newfoundland. The former breed accompanies the monks of the Hospice of St. Bernard, Switzerland, to find helpless persons overcome during storms. The Newfoundland, a strong swimmer, is used to carry life lines to stricken vessels and to aid in the rescue of shipwreck survivors.

The activities of other working breeds, including guide dogs for the blind and modern war dogs, are included in later paragraphs.

The Terrier Group.—(Airedale terrier, Bedlington terrier, border terrier, bull terrier [white], bull terrier [coloured], Cairn terrier, Dandie Dinmont terrier, fox terrier [smooth-haired], fox terrier [wire-haired], Irish terrier, Kerry blue terrier, Lakeland terrier, Lhasa terrier, Manchester terrier, Norwich terrier, schnauzer [miniature], schnauzer [standard], Scottish terrier, Sealyham terrier, Skye terrier, Staffordshire terrier, Welsh terrier, West Highland white terrier).

The terriers hunt by digging into the earth to rout furred animals such as badgers, woodchucks, otters and many others. In some cases their duty is merely to force the furbearers from their dens in order that the huntsman can complete the capture. In other cases the terrier's job is to find and destroy the furbearers, either on the surface or underground. The word terrier is from the Latin *terra*, earth.

The terrier group includes breeds which differ so profoundly from each other that the extreme types have hardly a character in common. The terriers are linked with the mastiff group through the bull terrier, which originally was produced by crossing the bulldog with the white English terrier, a breed now extinct. With the hound group the terriers are connected through the Airedale, which resulted from a cross between the otterhound and a terrier of the Aire valley in England. Apart from their size, the original Airedales did not differ greatly from rough-coated Welsh or Irish terriers.

England, Ireland and Scotland produced most of the terrier breeds. Among the breeds developed in England were the aforementioned Airedale, Bedlington, bull terrier, fox terrier, Manchester and Staffordshire. Scottish breeders developed the popular Scottish terrier in addition to the Cairn, Skye, and West Highland white. Ireland's contributions to the terrier family include the Irish terrier and the distinctive Kerry blue terrier, whose coat ranges from light steel blue to very dark blue. The Sealyham and the Welsh terriers came from Wales. The standard and miniature schnauzers were developed in Germany, and the Lhasa terrier is of Tibetan origin.

The Toy Group.—(Affenpinscher, Chihuahua, English toy spaniel, Brussels griffon, Italian greyhound, Japanese spaniel, Maltese, Mexican hairless, Papillon, Pekingese, miniature pinscher, Pomeranian, pug, toy Manchester terrier, toy poodle, Yorkshire terrier).

All of the dogs in the first four groups; *i.e.*, the sporting dogs, hounds, working dogs and terriers, originally mere bred for a specific purpose—to hunt, trail, rout vermin, serve as protectors of livestock or humans or fill some other need. In most cases, however, the dogs kept in modern homes are kept primarily as pets, secondly for the utilitarian purpose they can fulfill. Thousands of setters never are taken into the hunting field; thousands of sheep dogs never are used for herding stock, and only a comparatively few of the breeds developed as police aids are used for that work. These breeds are capable of such work if trained for it, but the modern dog serves mankind mainly as a companion and pet.

The dogs of the toy group make little claim to any value except as ideal house pets. Like most breeds, they develop a protective instinct which causes them to warn members of their masters' families upon the approach of a stranger, but aside from the performance of that valuable service they earn their keep by providing friendly companionship.

All of the dogs of the toy group are small, ranging from Chihuahuas, which may weigh as little as 1 lb., to pugs which may range up to 18 lbs. Most of the toy breeds are miniature counterparts of larger breeds. The English toy spaniels and Japanese spaniels, for example, are similar in conformation and physiognomy to the hunting spaniels. The Italian greyhound is a dwarfed specimen of the larger gazehound of the ancients. The Pomeranian is the smallest representative of the northern group, which includes the chowchow, Siberian husky, Eskimo, Norwegian elkhound, keeshond and schipperke. The toy Manchester terrier is the toy counterpart of the standard Manchester terrier.

It should not be assumed that toy breeds are new breeds. The Chinese are known to have kept "lion dogs" almost identical to the modern Pekingese as early as 2000 B.C. "Lap dogs" were popular during Caesar's reign. The forest laws written by Canute in the early years of the 11th century contained the provision that any dogs kept within 10 mi. of any of the king's forests must have their knee joints cut to prevent them from chasing game. An exception was made in the case of small dogs which could pass through a dog gauge, an oval ring 7 in. wide and 5 in. high.

Neither must it be assumed that all toy dogs are useless except as companions. As mentioned above, most dogs of the toy group develop a protective instinct after being in a home for a few months, thereafter serving effectively as sentries to warn of the approach of strangers. In many cases this instinct becomes so completely developed that toy dogs will attack intruders.

The Nonsporting Group.—(Boston terrier, bulldog, chowchow, Dalmatian, French bulldog, keeshond, poodle, schipperke)

In this miscellaneous sixth class of dogs are some of the most interesting of all canine types. Three of the eight breeds are of the bulldog family. These are the bulldog, Boston terrier and French bulldog. The distinguishing features of this family are the muscular neck and the strong jaws and teeth. The English-type bulldog was the first of the three modern bulldogs. This massive breed was mentioned in a book published in England in 1500, and probably was used at least two centuries before that in the sport of bullbaiting. In this activity, an English forerunner of bullfighting, a dog with strong jaws was needed to seize the bull by the nose and hold the animal close to the floor of the arena. This cruel sport was outlawed, but the massive and courageous bulldog was retained.

The French bulldog is a comparatively new breed, having been developed by the French from small bulldog stock imported from England. The Boston terrier is one of the few breeds developed in the United States, crossbred by Robert C. Hooper, of Boston, in the mid-19th century.

The chowchow probably is the oldest of the breeds in the nonsporting group. A bas relief dated to the Han dynasty of about 150 B.C. pictures a chow in a hunting capacity. The modern chow is popular in England and the United States as a companion and guard dog.

Wild Dogs.—A number of the best known of the undomesticated dogs deserve mention. The Australian dingo is somewhat like a fox in appearance. Although having a shorter coat, the dingo is both cunning and savage. The animal probably comes from wild stock native to Australia, but it is possible that it derived from crossbreedings of wild canines and dogs brought by

early settlers of the continent. Like the wolf, the dingo in its wild state is nocturnal in habit and hunts in packs. It is somewhat destructive of livestock, and the Australian settlers made attempts to exterminate it. The dingo can be domesticated, and when befriended becomes very much attached to Its master.

The wild dog of Turkey is a pariah, a medium-sized canine which varies greatly in colour and coat. They remain in packs, and are countenanced in Eastern cities to serve as scavengers.

India's native wild dog is the dhole. The same canine also inhabits Tibet. The dhole avoids human habitats but attacks such animals as tigers and leopards.

The licaone is a wild dog of the African continent. It belongs to the family of hairless dogs and has bell-shaped ears. The usual colour is black with white spots. These canines hunt in packs and have a keen sense of smell.

THE DOG'S SENSES

In most respects the dog's senses are considerably keener than man's. In hearing tests conducted by W. A. Engelmann, a German scientist, a German shepherd responded from a distance of 26 yds. to a command which could not be heard by a man 6½ yds. away. The so-called "silent whistles" used by many trainers of hunting dogs demonstrate the great range of a dog's hearing powers. A man standing only a few feet away cannot hear the sound which emanates from these instruments, yet a dog will respond to the same sound from a distance of more than 75 yds. The reason for this is that the sound range of the human ear is restricted, whereas the dog can hear extremely high-pitched tones from a considerable distance. These same tones are above the auditory range of the human ear.

The dog's nose is so sensitive that we are unable to conceive the great range of odours which canines detect. A piece of wood touched only by the tip of a master's finger can be selected by a trained dog from 20 other identical pieces. Bloodhounds have been known to follow perfectly the trail of a stranger 48 hrs. after the path was traversed. There is no known method of measuring this sensitivity of the dog's olfactory powers, but it is among his strongest and most often utilized senses.

The dog's sight, on the other hand, is considerably weaker than man's, forcing the dog to use his keen senses of smell and hearing to make identifications. In one scientific test it was found that dogs could not distinguish between a a-in. delta triangle and a a-in. inverted triangle at a distance of 20 in. On the other hand, dogs have great sensitivity to movements, however slight. This ability to detect very slight motions explains the ability of stage dogs to solve problems in arithmetic. Such trained dogs bark the answers to addition and multiplication problems by following movements of the trainer's hand or jaw which cannot be detected by the human eye.

In another respect dogs' sight is inferior, in that they are colour blind. Their world is one of white, black, and shades of gray, and most tests indicate that their ability to differentiate between gray shades is inferior to that of man.

Guide **Dogs for** the Blind.--One of the most concentrated efforts to turn dogs to the use of man has been the training of thousands of guide dogs for the blind. The Germans led this movement by training several thousand dogs to guide soldiers who returned sightless from World War **I.** Nearly all other countries which participated in that war started similar training programs. In the United States the Seeing Eye foundation, Morristown, N.J., became the leading school for training guide dogs; several others were established in the middle west and western states.

The German shepherd is the breed most often used for this work, about 90% of all U.S. guide dogs being of this breed. Other breeds sometimes used are the boxer, Doberman pinscher and Labrador retriever. Bitches are preferred for guide service, but temperament is the guiding factor in selecting individual canines for the work.

Guide dogs wear a leather harness to which is attached a leather-covered metal hoop which extends to the master's palm. The blind person holds this hoop lightly as the dog walks close to his legs, and is guided according to the pressure exerted by the dog's movements as transmitted through the harness. The dogs guide their masters at about the same speed as that of the normal walker. They proceed largely without commands except for "right," "left," "forward" and "halt." They guide their masters around all holes and barriers and stop before going down or up a curb stone. After making such a stop the dog waits until the master determines the height of the curb and orders "forward." In addition to serving as a guide animal, the dogs perform such other services as picking up articles which the master may have dropped unintentionally. Such services are rendered without command.

A question commonly asked about guide dogs relates to their ability to follow red, green and yellow traffic signals. Inasmuch as dogs are colour blind, they obviously cannot interpret such signals. In fact, trained dogs do not watch traffic signals. They are trained to watch the flow of traffic and to guide their masters across streets when traffic permits safe movement.

The training of guide dogs is complicated for many reasons. These canines must be taught to judge, for example, the speed of approaching vehicles to determine if there is time to cross the street before the vehicle reaches the blind person's path. Similarly, they must be trained to judge heights to determine if the blind person can pass under a barrier, or must walk around it.

Institutions which train guide dogs believe, with good reason, that the work of these canines provides psychological as well as economic benefits. Not only do the dogs give their masters almost complete independence of human aid, but in many cases have changed their masters' entire temperament and approach to life.

Dogs in World War 11.—All of the major powers engaged in World War II used trained dogs in numerous capacities. The United States army organized a K-9 corps as a branch of the quartermaster department for the sole purpose of training dogs for war use. It is known that Germany had 40,000–50,000 trained dogs available for service at the start of the war and later gave Japan 10,000 of these. Russia and England also adopted dogs for military purposes.

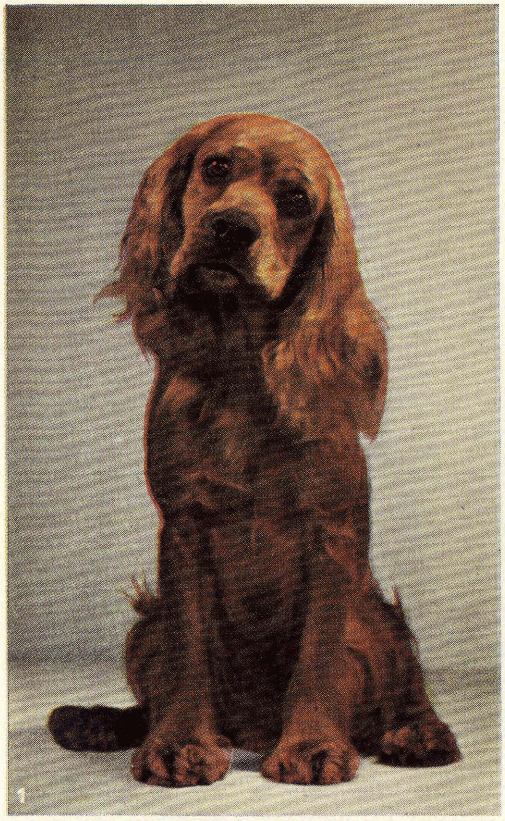
American military dogs were put to use by all branches of the service—army, navy, marines and coast guard. The breeds wanted and approved by the armed forces for war dog training. as of 1943, were as follows: Airedale terriers, Alaskan Malamutes, Belgian sheep dogs, Bouviers de Flandre, boxers, briards, buil mastiffs, Chesapeake Bay retrievers, collies (both rough and smooth), curly-coated retrievers, Dalmatians, Doberman pinschers, English springer spaniels, Eskimos, flat-coated retrievers, German shepherds, German short-haired pointers, giant schnauzers, Great Pyrenees, Irish water spaniels, Labrador retrievers, Newfoundlands, Norwegian elkhounds, pointers, Rottweilers, Samoyedes, Siberian huskies, St. Bernards, standard poodles, wire-haired pointing griffons, and crossbred dogs of any of the above breeds.

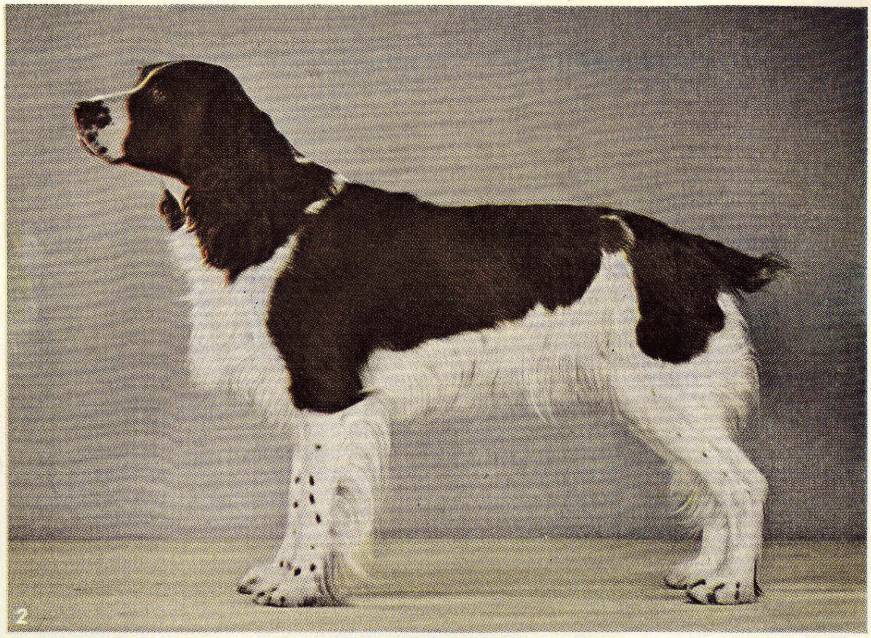
The major use of dogs trained for the military is that of aiding sentries. The canines are taught to accompany guard soldiers, either inside supply depots or outside military buildings or encampments. Under such conditions the dog is expected to range away from its handler, using its nose to find and rout any intruders. Other uses for which war dogs are trained are as messengers, detectors of machine gun nests, pack dogs, sledge dogs and first aid assistants.

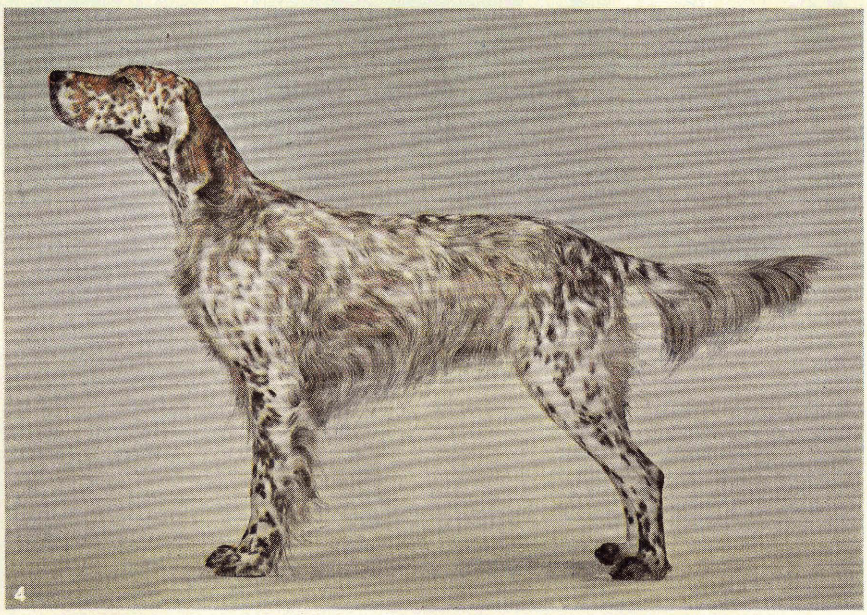
FEEDING THE DOG

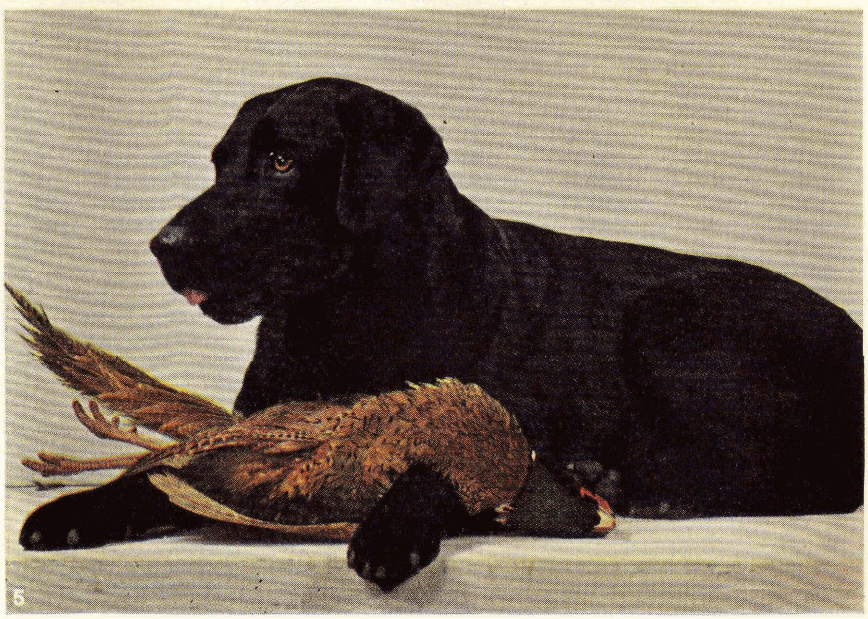
The basis of canine health is a proper diet. A well-fed dog has the resistance to throw off minor diseases and resist major ailments. Similarly, a well-fed dog is most likely to be active and alert, with clear eyes and a healthy skin and coat. Conversely, a poor diet may be the forerunner of many troubles, including diseases of the heart, intestines, lungs and skin.

In their natural state dogs are carnivorous animals. Wild canines live almost entirely on the flesh, skins and bones of animals which they catch. It therefore follows that meat is the prime requisite in the dog's diet, although the variations in the mode of existence between wild dogs and modern house pels









PHOTOGRAPHS, HENRY WAXMAN FROM PUBLIX; (1) WALIDA RED BRUCIE, OWNED BY MR. AND MRS. WATERS F. DAVIS, JR., (2) CHAMPION ELDGYTH APOLLO, OWNED BY RALPH RUBINGER, (3) LATCH-UP BITTERSWEET, OWNED BY NATALIE W. LEWIS AND OLGA H. AND BYRON H. ROGERS, (4) CHAMPION MARO OF MARIDOR, OWNED BY MRS. ST. GEORGE DUKE, (5) FIELD TRIAL CHAMPION HI-WOOD MIKE, OWNED BY MRS. JOHN S. WILLIAMS

SPORTING DOGS

1. American cocker soaniel
2. English springer spaniel
3. German short-haired pointer
4. English setter
5. Labrador retriever

DOG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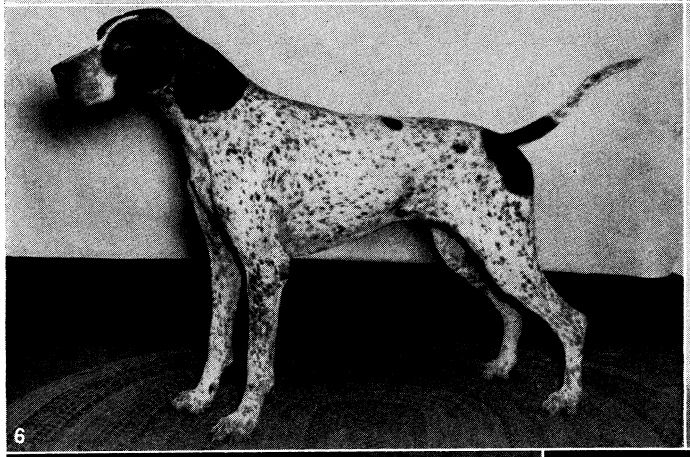
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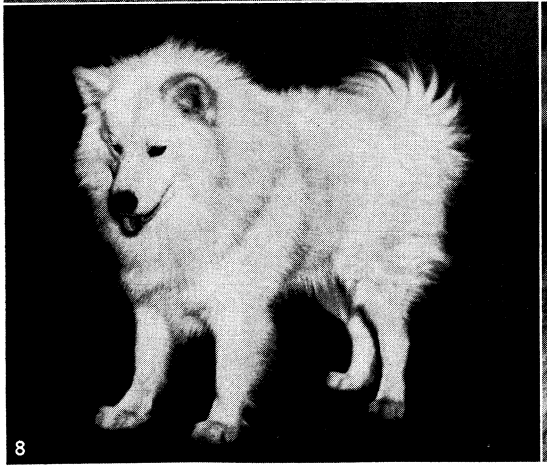
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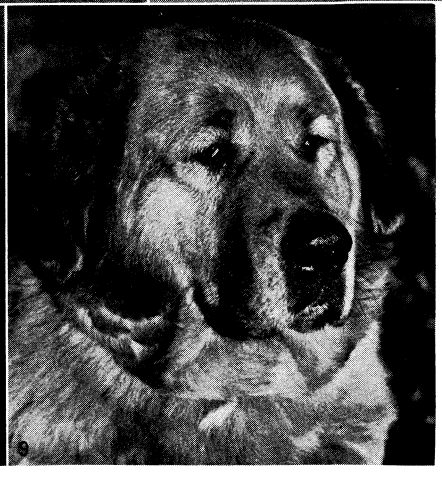
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PHOTOGRAPHS (1, 3, 6-8) CHICAGO TRIBUNE, (2) CAROLA GREGOR FROM MONKEMEYER, (4) MEERKAMPER FROM MONKEMEYER, (5) RALPH MORGAN, (9) W. SUSCHITZKY-PIX. NAMES AND OWNERS OF DOGS: (1) CHAMPION LADDIE OF INGLEHURST, OWNED BY C. C. HENDEE, (3) CHAMPION KING'S MESSENGER, OWNED BY STANLEY F. KRAFT, (5) STAR LEA SKIPPER, OWNED BY MRS. ANTHONY A. BLISS, (6) EDELWEISS' PRINCESS, OWNED BY C. B. OLIPHANT, (7) CHAMPION MASTER JUMBO, OWNED BY CHARLES WILLIAM MILLER, (8) SOLON'S CZAR, OWNED BY MRS. W. R. BOLTON.

SPORTING DOGS AND WORKING DOGS

1. Gordon setter (sporting)
2. Irish setter (sporting)
3. Old English sheepdog (working)
4. Cocker spaniel puppies (sporting)
5. Chesapeake Bay retriever (sporting)
6. Pointer (sporting)
7. Newfoundland (working)
8. Samoyede (working)
9. Tibetan mastiff (working)

naturally requires that there be variations in their diet.

Wild dogs, for example, require more food and a higher ratio of protein foods than do domesticated house pets, for the obvious reason that a wild dog utilizes considerable energy for chasing and killing the game which he eats, whereas the pet kept in a home gets his meals without effort.

The meat which forms the backlog of the dog's diet may be supplied in one of several forms. It may be fresh meat, commercially-packed dog meat or dehydrated meat in biscuit form. Many large kennels which keep dogs in almost perfect condition for exhibition in shows feed almost no fresh meat, but depend upon commercially manufactured biscuit focds which contain dehydrated meat in addition to bone meal, corn and wheat products, soybean meal, dried milk, yeast, bran, cheese meal, fish meal, molasses arid cod liver oil. Pet owners who keep only one dog in the house can economically follow the example set by the large kennels by feeding biscuit foods in conjunction with table scraps, milk and other beneficial dog foods. These prepared cereal foods may be fed dry, but are more palatable if softened with milk, hot water or broth.

Since the dog is primarily a carnivorous animal, vegetables must be considered as a subsidiary food in his diet. Vegetables may be fed to dogs in small portions and mixed with other foods. In almost every case they should be cooked and mashed, since the dog cannot digest vegetable chunks. Among the vegetables which, in small quantities, are beneficial to the dog are spinach, carrots, asparagus, beans, tomatoes and potatoes. Milk can be given to dogs of any age and is particularly beneficial to puppies just past the weaning stage. Among the foods which should be avoided are pork, uncooked fish and fowl.

A common query relates to the quantity of food to be given to a dog and the number of meals each day. Most veterinarians recommend that a puppy from 6 to 10 weeks old be given 4 meals a day at 4 hr. intervals. Between the ages of 10 weeks and 6 months the dog can be fed 3 times a day at 5 hr. intervals. After 6 months most dogs thrive on a light meal in the morning and a major meal in the evening.

There is no fast rule on the amount of food a dog should be given each day. Roughly, toy breeds require about ½ lb. of food per day; breeds weighing 10–20 lbs. require about 1 lb. of food; dogs weighing 20–50 lbs., about 1½ lbs. of food, and those weighing more than 50 lbs. may consume 2–4 lbs. of food per day. This schedule varies greatly, however, according to the temperament of the individual dogs. A very active terrier weighing only 20 lbs., for example, may eat as much as a 50 lb. dog that has a placid temperament. The best rule is to watch the dog's actions to determine the amount of food he can assimilate. The owner should feed no more than the dog eats readily at each meal and naturally change or reduce the diet if the dog becomes overweight or underweight.

DOG AILMENTS

Distemper. — Sometimes called "canine plague" because of its widespread occurrence and virulence, distemper is one of the most serious of all the diseases of dogs. The virus causing distemper is air-borne, and can affect dogs of any age, although it is most serious in puppies under a year of age because these young dogs often do not have the strength to combat the disease.

The most common symptoms of distemper are discharges from the nose and eyes; an offensive odour of the skin, caused by slight skin eruptions; sneezing and coughing; loss of appetite and a general indication of waning strength.

Distemper is more easily prevented than cured. A series of three inoculations, given to puppies over three months of age by a veterinarian, provides dogs with almost complete protection.

Rabies. — Rabies is an infectious disease affecting many warm-blooded animals, including man, in which case it is termed hydrophobia. It is more common in dogs than in any other animal because of their roving nature, but it can affect and be transmitted by rodents, cattle, horses, cats, monkeys and other animals. The usual method of transmission of the rabies virus is through the bite of an infected animal, in which case the rabies bodies in the saliva of the infected animal are injected into the nervous system of the animal attacked. In rare cases the disease can be transmitted without biting taking place. This occurs if saliva from an infected animal enters the nervous system of another animal through a skin abrasion.

There are two types of true rabies in dogs. The first is dumb rabies, so-called because the lower jaw of a dog thus affected becomes paralyzed, preventing barking and biting. The second type is violent rabies, the symptoms including extreme nervousness and biting of other animals without reason.

Veterinarians and scientists disagree as to the value of preventive rabies inoculations. Many U.S. states require annual anti-rabies inoculations. England has almost eliminated rabies by a strict quarantine law which bans dogs from the country until after six months of observation. The most certain method of protecting a family dog against rabies is to keep it under strict control, either on its home property or otherwise on leash, since the only manner by which it can contract the disease is through the bite of an infected animal.

There is no cure for rabies or hydrophobia, but it can be prevented by the Pasteur treatment, provided this treatment is started while the disease is in the incubative stage.

Internal Parasites. — Several types of worms may be internally harboured by dogs. They can be inherited, but more commonly the worm larvae is taken into the dog's organs through its food. The most common internal parasites are roundworms, tapeworms, hookworms, whipworm and heartworm. The latter type is most common in the southern United States and usually is fatal.

Worms sometimes can be detected in the dog's bowel excretions, but a microscopic examination usually is necessary to determine the type of worms present. External indications of the presence of worms include excessive appetite, or almost complete lack of appetite, laziness, loss of weight, eve excretions and vomiting. These same symptoms also are present in other dog ailments. however. and therefore are not wositive guides. The aforementioned microscopic examination of the dog's stool is the only definite proof of worm presence Treatment for worms varies according to the types present, and should not be undertaken in the home without veterinary recommendations.

INDIVIDUAL BREEDS

Sporting Breeds. — Griffon (Wire-Haired Pointing). — A medium-sized dog developed in the last quarter of the 19th century. Primarily a pointing breed.

Pointer.--One of the leading sporting breeds, and the first type of dog developed to stand game as we understand the term today. Originally used in England to point hares. The pointer probably was developed from foxhound, greyhound, bloodhound and spaniel blood. Common colours are white and black, white and liver, white and orange and white and lemon.

Pointer (German Short-Haired). — A versatile breed developed in Germany about 1895 for pointing upland game and coursing furbearers and large game.

Retriever (Chesapeake Bay). — Hunters' retriever used for finding and delivering upland game and waterfowl. Developed in America.

Retriever (Curly-Coated), — First breed developed exclusively for retrieving game in the hunting field. First exhibited publicly in England in 1859.

Retriever (Flat-Coated). — Similar to the curly-coated retriever and developed at about the same time for the same uses.

Retriever (Golden). — Developed in England about 1870 from the Russian tracker breed, with bloodhound crosses.

Retriever (Labrador). — An all-black, short-haired retrieving breed developed in England from stock imported from Newfoundland.

Setter (English). — One of the most popular game pointing breeds in the British Isles and the United States. Developed in England in the 15th century for pointing upland game birds.

Setter (Gordon). — Similar to the English setter and Irish setter, but black and tan in colour. Developed in Scotland, and

takes its name from the Duke of Gordon, a Scotch breeder of the late 18th century.

Setter (Irish).—A red- or chestnut-coated pointing breed developed in Ireland early in the 18th century.

Spaniel (American Water).—Smaller than the Irish water spaniel, and used both for flushing and retrieving game.

Spaniel *(Brittany)*.—Developed in France, this is the only member of the spaniel family which points game.

Spaniel *(Clumber)*.—A large and deliberate sporting dog, the clumber was developed in England from spaniel and bassethound bloodlines.

Spaniel (Cocker).—In the 1940s the most popular breed in America, being kept primarily as a house pet and hunting dog. Originally developed in England for hunting woodcock, hence its name. Specimens of this breed weigh 18-24 lbs. and may be either solid-coloured or two-coloured.

Spaniel (Cocker—Englislz Type).—Similar to the American-type cocker spaniel in conformation, colour and temperament, but slightly larger in size.

Spaniel (English Springer).—One of the most popular of the sporting dogs of general usage, the springer flushes and retrieves upland game and also retrieves in water. Dogs of this breed weigh 42-50 lbs. and have the typical spaniel head and body conformation.

Spaniel (Field).—Dark-coated hunting spaniel developed in England; weighs 35-50 lbs.

Spaniel *(Irish* Wafer).—Developed in Ireland in the first half of the 19th century. Tallest of the spaniels, the breed is used primarily as a retriever on land and water.

Spaniel (Sussex).—A determined and valuable hunter of upland game, the Sussex works more slowly and deliberately in the field than does the cocker or springer. Weighs 35-45 lbs.

Spaniel (Welsh Springer).—A red and white spaniel developed in Wales and used primarily in the British Isles for upland game.

Weimaraner.—A German breed similar in appearance to the short-haired pointer. An all-around hunting breed, but most commonly used for pointing upland game.

Hound Breeds.—Afghan Hound.—One of the oldest of all breeds, there being evidence that it was kept in Egypt 5,000 to 6,000 yrs. ago. Later bred in northern Afghanistan, the breed hunts by sight.

Basset Hound.—Developed in France, the basset weighs 25-40 lbs. and is used in the United States for trailing foxes, rabbits, pheasants and raccoons.

Beagle.—One of the five most popular breeds in America, the beagle is primarily a rabbit hunter and companion dog. Became popular during the Elizabethan period for hunting hares. May be hunted singly, in braces or in packs.

Bloodhound.—One of the oldest of the scent-hunting hounds, having been known in Italy as early as the 3rd century. The breed name is derived from the fact that it was one of the first of the "blooded" or purebred hounds, and its main modern use is that of trailing criminals or lost persons.

Borzoi.—Used as coursing hounds since the 13th century, the borzoi also is called the Russian wolfhound. Large, angular canines, the borzois stand from 26-31 in. at the shoulder and weigh 55-105 lbs.

Dachshund.—One of the most popular of the hounds, the dachshund has the temperament, size and intelligence to qualify it as an ideal house pet. Developed in Germany to enter badger dens, hence its long body and short, powerful legs. The short-haired variety is most common, but there also are long-haired and wire-haired types.

Deerhound (Scottish).—As its name implies, this breed was used most extensively in Scotland and England for coursing deer. Completely established as a distinct breed in the 16th century.

Foxhound (American).—A variation of the English foxhound, and well established in the United States in colonial days. George Washington was one of the first U.S. enthusiasts of the breed.

Foxhound (English).—Somewhat larger than the American foxhound, and hunted in packs for trailing the fox. The most common colour combination for both the American and English foxhound is black, white and tan.

Greyhound.—One of the oldest established breeds, having been established in Egypt between 4000 and 3500 B.C. and later favoured by the Greeks. Used for tracking all types of game, but most commonly used in hunting hares.

Harrier.—One of the early hounds used in pack hunting, the harrier probably was introduced into England by the Normans. Similar to but smaller than the foxhound.

Norwegian *Elkhound*.—Another of the ancient hound breeds, having been used by the Vikings as early as 4000 B.C. Has a thick, grey coat, and stands 18-20½ in. tall at the shoulder.

Otterhound.—Hounds were used for killing otter in England as early as A.D. 1200, and this breed was established for this type of hunting as early as A.D. 1300. A large, rough-coated dog weighing up to 6j lbs.

Saluki.—Perhaps the oldest known breed of domesticated dog; excavations of the Sumarian empire of 7000 to 6000 B.C. show canines of the saluki type. Similar to the greyhound in conformation, but with silky feathering on the ears and tail.

Whippet.—The fastest of all the small, domesticated animals, the whippet is similar to but smaller than the greyhound, weighing 10-28 lbs.

Wolfhound (Irish).—The tallest of all dogs, having a greyhound conformation. The Irish wolfhound was kept by Celts as early as 273 B.C.

Working Breeds.—Alaskan *Malamute*.—One of the oldest of the Arctic sled dogs. A heavy-coated, compact dog weighing 50-85 lbs.

Belgian *Sheep* Dog.—There are six varieties of Belgian sheep dogs, the Groenendael, a long-coated black type, being the most popular. This variety weighs 50-55 lbs. and is used mainly for herding.

Bernese Mountain Dog.--One of the four varieties of Swiss mountain dogs, used mainly as a draught animal. Stands 21-27½ in. high at the shoulder.

Bouvier de Flandre.—A Belgian breed used as police and army aids. Usually fawn or black in colour, and stands 22¾-27½ in. at the shoulder.

Boxer.—Related to other breeds of the bulldog type, having some terrier blood. The boxer is smooth-coated, of medium size and handsome conformation. Excellent as a police aid and home protector.

Briard.—A French breed known as early as the 12th century. A dark-coloured dog standing 22-27 in. at the shoulder. Used primarily as a sheep herder, guard dog and police aid.

Bull-Mastiff.—A massive, short-haired breed developed in England in the latter half of the 19th century by crossbreeding the mastiff and the bulldog.

Collie.—The smooth-coated collie and the more common rough-coated collie are recognized as separate breeds. Both developed in Scotland in the 18th century, the former for driving sheep and the latter for guarding sheep.

Dobernzan *Pinscher*.—A medium-sized guard dog and companion developed by Louis Dobermann, a German breeder, around 1890. Usually black and rust or rust in colour, short-haired and weighing 60-75 lbs.

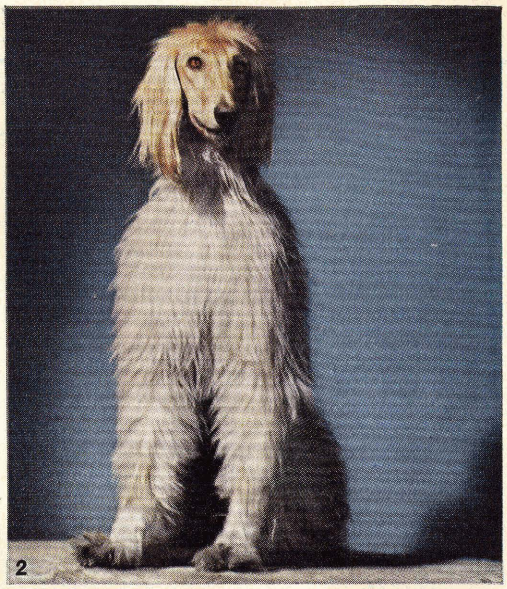
Eskimo.—One of the northern breeds, famed as a sledge dog. Has long hair and weighs 50-85 lbs.

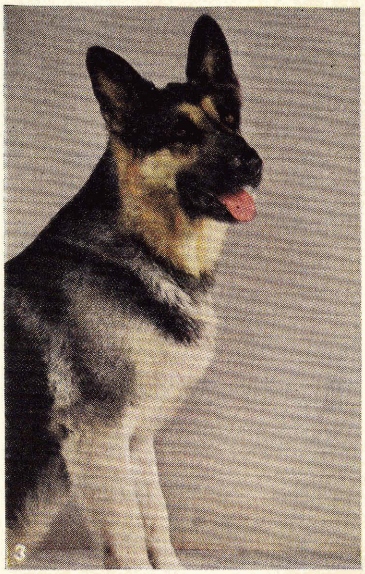
German *Shepherd*.—A leading working breed, having been used in herding, guard work, battlefield rescue missions, guiding the blind and police assistance. Has long hair, of almost all colours, and stands 22-26 in. at the shoulder.

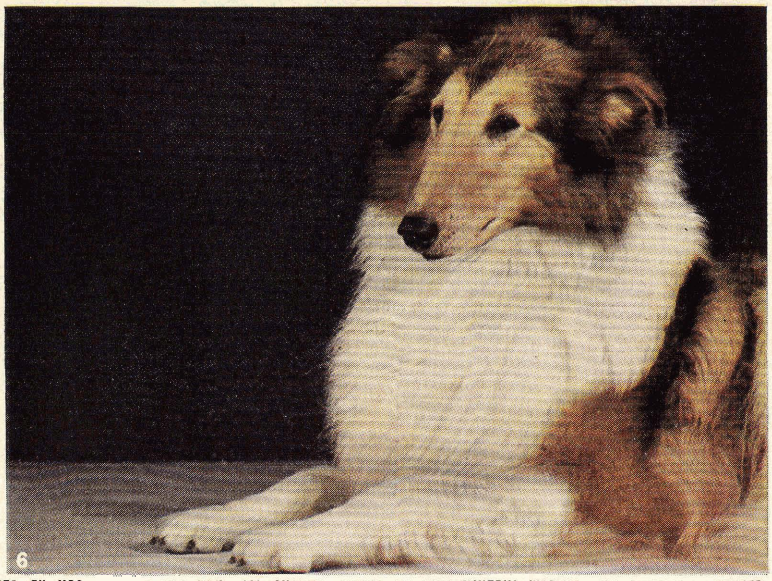
Great Dane.—One of the largest of the modern breeds, having been developed in Germany to hunt boars. Probably has Irish wolfhound and old English mastiff blood. May be brindle, fawn, blue, black or black and white. Females measure more than 28 in. at the shoulder, males 30 in.

Great Pyrenees.—A large dog, usually white, most commonly used as a watch dog, companion and pack dog. Known in Europe more than 3,000 yrs. ago, and became a favourite of French royalty in the 17th century.

Komondor.—One of the three breeds of Hungarian working





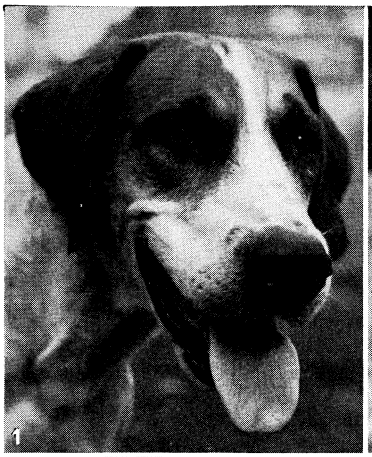


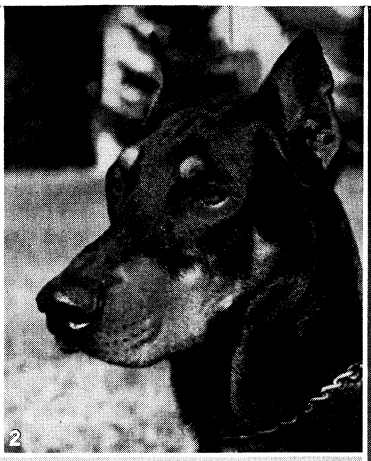
PHOTOGRAPHS. HENRY WAXMAN FROM PUBLIX; (1) OLAUS OF WARRENDANE, OWNED BY MRS. THOMAS VAN URK, (2) SHANTY, OWNED BY MISS MINERVA WRIGHT, (3) CHAMPION PFEFFER VON BERN, OWNED BY JOHN GANS, (4) VEGA, OWNED BY MRS. GERARD B. LAMBERT, (5) CHAMPION BASIL V. WALDECK, OWNED BY THE WALDECK KENNELS, (6) CHAMPION HEIDI OF NORANDA, OWNED BY MR. AND MRS. WILLIAM H. LONG, JR.

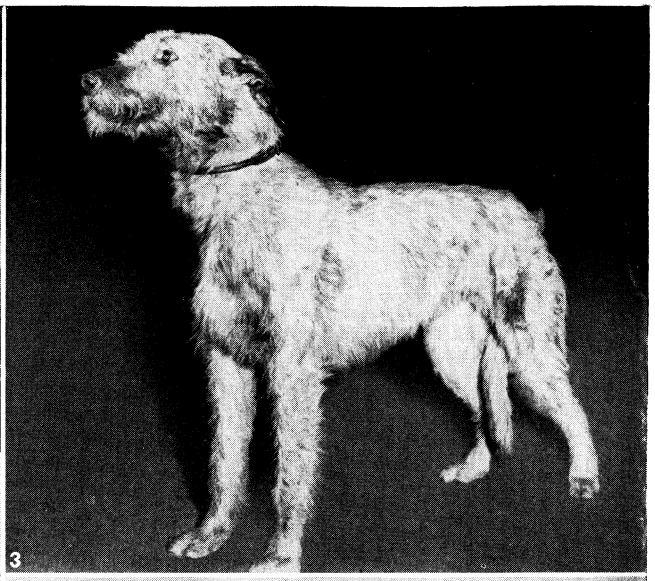
HOUNDS AND WORKING DOGS

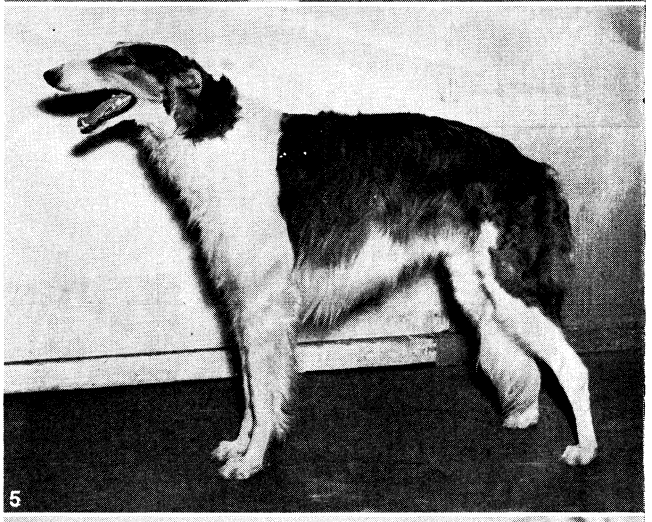
1. Great Dane
2. Afghan hound
3. German shepherd
4. Greyhound
5. St. Bernard
6. Collie

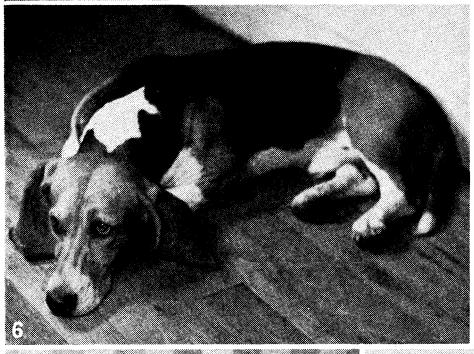
DOG

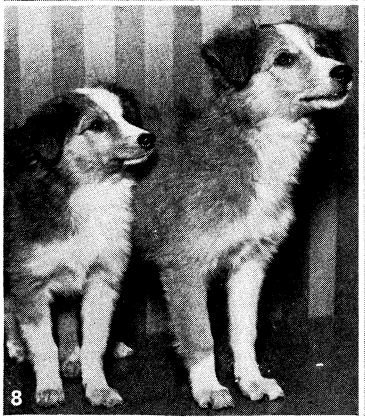


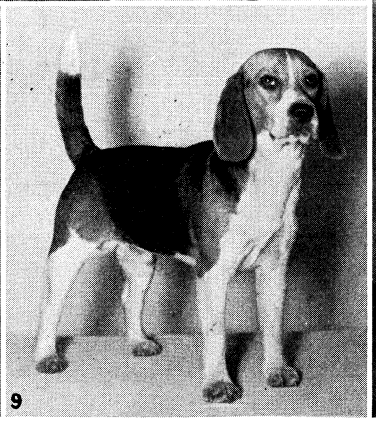


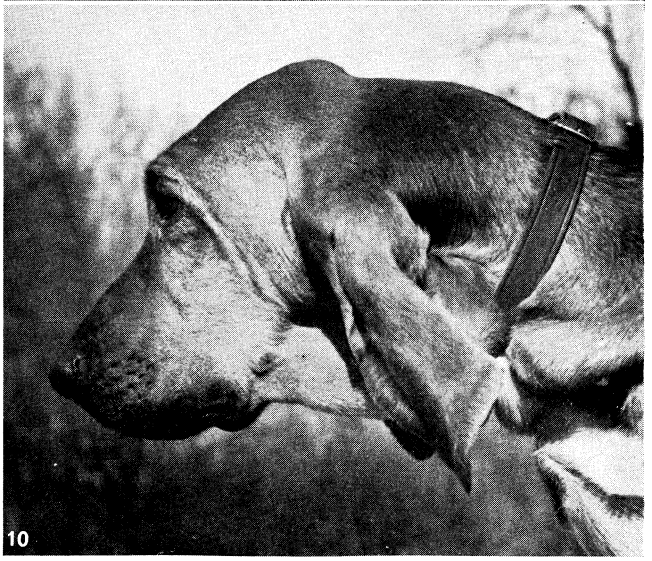








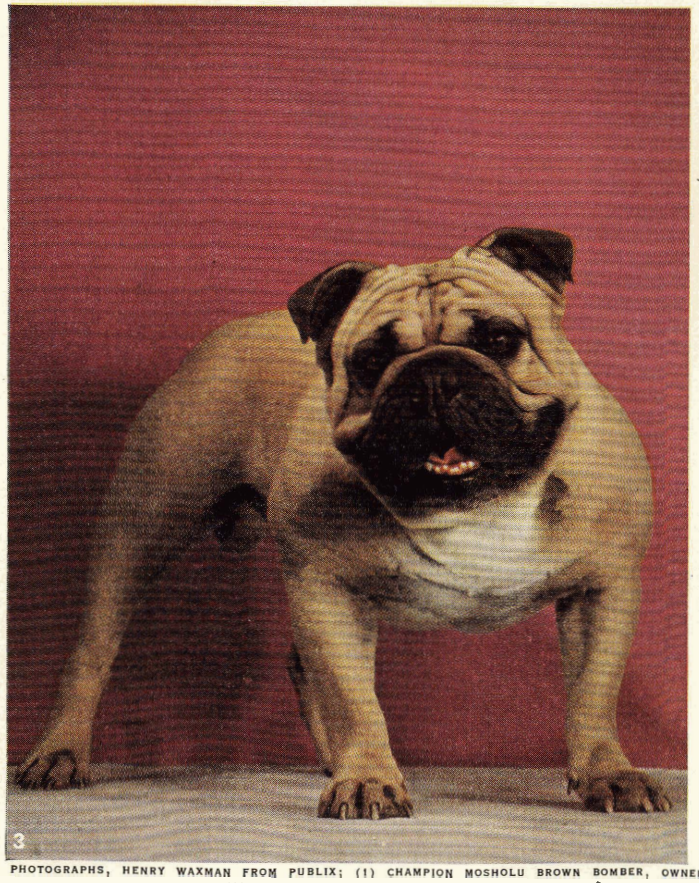




PHOTOGRAPHS (1, 2, 4, 6) YLLA FROM RAPHO-GUILLUMETTE, (3, 5, 7, 8) CHICAGO TRIBUNE, (9) GEORGE A. KELLER, (10) ROY PINNEY FROM MONKEMEYER. NAMES AND OWNERS OF DOGS: (5) CHAMPION KORILHNEVI MALCHIK OF MOCEDO, OWNED BY MRS. GEORGE MENDEL, (7) CHAMPION YEOMAN, OWNED BY MR. AND MRS. THOMAS KINWALD, (8) WRAIN AND WILLOUGHBY, OWNED BY MRS. WALTER PETERSEN, (9) KINSMAN MR. DICKENS, OWNED BY LEE S. WADE

HOUNDS AND WORKING DOGS

1. English foxhound
2. Doberman pinscher (working)
3. Irish wolfhound
4. Dachshund with puppies (hound)
5. Borzoi, or Russian wolfhound
6. Basset hound
7. Boxer (working)
8. Shetland sheepdog puppies (working)
9. Beagle (hound)
10. Bloodhound

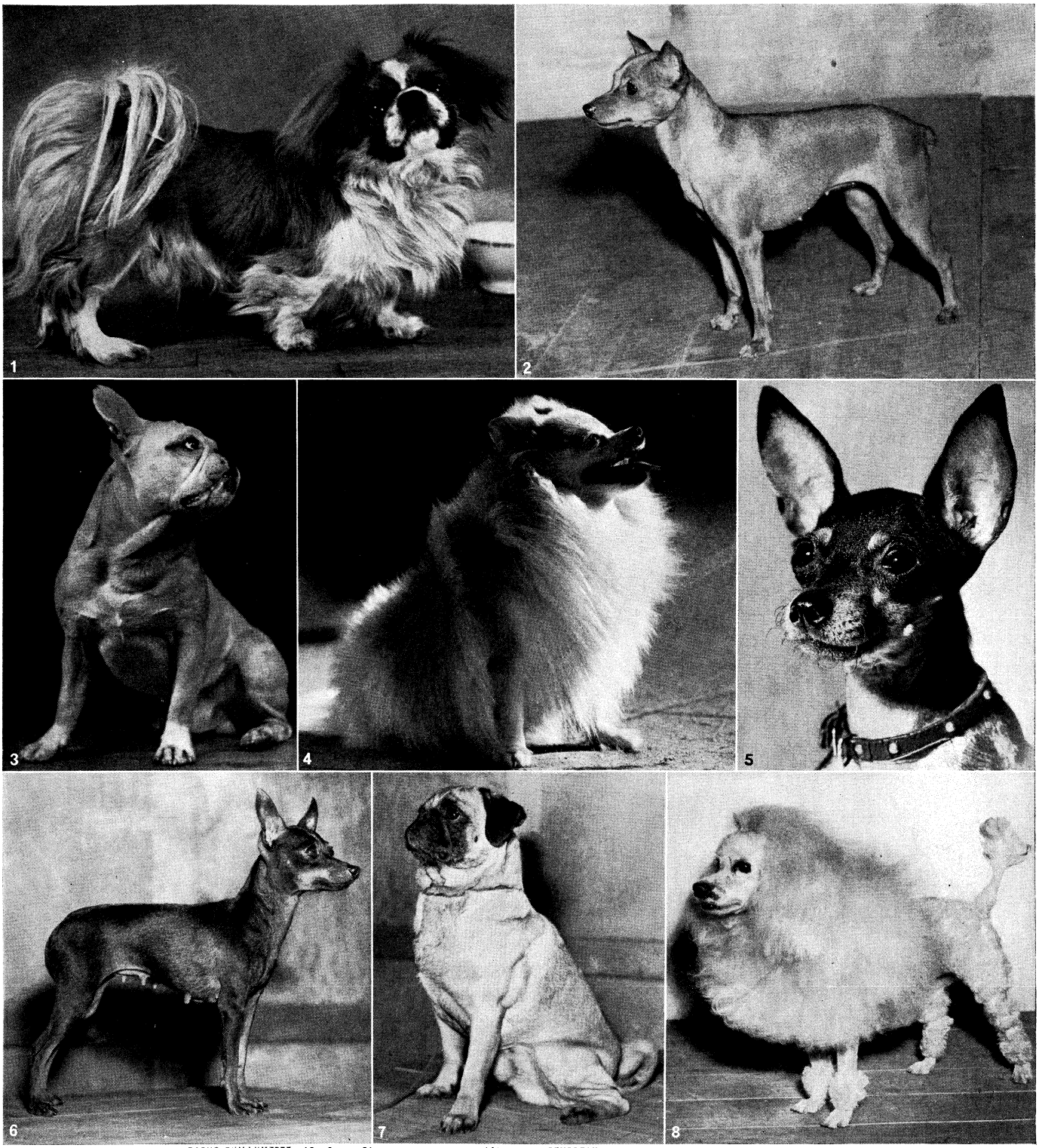


PHOTOGRAPHS, HENRY WAXMAN FROM PUBLIX; (1) CHAMPION MOSHOLU BROWN BOMBER, OWNED BY MRS. MADELINE C, MC GLONE, (2) CHAMPION JIMMIE BOY, OWNED BY MISS KATHERINE STAPLES, OYSTER BAY, N.Y., (3) CHAMPION JACKMINS FERDINAND, OWNED BY W. S. FLETCHER, JR., (4) DALMATIAN OWNED BY MRS. L. W. BONNEY

NONSPORTING DOGS

1. Boston terrier
2. Chow
3. English bulldog
4. Dalmatian

DOG



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NONSPORTING AND TOY DOGS

1. Pekinese (toy)
2. Miniature pinscher (toy)
3. French bulldog (nonsporting)
4. Pomeranian (toy)
5. Chihuahua (toy)
6. Toy Manchester terrier
7. Pug (nonsporting)
8. Toy poodle

dogs, kept mainly by shepherds of that country for protecting the flocks. An all white breed, with long hair, standing at least 23½ in. at the shoulder.

Kuvasz.—Developed in Hungary in the 15th century from forbears brought from Tibet, the Kuvasz was used for hunting big game, for guard duties and for herding purposes. All specimens are pure white, long-haired and stand 25-27 in at the shoulder.

Mastiff.—A giant, short-haired dog, with heavy head and short muzzle, which has been used in England for more than 2,000 yrs. as a watch dog. A representative of the mastiff family known in Egypt as early as 3000 B.C.

Newfoundland—Originated in Newfoundland from forbears brought there by fishermen from Europe. A large, strong, active dog, black in colour and weighing 110-150 lbs. Landseer Newfoundlands may be almost any colour, but usually are white with black or bronze markings.

Old English *Sheep* Dog.—Developed in England early in the 19th century for driving cattle and sheep. Usually white with markings of grey, grizzle or blue; with long hair over entire body, including the head.

Puli.—The third of the Hungarian working breeds, the puli is an alert, medium-sized dog used primarily for herding sheep. Has a long coat, usually black, grey or white in colour.

Rottweiler—A large, mastiff-type working dog developed by German breeders from stock known to the Romans. Primarily a guard dog and cattle driver, the Rottweiler is black with tan markings and stands 21¾-27 in. at the shoulder.

Samoyede.—An Arctic sledge dog, white in colour and weighing 36-55 lbs.

Schnauzer (Giant).—See Schnauzer under Terrier Breeds, below.

Shetland Sheep Dog.—A miniature collie in appearance, this breed was developed in the Shetland Islands. Stands 12-15 in. at the shoulder, and is usually sable, black or blue with markings of white and tan.

Siberian Husky.—A sled dog developed in Siberia and commonly used in Alaska. Usually grey with white and black markings and weighing 40-65 lbs.

St. Bernard.—This breed has been kept by monks at the Hospice of St. Bernard in the Swiss Alps since the latter part of the 17th century. It is massive, stands 25½-27½ in. at the shoulder, and has red or brindle markings.

Welsh Corgi (Cardigan Type).—This breed was introduced to Wales by the Celts at about 1200 B.C. It is similar to the dachshund in conformation, but has a medium-length coat and erect ears. Used for driving cattle.

Welsh Corgi (Pembroke).—Similar to the Cardigan type corgi in conformation, but having a short tail. Introduced into Wales by Flemish immigrants in A.D. 1107.

Terrier Breeds.—Airedale *Terrier.*—Developed by cross-breeding the now extinct old English terrier with the otterhound. One of the largest of the terriers, black and tan in colour and weighing 38-45 lbs.

Bedlington Terrier.—Developed about 182; in Bedlington, Northumberland, England. Distinctive because of its sheep-like appearance, it weighs 22-24 lbs. and has a thick coat of light blue, liver or sandy hue.

Border Terrier.—An active, game terrier weighing 11½-15½ lbs., with a head akin to that of an otter.

Bull Terrier.—Developed early in the 19th century by cross-breeding of the white English terrier, bulldog and Spanish pointer. There are two varieties—one all-white and rhe other any colour other than white or coloured with white markings. The weight of the standard varieties is 25-60 lbs.

Cairn Terrier.—One of the Scottish breeds, developed for routing otter, foxes and other furbearers. Females weigh 13 lbs., males 14 lbs., and may be any colour except white.

Dandie Dinmont Terrier.—A native of the borderlands between England and Scotland, first recorded as a distinct breed about 1700. Mustard or pepper in colour, dogs of this breed weigh 14-24 lbs.

Fox Terrier.---One of tile best known of the terriers, being popular in the United States, Britain and most of the nations of continental Europe. Developed by the English for routing vermin, the fox terrier may have either a smooth- or wire-haired coat. White is the predominating colour, with dark markings. The fox terrier weight is 16-18 lbs.

Irish Terrier.—An all-red terrier with a wire-haired coat, this breed was developed in Ireland. Similar to the fox terrier in conformation, but somewhat larger, weighing 25-27 lbs.

Kerry *Blue* Terrier.—Ireland's national dog, having been developed in County Kerry before 1835. A distinctive breed, having a light or dark blue coat and weighing 32-38 lbs.

Lakeland Terrier.—Similar to the Irish terrier in conformation, but weighing only 16-17 lbs. Developed in the lake districts of England for routing fox and otter, dogs of this breed may be black and tan, grizzle and tan or blue and tan in colour.

Lhasa Terrier.—Developed in Tibet more than Soo years ago. the Lhasa terrier has a long, straight coat, usually of golden hue.

Manchester Terrier.—The standard Manchester terrier weighs 14-22 lbs., whereas the toy Manchester weighs 7-12 lbs. Both are black and tan in colour, short-haired, with somewhat roached backs. Developed in the Manchester district of England.

Norwich Terrier.—A small, short-legged, wiry-coated dog used for routing foxes, the Norwich usually weighs about 11 lbs. and is red, black and tan or grizzled in colour.

Schnauzer.—There are three size varieties of this breed, the giant standing 21½-25½ in. at the shoulder, the standard type measuring 17-20 in. at the withers, and the miniature type 11½-13½ in. at the shoulder. All are similar in conformation, with hard, wiry coats, rectangular heads and short tails.

Scottish Terrier.—One of the earliest of the terriers indigenous to Scotland, this popular breed usually is black in colour, but may be wheaten, grey or grizzled. An active, short-legged breed weighing 18-20 lbs. and used for routing foxes, rodents and other furbearers.

Sealyham Terrier.—A white terrier having conformation and size similar to that of the more common Scottish terrier. Developed in Wales between 1850 and 1890.

Skye Terrier.—A short-legged and long-bodied Scotch breed, being about 9 in. high at the shoulder, about 40 in. long and weighing 16-18 lbs. The breed's coat is about 5½ in. long and is blue, grey or fawn in colour.

Staffordshire *Terrier.*—Similar to and related to the white bull terrier, but dark in colour, the Staffordshire weighs 35-50 lbs. and was developed from bulldog and terrier blood.

Welsh Terrier.—A squarely-built black and tan terrier standing 15 in. high at the shoulder and weighing about 20 lbs., this breed was developed in Wales for hunting the otter, fox and badger.

West Highland White Terrier.—Of the Scottish family of terriers, this breed is all white and weighs 13-19 lbs. It has the conformation of most of the Scottish terrier breeds, with short legs and a short, cobby body.

Toy Breeds.—*Affenpinscher.*—A rare breed in America, somewhat similar to the more common Brussels griffon in appearance, the affenpinscher has a red or grey wiry coat, a distinctive "beard" and never exceeds 10¼ in. in height.

Chihuahua.—The smallest of all breeds, weighing only 1-6 lbs., the Chihuahua is a native of Mexico. This breed should not be confused with the Mexican hairless, since it may be either short-haired or long-haired.

English Toy Spaniel.—A breed weighing 9-12 lbs., the English toy spaniel has a long silky coat and a head formation somewhat like that of the Pekingese. There are several varieties of this breed, including the Prince Charles, King Charles, Ruby and Blenheim, the main variations being in colour.

Griffon (Brussels).—Developed prior to the 17th century from the affenpinscher, the now extinct Belgian street dog, the Chinese pug and the Ruby spaniel, the Brussels griffon has a wiry, reddish-brown coat and weighs 7-12 lbs.

Italian Greyhound.—A small, short-haired breed of typical greyhound conformation, the Italian greyhound has existed in its present form for more than 2,000 yrs. The average dog of this

breed weighs about 8 lbs.

Japanese Spaniel.—This breed is similar to the English toy spaniel in appearance, but is always black and white or red and white in colour. This spaniel has a head somewhat similar to that of the Pekingese, its coat may be profuse or short and its average weight is about 7 lbs.

Maltese.—This breed, somewhat like the Skye terrier in conformation and type of coat, was developed on the island of Malta more than 2,800 yrs. ago. Its coat is white and long, and it weighs 2-7 lbs.

Mexican Hairless.—A rare breed, probably having descended from the hairless dogs of China, these dogs were established in Mexico by the Aztecs. Not to be confused with the Chihuahua, which is a distinct breed.

Papillon.—A member of the toy spaniel group of dogs which probably was developed in Spain but attained its greatest popularity in France during the reign of Louis XIV. A small breed, predominantly white with patches of other colours.

Pekingese.--One of the most popular of the toy breeds, the Pekingese originated in China before the 8th century. It has a pug type head, including a very short, flat nose. The profuse Pekingese coat may be any colour, and specimens of the breed weigh under 14 lbs.

Pinscher (Miniature).—Similar to the more common Doberman pinscher in conformation and coat, but weighing only 6-10 lbs., this breed was developed in Germany.

Pomeranian.—One of the northern breeds, being related to the chowchow, Alaskan malamute and Norwegian elkhound, the Pomeranian was developed in Pomerania. Germany. Ideal specimens of the breed are compact, short-coupled, weigh about 7 lbs. and have profuse coats and plume tails of varying colours.

Pug.—A short-faced dog which probably originated in China, the pug is a square, cobby breed which weighs 14-18 lbs. and has a short coat which is silver or apricot-fawn in colour.

Toy *Manchester* Terrier.—See Manchester Terrier under Terrier Breeds, above.

Toy Poodle.—See Poodle under *Non-Sporting* Breeds, below.

Yorkshire Terrier.—Probably a descendant of the Skye terrier, having been developed in the Lancashire and Yorkshire areas of England, this small terrier type has a long, straight coat which often touches the ground and usually is dark blue mingled with fawn or bronze.

Nonsporting Breeds.—Boston Terrier.—One of the few breeds developed in America, the Boston terrier became one of the most popular of U.S. dogs. It was developed in Boston in the middle of the 19th century by crossbreeding the English bulldog and the white English terrier. The breed is compactly built, with a square skull, bulldog-type face, brindle and white or black and white in colour, short coat and a weight of about 12-25 lbs.

Bulldog.—An English breed originally used in baiting and fighting bulls. Like other members of the bulldog family, this breed has a short, broad face with protruding lower jaw, a deep-set nose, massive neck and body and rather short, strong legs. Females of this breed weigh around 40 lbs., males 10 lbs. more.

Chowchow.—One of the oldest dog breeds, the chow was standardized in China as early as 150 B.C. It has a large, massive head, flat skull, short nose, deep-set eyes and erect ears. Its coat is abundant, outstanding and may be any solid colour.

Dalmatian.—A medium-sized, short-haired dog, white spotted with black or liver, this breed gets its name from Dalmatia, on the eastern shore of the coast of Venice. The Dalmatian weighs 35-50 lbs.

French Bulldog.—This breed probably was developed of miniature bulldog stock sent to France from England. Specimens are similar to the more common English bulldog in conformation, but are smaller, weighing less than 28 lbs., and have erect ears.

Keeshond.—One of the northern breeds, related to the Samoyede, chowchow, and Pomeranian, the keeshond is considered the national dog of Holland. It has a short, compact body; small, erect ears; fox-like head and a dense grey coat. The breed height is 17-18 in, at the shoulder.

Poodle.—Although the poodle probably was originated by the Germans, it attained its greatest popularity in France and sometimes is called the "French poodle." The standard poodle stands more than 15 in. at the shoulder; the miniature poodle less than 15 in., and the toy poodle never exceeds 12 lbs. All three types may be any solid colour.

Schipperke.—A native of the Flemish provinces of Belgium, the schipperke is all black, tailless and weighs up to 18 lbs. It has a small, foxlike head and is alert and active.

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DOG-BANE (*Apocynum androsaemifolium*), **N.** American plant of the dog-bane family (Apocynaceae), called also spreading dog-bane, honey-bloom, wild ipecac and American fly-trap, native to fields and thickets from Quebec to British Columbia and southward to Georgia, Missouri, Arizona and California. It is a rather slender, herbaceous perennial, 1 ft. to 4 ft. high, with widely branching stems, opposite, oval, slightly pointed leaves, and numerous, small, bell-shaped pink flowers, with darker stripes inside, borne in clusters at the ends of the branches. When in blossom from late June to August it is a beautiful wild flower. (*See* APOCYNACEAE; HEMP.)

BY COURTESY OF WILD FLOWER PRESERVATION SOCIETY

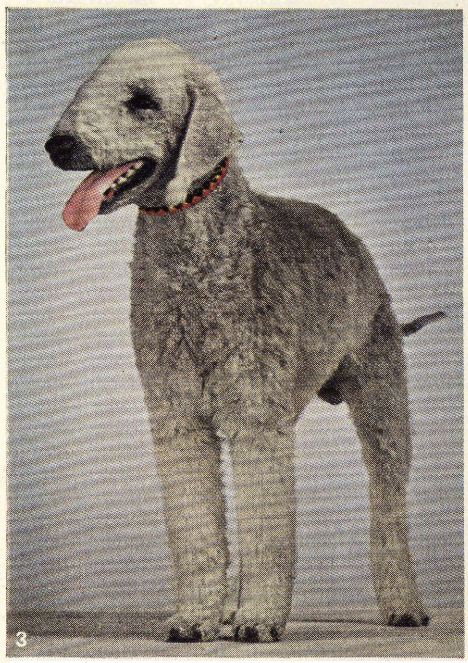
NORTH AMERICAN DOG-BANE, AN HERBACEOUS PLANT VALUED FOR THE TONIC PROPERTIES OF ITS ROOT

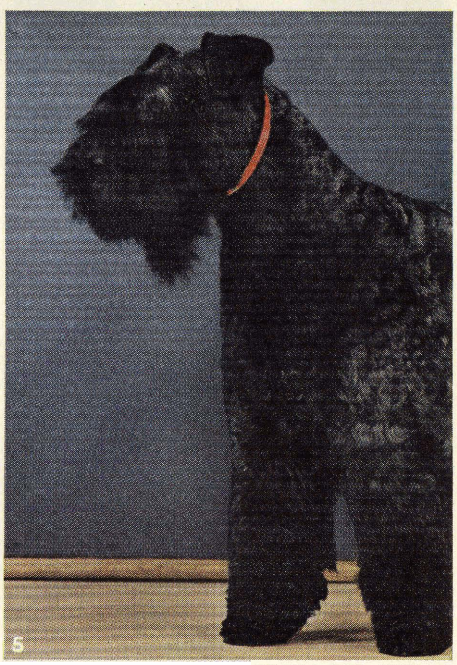
DOG DAYS, hot summer days, when Sirius, the dog-star, rises in conjunction with the sun.

DOGE, the title of the chief magistrate in the extinct republics of Venice and Genoa. For the character of the office at Venice see the articles COMMUNE: Mediaeval; BUCENTAUR. In Genoa the institution of the doge dates from 1339. At first he was elected without restriction and by popular suffrage, holding office for life; but after the reform effected by Andrea Doria (*q.v.*) in 1528 the term of his office was reduced to two years. At the same time plebeians were declared ineligible, and the appointment of the doge was entrusted to the members of the great and the little councils, who employed for this purpose a machinery almost as complex as that of the later Venetians.

See B. Cecchetti, *Il Doge* di Venezia (1864); E. Musatti, *Storia* della *promissione* ducale (Padua, 1888); and H. F. Brown, Venice: a Historical Sketch (1893).

DOG-FISH, a name applied to several species of the smaller sharks, and given owing to the habit these fishes have of pursuing or hunting their prey in packs. The small-spotted dog-fish or rough hound (*Scyllium* canicula) and the large-spotted or nurse hound (*Scyllium catulus*) are also known as ground-sharks. They keep near the sea bottom, feeding chiefly on the smaller fishes and crustacea. They differ from the majority of sharks in being oviparous. The eggs are enclosed in semi-transparent horny cases, often called "mermaids' purses" and these have tendril-like prolongations from each of the four corners, by means of which they are moored to sea-weeds or other fixed objects, until the young dog-fish is ready to make its exit. The larger of these species attains a length of 4 to 5 ft., the smaller rarely more than 30 in. The picked dog-fish (Acanthias *vulgaris*) is abundant in the temperate seas of both hemispheres, and on both sides of the Atlantic. It attains a length of 4 ft., but the usual length is 2 to 3 ft., the female, as in most sharks, being larger than the male. The body is round and tapering, and the mouth is placed ventrally some distance from the end of the snout. There are two dorsal fins, each armed anteriorly with a sharp spine. This species is viviparous, the female producing five to nine young at a birth; the young when born are 9 to 10 in. long and similar to the parents, except in size. The picked dog-fish is gregarious, and is abundant at all seasons everywhere on the British coasts. They, even more than other dog-fish, are the special enemies of the fisherman, injuring his nets, removing the hooks from his lines, and



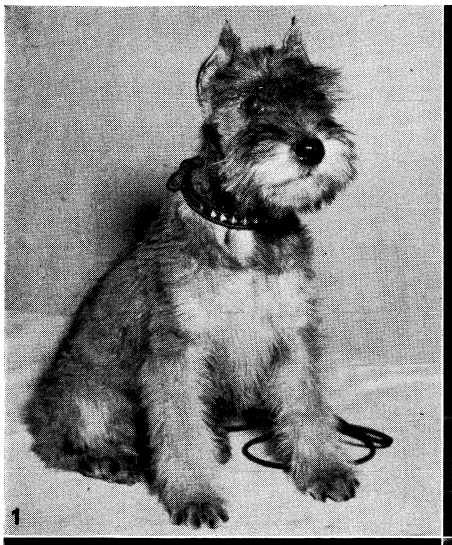


PHOTOGRAPHS, HENRY WAXMAN FROM PUBLIX; (1) CHAMPION RELGALF RIBBON RAIDER, OWNED BY MRS. FLAGLER MATTHEWS, (2) CHAMPION CRACKLEY STRIKING OF WILD OAKS, OWNED BY MRS. RICHARD C. BONDY, (3) CHAMPION SIR LANCELOT OF ROWANOAKS, OWNED BY COL. P. V. G. MITCHELL, (4) CHAMPION ANTINEA V. RPGENTENHOF OF IRADELL, OWNED BY MRS. CONSUELA FAIR, (5) CHAMPION SIRARNO'S SOPHISTICATED LADY. OWNED BY MR. AND MRS. AL ROSE

TERRIERS

1. Scottish terrier
2. Wire-haired fox terrier
3. Bedlington terrier
4. Skye terrier
5. Kerry blue terrier

DOG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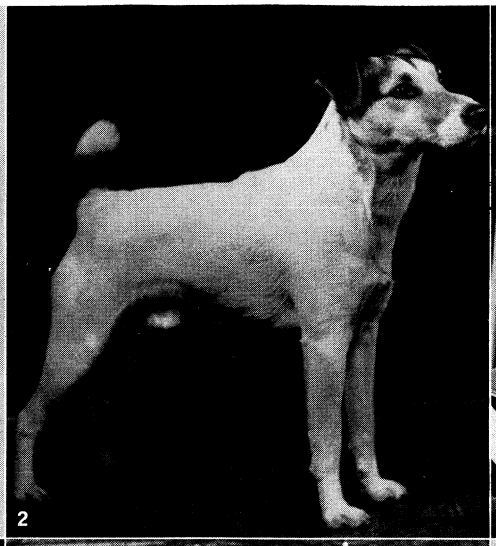
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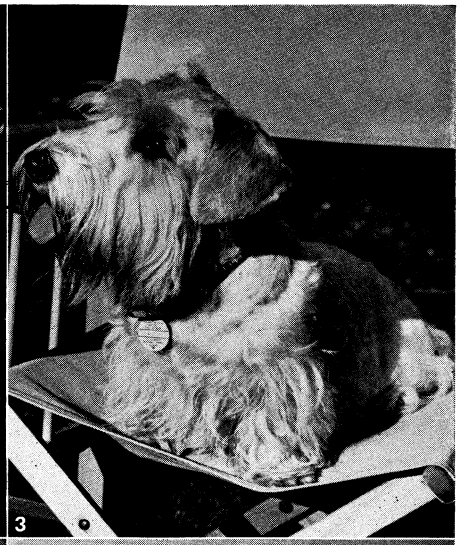
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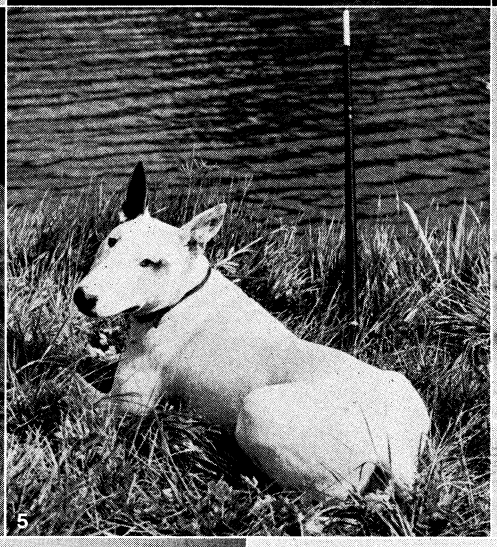
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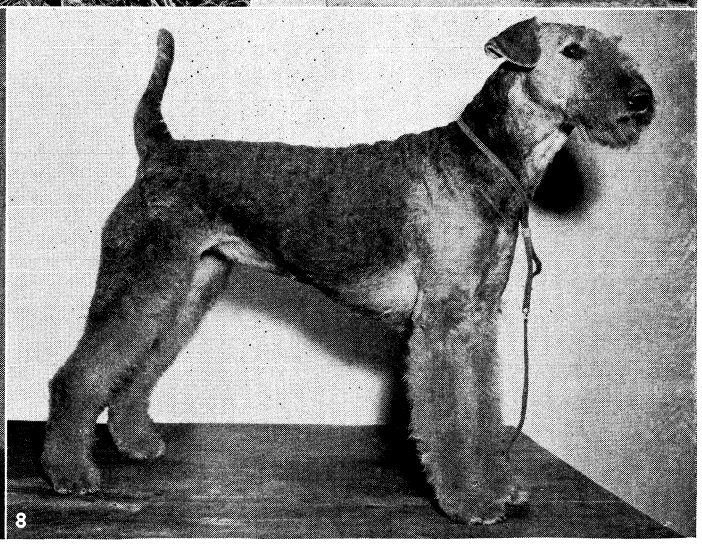
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PHOTOGRAPHS (1, 7, 8) CHICAGO TRIBUNE, (2, 4, 6) YLLA FROM RAPHO-GUILLUMETTE, (3, 5) W. SUSCHITZKY-PIX. NAMES AND OWNERS OF DOGS: (1) ROLLO OF MERTRAY, OWNED BY RAYMOND BOISACQ, (7) CRUADAL, OWNED BY MRS. R. T. ALLEN, (8) CHAMPION BODELM TORCHE, OWNED BY MARGARET A. AND HAZEL BENISH

TERRIERS

1. Miniature schnauzer puppy
2. Smooth fox terrier
3. Sealyham terrier
4. Irish terrier
5. Bullterrier
6. Welsh terrier puppy
7. Cairn terrier
8. Airedale terrier

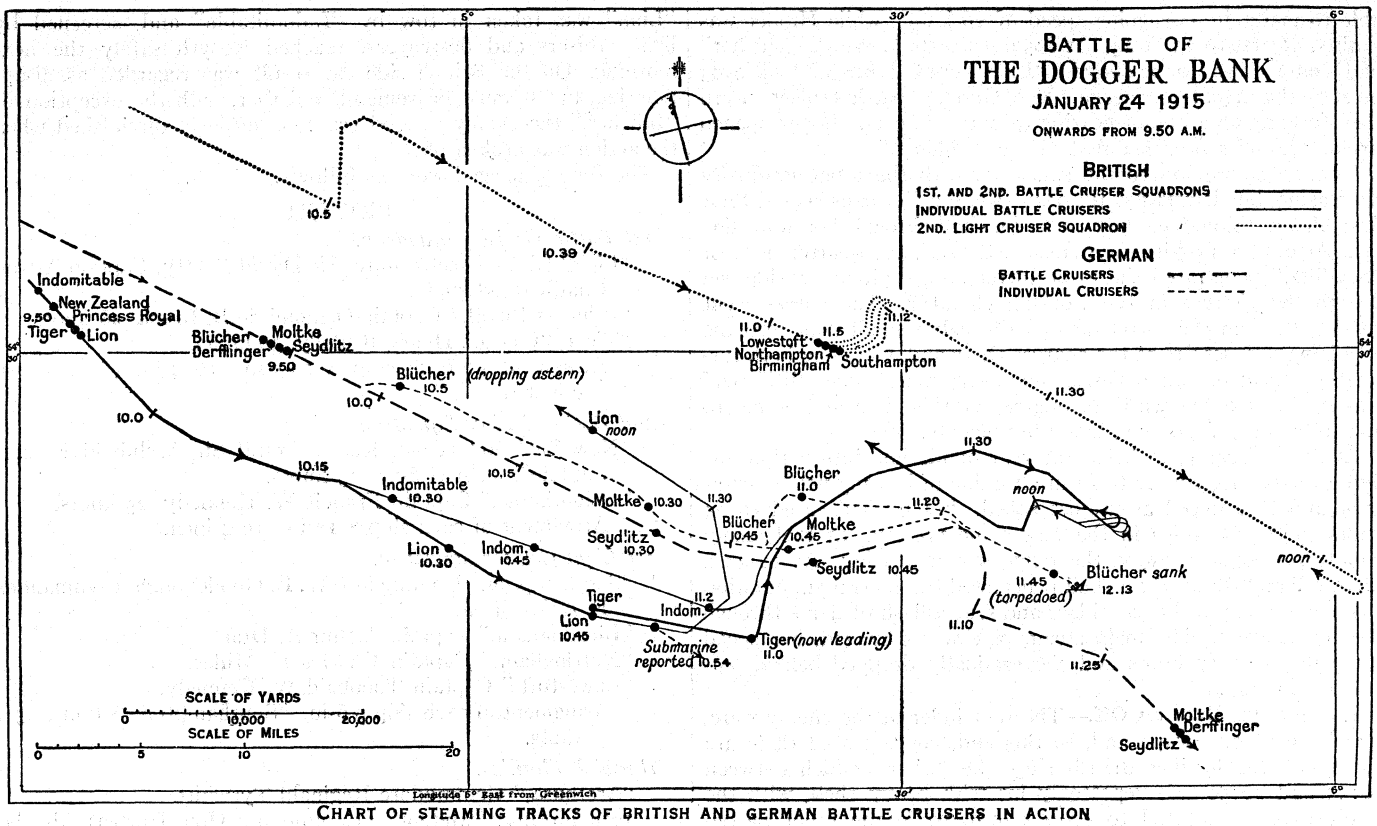

CHART OF STEAMING TRACKS OF BRITISH AND GERMAN BATTLE CRUISERS IN ACTION

Admiral Beatty, with the 1st and 2nd battle-cruiser squadrons, surprised Admiral Hipper, commanding the German 1st scouting group, near the Dogger Bank, in the North Sea, on Jan. 24, 1915. A running fight ensued, the German squadron making for port under full steam as soon as they sighted Beatty's ships. The "Blücher" was finally sunk by two torpedoes from the "Arethusa," and the "Seydlitz" was seriously damaged. The approach of the German High-Sea Fleet enabled Hipper to escape without further loss. German casualties were 954 killed, 90 wounded, and 189 taken prisoners; the British, 15 killed and 32 wounded

spoiling his fish. They are eaten, both fresh and salted, on the west coast of England, and are sold regularly in the French markets. Of recent years an attempt has been made to sell them in London under the name of "flake." (*See* SELACHIANS; FISHES.)

DOGGER BANK, an extensive shoal in the North Sea, about 60 m. E. of the coast of Northumberland, England. The depth of water, in some parts only 6 fathoms, is generally from 10 to 20 fathoms. It is well known as a fishing ground. The origin of the name is obscure; but the middle Dutch *dogger* signifies a trawling vessel, and was formerly applied to two-masted vessels employed in the North Sea fisheries, and also to their crews (doggermen) and the fish taken (dogger-fish). Off the south end of the bank an engagement took place between English and Dutch fleets in 1781. Here on Oct. 21, 1904, during the Russo-Japanese War, some British trawlers were fired on by the Russian Baltic fleet. An acute crisis between Britain and Russia followed. The affair was settled by an international commission which reported on Feb. 25, 1905. Compensation was paid by the Russian government.

BATTLE OF THE DOGGER BANK

This naval action was fought during the World War on Jan. 24, 1915, near the Dogger Bank in the North Sea between British and German battle-cruisers and light forces.

Reports from America at this time had led the Germans to think that a plan for blocking their harbours was afoot and Rear-Admiral Hipper was despatched at nightfall on Jan. 23 to reconnoitre off the Dogger Bank. His force consisted of four battle-cruisers of the 1st scouting group, "Seydlitz" (flag), "Derfflinger," "Moltke" and "Bliicher," with four light cruisers and 19 destroyers. Before the ships left the Jade, their strength and intentions had been revealed by their own wireless and Vice-Admiral Beatty left the Forth to intercept them at 6 P.M. on the 23rd. With him were the five battle-cruisers of the 1st and 2nd Battle Cruiser Squadrons, the "Lion" (flag), "Tiger," "Princess Royal," "New Zealand" and "Indomitable," and the four light cruisers of the 1st Light Cruiser Squadron under Commodore W. E. Goodenough in the "Southampton." He was to proceed to a rendezvous in lat. 55deg. 12min. north, long. 3deg. 12min. east, 180m. from Heligoland, where he was to meet Commodore Tyrwhitt with three light cruisers and 30 destroyers of the Harwich force. The 3rd Battle Squadron, of seven "King Edwards," left Rosyth and Admiral Jellicae put to sea from Scapa with the battle-fleet at 9 P.M. In heavy guns Beatty's force was decidedly superior, mounting 24 13.5-in. and 16 12-in. against Hipper's 8 12-in., 20 11-in. and 16 8.2-in.

The Fight **Begins.**—Beatty reached the rendezvous at 7 A.M. It was a crisp winter morning with a calm sea and good visibility. The battle cruisers were in single line ahead with Goodenough's light cruisers two miles on the port bow. Course was then altered to south by west at 18 knots. Ten minutes later "Arethusa," Tyrwhitt's flagship, was sighted southeast about seven miles on the port bow. She had hardly been identified when the flash of guns was seen to the south-south-east. "Aurora," some 15m. behind Tyrwhitt, had met and engaged the German light cruiser "Kolberg," on the port bow of Hipper's squadron coming from the southeast. Each received a couple of hits and "Kolberg" retired at 7:25 A.M.

At the sound of the guns, Beatty ordered the light cruisers to chase to south. "Southampton" had barely gone two miles when she sighted "Aurora" on her starboard bow and, a few minutes later, German battle-cruisers on the port bow to the south-east. Dense clouds of smoke were pouring from their funnels and they were evidently raising steam for full speed. It was then 7:50 A.M. Beatty's appearance had come on Hipper as a surprise snd, turning to the southeast, the latter ran for home.

Pursuit **of** the Germans.—At 8:30 A.M. Beatty's position was lat. 54deg. 50min. north, long. 3deg. 40min. east, and the two had settled down to a long rush towards Heligoland, 140m. away. The British battle-cruisers were in single line ahead on a south-east by south course, working up to full speed. Hipper was 11m. sharp on "Lion's" port bow, in full flight on a south-south-east course. In speed Beatty's squadron bad a decided superiority. It was

able to maintain a seagoing speed of 26 knots, while Hipper was limited at first to 23 or 24. At 8:52, when the range of "Blucher" had come down to 22,000yd., "Lion" opened fire and at 9:05 hoisted the signal to engage. The German battle-cruisers were then forming on a line of bearing to port. At 9:09 Hipper opened fire as "Lion" scored her first hit on "Bliicher."

The action ran on to the southeast with the range gradually decreasing, but it was not till 9:28 that the Germans scored their first hit on "Lion," sending an 11-in. shell through her waterline aft. At 9:43 a 13.5-in. shell crashed through the quarter deck of "Seydlitz," penetrated the after turret and, exploding inside, set fire to the charges in the working chamber. The flames went roaring through the turret, passed through a small door into the adjoining one, set fire to the charges there and, wrapping both turrets in a sheet of flame, slew as one every man inside. "Bliicher" was having trouble with her engines at this time and about 10 A.M. drew out of the line, labouring heavily.

At 10:22 Beatty, to bring the rear of his line into action, ordered the battle-cruisers to form on a line of bearing north-north-west and to proceed at utmost speed. "Lion" had eased to 24 knots to let the ships in the rear come up, and, as the enemy had turned slightly away, the range was increasing. At 10:30 a salvo fell on "Blücher"; a shell penetrated the central ammunition passage, set fire to the cartridges and sent a flash of flame through the fore turrets. The main steam pipe was damaged, her speed came down to 17 knots and she gradually dropped behind, enveloped in smoke.

The Action Broken Off.—The remainder of the enemy were, clearly, bent on escape and, to this end, concentrated their fire chiefly on the leading British ship, the "Lion," which between 10:35 and 10:50 was repeatedly hit with heavy shell, with the result that she started to drop astern, while the other battle-cruisers raced past her. At 11 A.M. the flagship received such heavy injuries that she was thrown definitely out of the fight. Beatty, however, still retained control. Just before this the periscope of an enemy submarine was reported on the starboard bow, and at 10:54 he had made a signal to alter course 8 points (90°) to port to a course north by east. This was the initial cause of the action being broken off. The usual submarine warning was not made by the "Lion," thereby mystifying the other ships and Rear-Admiral Sir A. G. H. W. Moore, the second in command, as to the reason for the manoeuvre, and making it doubly difficult for the signals intended to convey Beatty's subsequent wishes to be interpreted. These, made at 11:02, were an endeavour by the latter to get the squadron to turn back again three points to the north-east, followed by a signal "Attack the enemy's rear." The form in which the signals were displayed, however, was such that they were understood to mean that the ships were to attack the enemy bearing north-east, which was the "Blucher." This ship was by now disabled and rapidly drifting astern of her companions.

Beatty made a final effort to turn the squadron back on to the course of pursuit by signalling "Keep closer to the enemy," but which enemy was not specified. By now, however, the "Lion" was so far astern that Moore, in the "New Zealand," could not read the flagship's signal. Fire was therefore concentrated on the unfortunate "Blucher," while Hipper, with the remainder of the German force, having turned to the east-south-east, drew rapidly out of range. At 11:38 the "Arethusa" came up and fired two torpedoes into the "Bliicher." She ceased firing and, listing heavily, ablaze fore and aft, she sank at 12:13. Hipper was out of sight some fifteen miles off, so Moore formed the battle-cruisers into line ahead and steered to the westward.

Beatty by this time had transferred his flag to the destroyer "Attack" and was racing after his squadron. He reached "Princess Royal" at 12:30 and hoisted his flag, but pursuit was then hopeless and a warning had been received of the approach of the High Sea Fleet. He therefore gave up all idea of renewing the action. Hipper made for home and got in touch with the High Sea Fleet about 2:30 P.M. "Blücher" had been lost, "Seydlitz" seriously damaged and "Derfflinger" hit. On the British side "Lion" had been put out of action and "Tiger" damaged.

Admiral Jellicoe with the battle-fleet met Beatty at 4:30 P.M. "Lion" was taken in tow by "Indomitable" and, screened by light cruisers and destroyers, reached Rosyth safely the next morning. On the British side the result was regarded as disappointing, but it must be remembered that, with the exception of "Blücher," the enemy's speed was not seriously diminished when the action was broken off.

The forces engaged were as follows:

BRITISH

1st Battle Cruiser Squadron.

"Lion" (flag), Vice-Admiral Sir David Beatty, Captain Alfred Chatfield, 28 knots.

"Princess Royal," Captain Osmond de B. Brock, 28 knots.

"Tiger," Captain Henry B. Pelly, 30 knots.

Armament of each ship 8 13.5-in., 16 4-in. ("Tiger" 16 6-inch).

2nd Battle Cruiser Squadron.

"New Zealand" (flag), Rear-Admiral Sir Archibald Moore, Captain Lionel Halsey, 25 knots.

"Indomitable," Captain Francis W. Kennedy, 25 knots.

Armament of each ship 8 12-in., 16 4-inch.

1st Light *Cruiser Squadron.*

"Southampton," Commodore W. E. Goodenough, Commander E. A. Rushton.

"Birmingham," Captain Arthur A. Duff.

"Nottingham," Captain Charles B. Miller.

"Lowestoft," Captain Theobald W. Kennedy.

Armament of each ship g 6-in., "Southampton" 8 6-in.; 25·5 knots.

Harwich Flotillas.

"Arethusa," Commodore Reginald Tyrwhitt.

10th Flotilla: "Meteor" (Commodore Hon. Herbert Mead), "Miranda," "Milne," "Mentor," "Mastiff," "Minos," "Morris"; speed 34 knots.

3rd Flotilla: "Undaunted" (Captain Francis St. John), "Lookout," "Lysander," "Landrail," "Laurel," "Liberty," "Laertes," "Lucifer," "Lawford," "Lydia," "Louis," "Legion," "Lark; speed 29 knots.

1st Flotilla: "Aurora" (Captain Wilmot S. Nicholson), "Acheron," "Attack," "Hydra," "Ariel," "Forester," "Defender," "Druid," "Hornet," "Tigress," "Sandfly," "Jackal," "Goshawk," "Phoenix," "Lapwing"; speed 27 knots.

GERMAN

1st Scouting Group (battle-cruisers).

"Seydlitz," Rear-Admiral Hipper, 10 11-in., 12 5.9-in., 26.5 knots.

"Derfflinger," 8 12-in., 12 5.9-in., 26.5 knots.

"Moltke," 10 11-in., 12 5.9-in., 25 knots.

"Blucher," 12 8.2-in., 8 5.9-in., 24 knots.

2nd Scouting Group (*light cruisers*).

"Graudenz," "Stralsund," "Kolberg," "Rostock."

Casualties.—"Blücher," which sank, received about 40 hits and 2 torpedoes, had 792 of her crew killed, 45 wounded and 189 taken prisoner. "Seydlitz" sustained 3 hits, had 159 killed and 33 wounded. "Derfflinger" was only hit once, and "Kolberg" twice, the latter having 3 killed and 2 wounded.

On the British side "Lion" was put out of action with 12 hits; 1 killed and 20 wounded. "Tiger" received 7 hits, having 10 killed and 11 wounded: "Aurora" received 2 hits and "Meteor" sustained 1 hit, with 4 killed and 1 wounded. The British fired 1,154 rounds of heavy gun ammunition, of which 708 were armour-piercing shell, 77 common, g6j high explosive and 4 shrapnel. The Germans fired 976 rounds from their heavy guns.

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DOGGETT or **DOGGET, THOMAS** (d. 1721), English actor, was born in Dublin, and made his first appearance in London in 1691 as Nincompoop in D'Urfey's *Love* for *Money.* He followed Betterton to Lincoln's Inn Fields, creating the part of

Ben, especially written for him, in Congreve's *Love for Love*, with which the theatre opened (1695); and next year played Young Hobb in his own *The Country Wake*. He was associated with Cibber and others in the management of the Haymarket and Drury Lane, and he continued to play comedy parts at the former until his retirement in 1713. In 1715 he founded the prize of "Doggett's Coat and Badge," "in commemoration of his Majesty King George's happy Accession to the Brittish Throne." The prize was a red coat with a large silver badge on the arm, bearing the white horse of Hanover, and the race had to be rowed annually on Aug. 1 on the Thames, by six young watermen who were not to have exceeded the time of their apprenticeship by twelve months. The names of the winners have only been preserved since 1791. The race is still rowed each year, but under modified conditions. The date of his death is variously given as Sept. and Oct. 1721.

See Thomas Doggett, Deceased (1908).

DOG LICENCES. The great growth of dog-keeping is revealed by the record of the dog licence duties, which show that the dog populations have become enormous. In Great Britain dogs over six months old must have a licence which costs 7s. 6d. a year. Dogs used as guides by blind persons, sheep and cattle dogs, and hounds under 12 months old which have not hunted, are exempt. In 1936, 2,932,612 dog licences were taken out, but it is probable that there are about four million dogs in Great Britain. The penalty for non-compliance with the law is a fine up to £5. The licences are issued at post offices, and their revenue goes to the local authorities in whose areas the receiving post office is situated. The law requires also that dog collars should be engraved with their owners' names and addresses, but it is not strictly enforced. In Great Britain there is no way of telling if a particular dog is licensed or not.

In the Irish Free State dogs must be licensed when one month old and in Northern Ireland when six months old; in each case the licence costs 5s.

In the British oversea Dominions dog licensing is general. In Canada each province by statute empowers its municipalities to impose a dog tax. Thus in Ontario the licence costs $2 for a dog and $4 for a bitch, a higher duty being imposed when more than one animal is kept. In Australia licences vary little; in Victoria all dogs are taxed at 5s. a year; in South Australia a dog is licensed at 5s., a bitch at 7s. 6d. All dogs must wear a collar or tab unless kept for hunting or coursing. In South Africa the tax is high, being 12s. 6d. in Natal and 10s. in the Transvaal, where there is a £5 tax on all dogs with a greyhound strain that can be used for hunting.

In Germany all dogs are taxed, the amounts varying in the different districts, being usually small in villages and high in the big towns, and the law is strictly enforced. In Berlin the dog tax is £3 in English money. Sheep dogs on German farms go free of tax. A metal disc bearing the number of the licence must be attached to each dog's collar.

In the United States licences are issued variously by a State, county or municipality. Enforcement of the ordinances requiring registration of dogs is usually within the police powers conferred upon local corporations, but some States, such as Pennsylvania and Connecticut, have general laws on the subject. Registration of dogs above the age of six months, except those in kennels, for which there are special regulations, is usually required annually. A stated fee is paid to the city, county or State officer for the licence, the applicant receiving a tag which must be attached to the animal's collar as evidence of such registration. In case the tag is lost, a duplicate may be obtained, but failure to register a dog, under most ordinances, authorizes the officers to kill it.

DOGMA, DOGMATIC THEOLOGY. Theology, like political economy, has no technical terminology, but seeks to use the language of ordinary life in a specialized sense. Colloquially, to assert dogmatically is contrasted with speaking tentatively. But also, dogmatism is contrasted with proof. "I'm not arguing with you, I'm telling you"—he who so speaks is, reasonably or unreasonably, dogmatic. The claim of accuracy akin to that of science and of authoritativeness akin to that of law, are the two poles of the universe of dogma. In the New Testament the word means decree, although the Greek fathers early misunderstood it. The older philosophical use, for the leading and inviolate principles of any system, is best illustrated by the *Ipse dixit* of the Pythagoreans; whatever their master had said was final. German theologians have sought to define the word for their own purpose by drawing a line round those doctrines which deserve to be called dogmas and by separating them from the region of open questions. According to W. Herrmann (opening p. of *Dogmatik* in *Die Kultur der Gegenwart*), "We must not mainly understand by a 'Dogma' a definition upon Church authority. Such a definition is only the last stage in a long process, which has all along been actuated by the thought of a *revealed doctrine*. And that conception is the main element in 'Dogma.' .. In contrast with this F. Loofs (*Leitfaden zum Studium der Dogmengeschichte*, ed. 4. p. 9) holds that "Dogmas are those affirmations of religious faith whose acknowledgment a Church expressly requires from its members or at least from its teachers." Harnack in his great *History of Dogma* prefers a more historical definition. Dogma is (1) a creation of Greek thought on the soil of the gospel and (2) kindred mediaeval findings, but (3) it is transformed or disappears in Protestantism through deepening religious insight, in Socinianism and the Enlightenment through the dominance of rationalism, in the post-Tridentine church through more sweeping exercise of authority. Each of these definitions has its merits. Something is to be said also for the view that, in the modern Church of Rome, we have dogmatism superlatively developed—partly just because that Church forbids one to draw a hard and fast line separating dogmas from pious opinions, or formulated dogmas from unformulated; all the Church's teaching being infallibly and dogmatically true. The choice of a definition can only be made by balancing advantages against disadvantages.

As to dogmatic theology, all that need be said is that it is the most widely accepted name for the systematic statement of Christian doctrines—and not merely of dogmas, if dogmas are to be separated off from the floating mass of theories.

When the Church inherited the Jewish scriptures, it took over an instalment of dogma, and one beset for it by special difficulties too little recognized by theologians—a book holy and divine, and yet not the perfect revelation of God! When, in controversy with Gnosticism, a collection of New Testament writings was added to the "Old Testament," the inheritance grew; and the dogmatic postulate, that all scriptures contain the same teaching, became no easier to vindicate. One cannot deny that Calvinism in the past or that Fundamentalism in the present is in a very high degree dogmatic. For each of these, the corpus of scripture is the sum total of dogma; and to the scripture every thought of man is to bow. The Catholic ethos adds other things—an emphasis on sacraments; a gathering up of the contents of the Bible (with unconfessed modifications) into creeds; a franker announcement of church authority. In these features of Catholicism there appears to be a fuller realization of the dogmatic temper than where appeal is made to the Bible alone.

Harnack has good reason for insisting on the fundamental importance of the great Eastern dogmas, Trinity and Incarnation. These expressed the piety of Eastern Catholicism; and they passed into the mediaeval West and even into historic Protestantism as presuppositions—only presuppositions, but as such indispensable. And yet, in their original shaping, the West had played no small part, when curiously hard questions were raised by the East. It has been felicitously observed that "the East thought that everything could be explained; and the West, that nothing needed to be explained." Even at the first General Council (Nicaea, 325) it appears certain that Western minds brushed aside Eastern scruples in imposing the watchword "homoousios"—a term with questionable associations, but a term which not even the slipperiness of the Arians could evade. So again, at Chalcedon (451) and at the First Trullan Council (680), the West threw in the dogmatic watchword round which crystallization ensued The Councils of Constantinople (381) and Ephesus (431) were more Eastern. The adoption of a non-Biblical phrase at Nicea. constituted a landmark in the growth of dogma; it is true, since

the Church—the universal Church speaking by its bishops—says so; though the Bible does not! Even at Nicea there was a small obstinate minority. Oliver Wendell Holmes draws the inference that Catholic unanimity means "a majority vote" (followed by excommunication of the few). Similarly, from Nicea onwards, formulated dogma is-accompanied by anathemas. We have good reason for including in our definition of dogma this mark—dogma (for all who receive it) is an affirmation which it is sinful to deny, or to challenge, or to ignore. It is a singularly ominous claim.

Another landmark is established for us by the so-called Athanasian creed—a (probably later) Western summary and elaboration of Eastern results, with two well-marked divisions concerning the Trinity and concerning the Person of Christ. It is "before all things" necessary to be accurate in minute detail regarding these doctrines. Sacraments are not so much as named. Indeed, except in the "one baptism for the remission of sins" of the "Nicene-Constantinopolitan" creed, the great early creeds are strangely silent concerning sacraments; although no Catholic mind could ever doubt that it is "he that believeth and is baptized" who shall be saved. In one sense, then, the Athanasian creed marks a climax. It puts the claim of dogma amazingly high. Though it has not forgotten that Christ is "to judge . . . all men . . . according to their own works," orthodoxy is "before all things necessary."

Yet the mediaeval West goes on to alter the balance of emphasis in several ways. First, it works out the theory of sacraments in fuller detail—numbers them as seven; specifies them one by one; includes in its findings the staggering miracle of transubstantiation. And in all these points the East accepts results from the West. Sacraments will not save if an obex or hindrance is wilfully interposed (*e.g.,* by deliberate purpose of mortal sin); and the doctrine of reception in voto—heaven taking the will for the deed—seems to shake the theory to its foundation. But the emphasis is laid upon the necessity of sacraments, even at the expense of doctrine. For, secondly, implicit faith may suffice lay Christians—may possibly suffice many of the clergy. It is a popular error, though shared by some well educated persons, to speak of implicit "obedience." Fides *implicita* is the correct phrase. By assenting in general terms to Church teaching, while believing explicitly the minimum creed of Heb. xi. 6, one believes by *implication* whatever else is de *fide*. We even meet with the position that there is merit before God in believing heretically, if one honestly supposes that one's heretical view is taught by the Church. All this is a notable counter-stroke to the detailed dogmatism of the Athanasian creed. One understands the motives at work; but it is not with God that "we have to do," still less with conscience, but with—the Church. There is no shadow of excuse in the theory for dissent from Church teaching. Ignorance is encouraged; bad mistakes are excused; but submission is exacted to the uttermost.

The third mediaeval innovation is the Thomist doctrine of mystery. While reason and conscience warrant theistic belief, revelation includes things which reason cannot grasp. Again one comprehends the motive; but again one observes how the significance of the Church is aggrandized by the new doctrine. An enemy might say that doctrines which are "mysterious" in the technical sense are the fossilized remains of what once was living thought. We have a formula; true; but what does the formula contain? No child of the Church dare seek to answer. If the progress of dogmatic definition means the condemnation of views which in the past were innocent, the goal of the dogmatic progress seems to lie altogether beyond the region of knowledge.

Genius in Protestant theology was confined almost entirely to Luther; and even he in later life stiffened and hardened. When he proclaims that justification by faith is in itself the *articulus stantis* vel cadentis *ecclesiae*—"article" is a frequent synonym for dogma—he is seeking to gather up a multitude of authoritative dicta in one thrilling personal experience. So too when he graduates the books of the New Testament he is claiming to go beyond the letter even of scriptural authority in the strength of his knowledge of the gospel of salvation. In words of his. which are written on his monument at Worms, and which might be called the undying charter of evangelical Protestantism, Those who truly know Christ cannot be caught in the snare of any human authority. While Luther was incomparably the most daring, all the early reformers hesitated over the great Greek dogmas—but all alike brushed their hesitations aside, and reimposed upon the modern time the presuppositions of their fathers. Similarly, the Protestant doctrine of inspiration grew steadily harder. An imperfect but valuable attempt to construe Christianity as a thing of experience was made by Schleiermacher; and the school of Ritschl has even more carefully sought after "Anschluss an Luther." Historically it is a fair question whether Protestant evangelicalism ought to speak of dogmas at all. This means that doctrine is for it a less thing than Christian life, and that "we know in part."

The Council of Trent (1545–63) for the first time dogmatically places unwritten tradition side by side with scripture; it also subordinates scripture text and interpretation to the Church's authority. After the period of general relaxation in the 18th century, movements of reaction everywhere set in. In the Church of Rome Pius IX. (1854) proclaimed de suo the Immaculate Conception of the Virgin, and the Council of the Vatican (1870) recognized the Pope's personal authority as equal to that of any council. In quaint technical language, his formal pronouncements are "irreformable." Thus dogma makes quite clear that the "development" of which J. H. Kewman and others speak is purely one of accretion. Nothing can be cancelled. Nothing can be bettered—it is divinely perfect. Alike in 1854 and in 1870, the decreta claim to reiterate a "divinely revealed doctrine" or "dogma." The Vatican council also makes Thomist apologetic de *fide*. (1) Theism is demonstrable. But (2) there are unintelligible mysteries in revealed faith. The former position seems highly complicated. It is now a dogma that, dogmatic revelation apart, reason itself proves the being of God, if you hesitate over this, anathema *sis*. The highroad of reason is prescribed to you. authoritatively; and the goal is also prescribed. If your reason does not lead you to the goal, anathema sis. And if you fail to recognize mysteries above "though not contrary to" reason, anathema *sis*.

When for the first time a closure was introduced into the House of Commons, Lord Salisbury "did not believe the Liberals were sharpening a scimitar in order to cut bread and butter." The Church of Rome since 1871 has possessed the keenest possible cutting weapon, but has cut with it—nothing. The dogmatic impulse seems to have temporarily exhausted itself in placing the Pope upon his pinnacle.

At the opposite theological extreme from Roman Catholicism, radical Protestantism shows a germ or a vestige of dogma, or at any rate a real parallel to dogma, if it asserts (with G. B. Foster) the Finality of the Christian Religion.

It has been proposed by an eminent scientific writer, Dr. Whitehead, that we should speak of the "dogmas" of science, and should recognize that these must from time to time be "changed." Apparently, the first principles underlying scientific theory are working hypotheses. Such things of course are endlessly modifiable. But a student of theology must hold that it will not tend to clearness of thought if working hypotheses are called "dogmas."

LITERATURE.—Matthew Arnold's Literature and Dogma (1873) is important for literary usage: cf. A. B. Bruce, Chief End of Revelation. Classical and early Christian usages, E. Hatch, Hibbert *Lect.* (1888), pp, 119, 120; J. B. Lightfoot on Colossians ii. 14 (20); W. Schmidt, *Dogmatik,* vol. i. (1895)—many quotations in *extenso;* C. Stange, *Das* Dogma und seine Beurteilung in der neueren Dogmengeschichte (1898)—a pamphlet protesting against what Loofs terms the "generally accepted view." Articles in the (Roman Catholic) Kirchenlexikovz of Wetzer and Welte, 2nd ed. (by Hergenröther and Kaulen), 1882–1901. Arts. "Dogmatik" (J. Köstlin), "Dogmengeschichte" (F. Loofs) in Herzog-Hauck's Encykl. *f. prot. Theol.* (vol. iv., 1898). Art. "Glaubensartikel" in previous ed. (Herzog-Plitt, vol. v., 1879) by C. F. Kling and L. F. Schoeberlein. Along with Foster, Troeltsch should be studied; English summaries in R. S. Sleigh's *Sufficiency* of Christianity and *Ernst* Troeltsch, and briefly in a paper on Troeltsch by the present writer, Congregational *Quarterly* (April, 1925). J. M. E. McTaggart's Some *Dogmas* of Religion interprets dogma as claiming ultimate absolute truth. (See also THEOLOGY.) (R. MA.)

DOGMATISM is the uncritical acceptance and application of any belief, especially of those ultimate or fundamental beliefs

known as principles. In philosophy the term has been applied by Kant (*q.v.*) rather sweepingly to most preceding systems of philosophy on account of their alleged neglect to examine "critically" the nature and bounds of human knowledge as a preliminary step to their construction.

DOGON, a light-skinned patrilineal people of medium stature (also known as Habe) in the Bandiagara highland and Hombori hills districts of the French Sudan. Their language. with many dialects, is related to Mandinga. The villages are independent and ruled by an elected sacerdotal headman (*Hogon*), assisted by a council of elders and dignitaries (*seru*). In certain groups girls belong to their maternal uncle. The family estate is first inherited by the brother of the deceased who succeeds to the family headship. Personal property (according to its male or female character) passes to the son or daughter. They are excellent husbandmen, do some cattle raising, are animists and offer seasonal sacrifices, with, quite recently, human victims. Each village is protected by a sacred animal. There are traces of totemism and the dead are placed in cliff caverns.

See Arnaud, "Notes sur les montagnards Habe des Cercles de Bandiagara et de Hombori (Soudan Français)," ***Revue*** *d'Ethnogr. et Trad. pop.* (1921).

DOGRA, an inhabitant of the Duggar tract in the foothills. now mostly comprised in the Jammu territory of Kashmir, India. Duggar appears to mean the-"land between two lakes." as the original home of the Dogra people was situated between the lakes of Siroensar and Mansar. Sanskritized as Drigarh-desh, it is unknown to literature.

The Duggar is inhabited by a number of castes, including Brahmans, about five classes of Rājpūts with numerous septs and the usual under castes. The Dogra who enlists in the Indian army is or should be a Rājpūt of some degree from this or the adjacent sub-Himalayan tracts.

He is an excellent soldier. The Dogra regiments acquired their high reputation in the first Sikh war.

DOGS, ISLE OF, a district of east London, England, on the north bank of the Thames, forming the southern extremity of the metropolitan borough of Poplar (*q.v.*). It is enclosed on three sides by a bend of the Thames formed by Limehouse. Greenwich and Blackwall reaches, and includes Millwall (with Millwall dock) on the west and Cubitt Town on the east; the West India docks across its northern end make of it almost an island. Greenwich tunnel (1902) for pedestrians and vehicles passes under the river here. The whole district is occupied by docks, riverside works and poorhouses. The origin of the name is not certainly known. The suggestion that it is corrupted from the Isle of Docks falls to the ground on the question of chronology; another, that there were royal kennels here, is improbable.

DOG STAR: *see* SIRIUS.

DOG'S-TOOTH VIOLET, any plant of the genus *Erythronium* of the lily family (Liliaceae) comprising about 1*j* species. all, except one, North American. They are low herbs with unbranched stems which spring from deep corms and bear near the surface of the ground a pair of unequal leaves, often mottled with dark splotches, and large, nodding, lily-like, mostly solitary flowers on slender stalks. The European dog's-tooth violet (E. *denscanis*), the only old world species, a delicate spring-bloomer, with rose-purple flowers, is planted in borders and rockeries. The best known representative in eastern North America is the yellow dog's-tooth violet (E. *americanum*), known also as yellow adder's-tongue and trout-lily, with yellow flowers, $ in. to 1½ in. long, on stalks 6 in. to *8* in. high. This handsome spring wild flower is native to moist woods from Nova Scotia to Minnesota and southward to Florida and Arkansas. The similar but smaller white dog's-tooth violet (E. *albidum*), called also fawn lily, with white flowers, occurs in low woodlands from Ontario to Minnesota and southward to Georgia and Texas. A conspicuous species in the Rocky mountain region is the large-flowered (E. *grandiflorum*), variously called Adam-and-Eve and glacier lily with flower stalks *8* in. to *16* in. tall, bearing 1 to 5 yellow flowers *1* in. to 2 in. long. The avalanche lily (E. *montanum*), common in alpine meadows in Washington and Oregon, is a smaller plant with white flowers

DOG-TOOTH. in architecture, a band decoration of adjoining, projecting triangles, called, from its saw-tooth shape, in French, *dent de scie.* Early examples of this decoration are found in Syria and in the Mesopotamian valley, *e.g.*, in the palace front at Rabbath-Ammon (built either in the last years of the Sassanian dynasty or in the early part of the Mohammedan rule), where it is used on arch mouldings; and in a highly decorative form, in the palace of Machitta of the 8th century. It is found widely during the Romanesque period throughout Europe, where it is thought to have been introduced by the Crusaders from the east, and is particularly common in Norman work in France and England, appearing as the chevron (*q.v.*) and zig-zag. It often appears in arch mouldings as a series of projecting pyramids, the sides decorated with foliage. To its supposed resemblance, in this form, to a dog's-tooth violet, some people incorrectly attribute the origin of its name.

DOGWOOD, the name applied to shrubs and small trees of the genus *Cornus,* of the family Cornaceae, comprising some 60 species which, except for a single Peruvian species, are found in north temperate regions. They are mostly hardy shrubs, usually with handsome foliage and attractive flowers and fruits. Several are widely cultivated as summer and autumn ornamentals and also for the winter effect of their brightly coloured branches. The common European dogwood, prickwood, skewerwood, cornel or dogberry (*C. sanguinea*), is a shrub reaching a height of 8 ft. or 9 ft., and is commonly found in hedges, thickets and plantations in Great Britain. Its branches are dark red; the leaves, egg-shaped, pointed, about 2 in. long by 1½ in. broad, turn red in the autumn; the flowers are dull white, borne in terminal clusters. The berries are small, of a black-purple colour, bitter and one-seeded, and contain a considerable percentage of oil. The white wood is very hard, and, like that of various other dogwoods, is used for making ladder-spokes, wheelwork, skewers, forks and other implements.

About 20 species are native to North America, mostly found east of the Rocky mountains, only 6 occurring on the Pacific coast. Of these the most striking are the flowering dogwood (*C. j'iorida),* of the eastern and southern United States, one of the most beautiful of American flouering trees, and its very similar counterpart, the western dogwood (*C. nuttallii*), of the Pacific coast. The wood of the former is used for shuttles. Both are usually small trees 10 ft. to 1; ft. high, but occasionally 40 ft. or more, bearing in early spring a profusion of flower heads each surrounded by four flowering bracts (involucre) *1* in. to *3* in. long, usually white but varying to rose-red. giving the head the appearance of a flower *2* in. to 5 in. across. The red-flowered forms of *C. florida* are extensively propagated for ornament. Other well-known North American species are the red-osier dogwood or kinnikinnick (*C. stolonifera),* found across the continent, the silky dogwood (*C. amomum*), the panicled dogwood (*C. paniculata*), and the alternate-leaved or pagoda dogwood (*C. alternifolia*), natives of the eastern states and adjacent Canada. There are also two low, almost herbaceous, species—the dwarf cornel or bunchberry (*C. canadensis),* found from Newfoundland to Alaska south to Virginia and California, and the northern or Lapland cornel (*C. suecica),* native across Canada and northward of the Arctic zone, also in Scotland, northern Europe and Asia. Both bear clusters of brilliant red fruits; those of the latter are eaten by the Eskimos.

The widely planted Cornelian cherry (C. *mas),* a native of Europe and northern Asia. is a handsome shrub with glossy foliage, clusters of yellow flowers, and shining scarlet edible fruits which are made into preserves. The Japanese Kousa (*C. kousa*), native to eastern Asia, with creamy-white flowering bracts *3* in. across and fruits united in a globular head, is also grown as an ornamental shrub. The Jamaica dogwood, the root-bark of which is poisonous, is *Ichthyomethia piscipula,* of the family Leguminosae. (E. S. HR.)

DOHERTY, CHARLES JOSEPH (1855–1931), Canadian politician, was born at Montreal on May 11, *1855,* and educated at McGill university. Called to the Quebec bar in 1877, he became a Q C. in *188;* and was *a* puisne judge of the superior court of Quebec from 1891 to 1906. He was first elected to the

House of Commons as a Conservative member for the St. Anne's Division of Montreal in 1908 and became Minister of Justice in Sir Robert Borden's Government in 1911, a post which he held until 1921. He joined the Unionist Government in Dec. 1917 and, as acting Prime Minister and Minister of Justice, he had the difficult task of administering the Military Service Act. In 1918 he accompanied the prime minister to the Peace Conference at Paris, and in 1920 was one of the Canadian representatives at the League of Nations. He was appointed to the Privy Council, London, in the same year.

DOHERTY, HUGH LAWRENCE (1875–1919), English lawn-tennis player, was born at Clapham, London, on Oct. 5, 1875. He was educated at Westminster school and Trinity college, Cambridge. At Cambridge he and his brother, Reginald F. Doherty (1872–1911), made their names as tennis players. They were undoubtedly among the greatest and most artistic players of their day, and their joint work On *Lawn Tennis* (1903) is a classic of the game. The elder brother held the All England singles championship at Wimbledon from 1897–1900, and the younger from 1902–06, when he resigned the title. Playing in doubles, the brothers were champions from 1897 to 1905, being only once defeated, by S. H. Smith and F. L. Riseley, in 1902. H. L. Doherty won the American national championship in 1903. During the war he was in the anti-aircraft service, and the hard work entailed probably hastened his death, which took place on Aug. 11, 1919.

DOHNÁNYI, ERNST VON (1877–), Hungarian composer, pianist and conductor, was born at Bratislava (Pressburg) on July 27, 1877. He studied at the Budapest Royal Academy, and was for a short time a pupil of Eugen d'Albert. He attracted notice by his first pianoforte quintet as early as 1895. He was appointed professor of the pianoforte at the Berlin Hochschule (1908) and director of the Academy at Budapest in 1919. He became conductor of the Philharmonic orchestra of Budapest, and conducted with notable success in the United States. The style of his compositions is conservative and individual and carries on the romantic traditions of the 19th century. Among his principal works may be mentioned *Die Schleier der Pierrette* (ballet pantomime); Tante Simona (comic opera, 1912); *Der Turmder Woijwoden* (opera, 1922); also orchestral and chamber music and songs, all of a high order and giving him a place among the first composers of his day. As a pianist he also takes high rank.

DOHRN, ANTON (1840–1909), German zoologist, was born on Dec. 29, 1840, at Stettin, the son of Karl Dohrn, coleopterist, and editor of *Linnae Entomologia* (16 vols., 1846–66). After studying at Jena, under Haeckel, he devoted himself to the investigation of marine animals, and in 1870 founded the famous zoological station at Naples. He died on Sept. 26, 1909, at Munich. His publications are *Untersuchungen über Bau u. Entwicklung der Arthropoden* (18 jo); *Der Ursprung der Wirbelthiere* (1875); and *Studien zur Urgeschichte des Wirbeltlzierkorpers* (1882).

DOIRAN, BATTLE OF, 1917. This abortive offensive by the British on the Doiran sector on April 24, 1917, and the subsequent attempts is described under SALONIKA CAMPAIGNS. The British forces were here launched against the most formidable positions with the idea of easing the way, by attracting enemy reserves, for a decisive Allied stroke elsewhere—which was suspended almost before it began.

DOL, a town of north-western France, in the department of Ille-et-Vilaine, *36* m. N. of Rennes on the Ouest-État railway. Pop. (1936), 3,720. The town was unsuccessfully besieged by William the Conqueror, taken by Henry II. in 1164 and by Guy de Thouars in 1204. In 1793 the Vendeans there defeated the republican forces who had taken refuge within its walls. The bishopric was suppressed in 1790. Dol is situated to the south-west of the rich agricultural district known as the marsh of Dol, where market-gardening is especially flourishing. Picturesque houses of the 14th and 1 jth centuries still stand with projecting upper storeys. The grey granite cathedral, mainly 13th century. dedicated to St Samson, is interesting for the English character of its design, for its stained-glass windows of the 13th century and for the finely sculptured tomb of Bishop Thomas James (d. 1504). About 1½ m. from the town is the *pierre du Champ Dolent,* a menhir some 30 ft. in height; not far off stands the great granite rock of Mont Dol, over 200 ft. in height, surmounted by the statue and chapel of Notre-Dame de l'Espérance. Dol has trade in grain, vegetables and fruit, and there are salt-marshes. Tanning and leather-currying are carried on.

DOLABELLA, PUBLIUS CORNELIUS, Roman general and son-in-law of Cicero, was born about 70 B C. In the civil wars he at first took the side of Pompey, but afterwards went over to Caesar and was present at Pharsalus. To escape the demands of his creditors he introduced (as tribune) a bill proposing that all debts should be cancelled. This was resisted by his colleagues and led to disturbances in Rome. Caesar, on his return from Alexandria, seeing the expediency of removing Dolabella from Rome, took him as one of his generals in the expedition to Africa and Spain. On Caesar's death Dolabella seized the consulship (which had already been conditionally promised him), and, by making friends with Brutus and the other assassins, was confirmed in his office. When, however, M. Antonius offered him the command of the expedition against the Parthians and the province of Syria he changed sides at once. His journey to the province was marked by plundering, extortion, and the murder of C. Trebonius, proconsul of Asia, who refused to allow him to enter Smyrna. He was thereupon declared a public enemy and superseded by C. Cassius (the murderer of Caesar), who attacked him in Laodicea. On the capture of the place, Dolabella ordered one of his soldiers to kill him (43). Throughout his life he was a profligate and a spendthrift.

See Cicero's *Letters* (ed. Tyrrell and Purser); *G.* Boissier, *Cicero and his Friends* (Eng. trans. 1897); Orelli, *Onomasticon Tullianum;* Dio Cassius xli. 40, xlii. 29, xliii. 51, xliv. 22, xlvi. 40, xlvii. 30; Appian, *Bell. civ.* iii. 7, iv. 60.

DOLCE, LUDOVICO or **LUIGI** (1508–1568 or 1569), Italian writer, was a native of Venice. He wrote some 70 works, but is remembered chiefly for his *Marianna,* a tragedy from the life of Herod, which was recast in French by Tristan and by Voltaire, and still keeps a place on the stage. Four licentious comedies, *Il Ragazzo* (1541), *Il Capitano* (154j), *Il Marito* (1560), *11 Ruffian* (1560), and seven of Seneca's tragedies complete the list of his dramatic efforts.

See A. Salza, *Delle commedie di Ludovico Dolce* (1899).

DOLCI, CARLO or **CARLINO** (16 16–1686), Italian painter, was born in Florence on May 25, 1616, and died there on Jan. 17, 1686. He was a disciple of Jacopo Vignali; and when only 11 years of age he attempted a whole figure of St. John, and a head of the infant Christ. His portrait of his mother displayed a new and delicate style which brought him extensive employment at Florence and in other parts of Italy.

Carlo Dolci holds somewhat the same rank in the Florentine that Sassoferrato does in the Roman school. Without the possession of much genius, invention or elevation of type, both these artists produced highly wrought pictures, extremely attractive to some tastes. Many of his pictures represent the patient suffering of Christ, or the sorrows of the Mater Dolorosa. Dolci was, in fact, from early youth, exceedingly pious; it is said that during Passion week every year he painted a half-figure of the Saviour. Among his best works are the "St. Sebastian"; the "Four Evangelists," at Florence; "Christ Breaking the Bread," in the marquess of Exeter's collection at Burleigh; the "St. Cecilia" in Dresden; an "Adoration of the Magi"; and in especial "St. Andrew praying before his Crucifixion," in Florence, his most important composition, painted in 1646. There are examples also in the National gallery and Dulwich gallery, London; and at Rome. Vienna, Munich, Berlin and Leningrad.

DOLDRUMS, the shifting zone of equatorial calms or variable airs between the trade winds. The weather is hot, moist and extremely dispiriting with heavy and frequent rainfall usually accompanied by thunderstorms In the old days, sailing vessels sometimes lay helplessly becalmed for weeks with the crew "in the doldrums" ("in the dumps").

DOLE, SANFORD BALLARD (1844–1926), jurist and statesman of the Hawaiian Islands, was born in Honolulu on April 23, 1844, the son of American missionaries. After studying law in Boston he returned to Hawaii to become one of its leading lawyers, a member of the legislature from 1884 to 1887, and a leader in the reform movement which secured the Constitution of 1887. Also in 1887 he was appointed an associate justice of the supreme court, which office he held until the monarchy was overthrown in 1893 by a revolution of which Dole was himself a leader. In May, 1893, he was elected by the Constitutional Convention as the first president of the Republic of Hawaii. With firmness and wisdom he guided the Republic through a difficult period, suppressing revolutions and stabilizing the governmental machinery. When President Cleveland demanded the restoration of Queen Liliuokalani to the throne Dole refused to yield, claiming that Cleveland was without authority to act. In 1898 he went to Washington in the interests of annexation, and when that event took place in 1900 Dole was appointed by President McKinley as the first territorial governor. In 1903 he became United States district judge of Hawaii and in 1909 was reappointed to a second term. At its expiration in 1915 he retired to private life in Honolulu, where he died on June g, 1926.

DÔLE, a town of eastern France, capital of an arrondissement in the department of Jura, 29 mi. S.E of Dijon on the Paris-Lyon railway. Pop. (1936), 22,885. Dôle, the ancient *Dola,* was in Roman times the meeting place of several roads, and considerable remains have been found there; in the later middle ages, till 1648, it was the capital of Eranche Comté and seat of a parlement and a university; but in 1479 the town was taken and destroyed by Louis XI. It subsequently came into the hands of Maximilian of Austria, and in 1530 was fortified by Charles V. In 1668 and 1674 it was captured by the French and lost its parlement and university, both of which were transferred by Louis XIV. to Besançon. Dôle occupies the slope of a hill overlooking the forest of Chaux, on the right bank of the Doubs, and of the canal from the Rhone to the Rhine which accompanies that river. The steep, narrow streets contain many old houses recalling, in their architecture, the Spanish occupation of the town. The church of Notre Dame is Gothic of the 16th century. The college, once a Jesuit establishment, contains the library and a museum of paintings and has a chapel of the Renaissance period; the Hôtel-Dieu and hôtel de ville are both 17th century buildings; and the law court occupies an old convent of the Cordeliers. In the courtyard of the hôtel de ville stands an old tower dating from the 15th century. The birth of Louis Pasteur (1822) in the town is commemorated by a monument, and there is also a monument to Jules Grévy. Dôle is the seat of a sub-prefect and has tribunals of first instance and of commerce. Metal-founding and the manufacture of pumps. kitchen-ranges and other iron goods, chemical products, machinery, blue and blacking, and pastry are among the industries. There is a good trade in agricultural produce and live stock, and in wood, iron, coal and the stone of the vicinity. Wine is largely produced in the district.

DOLE, a portion, a distribution of gifts, especially of food and money, given in charity (O E. dal, *cf.* mod. "deal"). The distribution of alms to the local poor at funerals was a universal custom in the middle ages. Thus in 1399 Eleanor, duchess of Gloucester, ordered in her will that 15 poor men should carry torches at her funeral, "each having a gown and hood lined with white, breeches of blue cloth, shoes and a shirt, and £20 amongst them." Later, doles usually took the form of bequests of land or money, the interest or rent of which was to be annually employed in charity. Often the distribution took place at the grave of the donor. Lenten doles were also formerly common. A will of 1537 bade a barrel of white herrings and a case of red herrings be given yearly to the poor of Clavering, Essex, to help them tide over the fast. A pilgrim's dole of bread and ale can be claimed by all wayfarers at the Hospital of St. Cross, Winchester. This is said to have been founded by William of Wykeham. Emerson, when visiting Winchester, claimed and received the dole. What were known as scrambling doles, so called because the meat and bread distributed were thrown among the poor to be scrambled for, were not uncommon in England. At Wath, near Ripon, a testator in 1810 ordered that 40 penny loaves should be thrown from the church leads at midnight on every Christmas eve. The best known dole in the Cnited States is the "Leake dole of bread." John Leake, a millionaire, dying in 1792, left £1,000 to Trinity church, New York, the income to be laid out in wheaten loaves and distributed every Sabbath morning after service. (X.)

Dole in Unemployment. — While, as explained above, a dole is strictly a charitable gift, usually of food, the term came in Great Britain after the World War to be applied loosely to the various kinds of weekly payments to the unemployed.

These payments were first made on a national scale under the out-of-work donation scheme which was instituted immediately after the Armistice in 1918, and inasmuch as the scheme was entirely non-contributory, the term "dole" might be regarded as not inappropriate. The expression "dole" in relation to donation payments obtained currency soon after the scheme began.

The scheme applied not only to unemployed ex-members of the Forces who had served during the World War, but to civilian unemployed workers also. The payments came wholly from the Exchequer and amounted to £62,448,000 (£40,723,000 to ex-members of the Forces and £21,725,000 to civilians). The scheme for civilians was in existence for the year Nov. 1918 to Nov. 1919. For ex-members of the Forces it continued until March 1921.

By what may be described as a natural, or at least an easy, transition the term "dole" was afterwards applied to the weekly payments made under the National Unemployment Insurance scheme (see UNEMPLOYMENT INSURANCE). This general scheme of insurance against unemployment was, however, on a contributory basis from its inception. The contributing parties were the employer, the employed person, and the Exchequer, the share of the contribution borne on national funds being only one-fifth of the whole. (The Exchequer share was later increased and in the year 1930 amounted to one-third of the whole.)

From 1920 to Dec. 1929, over £284,000,000 were contributed by employers and workers and over £110,000,000 by the Exchequer.

Unemployment Benefits **Subscribed** For. — The unemployment insurance scheme was launched on what may be called a strictly insurance basis, persons who contributed to it being entitled when unemployed to receive benefit in proportion to their contributions, subject to a maximum period in each year. Owing, however, to the scheme coming into operation just when the severe industrial depression began, it became necessary to graft on to it a supplementary scheme under which benefit might be drawn by persons who would normally have contributed to the scheme but who, owing to the slump, either had not paid a sufficient number of contributions or had exhausted their benefit rights. The term "dole" was soon commonly applied to this extra or uncovenanted benefit, and it almost inevitably became associated with the insurance scheme as a whole, to which, however, as an insurance scheme it is quite inappropriate.

The term has also been applied to payments by the Poor Law authorities for relief of the able-bodied unemployed — an application which, having regard to the nature of the payments, is more justified than one referring to the unemployment insurance scheme.

Generally, it may be said that from the year 1919 the term "dole" has been loosely applied to payment made from national or local funds to the unemployed and even to benefits paid from insurance funds to which the recipients themselves contribute heavily. (J. F. G. P.)

DOLERITE is a word which has carried more than one meaning. It was originally applied by Haüy (from Gr. *δολερός* deceptive) to coarse-grained basalts with little or no glass, but it is now usually taken to indicate intrusive rocks, of basic composition belonging to the hypabyssal group, and therefore intrusions and not lavas. It is, however, sometimes difficult to ascertain whether a particular sheet is an intrusion or a lava-flow, because in the later stages of volcanicity the lava does not always reach the surface, but may be injected among the earlier flows.

The dolerite group includes both cale-alkaline and alkaline

varieties, of which the former are by far the commoner. Their essential minerals are a basic plagioclase felspar (usually ranging from andesine to anorthite, the most typical being labradorite) and augite; the more basic varieties contain olivine, while in more acid types a little alkali-felspar and quartz may be present, often as micropegmatite (*q.v.*). Original hornblende is not very common, though the augite is often more or less converted to hornblende by secondary changes. In some varieties enstatite or hypersthene are found, often with quartz. The commonest accessories are ilmenite and apatite. In the alkaline dolerites, often called teschenites, there is rather more alkali-felspar and either nepheline or more commonly analcite.

The dolerites are dark-coloured, heavy rocks, most commonly of even grain, though sometimes carrying phenocrysts of felspar, augite or olivine. The structure is typically ophitic; *i.e.,* the crystals of felspar of prismatic form are enclosed in large plates of augite, giving a sort of shimmery appearance. The centre of a comparatively large mass may approach a gabbro in texture, while the margins are often of very fine grain, or even glassy, owing to chilling during intrusion by the cold country rock.

Dolerites may form small bosses and laccoliths, thus merging into the gabbros, but the most typical manner of occurrence is as sills and dikes, varying in thickness or width from a mere film to hundreds of feet. Often there is to be observed a considerable variation in composition from the centre to the margins of a large intrusion, owing to differentiation of the magma during cooling, the basic minerals concentrating near the margin, while felspar, including orthoclase or albite and even quartz may be found at the centre. Again it is not infrequent to find an injection of some acid rock in the same dike-fissure, or forming a parallel sheet or sill. This phenomenon is due to differentiation before crystallization.

The ordinary dolerites, poor in alkalis and correspondingly rich in lime, are undoubtedly the most abundant of all basic intrusive~.They occur in great quantity along with surface flows of basalt in innumerable localities. In Britain dolerites, mostly carrying olivine, are abundant in the Tertiary volcanic province of western Scotland and north-eastern Ireland, as well as among the carboniferous eruptives of the central valley of Scotland. Well-known examples of enstatite-dolerite (with quartz) are the Great Whin Sill of northern England, and Penmaenmawr in north Wales. By far the greatest known development of dolerite, however, is that of the Karroo region, Natal, etc., in South Africa, where individual sheets may be thousands of feet thick.

Alkaline dolerites (teschenites) are less common; the type example is that of Teschen in Moravia, while a good many occurrences are known in Scotland, of both carboniferous and Tertiary age, and in the English midlands (Clee hills, etc.).

The dolerites are of considerable economic value, as when fresh the stone is hard, heavy and tough, being well-suited for paving setts and road metal.

In America and in mining literature generally the dolerites are often called *diabase,* but this name is not to be recommended, owing to the different-senses in which it has been used in past times. (R. H. RA.)

DOLET, ETIENNE (1509–1546), French scholar and printer, was born at Orleans. After studying at Paris and Padua, he became secretary in 1530 to the bishop of Limoges, who was French ambassador to the republic of Venice. He then studied law at Toulouse. In 1535 he entered the lists against Erasmus in the famous Ciceronian controversy, by publishing a *Dialogus de imitatione Ciceroniana;* and the following year saw his *Commentariolum linguae Latinae.* This work was dedicated to Francis I., who gave him the privilege of printing during ten years any works in Latin, Greek, Italian or French, which were the product of his own pen or had received his supervision; and accordingly, on his release from an imprisonment occasioned by his justifiable homicide of a painter named Compaing, he began at Lyons his typographical and editorial labours. He started by publishing a *Cato christianus,* or Christian moralist, in which he made profession of his creed. The catholicity of his literary appreciation, in spite of his ultra-Ciceronianism, was soon displayed by the works which proceeded from his press—ancient and modern, sacred and secular, from the New Testament in Latin to Rabelais in French. After being thrice imprisoned for atheism, he was tortured and burnt at Paris on Aug. 3, 1546. On his way to the stake, he is said to have composed the punning pentameter—Non *dolet ipse Dolet, sed pia turba dolet.*

Whether Dolet was a Protestant or an anti-Christian rationalist is debatable. He was condemned by Calvin but many of his books were of a religious character, and he repeatedly advocated the reading of the Scriptures in the vulgar tongue.

See A. F. Didot, *Essai sur la typographie* (1852); L. Michel, *Dolet* (1889); R. C. Christie, *Étienne Dolet, the Martyr of the Renaissance* (2nd ed. 1889, bibl.); O. Galtier, *Étienne Dolet* (1908), and pt. 3 of J. C. Dawson's *Toulouse in the Renaissance* (New York, 1923).

DOLGEELY, a market and county town of Merionethshire, Wales, situated on the streams Wnion and Aran, at the north base of Cador Idris, on the G.W. railway. Pop. of urban district (est. 1938) 2,461. It consists of small squares and narrow streets, with a grammar school (1665), market hall and assize hall. There is a little manufacture of flannel and coarse woollens. An ancient house has associations with Owain Glyn Dwr, who established relations with the Continent from here in 1404. Hengwrt, a mansion near the ruins of Cymmer Abbey, has given its name to a famous collection of Welch mss. once housed there, and now in the National Library of Wales, Aberystwyth.

DOLGORUKI, VASSILI LUKICH, COUNT (1672–1739), Russian diplomatist and minister, was one of the first group of young Russians whom Peter the Great sent abroad to be educated. On his return home he entered the diplomatic service, and served on a series of important missions. During the reign of Peter II. (1727–30) Dolgoruki was appointed a member of the supreme privy council, and, after procuring the banishment of Menshikov, he took charge of the young emperor, whom he would have forced to marry his niece Catherine but for Peter's sudden death. He then drew up a letter purporting to be the last will of the emperor, appointing Catherine Dolgoruki his successor, but had to abandon the scheme as impracticable. He supported the election of Anne of Courland to the throne on condition that she first signed nine "articles of limitation" which left the supreme power in the hands of the Russian council. Anne, who repudiated the "articles" on the first opportunity, never forgave Dolgoruki. He was banished first to his country seat and then to the Solovetsky monastery. Nine years later the charge of forging the will of Peter II. was revived, and he was tortured and then beheaded at Novgorod on Nov. 8, 1739.

See Robert Nisbet Bain, *The Pupils of Peter the Great* (1895).

DOLHAIN, the most eastern town of Belgium, situated on the Vesdre, north-east of Verviers and close to the German frontier. It is quite a modern town, occupying the site of the lower town of the ancient city of Limburg, which was destroyed by Louis XIV. in 1675 On a rocky eminence above Dolhain are still to be seen the fine ruins of the old castle of Limburg, the cradle of the ancient family of that name from which sprang the Luxemburg family and several emperors of Germany. At a short distance from Dolhain is the famous dam of the Gileppe, the vast reservoir constructed to supply Verviers with water free from lime for its cloth manufactures.

DOLICHOCEPHALIC (long-headed), a term denoting skulls the diameter of which from side to side, or the transverse diameter, is 75% or less of the longitudinal diameter or that from front to back taken as 100.

DOLLAR, burgh and parish, Clackmannanshire, Scotland, 6 m. N.E. of Alloa by the L.N.E.R., not far from the Devon. Pop. (1938) 1,428. The village is beautifully situated. It has a well known school, the academy, housed in a fine mass of buildings of the Grecian order (opened about 1819).

DOLLAR, a silver coin at one time current in many European countries, and adopted under varying forms of the name elsewhere. The word "dollar" is a modified form of *thaler,* which, with the variant forms (daler, dalar, daalder, tallero, etc.), is said to be a shortened form of *Joachimsthaler.* This *Joachimsthaler* was the name given to a coin intended to be the silver equivalent

of the gold gulden, a coin current in Germany from the 14th century. In 1516 a rich silver mine was discovered in Joachimsthal (Joachim's dale), a mining district of Bohemia, and the count of Schlick, by whom it was appropriated, caused a great number of silver coins to be struck (the first having the date 1518), bearing an effigy of St. Joachim, hence the name. The *Joachimsthaler* was also sometimes known as the *Schlickenthaler*. The first use of the word dollar in English was as applied to this silver coin, the thaler, which was current in Germany at various values from the 16th century onwards, as well as, more particularly, to the unit of the Germany monetary union from 1857 to 1873, when the mark was substituted for the thaler. The Spanish piece-of-eight (real) was also commonly referred to as a dollar; it was used both in the Spanish-American and in the English colonies.

On July 6, 1785, the dollar was adopted by the Continental Congress as the monetary unit of the United States. Actual coinage was not begun until after the enactment of the law, April 2, 1792, providing for a dollar of $371\frac{1}{4}$ grains of pure silver or 416 grains of standard silver. An act of March 3, 1849, directed the coinage of gold dollars of $25\frac{8}{10}$ grains, of which 23.22 grains were to be fine gold, and by act of Feb. 12, 1873 this became the American unit of currency. According to the Constitution, Congress has the power to regulate the currency, and under that power Congress by act of May 12, 1933, provided that the weight of gold in the dollar might be fixed by the President but not below 60% of its then weight. By proclamation of the President, Jan. 31, 1934, the gold in the dollar was fixed at $15\frac{5}{21}$ grains, nine-tenths fine, a reduction of approximately 41 per cent. The silver dollar contains $412\frac{1}{2}$ grains, nine-tenths fine. No gold is now coined, having been withdrawn from circulation in 1934. The present subsidiary coins are the half-dollar or so-cent piece, the quarter-dollar or 25-cent piece, the dime or 10-cent piece, all in silver; the 5-cent piece in nickel; and the 1-cent piece in copper.

The Spanish piece-of-eight was the ancestor of the Mexican, the Newfoundland. and the Spanish-American dollar.

DOLLAR STABILIZATION. Under the existing currency system, the so-called "level of prices" is largely at the mercy of monetary and credit conditions. The purchasing power of money has. in the past, always been unstable, because a unit of money was not determined as a unit of purchasing power but only as a unit containing a certain weight of gold or silver. Other units—the yard, pound, bushel, etc.—were once as unstable as monetary units, but, one after another, they have all been stabilized or standardized. Short weights and measures cheat the buyer; long weights, the seller. So a unit of money which changes in value or purchasing power is always playing havoc between contracting parties. The following table shows how the level of prices and the purchasing power of the dollar have fluctuated, according to Prof. Irving Fisher's index number of wholesale prices.

	Index number of prices in % of 1926, *i.e.*, 1926 = 100%	Purchasing power of the dollar in 1926 cents, *i.e.*, 1926 = 100 cents
1860	67	151
1865 (high)	143	70
1896 (low)	46	218
1913	70	143
1920 May (high)	167	60
1922 Jan. (low)	96	104
1926	100	100
1929	96	104
1931	71	140
1932	62	162
1933	65	157
1934	77	131
1935	83	121
1936	84	120
1937	91	110
1938	81	123

An Unsatisfactory System.—When prices are rising, *i.e.*, when the purchasing power of the dollar is falling, creditors and recipients of fixed incomes suffer injustice. The sufferers include savings-bank depositors, bondholders and salaried classes. On the other hand, when prices fall, it is other classes, such as debtors, stockholders, farmers and independent business men generally, who suffer. The indirect effects of falling or rising prices, *i.e.*, of a rising or falling dollar, are equally bad. These indirect effects include industrial discontent, due either to the high cost of living or to unemployment and economic crises.

Hitherto there was ample excuse for the unstable monetary units of various countries, in that no instrument for measuring their aberrations had been devised. Likewise, until weighing scales were invented weights could not be standardized, and until instruments for measuring electrical magnitudes were invented, electrical units could not be standardized. But for some years the index number of prices has provided a fairly accurate instrument for measuring the value of money in terms of its power to purchase goods. An index number of prices is a figure which shows, for a specific period of time or on a specific date, the average percentage increase or decrease of prices. This instrument for measuring changes in the purchasing power of money has been utilized, beginning in the 1920s, in adjusting wages and salaries to the cost of living, and a number of industrial and financial concerns, and some private agencies, have amended wages on the basis of an index number of the prices of commodities. A number of countries had also officially adopted the principle of adjusting a basic rate of the wages of labour in accordance with changes in the purchasing power of the monetary unit as expressed in an index number of the cost of living.

However, this method of offsetting fluctuations in the purchasing power of money has proved entirely inadequate; for it merely intended to prevent some of the symptoms of monetary instability, without attacking its cause. Since 1931 efforts have been made to incorporate the necessary corrections in the monetary unit itself by keeping it stable in purchasing power.

Trend Since 1931.—In 1929–30, as prices began to decline, practically all currencies were linked to one another by the fact that they could, either directly or indirectly, be exchanged into fixed weights of gold. The fall of prices, therefore, indicated not only that national currencies were increasing in purchasing power, but that the value of gold was changing correspondingly. Countries whose currencies were not thus linked to gold, as for instance China which was on a silver basis, experienced no corresponding change in purchasing power and consequently no depression. In Sept, 1931, England, followed by the countries belonging to the sterling area, cut loose from gold and thus prevented any further appreciation of purchasing power. The fact that these currencies were no longer exchangeable into fixed weights of gold, caused fears of a repetition of post-war experiences with paper money, namely, a chaotic rise of prices indicating complete collapse of purchasing power. In order to mitigate such fears and give direction to their monetary policies, the Scandinavian countries, notably Sweden, announced their determination to maintain the stability of purchasing power of their currencies as measured by an official price index. On July 3, 1933, President Roosevelt, in a message to the World Economic Conference then meeting in London, proclaimed a similar policy of dollar stabilization, saying that "the United States seeks the kind of dollar which a generation hence will have the same purchasing and debt-paying power as the dollar value we hope to attain in the near future."

Requirements of a Stabilization Policy.—Experience has shown that the declaration of a policy of stable money, or the construction of an official index number for measuring purchasing power, are not sufficient to actually maintain stability. Once a country has decided on purchasing power stability as the objective of monetary policy, it is essential that this goal be defined as narrowly as possible to eliminate the need for wide discretion on the part of the monetary authority—usually the central bank. Among the powers the monetary authority should possess is that of issue and control of the nation's money. This implies the need for banking reform so as to prevent commercial banks from arbitrarily changing the volume of money when lending their customers not actual currency but the bank's credit. The practice

of banks to issue their own credit when making loans, and destroying this credit when calling loans, has been one of the chief factors responsible for violent fluctuations in the purchasing power of money. In the United States, such bank-created-and-destroyed credit (called demand bank deposits) transacts more than nine-tenths of the nation's business. The monetary authority should also be required to change foreign exchange rates and the prices of gold and silver whenever necessary to maintain the stability of purchasing power of the monetary unit.

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DOLLFUSS, ENGELBERT (1892–1934), Austrian statesman, born in Texing, Lower Austria, in 1892, was educated at the universities of Vienna and Berlin. During the world war he served as an officer in the Austrian army. In October 1931 he became president of the Austrian Federal Railways, in March 1932 minister of Agriculture and Forestry, and in May 1932 was appointed Chancellor. On March 4, 1933, feeling the need of a strong government in face of the growing menace to Austria from German Nazis, he dispensed with further meetings of the *Nation*alrat. He was wounded in an attempt upon his life on Oct. 3, 1933; and on July 25, 1934, he was assassinated by a group of Austrian Nazis who, disguised as members of the Heimwehr, seized the Chancellery in Vienna.

DÖLLINGER, JOHANN JOSEPH IGNAZ VON (1799–1890), German theologian and church historian, was born at Bamberg, Bavaria, on Feb. 28, 1799, and was educated at the Würzburg gymnasium and at Bamberg. On April 5, 1822 he was ordained priest. In 1823 he became professor of ecclesiastical history and canon law in the lyceum at Aschaffenburg, and in 1826 professor of theology at Munich, where he spent the rest of his life. He entered into relations with the well-known French Liberal Catholic, Lamennais, whose views on the reconciliation of the Roman Catholic Church with the principles of modern society had aroused much suspicion in ultramontane circles. In 1832 Lamennais, with his friends Lacordaire and Montalembert, visited Germany, with a view to bringing about a modification of the Roman Catholic attitude to modern problems. In 1838 he published a treatise against mixed marriages, and in his works on The Reformation (3 vols. Regensburg, 1846–48) and on Luther (1851, Eng. tr., 1853) he is very severe on the Protestant leaders. In 1842 he entered into correspondence with the leaders of the Tractarian movement in England, notably with Pusey, Gladstone and Hope Scott; and two years later was made representative of his university in the second chamber of the Bavarian legislature. In 1847, in consequence of the fall from power of the Abel ministry in Bavaria, with which he had been in close relations, he was removed from his professorship at Munich, but in 1849 was invited to occupy the chair of ecclesiastical history. He was a delegate to the national German assembly at Frankfort in 1848.

It has been said that his change of relations to the Papacy dated from the Italian war in 1859, but no sufficient reason has been given for this statement. He was unfavourably impressed by the promulgation (1854) of the dogma of the Immaculate Conception of the Blessed Virgin, and he disliked the attitude of the zealots for the restoration of the temporal sovereignty of the pope. In 1863 he invited 100 theologians to discuss at Malines the question which Lamennais and Lacordaire had already raised in France, namely, the attitude that should be assumed by the Roman Catholic Church towards modern problems and modern science. His strong liberalism and the anti-ultramontane and anti-Jesuit attitude which he displayed at this conference led the pope to suppress it after four days session. On Dec. 8, 1864 Pius IX. issued the Syllabus (*q.v.*), in the 13th thesis of which he condemned certain of Dollinger's views. It was in connection with the problems raised at the conference that Dollinger published his Past and Present of Catholic Theology (1863) and his Universities Past and Present (Munich, 1867).

We now approach the critical period of Dollinger's life. The headquarters of the opposition to the movement for the declaration of papal infallibility which was now mooted in many quarters was Germany, and its leader was Dollinger. Among the group were his intimate friends Johann Friedrich (*q.v.*) and J. N. Huber, in Bavaria. In the rest of Germany he found many supporters, chiefly professors in the Catholic faculty of theology at Bonn, among whom were the famous canonist von Schulte, Franz Heinrich Reusch, the ecclesiastical historian Joseph Langen, as well as J. H. Reinkens, afterwards bishop of the Old Catholic Church in Germany, Knoodt, and other distinguished scholars; and, in Switzerland, Prof. Edward Herzog, who became Old (or, as it is sometimes called, Christ-) Catholic bishop in Switzerland Early in 1869 the famous Letters of *Janus,* written by Dollinger in conjunction with Huber and Friedrich (which were at once translated into English; 2nd ed. Das Papsttum, 1891), began to appear. The Letters pointed out the tendency of the *Syllabus* towards obscurantism and papal despotism, and marshalled the evidence against papal infallibility, a subject which had been placed on the agenda of the Vatican Council fixed for Dec. 8, 1869. During its session the world was kept informed of what was going on in the Letters of *Quirinus,* by Dollinger and Huber, who were supplied with information by Augustin Theiner, the librarian at the Vatican, then in disgrace with the pope for his outspoken Liberalism. The dogma was carried by an overwhelming ,majority, and the dissentient bishops, one by one submitted (see VATICAN COUNCIL). Dollinger, understanding infallibility to apply to all official exercise of the supreme magisterium, including encyclicals, headed a protest by 44 Munich professors, and convened a congress at Nuremberg, which met in Aug. 1870 and issued a declaration adverse to the Vatican decrees. The archbishop of Munich called upon Dollinger to submit. Dollinger answered (Nov. 28, 1871) that the decrees were opposed to Holy Scripture, to the traditions of the Church for the first 1,000 years, to historical evidence, to the decrees of the general councils, and to the existing relations of the Roman Catholic Church to the state in every country in the world. "As a Christian, as a theologian, as an historian, and as a citizen," he added, "I cannot accept this doctrine."

The archbishop replied (April, 1871) by excommunicating Döllinger (see VATICAN COUNCIL and INFALLIBILITY), who was thereupon almost unanimously elected rector-magnificus of the university of Munich while Oxford, Edinburgh and Marburg universities conferred upon him the honorary degree of doctor of laws and Vienna that of philosophy. The Bavarian clergy invited Bishop Loos of the Jansenist Church in Holland, which for more than 150 years had existed independent of the Papacy and had adopted the name of "Old Catholic," to hold confirmations in Bavaria. The offer was accepted, and the three Dutch Old Catholic bishops declared themselves ready to consecrate a bishop, if it were desired. The momentous question was discussed at a meeting of the opponents of the Vatican decrees, when Dollinger voted against the proposition, and withdrew from any further steps towards the promotion of the movement. He declined to initiate a schism (see OLD CATHOLICS).

Dollinger's attitude to the new community was not very clearly defined. His addresses on the reunion of the Churches, delivered at the Bonn Conference of 1872, show that he was not hostile to the newly formed communion, in whose interest the conference was held; in 1874 and again in 1875, he presided over the Reunion Conferences held there and attended by leading ecclesiastics from the British Isles and from the Orthodox Church. At the latter of these two conferences, when Dollinger was seventy-six years of age, he delivered a series of addresses in German and English, in which he discussed the state of theology on the continent, the reunion question, and the religious condition of the various countries of Europe in which the Roman Catholic Church held sway, and he succeeded in inducing the Orientals, Anglicans and Old Catholics present to accept a formula of concord, drawn

from the writings of the leading theologians of the Greek Church, on the question of the Procession of the Holy Spirit. During his last years of retirement he wrote, in conjunction with his friend Reusch, *Geschichte der Moralstreitigkeiten in der römisch-katholischen Kirche seit dem sechzehnten Jahrhundert mit Beiträgen zur Geschichte und Charakteristik des Jesuitenordens* (Nordlingen, 1889). Döllinger died in Munich on Jan. 14, 1890, at nearly ninety-one. He declined to receive the sacraments from the parish priest at the cost of submission, but the last offices were performed by his friend Professor Friedrich.

In addition to the works referred to in the foregoing sketch, we may mention *The Eucharist in the First Three Centuries* (Mainz, 1826); a *Church History* (1836, Eng. trans, 1840); *Hippolytus and Callistus* (1854, Eng. trans., 1876); *First Age of Christianity* (1860); *The Church and the Churches* (Munich, 1861); *Lectures on the Reunion of the Churches; The Vatican Decrees; Studies in European History* (tr. *M.* Warre, 1890); *Miscellaneous Addresses* (tr. *M.* Warre, 1894).

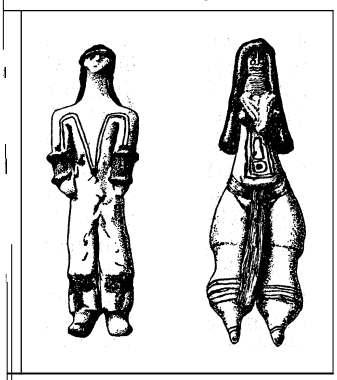
See L. von Kobell, *Conversations of Dr. Döllinger* (tr. by *K.* Gould, 1892); and J. Friedrich, *Ignaz von Dollinger* (Munich, 1899–1901).

DOLLOND, JOHN (1706–1761), F.R.S. (1761), English optician, was the son of a Huguenot refugee, a silk-weaver at Spitalfields, London, where he was born on June 10, 1706. He followed his father's trade, but found time to acquire a knowledge of Latin, Greek, mathematics, physics, anatomy and other subjects. In 1752 he abandoned silk-weaving and joined his eldest son, Peter Dollond (1730–1820), who in 1750 had started in business as a maker of optical instruments. His reputation grew rapidly, and in 1761 he was appointed optician to the king. In 1758 he published an "Account of some experiments concerning the different refrangibility of light" (*Phil. Trans.*, 1758), describing the experiments that led him to the discovery of a means of constructing achromatic lenses by the combination of crown and flint glasses. Following the suggestion of Leonhard Euler and the experiments of Samuel Klingenstjerna (1698–1765) Dollond commenced a series of tests on achromatism. Early in 1757 he succeeded in producing refraction without colour by the aid of glass and water lenses, and a few months later he obtained the same result by a combination of glasses of different refrangibilities (*see* TELESCOPE). Dollond also published two papers on apparatus for measuring small angles (*Phil. Trans.*, 1753, 1754). He died in London on Nov. 30, 1761.

DOLLS. The doll, the familiar toy puppet of childhood, is one of the oldest of human institutions. Common among both savage and civilized people, its antiquity is attested by Egyptian, Greek and Roman remains, among which small figures of clay, wood, bone and ivory are identified as dolls from being found in children's graves.

Dolls are among the first inventions of children, having been doubtless improvised in the earliest instances from natural objects such as sticks and stones. Aboriginal America and Japan are the chief sources of information. The child's doll occurs among the American Indians as the image of a deity, made of wood, regarded as sacred and entrusted to the child in its religious instruction. Such dolls, carved to represent the masked dancers who personate the gods, are used to-day throughout the Pueblo area of the United States in New Mexico and Arizona, and in a derived form among the Pomo in California. They are also treated with great respect by the Pueblos, their sale being forbidden. The dolls of the Keres Indians of Laguna and Cochiti are not elaborately carved or dressed, being flat or rounded billets, identical in form with the prayer sticks employed as ceremonial offerings. The Navajo who occupy the adjacent territory look with superstitious fear upon the Pueblo doll and use a wooden effigy representing a Hopi doll to work evil upon an enemy. Indian mothers among the Chippewa put feathers in the form of a child in the cradle of a dead infant, carrying this about with them and treating it as though living. The Eskimo and northern Indians make children's dolls of bone, ivory and mammoth teeth, and dress them in fur and hide. Small clothed clay dolls are found in ancient Peruvian graves. The beaded buckskin dolls of the Plains and other Indians appear to have been inspired by white influence.

In Japan a primitive type of child's doll consists of a shaved willow stick with shavings or strings for hair, and paper clothes, an obvious adaptation of the shaved willow sticks formerly set up on the banks of streams as scapegoats at the annual purification ceremony. An actual scapegoat doll, which was dressed and fed and generally treated as though alive, was given to mothers in old Japan to ward off evil from their children. Women desiring children presented dolls essentially emblems of maternity, at a certain shrine. Apart from these "magical" dolls, Japanese girl children have ordinary dolls as well as ceremonial dolls symbolizing the imperial court, which are not played with but exhibited formally at the girls' festival on May 3. Japanese boys have similar toy images of warriors, which are displayed at their festivals on the fifth of March.



BY COURTESY OF THE MUSEUM OF THE AMERICAN INDIAN

PRIMITIVE TYPES OF DOLLS OF THE CARAJA INDIANS, BRAZIL

In Korea little girls make their own dolls and cut a bamboo pipe stem about 5 in. long, in the top of which they put long grass, salted and made fine like hair. They never give these a face but sometimes paste a little white powder in its place. They dress the stick in clothes like those worn by women and sometimes put a pin, made by themselves, in the hair. The children's festival in Korea occurs on April 8, celebrated in Japan as the birthday of Buddha. On this occasion, the Koreans make an image of a woman of paper with a rounded base made of clay so that it stands erect. In Japan the corresponding toy is identified as the Buddhist *Daruma* and is purchased by boys at the festival of a certain temple. One which rises quickly to a vertical position is selected. The face is painted, but instead of eyes, two white paper discs are pasted. This doll is carried home, placed on the "god shelf" and a prayer is said. The god is promised eyes if he answers the prayer, and, this accomplished, black dots are made with ink on the vacant eye discs. In China this toy is made to represent an actor and described as a drunken man.

Among the Hindus and Mohammedans in India, where infant marriage prevails, elaborately dressed dolls with belongings are among the presents given to a girl at marriage. Their use is general throughout the Mohammedan East in spite of the laws of Islam which forbid the representation of the human figure. The nine year old wife of Mohammed, Aischa, brought her dolls when she entered his harem and the Prophet himself is said to have played with them. Mohammedan women in Baghdad are said to see a spirit in every doll that may bring harm to their children. Dolls, therefore, are not given to children as toys, but little girls, following their instincts, make dolls of pillows and blocks of wood. In Persia girls make their dolls of pieces of folded cotton which they clothe and mark with features. Here, too, an image of a doll is, it is said, sometimes placed in a temple at the time of its erection to secure its continued welfare.

Dolls are common in Africa, where certain forms are peculiar to certain regions and their use by children as toys is complicated by magical observances. Their general appearance is similar to the carved wooden fetishes to which they seem genetically related. Among the Fingo of the Orange Free State, a girl is given a doll when she becomes of age, which she keeps until she has a child. Then her mother gives her another doll which she keeps until she has a second child. Analogous to the scapegoat dolls of old Japan, these dolls are considered sacred and not parted with.

As regards Christian Europe there is little direct information, although dolls are known to have existed, as has been previously indicated, from Roman time.

It is known also that in earlier centuries those used as playthings were connected with images of the saints and were associated with the Christmas festival. A structure representing the scene of the Nativity was erected in churches and private houses, where the Christ child was displayed in its cradle with more or less elaborately costumed figures of the Holy Family, the Magi

and their retainers. These reached a poinr of great elaboration in the 17th and 18th centuries, as shown in the collection in the Bavarian National museum in Munich. And this custom still survives in France, Spain, Italy and all other Catholic countries. Toy fairs are held in the streets and purely secular dolls are sold side by side with toy images representing the Holy Infant, the Virgin Mary, St. Joseph, St. Nicholas and St. Christopher and other saints associated with this season.

In Protestant Europe the doll's house seems to have replaced the *crèche,* the *krippe* and the *nacimiento* of France, Germany and Spain and is highly developed, as may be seen in the Germanic National museum in Niirnberg, the South Kensington museum in London and in museums of Holland and Belgium.

As regards manufacture of dolls the Netherlands and the Tyrol have long been leading centres of the industry in Europe, while it may be noted further that dolls intended to illustrate seasonal fashions constitute a branch of the industry which came into existence much earlier than might be generally supposed. During the World War elaborately costumed dolls of the latter type, made very often by women artists as a means of livelihood in the period of distress, and bought by adults for ornamental purposes, if not as playthings, were produced in large numbers and acquired great popularity as gifts and keepsakes among the well-to-do.

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DOLMAN, originally a long, loose garment left unfastened in front, and with narrow sleeves. It is worn generally by the Turks, and is not unlike a cassock in shape. The name was given to the uniform jacket, worn by hussars, and slung from the shoulders with the sleeves hanging loose.

DOLMEN, the term used of a certain type of prehistoric monuments, which usually consists of several great stone slabs set edgewise in the earth to support a flat stone which serves as a roof. The structure was designed as a burial chamber and is typical of the Neolithic period in Europe. The word is Celtic in origin but probably is not Breton; the Welsh equivalent of the word is Cromlech. Dolmens, although found in covered form as far East as Japan are mainly confined to Europe and Northern Africa. There are many examples in the British Isles. *See* BARROW and Borlase, *The Dolmens of Ireland* (1897).

DOLMETSCH, ARNOLD (1858–1940), French musician, was born at Le Mans in 1858. He studied under Vieuxtemps in Brussels and later at the Royal College of Music in London. His keen interest in old music and obsolete instruments took the practical form of research among the manuscripts in the British Museum and other collections on the one hand and of collecting and repairing the instruments themselves on the other. To reconstruct new instruments on the lines of the old was the next step, and to this end he worked from 1902 to 1909 at the Chickering factory in Boston, U.S.A., and from 1911 to 1914 at the Gavaud factory in Paris. In 1914 he returned to London, where he became a familiar figure in the musical world by virtue of his interesting revivals of early English music and his ingenious reconstructions of harpsichords and clavichords. He maintained a workshop at Haslemere in Surrey, where he also organized annual festivals of old chamber music of the 16th, 17th and 18th centuries. On these occasions the fortnight's programmes were carried through, with but little outside assistance, by Dolmetsch and his family, the members of which he had trained to take their parts in a concert of viols or recorders or in any combination of instruments. These concerts continued until his death

Among Dolmetsch's published works are: *Select English Songs and Dialogues of the XVI. and XVII. Centuries* and *The Interpretation of the Music of the XVI. and XVII. Centuries* (1915).

DOLOMIEU, DÉODAT GUY SILVAIN TANCREDE GRATET DE (1750–1801), French geologist and mineralogist, was born at Dolomieu, near Tour-du-Pin, Isère, on June 24, 1750. He was admitted in his infancy a member of the Order or Malta. In his nineteenth year hc quarrelled with a knight of the galley on which he was serving, and in the duel that ensued killed him. He was condemned to death, but in consideration of his youth was pardoned, after nine months' imprisonment. In 1775 he published his *Recherches sur la pesanteur des corps à differentes distances du centre de la terre,* and soon after threw up his commission in the carabineers, and in 1777 accompanied the *bailli* (afterwards Cardinal L. R. E.) de Rohan to Portugal. In the following years he visited Spain, Sicily, the Pyrenees and Calabria, the scientific results being given in a series of important works. In 1789 and 1790 he studied the Alps, and the mineral *dolomite* (named after him) was described by Dolomieu in 1791. He returned to France in that year, bringing with him rich collections of minerals. On Sept. 14, 1792, his friend, the duc de la Rochefoucauld was assassinated at Forges, and Dolomieu retired with the widow and daughter of the duke to their estate of Roche Guyon. In 1798 he accompanied Bonaparte's expedition to Egypt, but ill health compelled his return. On the way home he was captured, and imprisoned at Naples in a pestilential dungeon, where he remained 21 months. Deprived of writing materials, he made a piece of wood his pen, and with the smoke of his lamp for ink he wrote upon the margins of a Bible, the only book he still possessed, his treatise *Sur la philosophie minéralogique et sur l'espèce minérale* (1801). He died at Château-Neuf, Saône-et-Loire, on Nov. 26, 1801.

See Lacépède, "Éloge historique de Dolomieu," in *Mtmoires de la classe des sciences de l'Institut* (1806); Thomson, in *Annals of Philosophy,* vol. xii. p. 161 (1808).

DOLOMITE, a mineral species consisting of calcium and magnesium carbonate, $CaMg(CO_3)_2$, and occurring as rhombohedral crystals or large rock-masses. Analyses of most well-crystallized specimens correspond closely with the above formula, the two carbonates being present in equal molecular proportions ($CaCO_3$,54·35; $MgCO_3$,45·65%). Normal dolomite is thus not an isomorphous mixture of calcium and magnesium carbonates, but a double salt. In crystalline form it is very similar to calcite, belonging to the same group of rhombohedral carbonates; the primitive rhombohedron, parallel to the faces of which there are perfect cleavages, has interfacial angles of 73° 45'. A specially characteristic feature is that this rhombohedron is frequently the only form present on the crystals (in calcite it is rare except in combination with other forms); the faces are also usually curved, sometimes to an extraordinary degree, giving rise to saddle-shaped crystals. In the degree of symmetry possessed by the crystals there is, however, an important difference between calcite and dolomite; the latter is hemihedral with parallel faces, having only an axis of triad symmetry and a centre of symmetry.

Dolomite is both harder (H=3·5–4) and denser (sp. gr. 2.85) than calcite. The two minerals may also be readily distinguished by the fact that dolomite is not acted upon by cold, dilute acids. Crystals of dolomite vary from transparent to translucent, and often exhibit a pearly lustre, especially when the faces are curved; the colour is usually white or yellowish.

The crystallized mineral was first examined chemically by P. Woulfe in 1779, and was named compound-spar by R. Kirwan in 1784; other early names are bitter-spar, rhomb-spar and pearl-spar (but these included other rhombohedral carbonates). The name dolomite (*dolomie* of N. *T.* de Saussure, 1792) is in honour of the French geologist, D. G. Dolomieu; this name was originally applied to the rock only, but was later extended to the crystallized mineral, first in the form dolomite-spar.

In the white crystalline dolomite-rock of the Binnenthal near Brieg in Switzerland beautiful water-clear crystals of dolomite are found; and crystallized masses occur embedded in serpentine, talc-schist and other magnesian silicate rocks. The best crystallized specimens are, however, usually found in metalliferous deposits; for example, in the iron mines of Traversella near Ivrea, Piedmont (as large twinned rhombohedra) and Cleator Moor, Cumberland; in the deposits of lead and zinc ores at Alston, Cumberland, Laxey in the Isle of Man and Joplin in Missouri. (L. J. S.)

DOLOMITES, THE, a mountain district in the South Tirolese Alps, and a subdivision of the Alps. The mountains are

BY COURTESY OF (1, 2, 3, 4, 6) THE DEPARTMENT OF FINE ARTS, BROOKLYN MUSEUM, (5) THE ROYAL ONTARIO MUSEUM OF ARCHAEOLOGY

ASIATIC AND EGYPTIAN DOLLS

1. Wooden Japanese puppet doll mounted on a staff
2. Japanese court dolls
3. Satsuma standing dolls of Japan, made of papel
4. Indian dolls, sometimes used as wedding presents to child brides
5. Coptic doll of bone, seven and one half inches high
6. Chinese "tilting" dolls, made to represent actors

formed of dolomite (magnesian limestone), which rises in peaks of a singular degree of sharpness and streaked by veins of startling colours. It is well known to tourists. Most of the more striking peaks were first ascended in the late sixties and early seventies of the 19th century by English mountaineers. Roughly speaking (from west to east) the Dolomite region lies between the Brenner railway from Franzensfeste to Trent and the road over the Monte Croce Pass from Innichen in the Drave valley by way of the Sexten glen and the Piave valley to Belluno and Feltre. On the north it is limited by the railway line from Innichen to Franzensfeste, and on the south by the railway and road from Trent to Feltre. The highest summit is the Marmolata (10,972 ft.), but far more typical are the Sorapis, the Cimone della Pala, the Langkofel, the Pelmo, the Drei Zinnen, the Sass Maor and the Rosengarten (see ALPS). Among the chief tourist resorts are St. Ulrich (in the Groden valley), San Martino di Castrozza (near Primiero), Caprile and Cortina d'Ampezzo.

Besides the Dolomites included in the above region there are several other Dolomite groups (though less extensive) in the Alps. North-west of Trent rises the Tosa group, while in Switzerland there are the Piz d'Aela group, south-west of Bergiin on the Albula Pass route, and the curious little group north of the village of Spliigen, besides other isolated peaks between the St. Gotthard and Lukmanier Passes. In Dauphin6 itself (the home of the geologist Dolomieu) the mountain districts of the Royannais, of the Vercors, and of the Dévoluy (all south-west of Grenoble) are more or less Dolomitic in character.

DOLPHIN, a name for the cetacean *Delphinus delphis,* and extended to include its allies. The dolphins or porpoises inhabit seas and large rivers. They rarely exceed 11ft. in length. They feed chiefly on fish and are mostly gregarious. They show great agility and grace in the water, and often play round ships. The common dolphin of the Mediterranean and Atlantic measures some 6-8ft. in length, with a back fin of 9 or 10in. The "forehead" descends abruptly to the base of the flattened beak, which is about 6in. long. The sharp teeth number some 160 to 200 in all. The eyes are of moderate size, the ear aperture minute, and the blow-hole crescentic. Dolphins are black above, white below. The female brings forth a single young and is a devoted parent.

There are many other genera in the family *Delphinidae,* while the *Platanistidae* include the blind susu (*Platanista* gangetica) of the Ganges, Brahmaputra, and Indus, and two other species inhabiting the Amazon (*Inia geoffroyensis*) and an estuary of the La Plata respectively. (See CETACEA.)

DOMAIN. EMINENT: see EMINENT DOMAIN.

DOMAT or **DAUMAT, JEAN** (1625–1696), French jurisconsult, was born at Clermont in Auvergne. He was closely in sympathy with the Port-Royalists, and was intimate with Pascal, at whose death he was entrusted with his private papers. He is principally known from his legal digest entitled Lois civiles *dans leur ordre naturel* (1689), for which Louis XIV. settled on him a pension of 2,000 livres. A fourth volume, Le Droit public, was published in 1697, a year after his death. This is one of the most important works on the science of law that France has produced. Domat endeavoured to found all law upon ethical or religious principles, his motto being *L'homme* est *fait* par *Dieu* et *pour* Dieu. Besides the Lois *Civiles,* Domat made in Latin a selection of the most common laws in the collections of Justinian, under the title of Legunt delectus (Paris, 1700; Amsterdam, 1703); it was subsequently appended to the Lois civiles. His works have been translated into English.

In the Journal des savants for **1843** are several papers on Domat by Victor Cousin, giving much information not otherwise accessible.

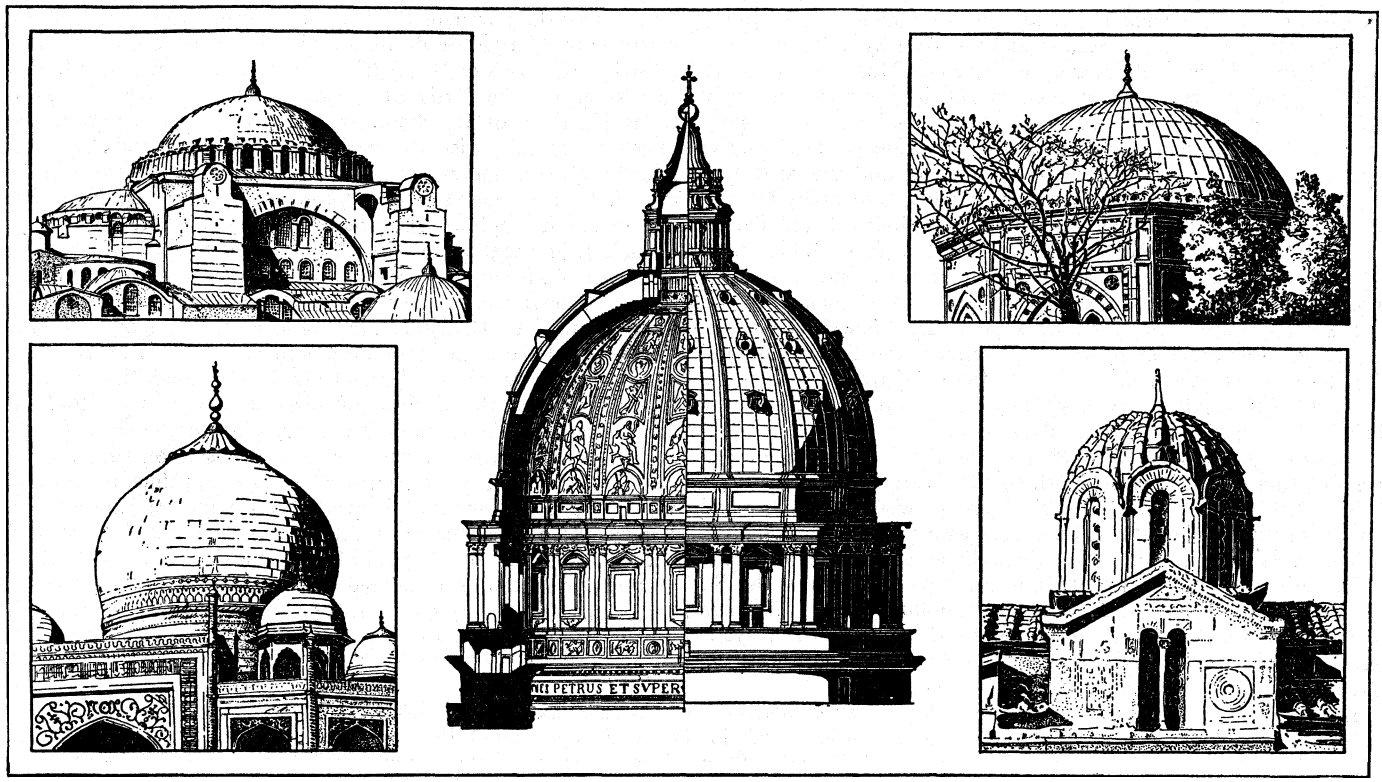
DOMBES, a district of eastern France, formerly part of the province of Burgundy, now comprised in the department of Ain, and bounded on the west by the Saône, south by the Rhone, east by the Ain and north by the district of Bresse. The region forms an undulating plateau with a slight slope towards the north-west, the higher ground bordering the Ain and the Rhone attaining an average height of about 1,000ft. The Dombes once formed part of the kingdom of Arles. In the 11th century, when the kingdom began to break up, the northern part of the Dombes came under the power of the lords of Baugé, and in 1218, by the marriage of Marguerite de Baugé with Humbert IV. of Beaujeu, passed to the lords of Beaujeu. The southern portion was held in succession by the lords of Villars and of Thoire. In 1400, Louis II., duke of Bourbon, acquired the northern part of the Dombes, together with the lordship of Beaujeu, and two years later bought the southern part from the sires de Thoire, forming the whole into a new sovereign principality of the Dombes, with Trévoux as its capital. The principality was confiscated by King Francis I. in 1523, along with the other possessions of the Constable de Bourbon, was granted in 1527 to the queen-mother, Louise of Savoy, and after her death was held successively by kings Francis I., Henry II. and Francis II., and by Catherine de'Medici. In 1561 it was granted to Louis, duke of Bourbon-Montpensier, by whose descendants it was held till, in 1682, "Mademoiselle," the duchess of Montpensier, gave it to Louis XIV.'s bastard, the duke of Maine, as part of the price for the release of her lover Lauzun. The eldest son of the duke of Maine, Louis Auguste de Bourbon (1700–5j), prince of Dombes, was made colonel-general of the Swiss regiment, governor of Languedoc and master of the hounds of France. He was succeeded, as prince of Dombes, by his brother the count of Eu (*q.v.*), who in 1762 surrendered the principality to the Crown.

See Guichenon, *Histoire* de Dombes **(1863,** 1872); **A. M.** H. J. Stokvis, Manuel d'histoire (Leyden, **1889);** and various works by M. C. Guigue, including Bibliotheca Dumbensis (with Valentin Smith) (1856–85).

DOMBROWSKI, JAN HENRYK (1755–1818), Polish general, was born at Pierszowice in the palatinate of Cracow, on Aug. 29, 17jj. Under Poniatowski, he took part in the campaign of 1792 against the Russians. In 1794 he distinguished himself under Kosciusko in the defence of Warsaw. He then went to Paris, and in Jan. 1797 was authorized by the Government of the Cisalpine republic to organize a Polish legion. This task he executed at Milan. In command of his legion he played an important part in the war in Italy, entered Rome in May 1798, and distinguished himself at the Trebbia (June 19, 1799), where his legion was annihilated, and in other battles and combats of 1799–1801. After the peace of Amiens he passed, as general of division, into the service of the Italian republic. Summoned by Napoleon in 1806 to promote a rising in Poland, he organized several divisions of Poles, and distinguished himself at Danzig and Friedland. In 1809 he served in the Polish campaign and in 1812 he commanded a Polish division in the Grande *Armée,* being wounded at the passage of the Beresina. He fought under Marmont at the battle of Leipzig, and in 1813 returned to Poland. He was one of the generals entrusted by the tsar with the reorganization of the Polish army, and was named in 1815 general of cavalry and senator palatine of the new kingdom of Poland. Gen. Dombrowski died at his seat of Wina-Gora in Posen on June 26, 1818.

DOME, in architecture, an ovoidal or hemispherical vault; also any vault of polygonal plan that approaches the true dome in shape. The origin of the term lies in the fact that such a vault was a common feature of the Italian cathedrals—duomo,

The dome is an obvious type of covering for the primitive circular hut in countries where building materials are only in small units, such as bricks, and where timber is lacking. In the Mesopotamian valley, where these conditions existed, domes, probably of sun-dried brick, were built from an early period; many representations of them are shown in Assyrian stone bas reliefs of the 7th and 8th centuries B.C.; in these the domes are of a high elliptical form, and certain authorities find their origin in tents. With the growing use of square and rectangular rooms, this early form of dome, because of the difficulties of building a circular vault over such structures, largely disappeared, although it persisted in tomb design, where circular chambers remained in use. In such primitive tomb chambers, however, the form may be that of a true vault, but the construction is usually by corbelling, or building the whole covering of horizontal courses, each one of which projects slightly in beyond the one below, until the opening at the top is small enough to be covered by a single slab of stone. Such an arrangement may be seen on a grand scale in



CENTRE: ITALIAN RENAISSANCE. ST. PETER'S, ROME. SHOWING DOUBLE SHELL. UPPER LEFT: BYZANTINE, SANTA SOPHIA. CONSTANTINOPLE. UPPER RIGHT: TURKISH. TOMB OF SHAH ZADÉH, CONSTANTINOPLE. LOWER LEFT: INDIAN. TAJ MAHAL. AGRA. LOWER RIGHT: BYZANTINE. CATHEDRAL, ATHENS. FROM BUHLMANN. "CLASSICAL AND RENAISSANCE ARCHITECTURE" (NEFF AND HELBURN)

the famous so-called Tholos or tomb of Atreus at Mycenae (*c.* 1200 B.C.), and in such Etruscan tombs as that from Volterra (6th century B.C.), now in the Archaeological museum at Florence. A rock-cut tomb at Viterbo, of approximately the same date, shows exactly the form of domical covering that appears on Assyrian reliefs.

Roman.—The Romans transformed this primitive idea into one of the most fruitful architectural forms. It first appeared as a half dome over niches, and was commonly so used throughout the early empire. In the Tabularium, Rome, 78 B.C., the square bays of the gallery, still existing, are roofed with vaults of ovoid section, rising equaily from all four sides—a type of vault known as the cloister vault, which in reality is a square dome. With the development of many buildings of circular plan, during the empire, such as *nymphaea*, or round garden buildings, and the *calidaria*, or hot rooms of the baths, the dome naturally came into use. An early example is the scalloped domical vault at the *nymphaeum* of the Garden of Sallust, Rome (*c.* A.D. 70–80). Hadrian, however, was the first to realize the tremendous opportunities of the simple dome form; he applied it on enormous scale to the circular Pantheon, built between A.D. 110 and 12;. This dome, 144 ft. in diameter, is constructed of brick, with the lower portion stiffened by a series of relieving arches. It is decorated on the inside with coffers, or deeply sunk panels, which seem to have been cut into the brick at a later period, and it is lighted by an enormous eye, or circular opening, at the top. Another interesting dome of the same period occurs in the villa of Hadrian at Tivoli, in the vestibule of the so-called Piazza d'Oro. Here, again, the scalloped type is used.

From the time of Hadrian, the dome became more and more common. In the baths of Caracalla, the *calidarium*, an immense, circular room, 116 ft. in diameter, was roofed with a dome, but still more interesting was the attempt to put a dome over an octagonal room in one of the side buildings. The problem thus presented, of supporting the in-curving parts of the dome, had puzzled the Romans for many years, and all sorts of attempts, by means of corbelling, and diagonal arches and niches, had been made. It was never thoroughly solved until the Byzantine period. Roman domes, except on a very small scale in late tomb chambers, are therefore limited to buildings of polygonal or circular plan. The most remarkable of the late Roman dome-roofs is that of the so-called temple of Minerva Medica, in reality, the *nymphaeum* of the Licinian gardens (*c.* 250), noteworthy because of the daring lightness of its construction and its use of a structural framework of brick ribs.

Byzantine.—The Byzantine perfection of the pendentive (*q.v.*) made possible the use of the dome over a plan of any shape. This style became pre-eminently a domed style, and its achievements, in building light but substantial domes, coloured not only all Renaissance church architecture, but also almost all Mohammedan building. A possible source for Byzantine skill in dome building was in the facility of the Sassanian vault constructors of Persia, who, in the palace at Firouzabad, probably end of the 5th century, used ovoid domes, about 50 ft. wide, supported on diagonal, arched squinches (*q.v.*).

The greatest of the Byzantine domes was that by Anthemius and Isidorus for the church of S. Sophia at Constantinople, consecrated 561, remarkable for the fact that 40 windows are pierced through its base, not only lessening its weight, but admirably lighting the great interior. This dome is 100 ft. in diameter, with a crown 180 ft. above the floor. S. Mark's at Venice, begun 1063, and modelled on the church of the Holy Apostles, Constantinople, exerted great influence on northern Italian Romanesque work (S. Antonio, Padua, 13th century). Later Byzantine domes are almost universally raised on drums, pierced with windows, as in the church of S. Theodore, at Athens. Another interesting offshoot of Byzantine dome design is a group of French domed churches, largely in Aquitania. Most of these date from the last half of the 11th and the first half of the 12th centuries, and are remarkable for their almost universal use of the pointed arch. These churches are without drums, and in some cases the curve of dome and pendentive is continuous, with, however, a projecting moulding at the dome base. Windows are occasionally pierced in the dome, as in early Byzantine examples. Cahors cathedral, 1119, and Angoulême, 1136, are outstanding instances, but the finest of the group is S. Front, Perigueux, begun 1120, whose plan is almost a replica of that of S. Mark's. These French domes are usually pointed in section, and decorated on the outside with

stone, carefully cut in scalloped patterns, and crowned with decorative finials. Smaller conical dome shapes, with similar details, are used frequently for spire tops and for ornamental pinnacles.

The Mohammedan builders were strongly under Byzantine influence; they adopted the dome as one of their favourite motives, using it in a lavish form, on a small scale, in Spain and northern Africa, but developing it as an important structural feature along Byzantine lines in the later architecture of Egypt, and in Persia, India and especially Turkey. Smaller domes and half domes were usually greatly enriched with fantastic stalactite ornaments, and sometimes elaborate systems of ribs, or transverse and diagonal arches replaced the pendentive. Particularly noteworthy is the Mohammedan work of India, especially the Djumma Musjid in Delhi (1560), and the Gol Gumbaz at Bijapur (1630). In certain examples, as the exquisite Taj Mahal at Agra (1630), the domes possibly follow Mohammedan Persian examples in their bulbous or onion form which appeared in Persia in about the 15th century and later, as in the tomb mosque of Tamerlane in Samarkand (1405), or the great mosque of Baghdad. Earlier Persian domes are of simple pointed outline, like the tomb at Sultanieh (1320). These domes are frequently double, the exterior surface raised high above the interior dome. The Muslim Turks carried out the Byzantine idea most directly and simply, making of the combination of domes and half domes, which they adopted from S. Sophia, compositions of the most powerful exterior, and airy interior effect. The mosque of Suleiman, designed by the famous Turkish architect Sinan, completed 1556, at Constantinople; that of Selim at Adrianople, finished 1574; and that of Yeni Djami, by Kassim, 1650, in Constantinople, are characteristic examples (see MOSQUE).

Renaissance.— The dome of the Pantheon at Rome exercised an enormous influence on the imagination of the Italian Renaissance (see RENAISSANCE ARCHITECTURE). Brunelleschi's so-called dome of the cathedral at Florence, completed 1431, lantern 1471, is, however, not a true dome, but a vast octagonal cloistered vault, with double shells, supported and connected by great stone ribs, which carry the weight of the stone lantern more than 300 ft. in the air. As this vault was supported on a high drum, no buttressing to withstand its thrust was possible, and although this was minimized by the shape chosen, it was, nevertheless, necessary to build in great bands of wooden beams tied together, in a chain, to prevent the base from spreading. Later designers combined the Byzantine pendentive with the idea of the drum, the dome and the lantern, and this combination became the governing motive of Renaissance dome design. Moreover, in order to get the requisite exterior effect without unduly raising the interior dome, the custom grew of building church domes with two or more shells, although such examples as the church of the Gesù at Rome (16th century, 57 ft. in diameter) are single. In some cases the exterior dome was merely a curved timber roof above the interior dome of masonry, as in the magnificent dome of S. Maria della Salute, in Venice, designed by Longhena (1631, 80 ft. in diameter). In the dome of S. Peter's, at Rome, designed by Michelangelo, and completed in 1590, after his death, both shells are of brick, but connected and strengthened, as in the cathedral at Florence, by stone ribs. The domes of S. Peter's and of the Florence cathedral are nearly of the same size, between 136 and 138 ft. in internal diameter. The support of such a heavy masonry construction as a Renaissance lantern, high in the air, caused great difficulties, tremendously increasing a tendency of the dome to spread. The original construction of the dome of S. Peter's embraced three chains to counteract this, but since its completion it has been necessary to add six more chains. In prder to diminish such thrusts Sir Christopher Wren, in the magnificent dome of S. Paul's, in London, used three shells, the inner one almost a hemisphere (102 ft. in diameter), the middle one a cone shaped structure carrying the stone lantern and the outer one merely a protecting roof of timber, whose weight is largely carried on the cone, thus helping to diminish its own thrust. In the dome of the chapel of Les Invalides, in Paris, by J. H. Mansard (1706, 92 ft. in diameter) there are also three shells, but in this case the lantern is of timber construction.

Modern.— The most daring of more recent domes is that of the Pantheon at Paris, 1735, by Soufflot (internal diameter 74 ft.). In this example, all three shells are of stone, with the lantern supported, as usual, on the central one, cut away with great arched openings so as almost to form four great hyperbolic legs. The outer dome is thinned to the last degree compatible with safety, being only 19 in. thick at the base, and further lightened by a series of arched recesses. In the United States the dome form has become common for State capitol buildings, due to the influence of the national capitol, whose enormous outer dome, of cast iron, was completed in 1865 by Thomas U. Walter. Notable examples are those at Madison, Wis.; St. Paul, Minn ; Jefferson City, Mo. Most of such domes are built with steel construction, and are, therefore, not true vaults. The domical form is also used in glass and steel construction for exposition buildings, and large conservatories. A notable example was the horticultural hall of the Panama Pacific Exposition in San Francisco, 191j, by Bakewell and Brown.

See BYZANTINE AND ROMANESQUE ARCHITECTURE, the several articles on RENAISSANCE ARCHITECTURE, and ROMAN ARCHITECTURE.

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(T. F. H.)

DOMENICHINO (or DOMENICO), **ZAMPIERI** (1581–1641), Italian painter, was born at Bologna, on Oct. 21, 1581, and died at Naples on April 1j, 1641. He was a pupil in the Academy of the Caracci, under Agostino. Towards the beginning of the 17th century he went to Rome to study under Annibale Caracci, and there obtained employment from Cardinals Borghese, Farnese, and Aldobrandini, for all of whom he painted works in fresco. His success excited the envy of some of his contemporaries, who accused him of plagiarism. Disgusted with these cabals, he left Rome for Bologna, where he remained until he was recalled by Pope Gregory XV., who appointed him principal painter and architect to the pontifical palace. He designed in great part the Villa di Belvedere at Frascati, and the whole of the Villa Ludovisi, and some other edifices. From 1630 onwards Domenichino was engaged in Naples, chiefly on a series of frescoes (never wholly completed) of the life of St. Januarius in the Cappella del Tesoro. He settled in that city with his family, and opened a school. There the so-called "Cabal of Naples"— the painters Corenzio, Ribera and Caracciolo—leagued together as they were to exclude all alien competition, annoyed the Bolognese artist in all possible ways; for instance, on returning in the morning to his fresco work, he would find not infrequently that someone had rubbed out the performance of the previous day. He died in Naples, after two days' illness, on April 15, 1641.

Domenichino is esteemed the most distinguished disciple of the Caracci, or second only to Guido Reni. Algarotti preferred him to the greatest masters; and Nicolas Poussin considered the painter of the "Communion of St. Jerome" to be the first after Raphael. His pictures of "Adam and Eve," and the "Martyrdom of St. Agnes," in the Gallery of Bologna, are amongst his leading works. Others of interest are his first known picture, a fresco of the "Death of Adonis," in the Loggia of the Giardino Farnese, Rome; the "Martyrdom of St. Sebastian," in Santa Maria degli Angeli; the "Four Evangelists," in Sant' Andrea della Valle; "Diana and her Nymphs," in the Borghese gallery; the "Assumption of the Virgin," in Santa Maria in Trastevere; and frescoes in the neighbouring abbey of Grotta Ferrata, lives of SS. Nilus and Bartholomew. His portraits are also highly reputed. It is admitted that in his compositions he often borrowed figures and arrangements from previous painters. Domenichino also excelled in landscape painting.

See C. Landon, *Works of Domenichino, with a Memoir* (1823); Bolognini, *Life of Domenichino* (1839).

DOMENICO VENEZIANO, Italian painter of the Florentine school (working 1438–61), probably Venetian by birth Very little is known about him. He may have acquired rhe rudiments

of art in Venice; his style was formed under the influence of Donatello, Masaccio and Fra Angelico. He is first heard of in a letter written to Pietro di Cosimo de Medici from Perugia on April 1, 1438, in which he asks for a recommendation. From 1439–45 he was working in Santa Maria Nuova in Florence in association with Piero della Francesca, who was his assistant, on frescoes no longer extant. He died in Florence on May 15, 1461. The story told by Vasari that he was murdered by Andrea del Castagno, who wished to monopolize the secret of oil-painting, which Domenico Veneziano is said to have received from Antonello da Messina, is now completely disproved, since Castagno is known to have died four years earlier than his alleged victim. There are only two authentic works by the master extant. The most important of these is an altarpiece painted for the church of Santa Lucia de Bardi. The central panel, representing the "Virgin and Child Enthroned with Four Saints," is in the Uffizi gallery. It is signed "Opus Dominici De Venetiis." A fragment of the predella of the same altarpiece with the "Martyrdom of St. Lucy" is in the Berlin museum. Two more fragments, representing the "Annunciation" and the "Miracle of St. Zenobius," were recently discovered in the Fitzwilliam museum at Cambridge. (Bequest of Prof. Fred. Fuller.) The other signed work by the artist is in the National Gallery, London, a "Madonna and Child Enthroned" on canvas transferred from fresco. The work is mentioned by Vasari as having been painted in the angle of two roads, the Canto de Carnesecchi. The painting has suffered much and is not in its original condition. A fresco representing John the Baptist and St. Francis in Santa Croce, Florence, is attributed to Domenico on stylistic evidence. All other attributions are problematical. Thus the series of women's profiles in the Berlin museum, the Mond collection, London, and the Poldi Pezzoli collection, Milan. (See J. P. Richter, Mond Collection II.)

Domenico Veneziano was in Florence at the time when Uccello and Castagno were working on the solution of problems involved in the pictorial representation of form. His contribution lay in the sphere of colour. Coming from Venice, it was natural that he should be a colourist. His tones are silvery and luminous, and his shadows are lit up by the play of numerous reflections. According to Vasari he was an innovator in Florence as regards the oil medium which he is supposed to have used in his paints.

See Vasari, Vite (ed. Milanesi); Crowe and Cavalcaselle, History of Painting in Italy (edit. Douglas); B. Berenson, Florentine Painters (1909); Schmarsow, *Repert. f. Kunst w. XVI.* (1893); *L'Arte* XV. (1912).

DOMESDAY BOOK, or simply DOMESDAY, the record of the great survey of England executed for William the Conqueror. We learn from the English Chronicle that the scheme of this survey was discussed and determined in the Christmas assembly of 1085, and from the colophon of Domesday Book that the survey (*descriptio*) was completed in 1086. But Domesday Book (liber), although compiled from the returns of that survey, must be carefully distinguished from them; nor is it certain that it was compiled in the year in which the survey was made. For the making of the survey each county was visited by a group of royal officers (legati), who held a public enquiry, probably in the great assembly known as the county court, which mas attended by representatives of every township, as well as of the local lords. The unit of enquiry was the Hundred, and the return for each Hundred was sworn to by 12 local jurors, half of them English and half Normans. What is believed to be a full transcript of these original returns is preserved for several of the Cambridgeshire Hundreds, and is of great illustrative importance. The Inquisitio *Eliensis,* the "Exon Domesday" (so called from the preservation of the volume at Exeter), and the second volume of Domesday Book, also contain the full details which the original returns supplied.

The original ms. of Domesday Book consists of two volumes, of which the second is devoted to the three eastern counties, while the first, which is of much larger size, comprises the rest of England except the most northerly counties. Of these the north-westerly portion, which had Carlisle for its head, was not conquered till some years after the survey was made; but the omission of Northumberland and Durham has not been satisfactorily explained. There are also no surveys of London, Winchester and some other towns. For both volumes the contents of the returns were entirely rearranged and classified according to fiefs. Instead of appearing under the Hundreds and townships they now appeared under the names of the local "barons," *i.e.,* those who held the lands directly of the crown in fee. In each county the list opened with the holding of the king himself (which had possibly formed the subject of separate enquiry); then came those of the churchmen and religious houses; next those of the lay tenants-in-chief (barones); and last those of women, of the king's serjeants (servientes), of the few English "thegns" who retained land, and so forth. The two volumes are distinguished even more sharply by the exclusion from the larger one of certain details such as the enumeration of the live stock, which would have added greatly to its size. It has been suggested that the eastern counties' volume represents a first attempt, and that it was found impossible, or at least inconvenient, to complete the work on the same scale.

For the object of the survey we have three sources of information: (1) the passage in the English Chronicle, which tells us why it was ordered, (2) the list of questions which the jurors were asked, as preserved in the Inquisitio *Eliensis,* (3) the contents of Domesday Book and the allied records mentioned above. Although these can by no means be reconciled in every detail, it is now generally recognized that the primary object of the survey was to ascertain and record the fiscal rights of the king. These were mainly (1) the national land-tax (*geldum*), paid on a fixed assessment, (2) certain miscellaneous dues, (3) the proceeds of the crown lands. After a great political convulsion such as the Norman Conquest, and the wholesale confiscation of landed estates which followed it, it was William's interest to make sure that the rights of the crown, which he claimed to have inherited, had not suffered in the process. The Domesday survey therefore recorded the names of the new holders of lands and the assessments on which their tax was to be paid. But it did more than this; by the king's instructions it endeavoured to make a national valuation list, estimating the annual value of all the land in the country, (1) at the time of King Edward's death, (2) when the new owners received it, (3) at the time of the survey, and further, it reckoned, by command, the potential value as well. It is evident that William desired to know the financial resources of his kingdom, and probable that he wished to compare them with the existing assessment, which was one of considerable antiquity, though there are traces that it had been occasionally modified. The great bulk of Domesday Book is devoted to the somewhat arid details of the assessment and valuation of rural estates which were as yet the only important source of national wealth. After stating the assessment of the manor, the record sets forth the amount of arable land, and the number of plough-teams (each reckoned at eight oxen) available for working it, with the additional number (if any) that might be employed; then the river-meadows, woodland, pasture, fisheries (*i.e.,* weirs in the streams), water-mills, saltpans (if by the sea) and other subsidiary sources of revenue; the peasants are enumerated in their several classes; and finally the annual value of the whole, past and present, is roughly estimated. Both in its values and measurements, the survey's reckoning is crude.

Apart from the wholly rural portions, which constitute its bulk, Domesday contains entries of interest concerning most of the towns, which were probably made because of their bearing on the fiscal rights of the crown therein. These include fragments of custumals, records of the military service due, of markets, mints, and so forth. From the towns, from the counties as wholes, and from many of its ancient lordships, the crown was entitled to archaic dues in kind, such as honey. The information of most general interest is that on political, personal, ecclesiastical and social history, which only occurs sporadically and, as it were, by accident. Much of this was used by E. A. Freeman for his work on the Norman Conquest. Although unique in character and of priceless value to the student, Domesday will be found disappointing and largely unintelligible to any but the specialist. Even scholars are unable to explain portions of its language and of its system. This is partly due to its very early date, which has placed

between it and later records a gulf that is hard to bridge.

But in the *Dialogus de scaccario (temp.* Hen. II.) it is spoken of as a record from the arbitrament of which there was no appeal (from which its popular name of "Domesday" is said to be derived). In the middle ages its evidence was frequently invoked in the law-courts; and even now there are certain cases in which appeal is made to its testimony. To the topographer, as to the genealogist, its evidence is of primary importance; for it not only contains the earliest survey of a township or manor, but affords in most cases the clue to its subsequent descent. The rearrangement on a feudal basis, of the original returns (as described above) enabled the Conqueror and his officers to see with ease the extent of a baron's possessions; but it also showed how far he had enfeoffed "under-tenants," and who those under-tenants were. This was of great importance to William, not only for military reasons, but also because of his resolve to make the under-tenants (though the "men" of their lords) swear allegiance directly to himself. As Domesday normally records only the Christian name of an under-tenant, it is vain to seek for the surnames of families claiming a Norman origin; but much has been done to identify the under-tenants, the great bulk of whom bear foreign names.

Domesday Book was originally preserved in the royal treasury at Winchester (the Norman kings' capital), whence it speaks of itself (in one later addition) as *Liber de Wintonia.* When the treasury was removed to Westminster (probably under Henry II.) the book went with it. Here it remained until the days of Queen Victoria, being preserved from 1696 onwards in the Chapter House, and only removed in special circumstances, as when it was sent to Southampton for photozincographic reproduction. It was eventually placed in the Public Record Office, London, where it can be seen in a glass case in the museum. In 1869 it received a modern binding. The ancient Domesday chest, in which it used to be kept, is also preserved in the building.

The printing of Domesday, in "record type," was begun by Government in 1773, and the book was published, in two volumes fol. in 1783; in 1811 a volume of indexes was added, and in 1816 a supplementary volume, separately indexed, containing (1) the "Exon Domesday" (for the south-western counties), (2) the *Inquisitio Eliensis,* (3) the *Liber Winton* (surveys of Winchester early in the 12th century), and (4) the *Boldon Book*—a survey of the bishopric of Durham a century later than Domesday. Photographic facsimiles of Domesday Book, for each county separately, were published in 1861–63, also by Government.

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DOMESTIC APPLIANCES: *see* HOUSEHOLD APPLIANCES.

DOMESTIC ARCHITECTURE: *see* SOCIAL ARCHITECTURE.

DOMESTIC OIL HEATING: *see* OIL HEATING, DOMESTIC.

DOMESTIC RELATIONS, a term used to express the legal relations subsisting between the various units that compose the family or domestic group. *See* HUSBAND AND WIFE; MASTER AND SERVANT: CHILDREN—PROTECTIVE LAWS; INFANT.

DOMESTIC SCIENCE: *see* HOUSEKEEPING; HOUSEHOLD APPLIANCES; BUDGET; FAMILY; etc.

DOMESTIC SERVICE, employment in household service. In this branch of employment in Great Britain, females outnumber males by about five to one. At the census of 1921, this group was included under the heading "personal service" in the occupational classification, the figures being as follows:—

Occupational group	Males	Females	Total	Percentage of grand total
1. Domestic servants (indoor)	64,443	1,270,946	1,335,389	60·3
2. Game keepers and game watchers	13,334	[2]	13.336	0·6
3. Restaurant keepers	20,643	16,081	36,724	1·7
4. Lodging and boarding house keepers	7,840	115,919	123,759	5·6
5. Matrons and stewards in schools and other private institutions	1,057	6,786	7,843	0·4
6. Inn, hotel-keepers; publicans; beersellers	74,385	37,151	111,136	5·0
7. Barmen	23,822	25,550	49,372	2·2
8. Waiters . . .	16,861	56,854	73,715	3·3
9. Hall and hotel porters; doorkeepers and carriage attendants	11,750	326	12,076	0·5
10. Laundry workers, washers, ironers, manglers	9,700	117,331	127,031	5.7
11. Managers, attendants of baths and wash houses	2,754	1,604	4,358	0·2
12. Hairdressers, manicurists, chiropodists	41,573	6,287	47,860	2·1
13. Caretakers and office keepers	27,221	20,983	48,204	2·2
14. Charwomen, office cleaners . .	3,153	133,470	136,623	6·2
15. Carpet beaters, vacuum cleaners, window cleaners . . .	14,928	741	15,669	0·7
16. Chimney sweeps .	5,537	25	5,562	0·3
17. Undertakers .	2,786	159	2,945	0·1
18. Others in personal service	29,895	34,359	64,254	2·9
Total . .	371,682	1,844,574	2,216,256	100·0

Nearly one-third of all female workers and about 10% of all females aged 12 and upwards enumerated were found to be employed in personal service. These proportions would, of course, be immensely increased if account could also be taken of those females not working for payment or profit who were occupied with the domestic duties of the home, of which the occupations within this classification may be regarded as an extension.

Between 1881 and 1901 the number of females engaged in indoor domestic service (including service in hotels, lodging houses and eating houses, as well as in private families) increased from 1,230,106 to 1,339,283, or by about 8%. This rate of increase was much below that of the population as a whole. In 1881 there were in England and Wales approximately 123 female domestic indoor servants to every 1,000 of the population aged ten years and upwards, 47 per 1,000 of the total population and 218 per 1,000 families. By 1901 the ratio had declined to 101 per 1,000 of the population aged ten years and upwards, 41 per 1,000 of the total population and 189 per 1,000 families. In Scotland the ratio of the population aged ten years and upwards fell during the same period from 91 per 1,000 to 80 per 1,000.

Changes introduced in 1921 into the basis of classification prevent comparison of the foregoing occupational statistics to the results of the census of 1921. The figures already quoted include all domestic servants, whether employed in private families or in establishments which were carried on for purposes of gain. It is possible, however, to make a rough comparison between the results of the censuses of 1911 and 1921 so far as they relate to private personal service and to service in hotels, boarding houses, etc.

In England and Wales, between 1911 and 1921, the number of females in private personal service declined from about 1,261,000 to about 1,005,000, or by over 20%. This represents a decline from 159 per 1,000 families in 1911 to 115 in 1921. In the same period the number of males in private personal service decreased from 266 000 to 227,000, or by 14·6%.

The tendencies in the various branches of the personal service

group outlined above, when looked at as a whole, may also reflect in some degree changes which are occurring in the social habits, of a section of the population. There has been a growth in the number and size of commercial establishments which cater for personal needs, together with a marked increase in the number of labour-saving devices for use in the home, and consequently much of the work formerly required in private households is being steadily eliminated. (X.)

United States,——Domestic service in the United States has always been the leading field of gainful employment for women. In colonial times, the servants were chiefly Indian and negro slaves and transported white convicts and "redemptioners." Girls were frequently apprenticed to domestic service until of age or married; and women probably "hired out" as "help" before they engaged in any handicraft for pay. The number of women in manufacturing increased rapidly, however, and, later, many entered clerical and professional pursuits. But in 1870 over half of the gainfully employed females were in domestic service; and even in 1920 this remained one of the principal fields of employment for women.

The relative importance of domestic service as a field of employment for women has declined steadily for many years, the decline being especially rapid during the decade 1910 to 1920. Regardless of colour or race, women are abandoning domestic service to seek employment in stores, factories and offices. The inducements are probably regular and shorter hours in other employments, greater standardization, more congenial companionship and pleasanter surroundings, and also a better social status. Other causes are: The high wages and the great demand for women workers outside the home during the World War; practical cessation of immigration between 1915 and 1920, which greatly reduced the number of foreign-born women available as servants; increased wages for servants, making them luxuries which only the well-to-do can afford; simplified housekeeping, resulting from the fact that much work formerly done in the home is now done outside, from increased use of electrical and other household appliances, and from the increase in apartment homes with the growing custom of taking meals in cafes and restaurants. Servants are less necessary than formerly, and people are doing without them. The number of servants per 1,000 of the population decreased from 19.1 in 1900 to 13 in 1920. During the half century from 1870 to 1920, the proportion of non-agricultural female workers of all ages employed as servants or in similar pursuits declined from 60.7 to 18·2%, while the proportion in clerical and similar pursuits increased from 0·8 to 25·6%, the proportion in factory occupations increased from 17.6 to 23·8%, and the proportion in the principal professions increased from 6.4 to 13·3%. Notwithstanding the marked decline in the relative importance of domestic service for female gainful workers, 1,358,665 of them were employed as servants or in similar pursuits in 1920. Of these, native whites formed 46·9%, foreign-born whites 20·7%, negroes 32·1% and others 0·3%. The native whites were rather widely distributed, the foreign-born whites were largely in the north-east, and the negroes mostly in the South. (A. M. E.)

DOMETT, ALFRED (1811–1887), British colonial statesman and poet, was born at Camberwell Grove, Surrey, on May 20, 1811. He became the intimate friend of Robert Browning, of whose poem "Waring" he was the subject. An interesting account of the friendship between the two men appeared in *The* Contemporary Review for Jan. 1905, by W. H. Griffin. (See also Robert Browning and Alfred Domett, edited by F. G. Kenyon, 1906.) In 1842 Domett emigrated to New Zealand, where he filled many important administrative posts, being colonial secretary for New Munster in 1848, secretary for the colony in 1851, and prime minister in 1862. He returned to England in 1871, was created C.M.G. in 1880, and died on Nov. 2, 1887. Among his volumes of verse, Ranolf and Amohia, a South Sea Day Dream, is the best known (1872), and Flotsam and Jetsam (1877) is dedicated to Browning.

DOMETTE. A term applied to a loosely-woven fabric of light texture of the plain calico weave and finished with a nap on both sides, similar to flannelette (q v). It is sometimes woven either plain or striped as an all-cotton fabric; and sometimes with a cotton warp and woollen weft, and employed for various purposes as, for example, a light wadding for use by dressmakers; waist-bands for hosiery pants, pyjamas, shirts and shrouds. One quality of domette contains 36 warp threads per inch, of 32's cotton, and 22 picks per inch, of 10's uoollen weft.

DOMFRONT, a town of northwestern France in the arrondissement of Alençon, in the department of Orne, 43 mi. W.N.W. of Alençon by rail. Pop. (1936) 2,803. The town, situated on a bluff overlooking the Varenne, has a church, Notre-Dame-sur-l'Eau, dating from the 11th century. Domfront is said to have grown up in the 6th century round the oratory of the hermit St. Front, and played an important part in the wars against the English and the religious wars. In 1574 it was occupied by the Protestant leader Gabriel de Montgomery, who after a stubborn siege was forced to yield it to Jacques Goyon, count of Matignon. In the middle ages it was one of the chief strongholds in Normandy, and there still remain several towers of its ramparts, and ruins of the keep of its castle built in 1011, rebuilt in the 12th century by Henry II., king of England, and dismantled at the end of the 16th century. The town is the seat of a sub-prefect, and has a tribunal of first instance. There are quarries in the vicinity. Domfront is known for its horse breeding.

DOMICILE, or DOMICIL, a residence; in law, the place where a person has his or her principal residence. In French law it is only a step to naturalization. In English law it implies something more than mere residence. A person has either a domicile of origin or a domicile of choice. The former is the place of his parents' home—and the latter is the place where he intends to reside. In the United States, it is the place where a person exercises his political rights.

Since the beginning of the 19th century most of the leading European States have unified their internal laws; and attachment to a province by domicile having thus become an unnecessary consideration, they have adopted political nationality as the criterion of the law to be applied in most of the questions which used to depend on domicile. Thus as between themselves they have greatly simplified the determination of those questions, but a similar elimination of domicile is impossible in what concerns British subjects, because the British empire continues to include a great variety of laws, as those of England, Scotland, the province of Quebec, the Cape Colony, etc. Within the British dominions domicile is the only available criterion of the legal character of a British subject, and all British courts continue to apply the same criterion to British subjects outside those dominions and to foreigners.

The Roman jurists defined domicile to be the place "*ubi* quis *larem rerumque* ac fortunarrrm *summam constituit;* unde *rursus non* sit *discessurus si* nihil avocet; *unde cum* profectus est, *peregrinari videtur:* quo *si* rediit *peregrinari* iam destitit." This makes that place the domicile which may be described as the headquarters of the person concerned; but a man's habits of life may point to no place, or may point equally to two places, as his headquarters, and the connection of domicile with law requires that a man shall always have a domicile, and never more than one. The former of these difficulties is met in the manner described by Lord Westbury in Udny v. Udny. (L.R., 1 H L. Sc.A.) "It is," he said, "a settled principle that no man shall be without a domicile, and to secure this end the law attributes to every individual as soon as he is born the domicile of his father, if the child be legitimate, and the domicile of his mother, if the child be illegitimate. This is called the domicile of origin, and is involuntary. It is the creation of the law, not of the party. It may be extinguished by act of law, as for example by sentence of death or exile for life, which destroys the *status civilis* of the criminal; but it cannot be destroyed by the will and act of the party. Domicile of choice is the creation of the party. When a domicile of choice is acquired, the domicile of origin is in abeyance, but is not absolutely extinguished or obliterated. When a domicile of choice is abandoned, the doinicile of origin revives, a special intention to revert to it not being necessary. A natural-born Englishman may domicile himself in Holland, but if he breaks up his establishment there and quits Holland, declaring that he will never return, it is absurd to suppose that

his Dutch domicil clings to him until he has set up his tabernacle elsewhere." If to this we add that legitimate minors follow the change's of the father's domicil and a married woman follows the domicil of her husband, also that compulsory detention will not create a domicil, the outlines of involuntary domicil will have been sufficiently sketched.

For the establishment of a domicil of choice there must be both *animus* and *factum,* intention and fact. The fact need not be more than arrival in the territory of the new domicil if there be the necessary intention, while any number of years' continuance there will not found a domicil if the necessary intention is absent. As the result of the most recent English and Scottish cases it may be laid down that the necessary intention is incompatible with the contemplation by the person in question of any event on the occurrence of which his residence in the territory in question would cease, and that if he has not formed a fixed and settled purpose of settling in that territory, at least his conduct and declarations must lead to the belief that he would have declared such a purpose if the necessity of making an election between that territory and his former one had arisen. The word territory, meaning a country having a certain legal system, is used advisedly, for neither the intention nor the fact need refer to a locality. It is possible that a Scotsman or a foreigner may have clearly established a domicil of choice in England, although it may be impossible to say whether London, Brighton or a house in the country is his true or principal residence. What is here laid down has been gradually attained. In the older English cases an intention to return to the former domicil was not excluded, if the event on which the return depended was highly uncertain and regarded by the person in question as remote. Afterwards a tendency towards the opposite extreme was manifested by requiring for a domicil of choice the intention to associate oneself with the ideas and habits of the new territory—*Quatenus* in *illo* exuere *patriam,* not in the political sense, which it was never attempted to connect with change of domicil, but in the social and legal sense. At present it is agreed that the only intention to be considered is that of residence, but that, if the intention to reside in the territory be proved to amount to what has been above stated, a domicil will be acquired from which the legal consequences will follow, even defeating intentions about them so clearly expressed as, for instance, by making a will which by reason of the change of domicil is invalid. The two most important cases are Douglas v. Douglas (1871), L.R., 12 Eq. 617, before Vice-chancellor Wickens, and *Winans* v. Att. Gen. (1904), A.C. 287, before the House of Lords.

When the circumstances of a person's life point to two territories as domicils, the selection of the one which alone can fill that character often leads to appeals even up to the highest court. The residence of a man's wife and family as contrasted with his place of business, his exercise of political or municipal functions, and any conduct which tends to connect his children with a given country, as by their education, or the start given them in life, as well as other indications, are often cited as important; but none of them is in itself decisive. The situation must be considered as a whole. When the question is between the domicil of origin and an alleged one of choice, its solution is rendered a little easier than it is when the question is between two alleged domicils of choice, the burden of proof lying on the party which contends that the domicil of origin has been abandoned.

In the state of the law which has been described it will not be found surprising that an act of parliament, 24 and 25 Vict. c. 121, recites that by the operation of the law of domicil the expectation and belief of British subjects dying abroad with regard to the distribution of their property are often defeated, and enacts that when a convention to that effect has been made with any foreign country, no British subject dying in such country shall be deemed to have acquired a domicil therein, unless he has been resident in such country for one year previous to death and has made a declaration in writing of his intention to become domiciled; and that British subjects so dying without having so resided and made such declaration shall be deemed for all purposes of testate or intestate succession as to movables to retain the domicil they possessed at the time of going to reside in such foreign country. Similar exemptions are conferred on the subjects of the foreign State dying in Great Britain or Ireland. But the act does not apply to foreigners who have obtained letters of naturalization in any part of the British dominions. It has not been availed of, and is indeed an anachronism, ignoring as it does the fact that domicil has no longer a world-wide importance, owing to the substitution for it of political nationality as a test of private law in so many important countries. The United States of America is not one of those countries, but there the importance of domicil suffers from the habit of referring questions of capacity to the law of the place of contract instead of to any personal law. (J. W.)

DOMINANT, in music, the fifth degree of the diatonic scale, *e.g.,* G in the key of C; A in that of D, and so on; so called from its exceptional influence and importance in relation to the tonic, or key-note, and the harmony in general.

Dominant was used by Mendel to describe a biological character which manifests itself, as opposed to a recessive character, which remains latent (see MENDELISM).

DOMINIC, SAINT (1170–1221), founder of the Dominican Order of Preaching Friars, was born in 1170 at Calaroga in Old Castile. He spent ten or twelve years in study, chiefly theological, at Palencia, and then, about 1195, he was ordained and became a canon in the cathedral chapter of Osma, his native diocese. The bishop induced his canons to follow the Rule of St. Augustine and thus make themselves Augustinian Canons (*q.v.*); and so Dominic became a canon regular and soon the prior or provost of the cathedral community. The years from 1195 to 1203 have been filled up with fabulous stories of missions to the Moors; but Dominic stayed at Osma, preaching much in the cathedral, until 1203, when he accompanied the bishop on an embassy in behalf of the king of Castile to "The Marches." This has commonly been taken as Denmark, but more probably it was the French or Italian Marches. When the embassy was over, the bishop and Dominic repaired to Rome, and Innocent III. charged them to preach among the Albigensian heretics in Languedoc, upon which work Dominic was engaged for ten years (1205–15).

The Albigenses (*q.v.*) have received much sympathy, as being a kind of pre-Reformation Protestants; but it is now recognized that their tenets were an extreme form of Manichaeism. They believed in the existence of two gods, a good (whose son was Christ) and an evil (whose son was Satan); matter is the creation of the evil principle, and therefore essentially evil, and the greatest of all sins is sexual intercourse, even in marriage; sinful also is the possession of material goods, the eating of flesh and many other things. So great was the abhorrence of matter that some even thought it an act of religion to commit suicide by voluntary starvation, or to starve children to death (see article "Neu-Manichäer" by Otto Zockler in ed. 3 of Herzog's Realencyklopadie fur *protestantische* Theologie [1903]; or c. iii. of Paul Sabatier's Life of St. Francis). Such tenets were destructive not only of Catholicism but of Christianity of any kind and of civil society itself; and for this reason so unecclesiastical a person as the emperor Frederick II. tried to suppress the kindred sects in Italy. In 1208, after the murder of a papal legate, Innocent III. called on the Christian princes to suppress the Albigensian heresy by force of arms, and for seven years southern France was devastated by one of the most bloodthirsty wars in history, the Albigenses being slaughtered by thousands and their property confiscated wholesale.

In the opinion of Grützmacher, one of the most recent Protestant writers on him, St. Dominic, though keeping on good terms with Simon de Montfort, the leader, and praying for the success of the crusaders' arms during the battle of Muret, "took no part in the crusade, but endeavoured to carry on his spiritual activity on the same lines as before. The oldest trustworthy sources know nothing of his having exercised the office of Inquisitor during the Albigensian war." This verdict of a fair-minded and highly competent Protestant church historian on the most controverted point of Dominic's career is of great value. His method was to travel over the country on foot and barefooted, in extreme poverty, simplicity and austerity, preaching and instructing in high-

ways and villages and towns, and in the castles of the nobility, controverting and discussing with the heretics. He used often to organize formal disputations with Albigensian leaders, lasting a number of days. Many times plots were laid against his life. Though in his ten years of preaching a large number of converts were made, it has to be said that the results were not such as had been hoped for, and after it all, and after the crusade, the population still remained at heart Albigensian. A sense of failure appears in Dominic's last sermon in Languedoc: "For many years I have exhorted you in vain, with gentleness, preaching, praying and weeping. But according to the proverb of my country, 'where blessing can accomplish nothing, blows may avail.' We shall rouse against you princes and prelates, who, alas, will arm nations and kingdoms against this land . . . and thus blows will avail where blessings and gentleness have been powerless." The threat that seems to be conveyed in these words, of trying to promote a new crusade, was never carried out; the remaining years of Dominic's life were wholly given up to the founding of his order.

The Order of Dominicans grew out of the little band of volunteers that had joined Dominic in his mission among the Albigenses. He had become possessed with the idea of addressing wider circles and of forming an order whose vocation should be to preach and missionize throughout the whole world. By 1214 the nucleus of such an institute was formed round Dominic and was known as the "Holy Preaching." In 1215 the bishop of Toulouse, Dominic's great friend, established them in a church and house of the city, and Dominic went to Rome to obtain the permission of Innocent III. to found his order of preachers *(see* DOMINICANS). After three years, in 1218, the full permission he desired was given by Honorius III. These last years of his life were spent in journeying backwards and forwards between Toulouse and Rome, where his abode was at the basilica of Santa Sabina on the Aventine, given to him by the pope; and then in extended journeys all over Italy, and to Paris, and into Spain, establishing friaries and organizing the order wherever he went. It propagated and spread with extraordinary rapidity, so that by Dominic's death in 1221, only five or six years after the first practical steps towards the execution of the idea, there were over 500 friars and *60* friaries, divided into *3* provinces embracing the whole of western Europe. Thus Dominic was at his death able to contemplate his great creation solidly established, and well launched on its career to preach to the whole world.

It appears that at the end of his life Dominic had the idea of going himself to preach to the heathen Kuman Tatars on the Dnieper and the Volga. But this was not to be; he was worn out by the incessant toils and fatigues and austerities of his laborious life, and he died at his monastery at Bologna, on Aug. 6, *1221.* He was canonized in 1234 by Gregory IX., who, as Cardinal Ugolino, had been the great friend and supporter both of Dominic and of Francis of Assisi.

As St. Dominic's character and work do not receive the same general recognition as do St. Francis of Assisi's, it will be worth while to quote from the appreciation by Prof. Griitzmacher of Heidelberg:—"It is certain that Dominic was a noble personality of genuine and true piety. . . . Only by the preaching of pure doctrine would he overcome heretics. . . . He was by nature soft-hearted, so that he often shed tears through warm sympathy. . . . In the purity of his intention and the earnestness with which he strove to carry out his ideal, he was not inferior to Francis."

The chief sources for St. Dominic's life are the account by Jordan of Saxony, his successor as master-general of the order, and the evidence of the witnesses at the Process of Canonization,—all in the Bollandists' *Acta sanctorum,* Aug. 4. Probably the best modern Life is that by Jean Guiraud, in the series *Les Saints* (Eng. trans. by Katharine de Mattos, 1901); the bibliography contains a useful list of the chief sources for the history of St. Dominic and the order, and of the best modern works thereon. *See* also the article "Dominicus" in ed. 2 of Wetzer and Welte, *Kirchenlexicon;* Grdtzmacher's excellent article "Dominikus," in ed. 3 of Herzog, *Realencyklopadie* fur *protestantische Theologie,* already referred to; also Bede Jarrett, O.P., *The Life of St. Dominic* (1924), and *H.* Petitot, O.P., *Vie de S. Dominique* (1925). (E. C. B.)

DOMINICA, the largest of the five presidencies in the colony of the Windward Islands, British West Indies. It lies in 15° 30′ N. and 61° 20′ W., between the French islands of Martinique and Guadeloupe, at a distance of about *25* m. from each, is 29 m. long, has a maximum breadth of *16* m. and an area of 304 sq.m. *A* range of lofty forest-clad mountains traverses the island from north to south, broken in the centre by a narrow plain drained by the rivers Layou and Pagoua, flowing west and east respectively. The highest point is Morne Diablotin (5,314 ft.), in the north. Signs of volcanic activity include solfataras, subterranean vapours and hot springs; while in the south the so-called Boiling Lake lies on the mountain side, 2,300 ft. above the sea; its banks are steep and its depth unknown. Its waters are often forced *3* ft. above the normal level by the pressure of the escaping gases; and the fumes are occasionally poisonous. The island is of extraordinary beauty and botanically remarkable for its great number of peculiar species. The hills produce valuable timber, while coffee, limes, oranges, india-rubber trees, spices and many tropical fruits grow luxuriantly in the rich lowlands. There are some thirty streams of considerable size, besides numerous mountain torrents. The fisheries are productive, and honey and wax are furnished by wild bees, originally introduced from Europe. The temperature varies from 78° to 86° F in the hot season from August to October, and from 72° to 84° in the cooler months; the rainfall varies in different parts from 50 to 162 in. per annum, but the porous soil soon absorbs the rain, and keeps the atmosphere clear and invigorating.

The manufactures include Sugar, lime-juice and essential oils; the exports are cocoa, coconuts, limes and lime products, oranges and bananas The inhabitants in 1939 numbered 51,951. The majority are negroes; the whites are of French and British descent. There are also a few Caribs, the remnant of the aboriginal population. A French *patois* is the language of the peasantry, but English is generally understood. The capital, Roseau (6,803), is a fortified town and a port; Portsmouth, the only other town, possesses the better harbour in Prince Rupert's Bay on the north-west. In religion Roman Catholics predominate, and a bishop resides at Roseau, but there is no established church. Education is free and compulsory.

History.—Dominica was thus named by Columbus in 1493, in commemoration of the date, Sunday (*Dies Dominica*) Nov. 3. The first European settlers (1632) were French. In 1660 a treaty appears to have been made between the French, British and the natives, assigning St. Vincent and Dominica to the Caribs, and in 1748 it was once more agreed that Dominica should be left in the undisturbed possession of the natives. Nevertheless the French settlers increased, and the island came under the rule of a French governor. It was captured by the British and recaptured by the French frequently in the wars from 1761 onwards, and in 1805 the French general, La Grange, at the head of 4,000 troops, took Roseau and pillaged the island. The French were, however, unable to make good their hold, and Dominica has since remained undisturbed in British possession.

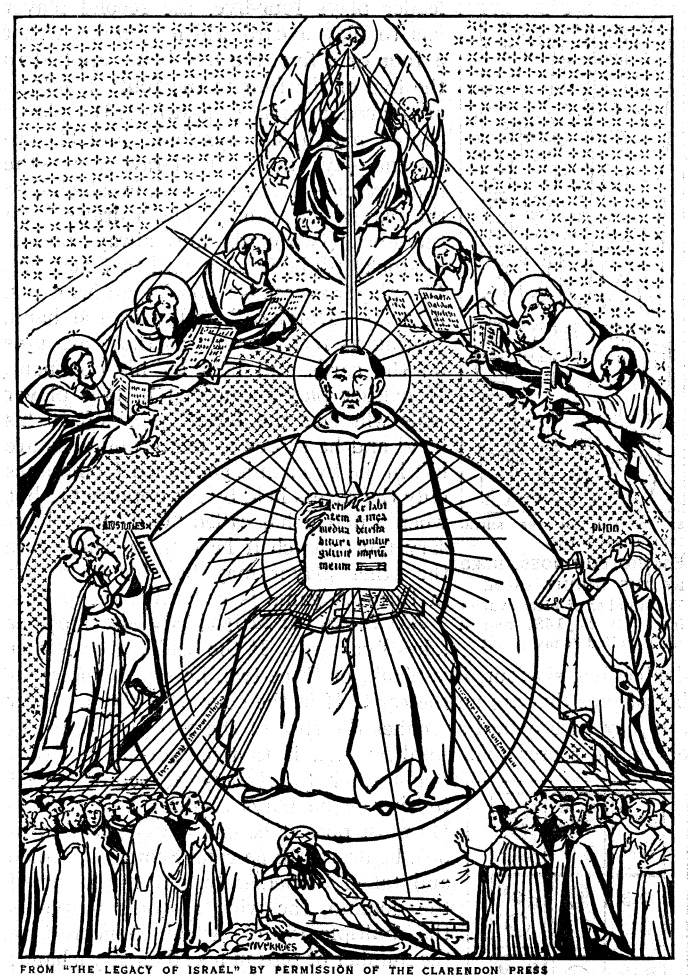
After 1872 Dominica formed part of the colony of the Leeward islands. In 1898 the local legislature, in consideration of pecuniary assistance from Great Britain, abrogated the semi-elective constitution and provided for a nominated legislative council, but in 1925 the island reverted to the elective system. In Jan. 1940, Dominica was transferred from the Leeward to the Windward Islands group.

DOMINICAL LETTERS or **SUNDAY LETTERS,** letters employed in the construction of the calendar to mark the Sundays throughout the year. The first seven letters of the alphabet are taken to mark the first seven days of the year, the following sets of seven following on according to this marking. As the year consists of *52* weeks and one day the dominical letters go backward one day every year, the same order of letters recurring every 28 years, making the solar circle. *See* also CALENDAR.

DOMINICAN REPUBLIC: *see* SANTO DOMINGO.

DOMINICANS, otherwise called Friars Preachers, and in England Black Friars, from the black mantle worn over a white habit, an order of friars founded by St. Dominic (*q.v.*). Their first house was in Toulouse, where the bishop established them at the church of St. Romain, *1215.* Dominic at once went to Rome

to obtain permission to found an order of preachers whose sphere of activity should be the whole world, but Innocent III. said they must adopt one of the existing rules. Dominic returned to Toulouse and it was resolved to take the Rule of St. Augustine, Dominic himself having been an Augustinian canon at Osma (see AUGUSTINIAN CANONS). Dominic went again to Rome, and in 1216 obtained from Honorius III. a series of confirmations of the



FROM "THE LEGACY OF ISRAEL" BY PERMISSION OF THE CLARENDON PRESS

ST. THOMAS TRIUMPHS OVER AVERROËS, THE MOORISH PHILOSOPHER
After an altar-piece by Traini in Santa Caterina at Pisa. Holding a bible in his hand and four of his own works on his knee, St. Thomas is the recipient of rays of wisdom from Christ (above), four apostles, Moses and St. Paul; Aristotle (at his right) and Plato (at his left). At his feet, between groups of faithful, lies the prostrate Averroës, with a ray of refutation piercing his "Commentary"

community at Toulouse as a congregation following the Rule of St. Augustine with a special mission to preach. Early in 1218 an encyclical bull was issued to the bishops of the whole Catholic world recommending to them the "Order of Friars Preachers," followed in 1221 by another ordering them to give to the friars faculties to preach and hear confessions in their dioceses. By this date the friars had penetrated into some parts of Italy, France, Spain, Poland and Bohemia, and some were on their way to England.

The order took definite shape at the two general chapters held at Bologna in 1220 and 1221. The manner of life was very austere —midnight office, perpetual abstinence from meat, frequent disciplines, prolonged fasts and silence. At St. Dominic's suggestion, and under his strong pressure, but not without considerable opposition, the general chapter determined that the poverty practised in the order should be not merely individual, as in the monastic orders, but corporate, as among the Franciscans; so that the order should have no possessions, except the monastic buildings and churches, no property, no fixed income, but should live on chsrity and by begging. Thus, doubtless in imitation of the Franciscans, the Dominicans became a mendicant order.

The extraordinarily rapid propagation of the institute suffered no diminution through the founder's death in 1221, for his four immediate successors in the generalate were men of conspicuous ability and high character. In a few years the Dominicans penetrated into Denmark, Sweden, Russia, Prussia and Poland, preaching and missionizing in the still pagan districts of these countries; and soon they made their way to Greece and Palestine and thence to central Asia. From the 14th century until the middle of the 17th the Dominicans had numerous missions in Persia, India and China, and in the northern parts of Africa. They followed the Spanish and Portuguese explorers and conquerors to both East and West, converting, protecting and civilizing the aborigines. Many suffered martyrdom.

Another conspicuous field of work of the Dominicans lay in the universities. It had been St. Dominic's policy to aim at founding houses first of all in the great university towns—at Paris, Bologna, Palencia, Oxford. This policy was adhered to, and the Dominicans soon became a power in the universities, occupying chairs in those just named and in Padua, Cologne, Vienna, Prague and Salamanca. The scholastic doctors Albert the Great and Thomas Aquinas mere the leaders in this side of Dominican activity, and the order's influence on the course of mediaeval theological development was exercised mainly by these doctors and by the Dominican school of theology, which to this day has maintained the principles and methods elaborated by St. Thomas.

The Dominican name is in a special way associated with the Inquisition, the office of Inquisitor in all countries, including Spain, having usually been held by Dominicans. The vicissitudes of the order have been much like those of other orders—periods of relaxation being followed by periods of revival and reform; but there were not any reforms of the same historical importance as in most other orders, the policy having been to keep all such movements strictly within the organization of the order. In 1425 Martin V. relaxed for some houses the law of corporate poverty, allowing them to hold property, and to have fixed sources of income; and 50 years later Sixtus IV. extended this mitigation to the entire order, which thereby ceased to be mendicant. This change caused no troubles, as among the Franciscans, for it was felt that it did not touch the fundamental Dominican ideal.

The Friars Preachers came to England and were established at Oxford in 1221, and by the end of the century 50 friaries were in existence in England, usually in the towns, and several in Ireland and Scotland. In London they were first on the site of Lincoln's Inn, but in 1275 migrated to that now occupied by Printing-house Square, their name, "Blackiriars," surviving as that of the adjacent district. The only nunnery was at Dartford. In Mary's reign some of the scattered friars were brought together and established in Smithfield, and the remnant of the nuns were restored to Dartford. In 1559 these houses were suppressed and the nuns and friars expatriated, and for a hundred years there was no English Dominican community. In 1658 Friar Thomas Howard (afterwards Cardinal) succeeded in establishing at Bornhem near Antwerp a house for the English friars. From that time there has always been an organized body of English Dominicans, again and again reduced almost to extinction, but ever surviving; it now has half a dozen thriving friaries. The Irish province also survived the days of persecution and possesses a dozen friaries. In 1840 Lacordaire restored the French province. Missionary work still holds a prominent place in Dominican life; there are missions in Annam, Tongking and China, and in Mesopotamia, Mosul and Kurdistan. They have also a remarkable school for Biblical studies and research at Jerusalem, and the theological faculty in the Roman Catholic university at Fribourg in Switzerland is in their hands. There have been four Dominican popes: Innocent V. (d. 1276), Benedict XI. (d. 1304), Pius V, (d. 1572), Benedict XIII. (d. 1730).

The friars form the "First Order"; the nuns, or Dominicanesses, the "Second Order." The latter may claim to have chronological precedence over the friars, for the first nunnery was established by St. Dominic in 1206 at Prouille in the diocese of Toulouse. as a refuge for women converted from the Albigensian heresy. The second convent was at San Sisto in Rome, also

founded by Dominic. From that time the institute spread widely. The rule resembled that of the friars, except that the nuns were to be strictly enclosed and purely contemplative; in course of time, however, they undertook educational work. They have schools and orphanages in South Africa, especially in the Transvaal.

See the Catholic Encyclopaedia, art. "Dominicans" and kindred topics; Heimbucher, *Orden* und Kongregationen (1896), §§ 86-91; and on the English houses: Gasquet, *English* Monastic Life; Palmer, Life of Cardinal Howard (1867) and Jarrett, The English Dominicans.

DOMINIONS OFFICE: see GOVERNMENT DEPARTMENTS.

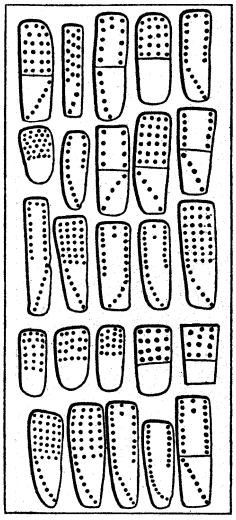
DOMINIS, MARCO ANTONIO DE (1566–1624), Italian theologian, was born on the island of Arbe, off the Dalmatian coast. He was educated by the Jesuits, and became professor of mathematics at Padua, and professor of rhetoric and philosophy at Brescia. In 1596 he was appointed to the bishopric of Segnia (Zengg) in Dalmatia, and in 1600 was raised to the archbishopric of Spalato and primacy of Dalmatia and Croatia. His attempts at reform brought him into conflict with his suffragans; and he also became involved in the quarrel between the papacy and Venice. He resigned his see in Sept. 1616, and wrote at Venice his *Consilium profectionis,* criticizing the papacy. In the same year, he crossed to England, and being regarded as a convert to Anglicanism, was appointed master of the Savoy (1618) and dean of Windsor (1619); he subsequently presented himself to the living of West Ilsley, Berkshire. His published attacks on the papacy include the *Papatus Romanus,* issued anonymously (London, 1617; Frankfurt, 1618), the *Scogli* del *naufragio Christiano* (London [?] 1618), and a Sermon preached in Italian, etc. before the king. But his principal work was the De *republica ecclesiastica,* of which the first part — after revision by Anglican theologians — was published under royal patronage in London (1617), in which he ably set forth his theory of the church. In 1619 Dominis published without the author's consent Paolo Sarpi's *Historia* del *Concilio Tridentino,* the ms. of which he had brought with him from Venice.

Three years later the ex-archbishop was back again in Rome, doing penance for his heresies. He may have been enticed back by the elevation of his kinsman, Alessandro Ludovisi, to the papal throne as Gregory XV. (1621), but if so, he had barely time to publish at Rome (1623) his *Sui reditus* ex Angliae *consilium,* a repudiation of his anti-papal works, when Gregory died (July 1623). The proceedings of the Inquisition against the archbishop were revived, but before they were concluded, Dominis died in prison, on Sept. 8, 1624. Judgment was pronounced over his corpse, which was publicly burnt in the Campo di Fiore. By a strange irony of fate the publication of his *Reditus* consilium was subsequently forbidden in Venice because of its uncompromising advocacy of the supremacy of the pope over the temporal powers.

See Herzog-Hauck, Realencyklopadie, where a full bibliography is given; G. Goodman, *The* Court of James *I.* ed. Brewer (London, 1839); H. Newland, *Life* and Contemporaneous Church *History of* Antonio de *Dominis* (Oxford, 1859).

DOMINOES, a game unknown until the 18th century, and probably invented in Italy, played by two or more persons, usually with 28 oblong pieces, or dominoes, known also as cards or stones (called pieces or *men* in America), having ivory faces backed with ebony; from this backing, as resembling the cloak (usually black) called a domino (see MASKS), the name is said to be derived. Cardboard dominoes to be held in the hand are also in use. The face of each card is divided into two squares by a black line, and in each square half the value of the card is indicated by its being either a blank or marked with one or more black pips, generally up to six, but some sets run as high as double-nine.

The Block and Draw Games. — The dominoes are shuffled face downwards on the table. The lead is usually decided by drawing for the highest card, but it is sometimes held that any doublet takes precedence. The cards are then reshuffled, and each player draws at random the number of cards required for the particular form of the game, usually seven. The cards left behind are called the stock. To play a card is known technically as to pose. The leader poses first, generally playing his highest domino, since at the end the player loses according to the number of pips in the cards he has left in his hand. By some rules, a player after playing a double may play another card which matches it; *e.g.,* if he plays double-six he may play another card which has a six at one end. The second player has to match the leader's pose by putting one of his cards in juxtaposition at one end; *i.e.,* if the leader plays four-five, the second player has to play a card which contains either a four or a five, the five being applied to the five or the four to the four. Doublets are placed *à* cheval (*crosswise*). If a player cannot match, he says "go," and his opponent plays, unless the Draw game — the usual game — is being played, in which case the player who cannot match draws from the stock (two cards must always be left in stock) till he takes a card that matches. If a player succeeds in posing all his cards, he calls "Domino!" and wins the hand, scoring as many points as there are pips on the cards still held by his opponent. If neither player can match, that player wins who has the fewest pips left in his hand and he scores as many points as are left in the two hands combined (sometimes only the excess held by his opponent); but when a player has called "Go!" his adversary must match if he can, in which case the other player may be able to match in turn. A game is generally 100 points.

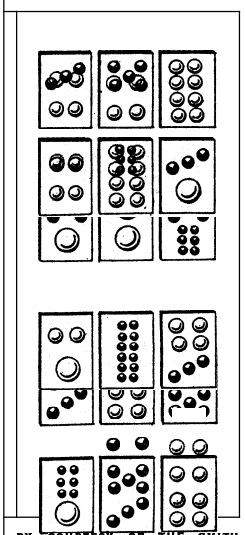


BY COURTESY OF THE SMITHSONIAN INSTITUTION

ESKIMO DOMINOES, USED BY THE INNUIT TRIBE

The number of pieces varies from 60 to 148, and a set is called A ma zu lat

All Fives (or Muggins). — Each player takes five cards. If the leader poses either double-five, six-four, five-blank, or three-two, he scores the number of pips that are on the card. If in the course of play a player can play such a card as makes the sum of the end pips 5, 10, 15 or 20, he scores that number; *e.g.,* if to two-four he can play double-four (h cheval) he scores 10; if to six-one he plays six-four he scores 5. He must pose if he can match; if he cannot, he draws till he can. Scores are called and taken immediately. At the point of the domino, the winner scores in points the multiple of five which is nearest to the number of pips in his adversary's hand; *e.g.,* he scores 25 if his adversary has 27 pips, 30 if he has 28. If neither hand can match, the lowest number of pips wins, and the score is taken as before, without addition or subtraction, according to the adversary's pips.



BY COURTESY OF THE SMITHSONIAN INSTITUTION

KOREAN DOMINO PIECES

The set consists of 32 pieces, made of wood, bone or ivory. There are no blanks

All Threes is played in the same manner as Muggins, save that three or some multiple of three are aimed at.

Threes and Fives is similar, but only one point is scored for each five or three made at the two ends, though they can be scored in combination. Thus A plays six-five; B six-one; B scores 2 points for five-one (two threes). A plays one-five; B double-five; B now scores 8 more. 5 for five threes and 3 for three fives.

Domino Whist is played by four players. Partners are drawn for as at whist; the player drawing the highest domino leads. Each player takes seven cards. There are no tricks, trumps or honours. The cards are played as in ordinary dominoes, a hand being finished when one of the players plays his last card, or when both ends are blocked. Pips are then counted, and the holder or holders of the highest number score to their debit the aggregate number of points. The side that is first debited with 100 points loses the game. Strength in a suit is indicated by the lead.

Matador.—This is a favourite and is perhaps also the most scientific form of the game. It is played on a different principle from the preceding variations, the object being not to match the end number, but to pose such a number, as, added to the end, will make seven; *e.g.*, to a five a two must be played, to a three a four, etc. Seven dominoes are drawn and the highest double begins. When a player cannot make a seven on either end he must draw from stock until he secures a card that will enable him to make seven, two cards remaining in the stock. As Matador is played with dominoes no higher than six, a blank means blocking of that end. In this case no further play can take place at that end excepting by posing a matador, which may be played at any time. There are four matadors, the 6-1, 5-2, 4-3, and double-blank. It is often better to draw one or more fresh cards than to play one's last matador, as it may save the game at a critical juncture. In posing a double counts as a single number only, but in scoring the full number of pips is counted. When the game has been definitely blocked the player whose pips aggregate the lower number scores the number of the combined hands (sometimes only the excess in his opponent's hand), the game being usually 100. Matador can be played by three persons, in which case the two having the lowest scores usually combine against the threatening winner; and also by four, either each for himself or two on a side.

Other varieties of the game not often played are the Bergen game, Sebastopol, Domino Loo, Bingo, Tiddle-a-Wink, the Game of Four, Malakoff, Cyprus, Round the Clock and others.

See Hoffman, *Card and Table Games;* F. *W*. Lewis, *Dominoes.*

DOMINUS, the Latin word for master or owner. As a title of sovereignty the term under the republic at Rome had all the associations of the Greek *τύραννος*; refused during the early principate, it finally became an official title of the Roman emperors under Diocletian. *Dominus,* the French equivalent being *sieur,* was the Latin title of the feudal (superior and mesne) lords, and also an ecclesiastical and academical title. The ecclesiastical title was rendered in English "sir," which was a common prefix before the Reformation for parsons, as in "Sir Hugh Evans" in Shakespeare's Merry Wives of *Windsor.* The academical use was for a bachelor of arts, and so is still used at Cambridge and other universities. The shortened form "dom" is used as a prefix of honour for ecclesiastics of the Roman Church, and especially for members of the Benedictine and other religious orders. The same form is also a title of honour in Portugal, as formerly in Brazil, used by members of the blood royal and others on whom it has been conferred by the sovereign. The Spanish form "don" is also a title, formerly applicable only to the nobility, and now one of courtesy and respect applied to any member of the better classes. The feminine form "doña" is similarly applied to a lady. The English colloquial use of "don" for a fellow or tutor of a college at a university is derived either from an application of the Spanish title to one having authority or position, or from the academical use of *dominus.* The earliest use of the word in this sense appears, according to the New English Dictionary, in South's Sermons (1660). An English corruption "dan" was in early use as a title of respect, equivalent to "master." The literary application to poets is due to Spenser's use of "Dan Chaucer, well of English undefyled" (*Faëry Queen,* IV. ii. 32).

DOMITIAN (TITUS FLAVIUS DOMITIANUS), Roman emperor A.D. 81–96, the second son of Vespasian, was born at Rome on Oct. 24, A.D. 51. When Vespasian was proclaimed emperor at Alexandria, Domitian escaped with difficulty from the temple of the Capitol, which had been set on fire by the Vitellians, and remained in hiding till his father's party proved victorious. After the fall of Vitellius he was saluted as Caesar by the troops, obtained the city praetorship, and was entrusted with the administration of Italy till his father's return from the East. But although in his father's lifetime he was several times consul, and after his death was nominally the partner in the empire with his brother Titus, he took no part in public business, but lived in great retirement, devoting himself to a life of pleasure and of literary pursuits till he succeeded to the throne. The death of Titus, if not hastened by foul means. was at least eagerly welcomed by his brother. Domitian's succession (on Sept. 13, 81) was unquestioned, and it would seem that he had intended, so far as his weak volition and mean abilities would allow, to govern well. Like Augustus, he attempted a reformation of morals and religion. He erected many temples and public buildings (amongst them the Odeum, a kind of theatre for musical performances) and restored the temple of the Capitol. He passed many sumptuary laws, and issued an edict forbidding the over-cultivation of vines to the neglect of corn-growing. Finally, he took a personal share in the administration of justice at Rome, checked the activity of the informers (*delatores*), and exercised a jealous supervision over the governors of provinces. Even when Rome and Italy smarted beneath his proscriptions and extortions, the provinces were undisturbed.

Though he took the title of imperator more than 20 times, and enjoyed at least one triumph, Domitian's military achievements were insignificant. He defeated the Chatti, annexed the district of the Taunus, and established the *Limes* as a line of defence; but he suffered defeats at the hands of the Quadi, Sarmatae and Marcomanni; in Dacia he received a severe check, and was obliged to purchase peace (90) from Decebalus by the payment of a large sum of money and by guaranteeing a yearly tribute—the first instance in Roman history. His jealousy was provoked by the successes of Agricola in Britain, who was recalled to Rome (85) in the midst of his conquests, condemned to retirement, and perhaps removed by poison. The revolt of Antonius Saturninus, the commander of the Roman forces in upper Germany (88 or 89), marks the turning-point in his reign (on the date see H. Schiller, Geschichte der romischen kaiserzeit, i. pt. 2, p. 524, note 2). It was speedily crushed; but from that moment Domitian's character changed. He got rid of all whom he disliked on the charge of having taken part in the conspiracy, and no man of eminence was safe against him. He was in constant fear of assassination and distrusted all around him. During the last three years of his life his behaviour was that of a madman. He sentenced to death his own cousin and nephew by marriage, Flavius Clemens, whose wife he banished for her supposed leaning towards Judaism (Christianity). He was stabbed in his bedroom by a freedman of Clemens named Stephanus on Sept. 18, 96.

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DOMREMY-LA-PUGELLE, a village of eastern France, in the department of Vosges, on the left bank of the Meuse, 7 m. N of Neufchâteau by road. Pop. (1936) 248. Domrémy was the birthplace of Joan of Arc, and the cottage in which she was born still stands. Above the door are the arms of France and of Joan of Arc and an inscription of 1481 reading Vive labeur; vivc le *roi Louys.* There are several monuments to the heroine, and a modern basilica has been erected in her honour on a neighbouring hill, where she is said to have heard the voices in obedience to which she took up the sword. The story of the heroine is annually celebrated by a play in which the villagers take part.

DON, river, south Aberdeenshire, Scotland, rising in peat-moss to the east of Glen Avon on the borders of Banffshire, at a height of nearly 2,000 ft. It follows a generally easterly course, roughly parallel with that of the Dee, and a few miles north of it, falling into the North Sea close to Old Aberdeen, after a run of 82 m. At the mouth the two rivers are only $2\frac{1}{3}$ m. apart. Dee and Don are excellent salmon streams.

DON, a river of European Russia (anc. *Tanais*), called *Tuna* or Duna by the Tatars, rising in Lake Ivan (580 ft. above sea-

level) in the province of Tula, where it has communication with the Volga by means of the Yepifan canal, which links it with the Upa, a tributary of the Oka, which itself enters the Volga. The Don, after curving east through Ryazan, flows generally south through Tambov, Orel, Voronezh and the North Caucasian Area, describing in the last-named a sweeping loop to the east, in the course of which it approaches within 48 m. of the Volga in 49° N. In the province of Stalingrad it turns definitely south-west, and finally enters the north-east extremity of the Sea of Azov, forming a delta 130 sq m. in extent. Its total length is 1,325 m., and its drainage area is calculated at 166,000 sq.m. The average fall of the river is about 5¼ in. to the mile. In its upper course, which may be regarded as extending to the confluence of the Voronezh in 51° 40′, the Don flows for the most part through a low-lying, fertile country, though in Ryazan its banks are rocky and steep, and in some places even precipitous. In the middle division, or from the mouth of the Voronezh to the point where it makes its nearest approach to the Volga, the stream cuts its way for the most part through Cretaceous rocks, which in many places rise on either side in steep and elevated banks, and at intervals encroach on the river-bed. A short distance below the town of Rostov it breaks up into several channels, of which the largest and most southern retains the name of the river. Before it receives the Voronezh the Don has a breadth of 500 to 700, or even in a few places 1,000 ft., while its depth varies from 4 to 20 ft.; by the time it reaches its most eastern point the depth has increased to 8–50 ft., and the ordinary breadth to 700–1,000 ft., with an occasional maximum of 1,400 ft.; in the lowest division the depth is frequently 70 ft., and the breadth in many places 1,870 ft. Generally speaking, the right bank is high and the left flat and low. Shallow reaches are not uncommon, and there are at least seven considerable shoals in the south-western part of the course; partly owing to this cause, and partly to the scarcity of ship-timber in the Voronezh province, the Don, although navigable as far up as Voronezh, does not attain any great importance as a means of communication till it reaches Kalach, where the railway (built in 1862) from the Volga has its western terminus. Of the tributaries of the river, the Voronezh, the Khoper, the Medvyeditsa and the Donets are navigable—the Donets having a course of 680 m., and during high water affording access to the government of Kharkov. The Manych, another large affluent on the left, marks the ancient line of water connection between the Sea of Azov and the Caspian sea. The lower section of the Don is subject to two annual floods, of which the earlier, known as the "cold water," is caused by the melting of the snow in the North Caucasian Area, and the later, or the "warm water," is due to the same process taking place in the region drained by the upper parts of the stream. About the beginning of June the river begins to subside with great rapidity; in August the water is very low and navigation almost ceases; but occasionally after the September rains the traffic with small craft is again practicable. Since the middle of the 18th century there have been five floods of extraordinary magnitude—namely, in 1748, 1786, 1805, 1820 and 1845. The river is usually closed by ice from November or December to March or April, and at rare intervals it freezes in October. At Aksai, in the delta, it remains open on the average for 250 days in the year, at the mouth of the Medvyeditsa for 239, and at Novocherkassk, on another arm of the delta, for 246. This river supports a considerable fishing population, who despatch salt fish and caviare all over Russia. Salmon and herrings are taken in large numbers. The areas of calcareous soil on its banks are favourable to vine cultivation and "Don Champagne" is in great demand.

DONAGHADEE, a market town of Co. Down, Ireland, near the south of Belfast Lough, 25 m. E. by N. of Belfast by rail. Pop. (1926), 2,534. It is 214 m. S.W. of Portpatrick in Wigtownshire, with which it is connected by telegraph and telephone cables. To the north-east is a rath or encampment 70 ft. high. The parish church dates from 1626. There are two holy wells, and the town is a seaside resort.

DONALDSON, SIR JAMES (1831–1915), Scottish classical scholar, educational and theological writer, was born at Aberdeen on April 26, 1831, and died on March 9, 1915. In 1854 he was appointed rector of the Stirling high school, in 1866 rector of that of Edinburgh, in 1881 professor of humanity in the University of Aberdeen, and in 1890 principal of the University of St. Andrews. He was knighted in 1907.

His chief works are *Modern Greek Grammar* (1853); *Lyra Graeca* (1854), specimens of Greek lyric poetry from Callinus to Soutsos; *A Critical History of Christian Literature and Doctrine from the Death of the Apostles to the Nicene Council* (i. iii., 1864–66; new ed. of i. as *The Apostolical Fathers,* 1874), a book unique of its kind in England at the time of its appearance and one which adds materially to the knowledge of Christian antiquities as deduced from the Apostolic fathers; *Lectures on the History of Education in Prussia and England* (1874); *The Westminster Confession of Faith and the Thirty-Nine Articles of the Church of England* (1905); *Woman, her position and influence in ancient Greece and Rome* (1907).

DONALDSON, JOHN WILLIAM (1811–1861), English philologist and biblical critic, was born in London on June 7, 1811. He was educated at University College, London, and Trinity College, Cambridge, of which he became fellow. Headmaster of King Edward's school, Bury St. Edmunds from 1841 to 1855, he spent the last years of his life at Cambridge; and died on Feb. 10, 1861. The *New Cratylus* (1839), the book on which his fame mainly rests, was an attempt to apply to Greek the principles of comparative philology; it was founded mainly on the comparative grammar of Bopp, but a large part of it was original, Bopp's grammar not being completed till ten years after the first edition of the *Cratylus.* In the *Varronianus* (1844) the same method was applied to Latin, Umbrian and Oscan.

DONATELLO (diminutive of Donato) (*c.* 1386–1466), Italian sculptor, was the son of Niccolò di Betto Bardi, a member of the Florentine Woolcombers' Gild, and was born in Florence probably in 1386. It is certain that Donatello received his first training in a goldsmith's workshop, and that he worked for a short time in Ghiberti's studio. He was too young to enter the competition for the baptistery gates in 1402, from which Ghiberti issued victorious against Brunelleschi, Jacopo della Quercia, Niccolò d'Arezzo and other rivals. But when Brunelleschi in his disappointment left Florence and went to Rome to study the remains of classic art he was accompanied by young Donatello. This Roman sojourn was decisive for the entire development of Italian art in the 15th century, for it was during this period that Brunelleschi undertook his measurements of the Pantheon dome and of other Roman buildings, which enabled him to construct the noble cupola of S. Maria del Fiore in Florence, while Donatello acquired his knowledge of classic forms and ornamentation. The two masters, each in his own sphere, were to become the leading spirits in the art movement of the 15th century. Brunelleschi's buildings and Donatello's monuments are the supreme expression of the spirit of the early Renaissance in architecture and sculpture and exercised a potent influence upon the painters of that age.

Donatello probably did not return to Florence before 1405, since the earliest works in that city that can be traced to his chisel are two small statues of "prophets" for the north door of the cathedral, for which he received payment in Nov. 1406 and 1408. In the latter year he was entrusted with the important commissions for the marble "David," now at the Bargello, and for the colossal seated figure of "St. John the Evangelist," which until 1588 occupied a niche of the old cathedral façade, and is now placed in a dark chapel of the Duomo. He was next employed at Or San Michele, where between 1340 and 1406 only four of the 14 niches had been filled. As the result of a reminder sent by the Signory to the gilds who had undertaken to furnish the statues, the services of Ciuffagni, Nanni di Banco, Ghiberti and Donatello were enlisted, and Donatello completed between 1412 and 1415 the "St. Peter," the "St. George" (the original, now in the Bargello, has been replaced by a copy) and the "St. Mark." He probably also assisted Nanni di Banco in his group of four saints. To this early period belongs the wooden crucifix in S. Croce, the most striking instance of Donatello's realism in rendering the human form and his first attempt at carving the nude. It is said that this crucifix was executed in rivalry with Brunelleschi's noble work at S. Maria Novella, and that Donatello, at the sight of his friend's work, exclaimed, "It has been left to you to shape a real Christ, whilst I have made a peasant." In

this early group of statues, from the prophets for the cathedral door to the "St. George," can be followed the gradual advance from Gothic stiffness of attitude and draping to a forceful rendering of the human form and of movement, which is a distinct approach to the classic ideal. All these figures were carved in marble and are admirably conceived in relation to their architectural setting. In fact, so strong is this tendency that the "St. Mark," when inspected at the master's workshop, was disapproved of by the heads of the Gild of Linen-weavers, but aroused public enthusiasm when placed in *situ.*

Between the completion of the niches for Or San Michele and his second journey to Rome in 1433, Donatello was chiefly occupied with statuary work for the campanile and the cathedral, though from this period dates the bronze figure of the Baptist for the christening font of Orvieto cathedral, which was never delivered and is now among the treasures of the Berlin museum. This, and the "St. Louis of Toulouse," which originally occupied a niche at Or San Michele and is now badly placed at S. Croce, were the first works in bronze which owed their origin to the partnership of Donatello with Michelozzo, who undertook the casting of the models supplied by his senior. The marble statues for the campanile, which are either proved to be Donatello's by documentary evidence or can be recognized as his work from their–style, are the "Abraham," wrought by the master in conjunction with Giovanni di Bartolo (il Rosso); the "St. John the Baptist"; the so-called "Zuccone" (Jonah?); "Jeremiah"; "Habakkuk" (?); the unknown "prophet" who is supposed to bear the features of the humanist Poggio Bracciolini; and possibly he may have had a share in the completion of the "Joshua" commenced by Ciuffagni in 1415. All these statues, and the "St. John" at the Bargello, mark a bold departure from the statuesque balance of the "St. Mark" and "St. George" to an almost instantaneous impression of life. The fall of the draperies is no longer arranged in harmonious lines, but is treated in an accidental, massive, bold manner. At the same time the heads are no longer, as it were, impersonal, but almost cruelly realistic character portraits of actual people, just as the arms and legs and necks are faithfully copied from life with all their angularities and deviations from the lines of beauty. During this period Donatello executed some work for the baptismal font at S. Giovanni in Siena, which Jacopo della Quercia and his assistants had begun in 1416. Though the Florentine's share in it is confined to a relief which may have been designed, or even begun, by Jacopo, and a few statuettes, it is of considerable importance in Donatello's life-work, as it includes his first attempt at relief sculpture — except the marble relief on the socle of the "St. George" — his first female figures, — "Faith" and "Hope," and his first *putti.* The relief, "Herod's Feast," shows already that power of dramatic narration and the skill of expressing the depth of space by varying the treatment from plastic roundness to the finest *stiacciato,* which was to find its mature expression in the panels of the altar of S. Antonio in Padua and of the pulpit of S. Lorenzo in Florence. The casting of the pieces for the Siena font was probably done by Michelozzo, who is also credited with an important share in the next two monumental works, in the designing of which Donatello had to face a new problem — the tomb of John XXIII. in the baptistery (begun about 1425), and that of Cardinal Brancacci at S. Angelo a Nilo in Naples (executed in Pisa, 1427). The noble recumbent figure of the defunct on the former, the relief on the sarcophagus, and the whole architectural design, are unquestionably due to Donatello; the figure of the pope is the most beautiful tomb figure of the 15th century, and served as the model on which Rossellino, Desiderio and other sculptors of the following period based their treatment of similar problems. Donatello's share in the Naples monument is probably confined to the characteristic low relief of the "Ascension." The baptistery tomb shows how completely Donatello had mastered the forms of Renaissance architecture, even before his second visit to Rome. An earlier proof of his knowledge of classic art is his niche for the "St. Louis" at Or S. Michele, now occupied by Verrocchio's "Christ and St. Thomas." Similar in treatment to the "Ascension" relief is the "Charge to St. Peter" at South Kensington, which is almost impressionistic in its suggestion of distance and intervening atmosphere expressed by the extreme slightness of the relief.

When Cosimo was exiled from Florence in 1433, Michelozzo accompanied him to Venice, whilst Donatello went to Rome to drink once more at the source of classic art. The two works which still testify to his presence in this city, the "Tomb of Giovanni Crivelli" at S. Maria in Aracoeli, and the "Ciborium" at St. Peter's, bear the stamp of classic influence. Donatello's return to Florence in the following year almost coincides with Cosimo's. Almost immediately, in May 1434, he signed a contract for the marble pulpit on the façade of Prato cathedral, the last work executed in collaboration with Michelozzo, a veritable' bacchanalian dance of half-nude *putti,* pagan in spirit, passionate in its wonderful rhythmic movement — the forerunner of the "singing tribune" for Florence cathedral, at which he worked intermittently from 1433 to 1440, and which is now restored to its original complete form at the museum of the Opera del Duomo. But Donatello's greatest achievement of his "classic period" is the bronze "David" at the Bargello, the first nude statue of the Renaissance, the first figure conceived in the round, independent of any architectural surroundings — graceful, well-proportioned, superbly balanced, suggestive of Greek art in the simplification of form, and yet realistic, without any striving after ideal proportions. The same tendencies are to be noted in the bronze *putto* at the Bargello.

In 1443 Donatello was invited to Padua to undertake the decoration of the high altar of S. Antonio, but in the period preceding his departure he not only assisted Brunelleschi in the decoration of the sacristy of S. Lorenzo, towards which the bronze doors are his chief contribution, but found time to chisel, or model in wax or terra-cotta, for Cosimo and other private patrons, most of the portrait busts and small reliefs, which are now distributed over the museums of the world. His first work in Padua was the bronze crucifix for the high altar, a work immeasurably superior to the early wooden crucifix at S. Croce, both as regards nobility of expression and subtlety of form. In the very year when Donatello arrived in Padua the famous Condottiere Erasmo de' Narni, called Gattamelata, had died, and when it was decided to honour his memory with an equestrian statue, it was only natural that this master should be chosen to undertake a task from the difficulties of which all others may well have shrunk. This commission, and the reliefs and figures for the high altar, kept Donatello in Padua for ten years, though during that time he visited Venice (where he carved the wooden "St. John" at the Frari) and probably Mantua, Ferrara and Modena. In his workshop in Padua he gathered around him quite a small army of assistants, stone-carvers, metal-workers, painters, gilders and bronze-casters. The Gattamelata was finished and set up in 1453—a work powerful and majestic in its very repose; there is no striving for dramatic effect, no exaggerated muscular action, but the whole thing is dominated by the strong, energetic head, which is modelled with the searching realism of the Zuccone and the Poggio heads. The high altar, for which Donatello executed 22 reliefs, seven statues and the crucifix, was completed in 1450, but had subsequently to undergo many changes, in the course of which the original disposition of the sculptures was entirely lost sight of, the present arrangement being due to Camillo Boito (1895). The chief features of the altar are the wonderfully animated and dramatic bronze reliefs, four in number, of the "Miracles of St. Anthony."

With the exception of another visit to Siena in 1457, of which the bronze "St. John" in the cathedral is a reminder, Donatello spent the remaining years of his life in Florence. Closely akin to the rugged "St. John" at Siena and therefore probably contemporaneous, is the repulsively ugly, emaciated "Magdalen" at the baptistery in Florence. The dramatic intensity of the "Judith" group in the Loggia de' Lanzi, which was originally placed in the court of the Medici Palace, marks it as belonging to the post-Paduan period of the master's life. His last work of importance was the bronze reliefs for the pulpit of S. Lorenzo, commissioned about 1460, and finished after Donatello's death by his pupil

Bertoldo. The reliefs of the "Flagellation" and "Crucifixion" at the Victoria and Albert Museum are typical examples of the master's style at this closing period of his life. He died on Dec. 13, 1366.

Donatello, whose supreme mastery had been acknowledged by Michelangelo, Raphael and the other giants of the late Renaissance, almost sank into oblivion during the 18th and early 19th centuries, and only in comparatively recent times has he been restored to the eminent position which is his due in the history of art. The full power of his genius was only revealed to the world when, at the quincentenary celebration of his birth, the greater part of his life-work was brought together in Florence. The large hall at the Bargello has ever since been devoted to the display of his works, the numerous original bronzes and marbles and terra-cottas being supplemented by casts of works at other places.

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DONATI, GIOVANNI BATTISTA (1826–1873), Italian astronomer, was born at Pisa on Dec. 16, 1826. In 1854–64 he discovered six comets, one of which, first seen on June 2, 1858, bears his name (*see* COMET). On Aug. 5, 1864, he discovered the gaseous composition of comets by submitting to spectroscopic analysis the light of one then visible.

See *Vierteljahrsschrift der astr. Gesellschaft* (Leipzig), ix. 4; *Monthly Notices Roy. Astr. Society*, xxxiv. 153; *Memorie degli spettroscopisti italiani*, ii. 12; (*G.* Cacciatore); *Nature*, viii. 556.

DONATIO MORTIS CAUSA (grant in case of death), in law, a gift of personal property made in contemplation of death and intended either expressly or impliedly to take complete effect only if the donor dies of the illness affecting him at the time of the gift. The conception as well as the name is borrowed from Roman law, and the definition given by Justinian (*Inst.* ii. 7. 1) applies equally to a *donatio ntortis causa* in Roman and English law. A distinction, however, has arisen between the English and civil codes; by English law delivery either actual or (when from the nature of the thing actual delivery is impossible) constructive is essential, and this delivery must pass not only the possession but the dominion of the thing given; by the civil law, delivery of possession was not essential. A *donatio mortis causa* is halfway between a gift *intcr vivos* and a legacy, and has some of the characteristics of each form of disposition. It resembles a legacy in that (1) it is revocable during the donor's life, (2) it is subject to death duties, (3) it is liable to satisfy debts of the testator in default of other assets. On the other hand, it resembles a gift *inter vivos* in that it takes effect from delivery; therefore the consent of the executor is not necessary. Anything may be the subject of a *donatio ntortis causa*, the absolute property in which can be made to pass by delivery after the donor's death either in law or equity; this will cover bankers' deposit notes, bills of exchange and notes and cheques of a third person, but not promissory notes and cheques of the donor in favour of the donee, for the donor's signature is merely an authority for his banker to pay, which is revoked by his death.

DONATION OF CONSTANTINE (*Donatio Constantini*), the supposed grant by the emperor Constantine, in gratitude for his conversion by Pope Silvester, to that pope and his successors for ever, not only of spiritual supremacy over the other great patriarchates and over all matters of faith and worship, but also of temporal dominion over Rome, Italy and "the provinces, places and *civitates* of the western regions."

The famous document, known as the *Constitutum Constantini* and compounded of various elements (notably the apocryphal *Vita* S. *Silvestri*),, now universally admitted to be a gross forgery, was fabricated at Rome between the middle and the end of the 8th century, was included in the 9th century in the collection known as the False Decretals, and two centuries later was incorporated in the *Decretum* by a pupil of Gratian. It was regarded as genuine both by the friends and the enemies of the papal pretensions throughout the middle ages, though at the close of the 10th century Leo of Vercelli, Otto III.'s chancellor, proclaimed its true character, as, in 1452, did the heretical followers of Arnold of Brescia. Though little use of it was made by the popes during the 9th and 10th centuries, from this time forward it was increasingly employed by popes and canonists in support of the papal claims, and from the 12th century onward became a powerful weapon of the spiritual against the temporal powers. It is, however, as Cardinal Hergenrother points out, possible to exaggerate its importance in this respect. By the partisans of the Empire the Donation was looked upon as the *fons et origo malorum*, and Constantine was regarded as having, in his new-born zeal, betrayed his imperial trust.

The genuineness of the *Constitutum* was first critically assailed by Laurentius Valla in 1440, whose De *falso credita et ementita Constantini donatione declamatio* opened a controversy that lasted until, at the close of the 18th century, the defence was silenced. In modern times the controversy as to the genuineness of the document has been succeeded by a debate scarcely less lively as to its date, its authorship and place of origin. The efforts of Roman Catholic scholars have been directed (since Baronius ascribed the forgery to the Greeks) to proving that the fraud was not committed at Rome. Thus Cardinal Hergenrother holds that it was written by a Frank in the 9th century, in order to prove that the Greeks had been rightiully expelled from Italy and that Charlemagne was legitimate emperor. The evidence now available, however, confirms those who ascribe an earlier date to the forgery and place it at Rome. The view held by Gibbon, Dollinger (*Papstfabeln des Mittelalters*, Eng. tr. 1871) and others, that the *Constitutum* is referred to in the letter of Adrian I. to Charlemagne (778), is now largely rejected; and the same must be said of Friedrich's attempt to find such reference in the letter addressed in 785 by the same pope to Constantine VI., emperor of the East, and his mother Irene. Still less safe is it to ascribe the authorship of the forgery to any particular pope on the ground of its style; for papal letters were drawn up in the papal chancery and the style employed tliere was apt to persist through several pontificates.

On one point, however, agreement seems now to have been reached, a result due to the labours of Scheffer-Boichorst (*Mitteilungen des Instituts fur osterr. Geschichtsforschung*, x., 1889, xi., 1890), namely; that the style of the *Constitutum* is generally that of the papal chancery in the latter half of the 8th century. This being granted, there is room for plentiful speculation as to where and why it was concocted. We may still hold the opinion of Dollinger that it was intended to impress the barbarian Pippin and justify in his eyes the Frank intervention in favour of the pope in Italy; or we may share the view of Loening that the forgery was a pious fraud on the part of a cleric of the Curia, committed under Adrian I., with the idea of giving a legal basis to territorial dominion which that pope had succeeded in establishing in Italy. The donations of Pippin and Charlemagne established him as sovereign *de facto;* the donation of Constantine was to proclaim him as sovereign *de jure*. It is significant in this connection that it was under Adrian (*c*. 774) that the papal chancery ceased to date by the regnal years of the Eastern emperor and substituted that of the pontificate. Dollinger's view is supported and carried a step further by G. H. Bohmer (art. "Konstantinische Schenkung." Herzog-Hauck, *Realencyclopädie*), who by an ingenious argument endeavours to prove that the *Constitutum* was forged in 753, probably by the notary Christophorus, and was carried with him by Pope Stephen II. to the court of Pippin, in 754, with an eye to the acquisition of the Exarchate. In support of this argument it is to be noted that the forged document first appears at the abbey of St. Denis, where Stephen spent the winter of 754. E. Mayer

("Die Schenkungen Konstantins und Pippins," *Deutsche Zeitschrift fur Kirchenrecht,* 1904), on the other hand, denies that the *Constitutum* can have been forged before the news of the iconoclastic decrees of the council of Constantinople of 754 had reached Rome. He lays stress on the relation of the supposed confession of faith of Constantine, embodied in the forgery, to that issued by Constantine V., pointing out the efforts made by the Byzantines between 7j6 and the synod of Gentilly in 767 to detach Pippin from the cause of Rome and the holy images. The forgery thus had a double object: as a weapon against Byzantine heresy and as a defence of the papal patrimony. As the result of an exhaustive analysis of the text and of the political and religious events of the time, Mayer comes to the conclusion that the document was forged about 775, *i.e.,* at the time when Charlemagne was beginning to reverse the policy by which in 774 he had confirmed the possession of the duchies of Spoleto and Benevento to the pope.

In addition to works already mentioned, *see* Hergenrother, *Catholic Church and Christian State* (Freiburg im Breisgau, 1872; Eng. trans. 2 vols. 1876); W. Martens, *Die romische Frage unter Pippin u. Karl d. Grossen* (Stuttgart, 1881), with text; L. Weiland, "Die Konst. Schenkung" in *Zeitschr. f. Kirchenrecht,* xxii. (1887–1888), maintaining that the *Constitutum* was forged at Rome between 813 and 875, in connection with the papal claim to crown the emperors; with text; Friedrich, *Die Konst. Schenkung* (Nordlingen, 1889), with text; W. Martens, *Die falsche Generalkonzession Konstantins des Grossen* (Munich, 1889); G. Kriiger, "Die Frage der Entstehungszeit der Konst. Schenkung," in *Theologische Literaturzeitung,* xiv. (1889); Laurentius Valla's treatise was issued in a new edition, with French translation and historical introduction, by *A.* Bonneau, La *Donation de Constantin* (Lisieux, 1879).

DONATISTS, a powerful sect which arose in the Christian church of northern Africa at the beginning of the 4th century. In its doctrine it sprang from the same roots, and in its history it had in many things the same character, as the earlier Novatians. The predisposing causes of the Donatist schism were the belief, early introduced into the African church, that the validity of all sacerdotal acts depended upon the personal character of the agent, and the question, arising out of that belief, as to the eligibility for sacerdotal office of the *traditores,* or those who had delivered up their copies of the Scriptures under the compulsion of the Diocletian persecution; the exciting cause was the election of a successor to Mensurius, bishop of Carthage (d. 311). Mensurius had held moderate views as to the treatment of the *traditores,* and accordingly a strong fanatical party, supported by Secundus, bishop of Tigisis and primate of Numidia, had formed itself in Carthage in opposition to him. There were thus two parties, each anxious to secure the succession to the vacant see. The friends of the late bishop fixed their choice on Caecilian, the archdeacon, and secured his election and his consecration by Felix, bishop of Aptunga, before the other party were ready for action. It had been customary for the Numidian bishops to be present at the election and consecration of the bishop of Carthage, who as metropolitan of proconsular Africa occupied a position of primacy towards all the African provinces. Caecilian's party, however, had not waited for them, knowing them to be in sympathy with their opponents. Soon after Caecilian's consecration Secundus himself with 70 of the Numidian bishops arrived at Carthage. A synod of Africa was formed, before which Caecilian was summoned; his consecration was declared invalid, on the ground that Felix had been a traditor; and finally, having refused to obey the summons to appear, he was excommunicated, and the "reader" Majorinus consecrated in his stead.

To investigate the dispute Constantine issued a commission to five Gallic bishops, under the presidency of Melchiades, bishop of Rome. Ten bishops appeared on each side, the leading representative of the Donatists being Donatus of Casae Nigrae. The decision was entirely in favour of Caecilian, and Donatus was found guilty of various ecclesiastical offences. An appeal was taken and allowed; but the decision of the synod of Arles in 314 not only confirmed the position of Caecilian, but greatly strengthened it by passing a canon that ordination was not invalid because performed by a traditor, if otherwise regular. Felix had previously been declared innocent after an examination of records and witnesses at Carthage. A further appeal to the emperor in person was heard at Milan in 316, when all points were finally decided in favour of Caecilian, probably on the advice of Hosius, bishop of Cordova. Henceforward the power of the state was directed to the suppression of the defeated party. Persistent Donatists were no longer merely heretics; they were rebels and incurred the confiscation of their church property and the forfeiture of civil rights.

The attempt to destroy the sect by force had the result of intensifying its fanaticism. Majorinus, the Donatist bishop of Carthage, died in 315, and was succeeded by Donatus, surnamed Magnus, a man of great force of character after whom the movement was named, and under whose influence it gained fresh strength from the opposition it encountered. In 321 Constantine, seeing probably that he had been wrong in abandoning his usual policy of toleration, sought to retrace his steps by granting the Donatists liberty to act according to their consciences, and declaring that the points in dispute between them and the orthodox should be left to the judgment of God. This wise policy, to which he consistently adhered to the close of his reign, was not followed by his son and successor Constans, who, after repeated attempts to win over the sect by bribes, resorted again to persecution, many of their bishops falling victims and Donatus and others being banished. The power which they had been the first to invoke having thus declared so emphatically and persistently against them, the Donatists revived the old world-alien Christianity of the days of persecution, and repeated Tertullian's question, "What has the emperor to do with the church?" *(Quid est imperatori cum ecclesia?)*

With the accession of Julian (361) an entire change took place; their churches were restored to the Donatists and their bishops reinstated, with the natural result of greatly increasing both the numbers and the enthusiasm of the party. A return to the earlier policy of repression was made under Valentinian I. and Gratian, by whom the churches were again closed, and all assemblies forbidden. It was not, however, until the commencement of the 5th century that the sect began to decline, owing largely to the rise among them of a group of moderate and scholarly men like the grammarian Tychonius, who vainly strove to overcome the more fanatical section. Against the house thus divided against itself both state and church directed not unsuccessful assaults. In 405 an edict was issued by the emperor Honorius commanding the Donatists, under the severest penalties, to return to the Catholic church. On the other hand, Augustine, bishop of Hippo, after several years' negotiation, arranged a great conference between the Donatists and the orthodox, which was held under the authority of the emperor at Carthage in 411. There were present 286 Catholics and 279 Donatist bishops. Before entering on the proceedings the Catholics pledged themselves, if defeated, to give up their sees, while in the other event they promised to recognize the Donatists as bishops on their simply declaring their adherence to the Catholic church. The latter proposal, though it was received with scorn at the time, had perhaps ultimately as much influence as the logic of Augustine in breaking the strength of the schism. The discussion, which lasted for three days, turned exclusively upon the two questions that had given rise to the schism —first, the question of fact, whether Felix of Aptunga who consecrated Caecilian had been a traditor; and secondly, the question of doctrine, whether a church by tolerance of unworthy members within its pale lost the essential attributes of purity and catholicity. The Donatist position, like that of the Novatians and, earlier, of the Montanists (*q.v.*) was that the church is a society of holy persons, and that the mark of the true church is to guard the essential predicate of holiness by excluding all who have committed mortal sin; the Catholic standpoint was that such holiness is not destroyed by the presence of unworthy members in the church but rests upon the divine foundation of the church and upon the gift of the Holy Spirit and the communication of grace through the priesthood. In the words of Optatus of Milevi, *sanctitas de sacramentis colligitur, non de superbia personarum pondera.* And the much wider diffusion of the orthodox church was also taken as practical confirmation that it alone possessed what was regarded as the equally essential predicate of catholicity.

The decision of Marcellinus, the imperial commissioner, was in favour of the Catholic party on both questions, and it was at once confirmed on an appeal to the emperor. The severest penal measures were enforced against the schismatics; in 414 they were denied all civil rights, in 415 the holding of assemblies was forbidden on pain of death. But they lived on, suffering with their orthodox brethren in the Vandal invasions of the 5th century, and like them finally disappearing before the Saracen onslaught two centuries later.

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DONATUS, AELIUS, Roman grammarian and teacher of rhetoric, flourished in the middle of the 4th century A.D. He was the tutor of St. Jerome. Of his numerous works, the following are extant: the *Ars grammatica;* most of his commentary on Terence (a compilation from other commentaries), but probably not in its original form; and a few fragments of his notes en Virgil, preserved and severely criticized by Servius, together with the preface and introduction, and life of Virgil. The *Ars,* though having little claim to originality, and based on the authorities used by Charisius and Diomedes, became so popular as a school-book that in the middle ages the writer's name became a common metonymy (in the form *donet*) for any rudimentary treatise. It is extant in the form of an *Ars Minor,* which only treats of the parts of speech, and an *Ars Maior,* which deals with grammar in general at greater length.

Aelius Donatus is to be distinguished from Tiberius Claudius Donatus, the author of a commentary (*Interpretationes*) on the Aeneid (of far less value than that of Servius), who lived about 50 years later.

The best text of the *Ars* and the commentaries upon it by Servius and others is in H. Keil, *Grammatici Latini,* iv.; of the commentary on Terence there is an edition by P. Wessner (1902, Teubner series), with bibliography and full account of mss. *See* generally E. A. Grafenhan, *Geschichte der klassischen Philologie im Altertum,* iv. (1850); P. Rosenstock, *De Donato, Terrenti . . . explicatore* (1886); *H.* T. Karsten, *De Comm. Don. ad Terenti fabulas origine et compositione* (Leyden, 1907). For the commentary of Tiberius Donatus see O. Ribbeck, Prolegomena to Virgil, Grafenhan (as above), and V. Burkas, *De Tiberii Claudii Donati in Aeneidem commentario* (1889). The text will be found in *G.* Fabricius's edition ot Virgil (1561), ed by H. George, i. (1905 foll.). *Sre* also R. Sabbadini, *Storia e Critica di Test. Latini* (Catania, 1914), dealing with the mss. of the commentaries of Aelius and Tiberius.

DONAUWÖRTH, a town of Germany in the *Land* of Bavaria, on the left bank cf the Danube, at the confluence of the Wörnitz, 25 m. N. of Augsburg by rail and at the junction of lines to Ulm and Ingolstadt. Pop. (1939) 6,041. It grew up during the 11th and 12th centuries under the protection of the castle of hlangoldstein, and became for a time in the 13th a seat of the duke of Upper Bavaria. The town received the freedom of the Empire in 1308, and resisted the encroachments of Bavaria till 1607, when the duke of Bavaria was authorized to punish the Protestant inhabitants for their interference with the abbot of the Heilig-Kreuz. In the Thirty Years' War it was stormed by Gustavus Adolphus (1632), and captured by King Ferdinand (1634). Important battles were fought in the neighbourhood in 1704 and in 1805. The imperial freedom restored to the town by Joseph I. in 1705 was again lost by reincorporation with Bavaria in 1714. The Kloster-Kirche (monasterial), a Gothic edifice, the church of the former Benedictine abbey, Heilig-Kreuz, the Gothic town hall and the so-called Tanz-haus, which now includes both a theatre and a school are notable. The industries include machinery, brewing and saw-milling; the place is a river port, and trade is in agricultural produce

DON BENITO, a town of western Spain, in the province of Badajoz; near the left bank of the river Guadiana, on the Madrid-Badajoz-Lisbon railway. Pop. (1930) 21,196. Don Benito, centre of a fertile district, dates from the 15th century, when it was founded by refugees from Don Llorente, driven out of their own town by floods from the Guadiana. Besides manufactures o oil, soap, flour, linen, lace and cloth, it has an active trade in wheat, cattle, wine and fruit, especially melons.

DONCASTER, market town, county borough, Doncaster parliamentary division, West Riding, Yorkshire, England, 156 mi. N. of London. Pop. (est. 1938) 71,600. Area 12.2 sq.mi. It lies astride the ridge dividing the watershed of the rivers Don and Trent. It is the centre of a large coal-mining area and an important station on the L.N.E. railway, whose principal locomotive and carriage works are here. It is also served by the L.M.S. railway, stands on the Great North road, and the river Don affords water communication with the Humber and Goole. The parish church of St. George (architect Sir G. G. Scott) occupies the site of an older structure, destroyed by fire in 1853. It is a fine cruciform structure of Decorated character, with a central tower 170 ft. high, and contains a fine organ. St. James's church was erected by the same architect and Lord Grimthorpe. Other important buildings are the guildhall, mansion house, public library, school of art, technical college, corn exchange and market hall. The grammar school was founded in 1553 and has been greatly enlarged. There is a large high school for girls and a school of art, while some of the elementary schools are the finest in the country.

The Doncaster racecourse lies 1 mi. S.E. of the town and is owned and managed by the corporation. The old course is 1 mi. 7 fur. 70 yd. long; the Sandall mile was added in 1892 and the straight mile in 1912. Race-meetings are normally held in September, October and May. In September the St. Leger race, which originated in 1776, is run. The grandstand was erected in 1777 but there are several other stands. Systems of electric tramways, trolley vehicles and motor omnibuses connect the borough with the coal-mining towns in the neighbourhood, there being about two dozen coal mines within a 10-mile radius. Agricultural trade is extensive, though coal working is the principal industry, and there are iron, brass, wagon, wire and agricultural machine works, toffee and chocolate works, wall-paper works and a woollen mill. Adjoining the borough are the Saxon and Norman ruins of Conisbrough castle and the remains of the Norman Tickhill castle. The town contains free libraries, a museum and art gallery, six public parks and a municipal swimming bath.

History.—There was a Roman station here, and numerous remains of the Roman period have been found. In the reign of Edward the Confessor, Doncaster belonged to Earl Tostig; but before 1086 it had been granted to Robert, earl of Mortain, nhose successor William was attainted for treason in the time of Henry I. The overlordship then fell to the crown, and the families of Fossard, Mauley and Salvin successively held the manor as underlords. Doncaster was evidently a borough held of the crown for a fee farm rent before 1194, when Richard I granted and confirmed to the burgesses their soke and town to hold by the ancient rent and by 2j marks yearly. The town was incorporated in 1467 by Edward IV. In 1623 Ralph Salvin tried to regain the manor of Doncaster from the mayor and burgesses who, fearing that the case would go against them, agreed to pay about £3,000, in return for which he gave up his claim. Charles II in 1664 gave the town a new charter, but since this was not enrolled, the burgesses obtained another charter from James II in 1684 by which the town was governed until the Municipal Corporation act. It was created a county borough in 1927. In 1200 a fair at Doncaster on the vigil and day of St. James the Apostle was confirmed, and by the charter of 1194 the burgesses received licence to hold a fair on the vigil, feast and morrow of the Annunciation. These fairs were confirmed by Henry VII in 1505. The fairs and markets are still held under these charters.

DONDERS, FRANZ CORNELIUS (1818–1889), Dutch ophthalmologist, was born on May 27, 1818, in Tilburg, and studied at Utrecht where, after being an army surgeon, he became professor of physiology in 1847. From 1852 onwards he specialized in ophthalmology to which belong his studies of the *muscae volitantes* (1847), the relation between convergence of visual axes and accommodation (1848), regeneration of the cornea

(1848), hypermetropia (1858), ametropia (1860), astigmatism (1862). His *lhe Anomalies of Refraction and Accommodation* was published in England in 1864. Donders died in Utrecht on March 24, 1889.

See: E. Clarke, *A Brief* Review *of the Work of Donders* (1914).

DONEGAL, a county in the extreme north-west of Eire, bounded north and west by the Atlantic ocean, east by Lough Foyle and the counties Londonderry and Tyrone, and south by Donegal bay and the counties Fermanagh and Leitrim. The area is 1,865 sq.mi. Pop. (1936) 142,310.

Geology.—The rocks of the county are chiefly igneous or archaean and, structurally, it is a continuation of the Scottish Highlands, the same north-east-south-west structural lines dominating both, as a result, probably, of post-Silurian ("Caledonian") earth movements. The archaean area usually forms the highest land, with quartzite standing out in white summits at Errigal (2,466 ft.) in the western or Derryveagh mountains, to the south of which is lower land towards Gweebarra bay, mostly formed by igneous rock which stretches north-eastwards along a valley with long lakes, and separates the Derryveagh from the Glendowan mountains, the latter again archaean. An important syncline of carboniferous sandstone and limestone forms the north-east shores of Donegal bay, and another one, or another part of the same one, forms the shores of Lough Foyle in Co. Londonderry and is continued south. Beyond the Donegal bay syncline, to the north-east, is a high igneous mass (Bluestack, 2,219 ft.). Much of the drainage is carried to the Foyle by the Derg and Finn rivers. Donegal includes the high Inishowen peninsula between Lough Swilly and Lough Foyle, formed mainly of archaean rocks (Slieve Snaght, 2,019 ft.), with some carboniferous along Lough Foyle. Lough Swilly is a marked feature; its upper part is related to the synclinal lines of Donegal bay and runs south-west-north-east; its lower part turns out of this direction, and is a feature related to the unequal denudation of igneous and archaean rocks and the general coastal sinking which has contributed so much to the complexity of Donegal's coast-line.

History.—The greater part of Donegal was anciently called Tyrconnell (*q.v.*) or the country of Conall; and it was sometimes called O'Donnell's country, after the head chieftains of the district. This district was formed into the county of Donegal in the reign of Queen Elizabeth, in 1585, by the lord-deputy, Sir John Perrot. At the head of Lough Swilly, on the summit of a hill 802 ft. high, are some remains of a fortress or palace of the northern Irish kings. These are known as the Grianan of Aileach, and evidently date from a period prior to the 12th century. On Tory island there are one of the best specimens of a round tower and other remains. Numerous ruins of castles along the coast prove that much attention was formerly paid to the defence of the country from invasion. The principal are Kilbarron castle, near Ballyshannon; Donegal castle and Burt castle. Traces of religious houses, some only in traditionary or documental records, are numerous; the ruins of that of Donegal, founded in 1474, may still be seen. At Raphoe, 5 m. N.W. of Lifford, is the cathedral of a former diocese united to that of Derry in 1835.

Industries.—The soil of the greater portion of the county, *i.e.*, the granite, quartz and mica slate districts, is thin and cold, while that on the carboniferous limestone is warm and friable. In most parts of the West the patches of glacial drift form the only agricultural land. Owing to the boggy nature of the soil, agriculture has not made much progress, although in certain districts (Gweedore, for instance) much land has been brought under cultivation through the enterprise of the proprietors. Wheat and barley are quite an inconsiderable crop, and in this, as well as in other respects, Donegal is much behind the rest of Ulster. It bears, however, a more favourable comparison as regards its live stock, as cattle, sheep and poultry are extensively kept.

The linen manufacture affords employment to a number of inhabitants, especially at Raphoe, while the manufacture of excellent homespun, woollen stockings and worked muslin is carried on fairly extensively. The trade in these manufactures and in the domestic produce of the county finds its principal outlets through the port of Londonderry and the inland town of Strabane, Co. Tyrone. The deep-sea fisheries are important, and are centred at Killybegs, Gweedore and Rathmullen. The salmon fishery is also prosecuted to a considerable extent, the principal seats of the trade being at Ballyshannon and Letterkenny. Bog iron-ore is raised as a gas-purifier; and talc-schist has been worked for steatite at Crohy Head. The fine-grained sandstone of Mt. Charles, near Donegal, is a well known building stone, and the granites of the north-west have attracted much attention.

Most of the railway lines are owned jointly by the G N. railway (Ireland) and the L.M S. railway, and are controlled by the Co. Donegal joint committee. The chief branch leaves the Great Northern line from Londonderry to Omagh at Strabane. From Stranorlar one line follows the upper Finn valley and serves Glenties, whilst another line utilizes a gap to the south-west and communicates with Donegal. From here local lines serve the fishing villages and resorts around Donegal bay. Letterkenny is also connected with Strabane by rail. The county town is Lifford, practically a suburb of Strabane in Co. Tyrone. Other important towns are Letterkenny (2,649), Ballyshannon (2,223) and Buncrana (2,295). The Revision of Constituencies Act (1935) assigned to East Donegal four members and to West Donegal three members in Dáil Eireann.

DONEGAL, a small seaport and market town of Co. Donegal, Eire, at the head of Donegal bay and the mouth of the river Eask. Pop. (1936) 1,315. There are ruins of a Jacobean castle (1610) on the site of a fortress of the O'Donnells of Tyrconnell, and of a Franciscan monastery (founded in 1474), at which were compiled the famous *Annals of tlze Four Masters*, a record of Irish history, completed in 1636. Donegal received a charter from James I. The name is said to allude to a settlement of the Northmen. Trade is hindered by shoals, which render difficult the approach to the harbour.

DONELSON, FORT, an entrenched camp at Dover, Tenn., U.S.A., erected by the Confederates in the Civil War to guard the lower Cumberland river, and taken by the Federals on Feb. 16, 1862. It consisted of two continuous lines of entrenchments on the land side, and water batteries commanding the river. After the capture (Feb. 6) of Fort Henry on the lower Tennessee the Union army under Brig.-gen. U. S. Grant moved to invest Donelson, two divisions marching overland while the third went by water, and the gunboat flotilla (Commodore A. H. Foote) descended the Tennessee and ascended the Cumberland to meet him. Albert Sidney Johnston, the Confederate commander in Kentucky, dividing his army, had retired himself to Nashville and had thrown a large garrison under Gen. Floyd into Donelson, and Grant was at first outnumbered; though continually reinforced, the latter had at no time more than three men to the Confederates' two. The troops of both sides were untrained but eager.

On Feb. 12 and 13, 1862, the Union divisions, skirmishing heavily during the second day, took up their positions investing the fort, and on the 14th Foote's gunboats attacked the water batteries. The latter received a severe repulse, Foote himself being amongst the wounded, and soon afterwards the Confederates determined to cut their way through Grant's lines. On the 1 jth Gen. Pillow attacked the Federal division of McClernand and drove it off the Nashville road; having done this, however, he halted, and even retired. Grant ordered Gen. C. F. Smith's division to assault a part of the lines which had been denuded of its defenders in order to reinforce Pillow. Smith personally led his young volunteers in the charge and carried all before him. The Confederates returning from the sortie were quite unable to shake his hold on the captured works, and, Grant having reinforced McClernand with Lew Wallace's division, these two generals reoccupied the lost position on the Nashville road. On the 16th, the two senior Confederate generals, Floyd and Pillow, having escaped by steamer, the infantry left in the fort under Gen. S. B. Buckner surrendered unconditionally. The Confederate cavalry under Col. Forrest made its escape by road. The prisoners numbered about 15,000 out of a total of 18,000.

See "Fort Donelson," *Military Historian and Economist,* vol. i, p. 33–62 (Cambridge, Mass, 1916); and "Campaign Against Forts Henry and Donelson," *Coast Artillery Journal,* vol. lxvii, p. 389–404 (Hampton, Va., 1927).

DONGA, a Bantu word for a narrow watercourse or eroded gully. Adopted by Europeans in S. Africa from the Kaffirs, it was applied to similar ravines or watercourses elsewhere. It is almost equivalent to the Arabic khor, which also means the dry bed of a stream and to the Indian *nullah* (properly a watercourse).

DONGAN, THOMAS: see LIMERICK, THOMAS DONGAN.

DONGOLA, a *mudiria* (province) of the Anglo-Egyptian Sudan. It lies wholly within the region known as Nubia and extends along both banks of the Nile from about 18° N. to 20° N. The rainfall is very slight, and the area of fertility is mainly confined to the lands watered by the Nile, and to the Wadi el Kab (Gab), west of and parallel to the Nile. Farther west is the extensive plateau of Jebel Abiad, and beyond, some 250 m. due west of Debba, is Bir Natron, or Bir Sultan, a valley whence natron is obtained. In this desert region is found the addax, the rarest of Sudan antelopes. The province is noted for a breed of strong, hardy horses. The largest town is Dongola, but the administrative headquarters of the mudiria are at New Merawi (Merowe, Meroe), on the left bank of the Nile, below the 4th cataract. Other towns, also on the Nile, are Debba and Korti, whence start caravan routes to Kordofan and Omdurman. Old Merawi, on the right bank of the Nile, and Sanam Abu Dom, on the left bank, indicate the site of the Ethiopian city of Napata. From Kareima, on the right or northern bank of the Nile, 6 m. above New Merawi, a railway (opened in March 1906) runs to join the main Sudan Government line at Abu Hamed. From Kareima downstream the Nile is navigable to Kerma, just above the 3rd cataract.

The Dongolese (Dongolawi, Danaglas, Danagalehs) are Nubas in type and language, but have a large admixture of Arab, Turk and other blood. They are great agriculturists and keen traders, and were notorious slave-dealers. South of Old Dongola the inhabitants are not Nubians but Shagia (*q.v.*), and the Nubian tongue is replaced by Arabic. Of the nomad desert tribes the chief are the Hawawir and Kabbabish.

History.—Dongola was once part of the empire of Ethiopia (*q.v.*), Napata being one of its capital cities. From about the beginning of the Christian era the chief tribes were the Blemmyes and the Nobatae. The latter became converted to Christianity about the middle of the 6th century. A chieftain of the Nobatae, named Silko, before the close of that century, conquered the Blemmyes, founded a new state, made Christianity the official religion of the country, and fixed his capital at (Old) Dongola. This state, generally known as the Christian kingdom of Dongola, lasted for eight or nine hundred years. Christianity, after the wars of Silko, spread rapidly, and when the Arab conquerors of Egypt sought to subdue Nubia they met with stout resistance. Dongola, however, was captured by the Muslims in 652, and the country laid under tribute (*bakt*)—400 men having to be sent yearly to Egypt. This tribute was paid when it could be enforced; sometimes the Nubians gained the upper hand, as in 737 when their king Cyriacus, marched into Egypt to redress the grievances of the Copts. By the close of the 10th century the Nubians seem to have regained almost complete independence. They did not, however, possess any part of the Red Sea coast, which was held by the Egyptians, who, during the 9th and 10th centuries, worked the emerald and gold mines between the Nile and the Red sea. The kingdom, according to the Armenian historian Abu Salih, was in a very flourishing condition in the 12th century. It then extended from Aswan southward to the 4th cataract, and contained several large cities. Gold and copper mines mere worked. The liturgy used was in Greek. In 1173 Shams ed Daula, a brother of Saladin, attacked the Nubians and captured the city of Ibrim (Primis). The Egyptians retired, and for about 100 years the country was at peace. In 1275 the Mameluke sultan Bibars aided a rebel prince to oust his uncle from the throne of Nubia; the sultans Kalaun and Nasir also sent expeditions to Dongola, which was several times captured. Though willing to pay tribute to the Muslims, the Nubians clung tenaciously to Christianity, and, despite Arab raids, the country appears during the 12th and 13th centuries to have been fairly prosperous. It is not certain how far south the authority of the Dongola kingdom (sometimes known as Mukarra) extended Another Christian state, Aloa (Alwa), with its capital Soba on the Blue Nile, was its near neighbour on the south.

Cut off from free intercourse with the Copts in Egypt, the Nubian Christians at length began to embrace Jewish and Mohammedan doctrines. The decay of the State was hastened by dissensions between Mukarra and Aloa, but the Nubians were strong enough to invade upper Egypt during the reign of Nawaya Krestos (1342–72), because the governor of Cairo had imprisoned the patriarch of Alexandria. The date usually assigned for the overthrow of the Christian kingdom is 1351. Only the northern part of the country (as far as the 3rd cataract) came under the rule of Egypt. Nevertheless, according to Leo Africanus, at the close of the 15th century Christianity and native states still survived in Nubia, and in the 16th century the Nubians sent messengers to Abyssinia to Father Alvarez, begging him to appoint priests to administer the sacraments to them—a request he was unable to grant. Thereafter the Nubian Church is without records. The region between Dongola and Shendi appears to have been depopulated. In the north the Turks introduced in the 16th century numbers of Bosnians, whose descendants ruled the district, paying a nominal allegiance to the Porte. At Ibrim, Mahass, and elsewhere along the banks and on the islands of the Nile, they built castles, now in ruins. South of Hannek the kings of Sennar became overlords of the country. As the power of the Sennari declined, the nomad Shaggia (or Shaikiyeh) attained pre-eminence in the Dongola district.

About 1812 Mamelukes fleeing from Mohammed Ali, the pasha of Egypt, made themselves masters of part of the country, destroying the old capital and building a new one lower down the Nile. In 1820 both Mamelukes and Shaggia were conquered by the Egyptians, and the Dongola province annexed to Egypt.

After the failure of the British relief expedition of 1884–85 and the Mahdist capture of Khartum it was decided to withdraw to the region of the 2nd cataract, and the Dongola Province was evacuated. The British rearguard left Dongola town in June 1885 and the Mahdists occupied it at the end of August. They held the province for 11 years, during which its northern villages were depopulated and their riverside lands laid waste. It was reoccupied by Kitchener's forces in 1896, Dongola being recaptured on Sept. 23. As a province of the reorganized Anglo-Egyptian Sudan, the country has been prosperous, and there is an increasing annual production of cotton.

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DONGOLA, a town of the Anglo-Egyptian Sudan, which gives its name to a *mudiria.* It is situated on the west bank of the Nile, about 45 m. above the third cataract, in 19° 10′ N., 30° 29′ E. It is 1,083 m. S. of Cairo by river and 638 m. N. of Khartum by the same route. It is a thriving, well-built town; an important agricultural and trading centre. Lignite is found on the east bank of the Nile opposite the town. Founded *c.* 1812 by Mamelukes who fled to Nubia from the persecutions of Mohammed Ali, the town is called Dongola Makara (New Dongola) to distinguish it from Dongola Agusa (Old Dongola), which it supplanted. The Mahdi Mohammed Ahmed was a native of Dongola. In 1884–1885 the town was the base of the British troops in their advance on Khartum.

Dongola Agusa, 75 m. upstream from New Dongola, now a heap of ruins, was the capital of the Nubian state usually called the Christian kingdom of Dongola. An Arab historian of the 11th century describes it as a large city with many churches, fine houses and wide streets. It is said to have been finally destroyed by the Mamelukes.

DONIZETTI, GAETANO (1797–1848), Italian musical composer, was born at Bergamo on Nov. 29, 1797. He studied at Naples under Simon Mayr, the operatic composer, and then under Mattei at Bologna. After his return to Bergamo, his father

insisted upon his giving lessons in order to earn his living. Donizetti revolted, and enlisted in the army. His regiment was quartered at Venice, and here the young composer's first opera, *Enrico comte di Borgogna,* saw the light in 1818.

The success of this work, and of a second opera brought out in the following year, established Donizetti's reputation. He obtained his discharge from the army, and henceforth his operas followed each other in rapid and uninterrupted succession at the rate of three or four a year. Although he had to contend successively with two such dangerous rivals as Rossini and Bellini he succeeded in taking firm hold of the public, and the brilliant reception accorded to his *Anna Bolena* at Milan, where Pasta and Rubini appeared in it, carried his name beyond the limits of his own country. In 1835 Donizetti went for the first time to Paris, where, however, his *Marino Faliero* failed to hold its own against Bellini's *Puritani,* then recently produced at the Théâtre Italien. The disappointed composer went to Naples, where the enormous success of his *Lucia di Lammermoor* (1835) consoled him far his failure in Paris. Returning to Paris he produced at the Opéra Comique what proved eventually his most popular opera, *La Fille du régiment,* but it was not till after the work had made the round of the theatres of Germany and Italy that it found favour with the French. A revival in Paris of his *Lucrezia Borgia,* produced at Milan in 1833, was interrupted by Victor Hugo's claim for infringement of copyright, and the libretto was altered. *La Favorita,* generally considered Donizetti's masterpiece, was produced in 1840. His next important work, *Linda di Chamounix,* was written for Vienna, where it was received most favourably in 1842, and the same success attended the production of *Don Pasquale* in Paris in 1843. Soon after this event the first signs of a fatal disease, caused to a great extent by overwork, began to show themselves. The utter failure of *Don Sebastian,* a large opera produced soon after *Don Pasquale,* is said to have hastened the catastrophe. A paralytic stroke in 1844 deprived Donizetti of his reason, and for four years he lingered on in a state of mental and physical prostration. A visit to his country was proposed as a last resource, but he reached his native place only to die there on April 1, 1848.

The sum total of his operas amounts to sixty-four. The large number of his works accounts for many of their chief defects. His rapidity of working made all revision impossible. It is said that he once wrote the instrumentation of a whole opera within thirty hours. And yet it may be doubted whether more elaboration would have essentially improved his work, for the dramatic last act of the *Favorita,* infinitely superior to the preceding ones, is also said to have been the product of a single night.

Without boasting the sweetness of Bellini or the sparkle of Rossini, Donizetti won the popular ear by his flow of melody and by his rare skill in writing for the voice, to which qualities may be added his power of humorous delineation, as evinced in *Don Pasquale* and *L'Elisir d'amore,* which works will probably last as long as anything he ever wrote.

See F. Cicconetti, *Vita di G. Donizetti* (1864); *Lettere inedite di Gaetano Donizetti* (ed. Eisner-Eiscnhoff, 1897); Ch. Malherbe, *Le centenaire de Donizetti* (1897); and *A.* Cametta, *Donizetti* (1907).

DONJON, the French term for the keep (*q.v.*) of a mediaeval castle, used in contradistinction to *dungeon* (*q.v.*), the prison, an anglicized spelling of the same word.

DON JUAN, a legendary character, whose story has found currency in various European countries. He was introduced into formal literature in the Spanish *El Burlador de Sevilla y convidado de piedra,* a play which was first printed at Barcelona in 1630, and is usually attributed to Tirso de Molina; but the story of a profligate inviting a dead man to supper, and finding his invitation accepted, was current before 1630, and is not peculiar to Spain. The available evidence goes to show that Don Juan is a universal type, the subject of local myths in many countries, that he received his name in Spain, and that the Spanish version of his legend has absorbed certain elements from the French story of Robert the Devil. The character of Don Juan as the incarnation of perverse sensuality and arrogant blasphemy, may be considered as the creation of the author of El *Burlador.* The drama was apparently more popular in Italy than in Spain, and was frequently given in pantomime by Italian actors, a company of whom took the story into France in 1657. It was dramatized by Dorimond in 1659 and by De Villiers in 1661; their attempts suggested *Le Festin de Pierre* (1665) to Molitre, who substituted prose for verse, reduced the supernatural element, and interpolated new comic effects. The story was introduced into England by Sir Aston Cokain in his unreadable *Tragedy of Ovid* (1669), and was the theme of *The Libertine* (1676) by Shadwell. *El Burlador* was recast, but not improved, by Antonio de Zamora early in the 18th century, and a hundred years later the character was endowed with a new name in Espronceda's *Estudiante de Salamanca.* But the most curious resuscitation of the type in Spain is the protagonist in Zorrilla's *Don Juan Tenorio,* which is usually played in all large cities during the first week in November, and has come to be regarded as an essentially national work. It is in fact little more than an adaptation of the elder Dumas' *Don Juan de Marana,* which, in its turn, derives chiefly from Mérimée's novel, *Les Ames du Purgatoire.* Byron's *Don Juan* resembles Ulloa's murderer in nothing but his name.

The sustained popularity of the Don Juan legend is undoubtedly due in great measure to Mozart's incomparable setting of Da Ponte's mediocre libretto. In this pale version of *El Burlador de Sevilla* the French romantic school made acquaintance with Don Juan, and hence, no doubt, the works of Mérimée and Dumas already mentioned, Balzac's *Élixir d'une longue vie,* and Alfred de Musset's *Une Matinée de Don Juan* and *Namouna.* The legend has been treated subsequently by Flaubert and Barbey d'Aurevilly in France, by Landau and Heyse in Germany, by Sacher-Masoch in Austria and in a highly modernized form by G. B. Shaw *(Man and Superman).* It has always fascinated composers. Mozart's *Don Giovanni* has annihilated the earlier operas of Le Tellier, Righini, Tritto, Gardi and Gazzaniga; but Gluck's ballet-music still survives, and Henry Purcell's setting—the oldest of all—has saved some of Shadwell's insipid lyrics from oblivion.

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DONKEY: *see* Ass.

DONKEY-ENGINE. A steam-engine of small or moderate power which works a crane or hoist, chiefly on board ship, to handle cargo and luggage. The steam is supplied by a donkey-boiler, instead of being taken from the main boilers. A donkey-pump is of very compact design, and suitable for being bolted to a ship's side, a column or wall, or a boiler. It is used for feeding boilers, tanks, vats, etc., and works by the direct action of a steam driven piston on a plunger in the pump cylinder. A flywheel helps to maintain a steady action of the pump. The smallest pumps, of the type shown *(see* p. 530), deliver about 90gal. per hour, and the largest 4,000.

DONKIN, SIR RUFANE SHAW (1773–1841), British soldier, son of Robert Donkin (d. 1821), joined the army at the age of 14. He was divisional commander in Hastings' operations against the Mahrattas (1817–18), receiving the K.C.B. as his reward. From 1820 to 1821 he administered the Cape of Good Hope with success, and named the rising seaport of Algoa bay Port Elizabeth in memory of his wife. In 1821 he became lieutenant-general and G.C.B.

See Jerdan, *National Portraits,* vol. iii.; *Gentleman's Magazine,* xcii. i. 273.

DONNAY, CHARLES MAURICE (1859–), French dramatist, was born of middle-class parents in Paris in 1859. He made his serious début as a dramatist on the little stage of the Chat Noir with *Phryné* (1891), a series of Greek scenes. *Lysistrata,* a four-act comedy, was produced at the Grand Théâtre in 1892 with Mme. Réjane in the title part. Later plays include *Folle Entreprise* (1894); *Pension de famille* (1894); *Amants* (1895), produced at the Renaissance theatre with Mme. Jeanne Granier as Claudine Rozeray; *La Douloureuse* (1897); *L'Affranchie* (1898); *Georgette Lemeunier* (1898); *Le Torrent* (1899), at the Comédie Française; *Education de prince* (1900), and *Oiseaux*

de Passage (1904), in collaboration with L. Descaves; *La Bascule* (1901); *L'Autre danger,* at the *Comédie Française* (1902); *Le Retour de Jérusalem* (1903); *L'escalade* (1904); and *Paraître* (1906). With *Amants* he won a great success, and the play was hailed by Jules Lemaître as the *Bérénice* of contemporary French drama. The whole series of plays reflect the various questions agitating society at the time, and the witty dialogue is written with an apparent carelessness that approximates very closely to the language of every day.

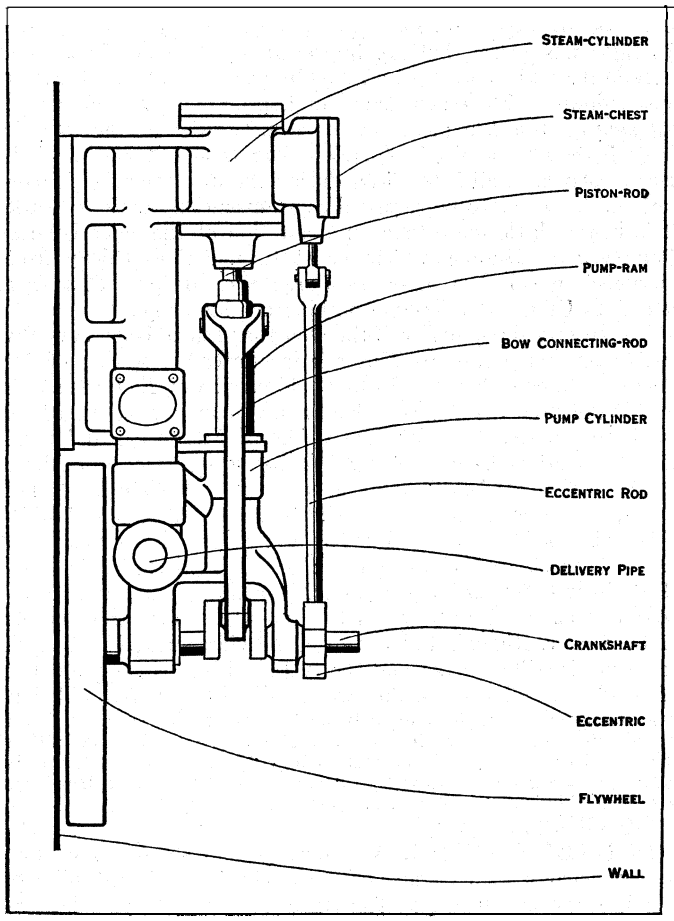


DIAGRAM OF A DONKEY PUMP. THE PUMP-RAM IS WORKED DIRECT BY THE PISTON ROD OF THE STEAM CYLINDER, AND THE FLYWHEEL PROVIDES A STEADY ACTION. (SEE P. 529)

DONNE, JOHN (1573–1631), English poet and divine of the reigns of James I., and Charles I., was born in 1573 in the parish St. Nicholas Olave, in the city of London. His father was a wealthy merchant, who next year became warden of the Company of Pronmongers, but died early in 1576. Donne's parents were Catholics, and his mother, Elizabeth Heywood, was directly descended from the sister of the great Sir Thomas More; she was the daughter of John Heywood the epigrammatist. As a child, Donne's precocity was such that it was said of him that "this age hath brought forth another Pico della Mirandola." He entered Hart Hall, Oxford, Oct. 1584, and left it in 1587, proceeding, according to Walton, to Cambridge, where he remained three years. At Oxford began his friendship with Henry Wotton, and at Cambridge, probably, with Christopher Brooke. Donne was "removed to London" about 1590 and in 1592 he entered Lincoln's Inn with the intention of studying the law.

When he came of age, he found himself in possession of a considerable fortune, and about the same time rejected the Catholic doctrine in favour of the Anglican communion. He began to produce *Satires,* which were not printed, but eagerly passed from hand to hand; the first three are known to belong to 1593, the fourth to 1594, while the other three are probably some years later. In 1596 Donne engaged himself for foreign service under the earl of Essex, and "waited upon his lordship" on board the "Repulse," in the magnificent victory of the 11th of June. We possess several poems written by Donne during this expedition, and during the Islands Voyage of 1597, in which he accompanied Essex to the Azores. According to Walton, Donne spent some time in Italy and Spain, and intended to proceed to Palestine, "but at his being in the farthest parts of Italy, the disappointment of company, or of a safe convoy or the uncertainty of returns of money into those remote parts, denied him that happiness." There is some reason to suppose that he was on the Continent at intervals between 1595 and the winter of 1597. His lyrical poetry was mainly the result of these years, if we are to believe Ben Jonson, who told Drummond of Hawthornden that Donne "wrote all his best pieces ere he was 25 years old." At his return to England he became private secretary to Sir Thomas Egerton, the lord keeper (afterwards Lord Chancellor Ellesmere), in whose family he remained four years. In 1600 he found himself in love with his master's niece, Anne More, whom he married secretly in Dec. 1601. As soon as this act was discovered, Donne was dismissed, and then thrown into the Fleet prison (Feb. 1602), from which he was soon released. His circumstances, however, were now very much straitened. His own fortune had all been spent and "troubles did still multiply upon him." Mrs. Donne's cousin, Sir Francis Wooley, offered the young couple an asylum at his country house of Pyrford, where they resided until the end of 1604.

During the latter part of his residence in Sir Thomas Egerton's house, Donne had composed the longest of his existing poems, *Of the Progress of the Soul,* not published until 1633. In the spring of 1605 we find the Donnes living at Camberwell, and a little later in a small house at Mitcham. He had by this time "acquired such a perfection" in civil and common law that he was able to take up professional work, and he now acted as a helper to Thomas Morton in his controversies with the Catholics. Donne is believed to have had a considerable share in writing the pamphlets against the papists which Morton issued between 1604 and 1607. In the latter year, Morton offered the poet certain preferment in the Church, if he would only consent to take holy orders. Donne, however, although he was at this time become deeply serious on religious matters, did not think himself fitted for the clerical life. In 1607 he started a correspondence with Mrs. Magdalen Herbert of Montgomery castle, the mother of George Herbert. Some of these pious epistles were printed by Izaak Walton. These exercises were not of a nature to add to his income, which was extremely small. His uncomfortable little house he speaks of as his "hospital" and his "prison"; his wife's health was broken and he was bowed down by the number of his children, who often lacked even clothes and food. In the autumn of 1608, however, his father-in-law, Sir George More, became reconciled with them, and agreed to make them a generous allowance. Donne soon after formed part of the brilliant assemblage which Lucy, countess of Bedford, gathered around her at Twickenham; we possess several of the verse epistles he addressed to this lady. In 1609 Donne was engaged in composing his great controversial prose treatise, *Pseudo-Martyr,* printed in 1610; this was an attempt to convince Roman Catholics in England that they might, without any inconsistency, take the oath of allegiance to James I. In 1611 Donne wrote a curious and bitter prose squib against the Jesuits, entitled *Conclave Ignati.* To the period between 1602 and 1609, belongs the apology for the principle of suicide, which was not published until 1644, long after Donne's death. This work. *Biathanatos,* is an attempt to show that "the scandalous disease of headlong dying," to which Donne himself in his unhappy moods had "often such a sickly inclination," was not necessarily and essentially sinful.

In 1610 Donne formed the acquaintance of a wealthy gentleman, Sir Robert Drury of Hawsted, who offered him and his wife an apartment in his large house in Drury lane. Drury lost his only daughter, and in 1611 Donne published anonymously an extravagant elegy on her, entitled *An Anatomy of the World,* to which he added in 1612 a *Progress of the Soul* on the same subject; he threatened to celebrate the "blessèd Maid," Elizabeth

Drury, in a fresh elegy on each anniversary of her death, but he happily refrained from the third occasion onwards. At the close of 1611 Sir Robert Drury determined to visit Paris (but not, as Walton supposed, on an embassy of any kind), and he took Donne with him. When he left London, his wife was expecting an eighth child. It seems almost certain that her fear to have him absent led him to compose one of his loveliest poems:

Sweetest Love, I do not go
For weariness of thee.

He is said to have had a vision, while he was at Amiens, of his wife, with her hair over her shoulders, bearing a dead child in her arms, on the very night that Mrs. Donne, in London (or more probably in the Isle of Wight), was delivered of a still-born infant. He suffered, accordingly, a great anxiety, which was not removed until he reached Paris, where he received reassuring accounts of his wife's health. The Drurys and Donne left Paris for Spa in May 1612, and travelled in the Low Countries and Germany until September, when they returned to London. In 1613 Donne contributed to the Lachrymae *lachrymarum* of Sylvester an obscure and frigid elegy on the death of the prince of Wales, and wrote his famous Marriage Song for St. Valentine's Day to celebrate the nuptials of the elector palatine with the princess Elizabeth. About this time Donne became intimate with Robert Ker, then Viscount Rochester and afterwards the infamous earl of Somerset, from whom he had hopes of preferment at court. Donne was now in weak health, and in a highly neurotic condition. It is probable that at this time he went through a spiritual crisis which, after many misgivings on his part, ended in a determination to enter the ministry—a course which some of his friends had been urging him to adopt for no little time. At the close of 1614 the king sent for Donne to Theobald's, and "descended to a persuasion, almost to a solicitation of him, to enter into sacred orders," but Donne asked for a few days to consider. Finally, early in 1615, King, bishop of London, "proceeded with all convenient speed to ordain him, first deacon, then priest." He was, perhaps, a curate first at Paddington, and presently was appointed royal chaplain.

His earliest sermon before the king at Whitehall carried his audience "to heaven, in holy raptures." In April, not without much bad grace, the University of Cambridge consented to make the new divine a D.D. In the spring of 1616, Donne was presented to the living of Keyston, in Hunts, and a little later he became rector of Sevenoaks; the latter preferment he held until his death. In October he was appointed reader in divinity to the benchers of Lincoln's Inn. His anxieties about money now ceased, but in Aug. 1617 his wife died, leaving seven young children in his charge. Perhaps in consequence of his bereavement, Donne seems to have been inspired with a peculiar fervour of devotion. In 1618 he wrote a cycle of Holy Sonnets, which was not printed in complete form until by Sir Edmund Gosse in 1899. Of the very numerous sermons preached by Donne at Lincoln's Inn, 14 have come down to us. His health suffered from the austerity of his life, and it was probably in connection with this fact that he allowed himself to be persuaded in May 1619 to accompany Lord Doncaster as his chaplain on an embassy to Germany. Having visited Heidelberg, Frankfurt and other German cities, the embassy returned to England at the opening of 1620.

In Nov. 1621, James I., knowing that London was "a dish" which Donne "loved well," "carved" for him the deanery of St. Paul's. He resigned Keyston, and his preachership in Lincoln's Inn (Feb. 1622). In Oct. 1623 he suffered from a dangerous attack of illness, and during a long convalescence wrote his Devotions, a volume published in 1624. He was now appointed to the vicarage of St. Dunstan's in the West. In April 1625 Donne preached before the new king, Charles I., a sermon which was immediately printed, and he now published his Four Sermons upon Special Occasions, the earliest collection of his discourses. When the plague broke out he retired with his children to the house of Sir John Danvers in Chelsea, and for a time he disappeared so completely that a rumour arose that he was dead. Sir John had married Donne's old friend, Mrs. Magdalen Herbert, for whom Donne wrote two of his most ingenious poems, "The Primrose" and "The Autumnal." The popuiarity of Donne as a preacher rose to its zenith when he returned to his pulpit, and it continued there until his death. Walton, who seems to have known him first in 1624, now became an intimate and adoring friend. In 1630 Donne's health, always feeble, broke down completely, so that, although in August of that year he was to have been made a bishop, the entire collapse of his health made it worse than useless to promote him. The greater part of that winter he spent at Abury Hatch, in Epping Forest, with his widowed daughter, Constance Alleyn, and was too ill to preach before the king at Christmas. It is believed that his disease was a malarial form of recurrent quinsy acting upon an extremely neurotic system. He came back to London, and was able to preach at Whitehall on Feb. 12, 1631. This, his latest sermon, was published, soon after his demise, as *Death's* Duel. He now stood for his statue to the sculptor, Nicholas Stone, standing before a fire in his study at the deanery, with his winding-sheet wrapped and tied round him, his eyes shut, and his feet resting on a funeral urn. This lugubrious work of art was set up in white marble after his death in St. Paul's cathedral, where it may still be seen. Donne died on March 31, 1631, after he had lain "15 days earnestly expecting his hourly change." His aged mother, who had lived in the deanery, survived him, dying in 1632.

Donne's poems were first collected in 1633, and afterwards in 1635, 1639, 1649, 1650, 1654 and 1669. Of his prose works, Pseudomartyr appeared in 1610; *Ignatius,* both in Latin and in English, in 1611; the Devotions, in 1624; the Juvenilia in 1633; the *LXXX* Sermons in 1640; Biathanatos in 1644; Fifty Sermons in 1649; Essays in Divinity 1651; his Letters to Several Persons of Honour; 1651; Paradoxes, Problems and Essays (a reprint of *Ignatius* and the *Juvenilia* with some new, and some spurious, matter), 1652; and Six and Twenty Sermons, 1661. Izaak Walton's Life of Donne, an admirably written but not entirely correct biography, preceded the Sermons of 1640. The principal editor of his posthumous writings was his son, John Donne the younger (1604–62), a man of eccentric and scandalous character, but of considerable talent.

The influence of Donne upon the literature of England was singularly wide and deep, although almost wholly malign. His originality and the fervour of his imaginative passion made him extremely attractive to the younger generation of poets, who saw that he had broken through the old tradition, and were ready to follow him implicitly into new fields. In the 18th century his reputation almost disappeared, to return, with many vicissitudes in the course of the 19th. The first impression of an unbiassed reader who dips into the poems of Donne is unfavourable. He is repulsed by the intolerably harsh and crabbed versification, by the recondite choice of theme and expression, and by the oddity of the thought. In time, however, he perceives that behind the fantastic garb of language there is an earnest and vigorous mind, an imagination that harbours fire within its cloudy folds, and an insight into the mysteries of spiritual life which is often startling. Donne excels in brief flashes of wit and beauty, and in sudden daring phrases that have the full perfume of poetry in them. Some of his lyrics and one or two of his elegies excepted, the Satires are his most important contribution to literature. They are probably the earliest poems of their kind in the language, and they are full of force and picturesqueness. Their obscure and knotty language only serves to give peculiar brilliancy to the not uncommon passages of noble perspicacity.

BIBLIOGRAPHY.—Izaak Walton's Life, first published in **1640,** and entirely recast in **1658,** has been constantly reprinted. Donne's prose works have not been collected. In **1899** Edmund Gosse published in two volumes Tke Life and Letters of Jokn Donne, for the first time revised and collected. The standard edition of Donne's Poems is that published in two volumes, by Professor Herbert J. C. Grierson (Oxford **1912**); A Study of Donne's Prose Works by Evelyn M. Simpson (Oxford 1924) deals with the rest of his work and prints new letters. A full Bibliography by G. L. Keynes was published at the Cambridge Press in 1915. (E. G.)

DONNER, RAPHAEL GEORG (1693–1741), Austrian sculptor, born on May 24, 1693, at Esslingen in Lower Austria, went to Heiligenkreuz intending to take holy orders, but he was there encouraged to follow his artistic bent by the sculptor Giul-

iano, and, after working in his studio, entered the Vienna academy. His fine work brought him to the notice of the court and he found employment in Salzburg for some years, afterwards returning to Vienna, where he died on Feb. 15, 1741. His masterpiece is the fountain on the Neumarkt in Vienna, which he executed in the years 1738 and 1739. The figures originally cast in lead, a technique favoured by the artist, were replaced by exact copies in bronze in 1873. Other works are the fountain with Perseus and Andromeda in the courtyard of the Vienna Rathaus and a statue of Charles VI. in the Belvedere, Vienna. Donner's refined plastic form and clear outline contrasted with the art of his contemporaries and predecessors, who tended towards exaggerating the restlessness of Bernini's baroque style, and influenced his followers to adopt a more classic conception of form.

DONNYBROOK, part of Dublin, Eire. The former village of the name was famous for a fair held under licence from King John in 1204, but discontinued in 1855.

DONO, PAOLQ DI: see UCCELLO.

DONORA, a borough of Washington county, Pa., U.S.A., on the Monongahela river and the Pennsylvania railroad, 20 mi. S. by E. of Pittsburgh. The population in 1920 was 14,131; in 1930 it was 13,905; in 1940, 13,180 by federal census. It is an important manufacturing centre of the Pittsburgh district, producing steel, nails, wire, zinc and chemicals.

DONOSO CORTÉS, JUAN, marquis de Valdegamas (1809–1853), Spanish author and diplomatist. After entering politics as an advanced liberal, he made a complete volte-face after 1848, and in his Ensayo *sobre* el *catolicismo,* el *liberalismo,* y el socialismo, *considerados* en *sus principios fundamentales* (1851), denounced reason as the enemy of truth and liberalism as leading to social ruin. With all its rhetorical excesses, the Ensayo remains one of the finest specimens of impassioned prose published in Spain during the 19th century.

DOOM, originally a law or enactment, the legal decision of a judge, and particularly an adverse sentence on a criminal (O.E. *dóm,* a word common to Teut. languages for that which is set up or ordered). The word is thus applicable to the adverse decrees of Fate, and particularly to the day of judgment. The verb "deem," to deliver a judgment, is seen in "deemster," the name of the two judges of the Isle of Man (*q.v.*).

DOON DE MAYENCE, a hero of romance, who gives his name to the third cycle of the Charlemagne romances, those dealing with the feudal revolts. There is no real unity in the geste of Doon de Mayence. The rebellious barons are connected by the *trouvères* with Doon by imaginary genealogical ties, and all are represented as in opposition to Charlemagne, though their adventures, in so far as they possess a historical basis, must generally be referred to earlier or later periods. The general insolence of their attitude to the sovereign suggests that Charlemagne is here only a name for his weaker successors. The tradition of a traitorous family of Mayence, which was developed in Italy into a series of stories of criminals, was, however, anterior to the Carolingian cycle, for an interpolator in the chronicle of Fredegarius states (iv. 87) that the army of Sigebert was betrayed from within its own ranks by men of Mayence in a battle fought with Radulf on the banks of the Unstrut in Thuringia. The chief heroes of the poems which make up the geste of Doon de Mayence are Ogier the Dane (*q.v.*), the four sons of Aymon (see RENAUD), and Huon of Bordeaux (*q.v.*). It is probable that Doon himself was one of the last personages to be clearly defined, and that the chanson de geste relating his exploits was drawn up partly with the view of supplying a suitable ancestor for the other heroes. The latter half of the poem, the story of Doon's wars in Saxony, is perhaps based on historical events, but the earlier half is obviously pure fiction and dates from the 13th century.

See *Hist. litt.* de la France, vols. xxii. and xxvi. (1852 and 1873), for analyses of these poems by Paulin Paris; also J. Barrois, *Éléments* rarolingiens (1846); W. Niederstadt, Alter und Heimat der altfr. *Doon* (Greifswald, 1889). The prose romance, La *Fleur des batailles* Doolin de Mayence, was printed by Antoine Vérard (1501), by Alain Lotrian and Denis Janot (c. 1530), by N. Bonfons (no date), by J. Waesbergue (Rotterdam, 1604), etc. The chief poems of the cycle are available in the series of Anciens *Poètes* de la France (1859, etc.).

DOOR, a single piece, or assemblage of pieces, of wood, metal, stone or other material, supported movably in an opening, so as to allow or prevent passage through that opening. In door openings of primitive huts sheets of hide or textiles were hung as doors. These were either hung as flaps or else arranged to roll up. In the tomb of Ti, in Egypt, of the 5th dynasty, there are elaborate wall-painting representations of doors of richly decorated matting which were rolled up to the top, like an awning, to admit entrance, and in certain Italian churches to the present day similar flaps of leather are used as secondary doors. Doors of more rigid materials came into use early and consisted, apparently, of single heavy wooden boards, with pivots at the top and bottom of one side, fitted into sockets in the sill and head. This seems to have been the common practice in Egypt; when the doorway was wide, two such doors were used, pivoted on opposite sides.

In countries where wood was scarce, stone doors were used. This is notably the case in Syria, where many stone doors dating from the 4th to the 6th century have been found. Similar doors of stone or marble were frequent in tombs. There is a famous marble door from a tomb in Pompeii, probably of the Augustan era. These stone doors were always panelled, very likely to lessen the weight without reducing the strength.

In countries with damp climates, where single pieces of wood would warp, wooden doors are built up of several pieces, either by forming them of a series of vertical planks, tied together by tenons, dowels or horizontal braces known as battens, or else by forming a framework of uprights called stiles, and horizontal members called rails, with thinner panels placed between them and held in by grooves or additional mouldings. In Syria, Palestine and Mesopotamia wooden doors were frequently sheathed in sheets of metal richly *repoussé.* In the British Museum there are numerous examples of the bronze bands decorated with processions of figures and battle scenes and also the bronze pivots from the gates at Balawat (895–825 B.C.). These gates were of two leaves, each about 8ft. 4in. wide and 27ft. high, and the bands which decorated them are 10in. high. Solomon's temple is described (I Kings vi.) as having doors of carved wood covered with gold leaf.

Classic doors were usually of wood, panelled. Representations in Pompeiian wall paintings and contemporary reliefs show that they greatly resembled the doors of the present day, and a plaster cast of an original charred door confirms this. These ancient doors seem to have been frequently in two, three or four leaves, and hinges connecting the leaves of such a door have been found. The doors for monumental buildings were largely of bronze (see BRONZE) and the beautifully designed example in the Pantheon (A.D. 110–125) is famous. Several similar Roman examples remain, especially those of the basilica of SS. Coamas and Damian, in Rome, taken from an earlier building dating from the best Roman imperial period, and those of the Lateran basilica. The most important Byzantine examples extant are those of S. Sophia, Constantinople. They are heavily panelled with deep mouldings and further enriched by rows of rosettes and decorative bolt heads. The influence of Roman precedent is obvious in the design. Many Romanesque bronze doors exist in south Italy. In these the panels are small, shallow and usually square. The richness is obtained through low relief that is sometimes scarcely more than engraving. The finest examples are those at Amalfi (1060), two at Troja (1119 and 1124), that at Ravello (1179) and the doors of Trani cathedral (late 12th century).

Late in the 12th century the pivoting of the doors at top and bottom gave way, generally, to the use of hinges; this change offered great opportunities for door decoration which was represented in most of the important Gothic cathedrals. Here the doors are usually simple planked doors of wood, the decoration consisting of the elaborate wrought iron hinge plates (see IRON IN ART) hammered into intricate foliated scrolls; occasionally, as in the famous doors of Notre Dame at Paris (early 13th century), additional cross braces of similar foliated wrought iron are introduced among the three hinges. In the late Gothic period this usage died out. Decoration was obtained in the wood of the door itself by forming the panels with tracery, occasionally very

intricately, and sometimes adding miniature buttresses and carved figures. In the smaller doors the use of the linen fold (simulating folded cloth) decoration is common. With the coming of the early Renaissance a similar kind of decoration was carried out with even greater richness, and wooden doors, in which panels crowded with figures, buttresses, simulated architectural forms and decorated mouldings give an impression of extraordinary richness. arc characteristic: *e.g.,* the doors of S. Maclou at Rouen, by Jean Goujon, 1540. The later Renaissance returned to more classic and simple forms. Typical are the bronze doors of the Baptistery at Florence designed by Ghiberti (1402–52). Although in the north doors he followed the Gothic scheme of Andrea Pisano's south door, in the east, despite the complexity and beauty of the figure decoration, the scheme is rigidly rectangular. The use of rectangular or square panels remained constant throughout the Italian Renaissance, but in France, from the time of Henry IV. on, doors became more and more fantastic, culminating in those of the time of Louis XIV. and Louis XV., with their curved headed panels and double or triple mouldings.

In Muslim doors the enormous skill in elaborate wood framing possessed by Mohammedan carpenters finds congenial expression and the most intricate panelled types, with star-shaped and polygonal panels, are common. Frequently additional decoration is given by complicated pierced and cut out metal mountings; somewhat similar mountings ornament the corners of the temple doors of China and Japan. These doors are usually of two panels, the lower solid, the upper filled with elaborate grill work in wood, either based on hexagonal patterns and triangles or an intricate network of straight lines of varying angles and lengths, over which paper is pasted in lieu of glass. In Japanese houses doors are usually sliding and may have the same pattern as the walls.

Modern wooden doors continue the traditional panel type. In construction, however, solid doors are more and more giving place to those in which a core of small pieces of soft wood is covered by sheets of veneers, enabling the occasional abandonment of panels and the making of flush doors which are commonly used in hospitals. Another characteristic modern development has been the tremendous increase in the number and variety of metal doors in connection with fire-proof construction. These are of two types: metal covered or kalamein, in which a core of wood is covered with metal sheets, carefully soldered and locked together; and hollow metal, in which a frame of structural metal sections is encased with metal plates. In both of these types, for structural reasons, the panel design is usually perpetuated, but flush pattern hollow metal doors are becoming more and more common. The use of top and bottom pivots instead of hinges is frequent in exterior doors, particularly where there are several doors in a row, in order to avoid vertical bars or mullions between them. Elaborate mechanical development of all types of locks, hinges, pivots, door checks and door closers is noteworthy. *(See* DOORWAY.) (T. F. H.)

DOORWAY, in architecture, the entrance of a building, room or enclosure, especially the framing of such an opening. In primitive construction with brick or rubble, opening frames were usually of wood, and consisted of uprights or jambs on each side, and lintels or heads at the top. Such doorways occurred in the archaic work in Greece, and evidences of wooden frames exist in Tiryns from about the 12th century B.C. and in the Heraeum at Olympia, where the early, crude arrangement was preserved all through. In wooden framed buildings the lintel is usually framed between the uprights which continue up beyond it. Examples of this arrangement are represented in certain Egyptian mastaba tombs of the second, third and fourth dynasties. Where building is all in cut stone, no separate door frame is necessary, but decorative lines are, nevertheless, frequently carried around the opening, as a legacy from other and earlier types of building.

In Egyptian work, although the doorway jambs are not indicated, and the banding of the cut stone wall is frequently carried, unbroken, straight to the opening, the head was expressed by means of a projecting cornice This cornice was of the usual *cavetto* or concave type, and often carried a decoration in the centre, formed of the winged globe symbolizing the sun. In some of the doorways in the stone screen walls of later Egyptian temples it was necessary for the door opening to be carried up higher than the height of the screen, to allow banners and the sacred boats to be carried through in processions. In order to accomplish this and still. preserve the doorway form, the head was not complete and was formed merely by stones with small projections inward from the jambs, ornamented, however, like the complete lintels, as in the famous Ptolemaic temple at Edfu (237 to 57 B.C.).

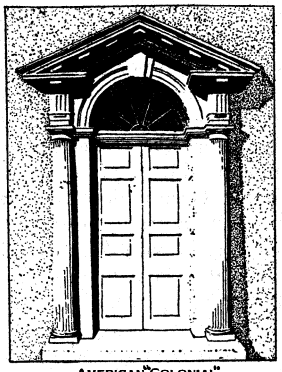
In archaic Etruria as well as in Greece doorways were frequently smaller at the top than at the bottom, in order to lessen the length of the lintel, and apparently in both countries, at nearly the same time, the idea occurred of decorating the jambs and lintel by means of a continuous moulding, running up the sides and across the top. As the lintel was frequently longer than the combined width of opening and jamb stones, and the moulding was cut round the outside, projections in the architrave or moulding were formed at the level of the lintel. These are called keys or *croisettes.* Examples of this occur in the Beule gateway of the Acropolis at Athens, in many Etruscan tombs from the 7th to the 5th century B.C., and in the temple of Hercules at Cori (72 B.C.). In the Etruscan examples the lintel keys are sometimes further decorated by down-curving pendants. In the developed classic treatment the moulding around the jamb and heads is treated as an architrave, usually with two or three bands and a raised moulding on the outside. Frequently a frieze and cornice are added, sometimes with consoles (*q.v.*), which are always set on the outside of the architrave moulding, as in the doorway of the Erechtheum (*q.v.*) at Athens, completed 408 B.C., and in the colossal doorway of the temple of Jupiter at Baalbek (C. A.D. 120) which is zoft. wide and 45ft. high. The doorway of the Pantheon at Rome (A.D. 110–125), of the same width, still possesses the original Roman bronze door frame, door and transom screen.

In both the Romanesque and Gothic periods church doorways were among the most characteristic features of the styles. They were formed by means of an elaborate series of recesses in the thickness of the wall, usually in steps or orders, which ran not only up the sides, but also in an arch over the top, leaving a lunette (*q.v.*) or *tympanum* (a section of vertical wall) between the under side of the arch and the horizontal head of the door opening. These steps or orders were ornamented with mouldings, carvings and sculpture; occasionally columns were placed at the side. In Gothic work statues often take the place of columns, and bands of angels, under little canopies (*q.v.*), encircle the arch between the mouldings. The *tympanum* and door lintel are also richly sculptured, and there is often a central pier dividing the door opening in two, frequently carrying a statue, especially in the Gothic. A moulding projecting from the wall surface and called a drip or hood mould frequently surrounds the entire arch.

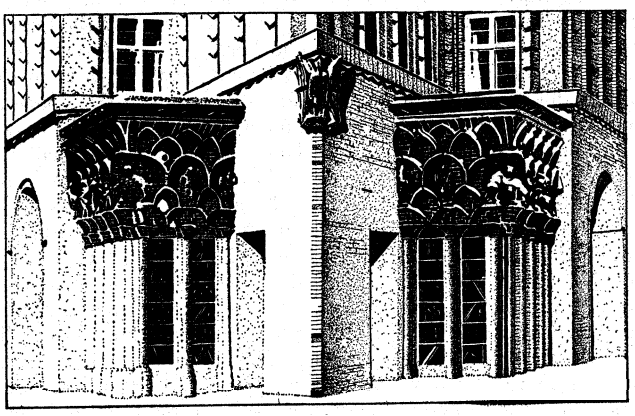
In the Renaissance period doorway design returned to generally classic lines. In the early Renaissance, however, classic motives of great complexity were used for doorway decoration in a manner far different from the usual Roman or Greek precedent. Colonnettes, gaines (half figures used as supports), pediments and arches with decorated lunettes are common; especially fantastic are the examples found in the transitional Renaissance of Germany, France and England. With increasing knowledge of classic detail more sober treatments prevailed. The use of columns and pilasters with pediments remained general. During the baroque period these basically classic motives received the typical fantastic and imaginary treatment. Noteworthy among these later Renaissance doorways are those of England and America in the late 18th and early 19th centuries, in which side-lights at each side of the door and a fanlight above, often with rich decorative leading, are all enclosed in a single doorway frame.

In Muslim countries doorways achieve enormous importance, the door itself being often merely an incident in a rich composition running the entire height of the wall. This usually takes the form of an arched niche or recess, sometimes crowned with a stalactite vault, sometimes simply a high pointed arch, as in the magnificent tile-lined mosque doorways of Persia.

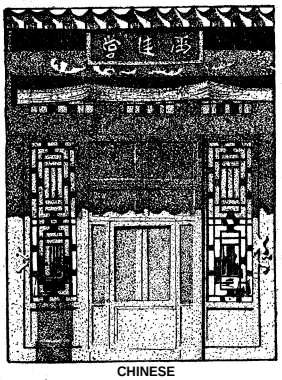
Chinese and Japanese doorways are commonly simple, their type of timber framing allowing little decorative treatment. Occa-



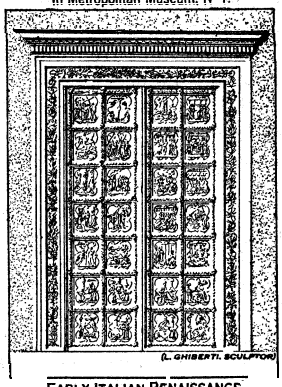
AMERICAN "COLONIAL" TAVERN. ALEXANDRIA. VA.
In Metropolitan Museum. N Y.



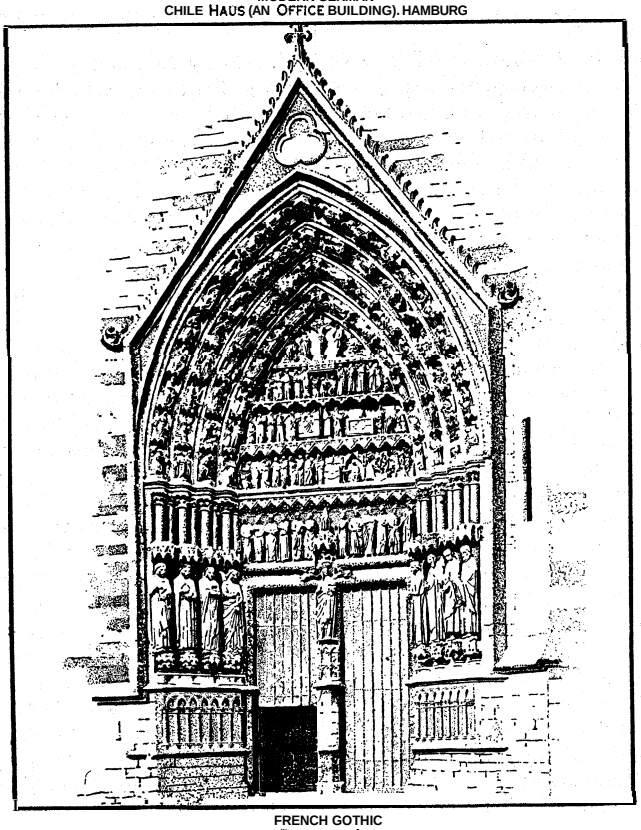
MODERN GERMAN
CHILE HAUS (AN OFFICE BUILDING). HAMBURG



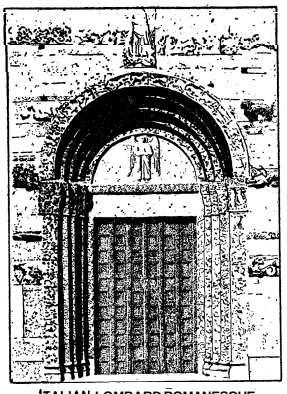
CHINESE
SUMMER PALACE. PEKING



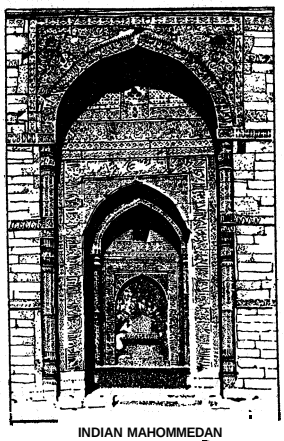
EARLY ITALIAN RENAISSANCE
FROM BAPTISTRY. FLORENCE



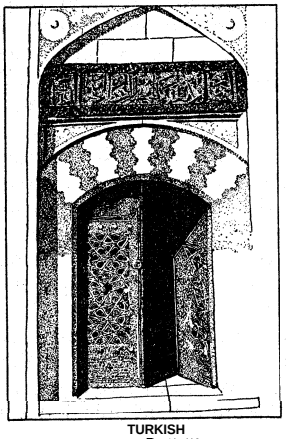
FRENCH GOTHIC
SOUTH TRANSEFT DOORWAY. AMIENS CATHEDRAL



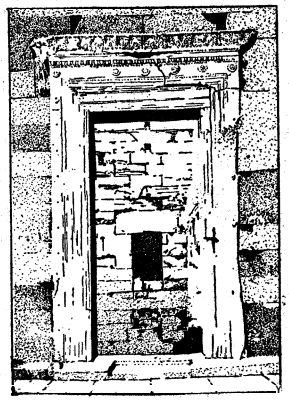
ITALIAN LOMBARD ROMANESQUE
SAN MICHELE. PAVIA



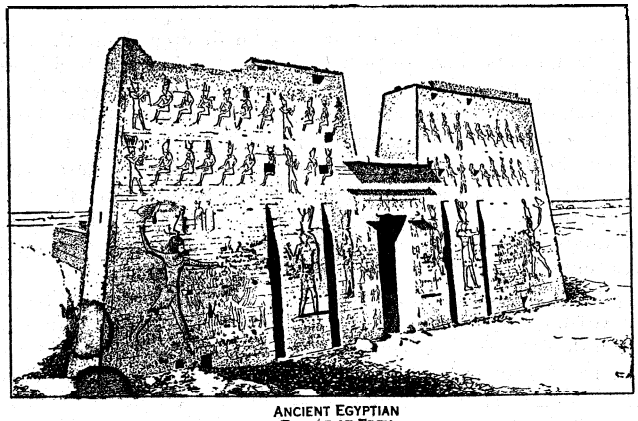
INDIAN MAHOMMEDAN
TOMB OF ALTAMASH. DELHI



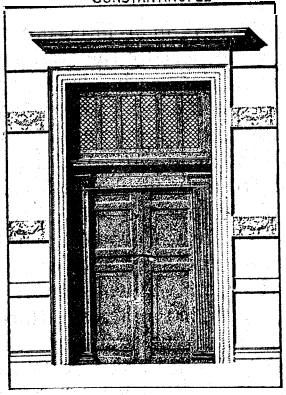
TURKISH
MOSQUE OF RUSTEM PASHA
CONSTANTINOPLE



ANCIENT GREEK
ERECHTHEUM. ATHENS



ANCIENT EGYPTIAN
TEMPLE AT EDFU



ANCIENT ROMAN
PANTHEON. ROME

MODERN GERKAN CHILE HAUS, BY COURTESY OF THE GERMAN RAILROADS INFORMATION BUREAU; INDIAN MAHOMMEDAN TOMB, BY COURTESY OF THE CANADIAN PACIFIC STEAMSHIP COMPANY

sional arched doorways with ornamented lunettes are found in city gates, temples or palaces, especially in northern China.

Although the *art nouveau* movement of the '90s gave rise to many fantastic doorway schemes, the general modernist treatment is a return to simplicity. Exceptions are, however, frequent, and certain modernist doorways, particularly of commercial buildings, are rich with carved ornament. *(See* ARCHITRAVE, BYZANTINE AND ROMANESQUE ARCHITECTURE, CONSOLE, DOOR and articles on architecture.) (T. F. H.)

DOPOLAVORO (literally "Afterwork") is a state-controlled Italian organization which takes care of the recreation of the workers during their leisure hours.

Since 1910, there has existed in Rome an "Afterwork Office" to promote and assist the development of welfare and recreational efforts organized by employers for their dependents. Before fascism came into power (1922), the "Afterwork Office" had only a limited scope. The majority of workers preferred their own organizations established by the trade unions.

Pursuing its policy of acquiring control over individuals and the masses through a complete hold on their organizations, the fascist party annexed the *Dopolavoro* in 1922 with the aim of expanding it and absorbing other organizations. At the close of 1923, the *Dopolavoro* passed under the control of the Confederation of Fascist Trade Unions.

In 1925, all Italian athletic and sport societies, choral societies, bands, University extension groups, night schools, circulating libraries and pleasure clubs which were not already under fascist administration, were submitted to the control of commissars appointed by the fascist government. The buildings of the democratic sport and cultural organizations like the Spreti Palace in Ravenna and the People's House in Rome were confiscated and donated by the government to the *Dopolavoro.*

On May 1, 1925, the *Dopolavoro* received its charter of incorporation under the name of *Opera Nazionale Dopolavoro* and became officially one of the institutions of the fascist state. The government granted the *Opera* an endowment of 1,000,000 lire and an annual grant of 400,000 lire. Besides this, it received annual contributions from local authorities and from various associations, the annual dues paid by the affiliated societies, etc. As a result of its "fascistization" the *Dopolavoro* devoted itself not only to the organization of sport and welfare, but also to fascist political propaganda.

With the consolidation of the fascist dictatorship (1926) the *Dopolavoro* grew rapidly. It extended from factory workers to other large groups, including the employees of the state railways, of the postal, telegraph and telephone services, of the central and local state administration, of the banks and trade corporations, etc.

Members of families of workers and of employees were also organized in the *Dopolavoro.* Special sections were established for women. At the beginning of 1936, the *Dopolavoro* included in Italy over 20.000 societies and a total membership of 2,108,227. At the end of 1926. the Italian preparation for the Olympic games was entrusted—by order of the secretary general of the fascist party—to the *Dopolavoro,* which had to supervise all activities concerning physical education and sport. Later the members of the largest trade unions, which had already been put under the control of the fascist party, were officially obliged to join the *Dopolavoro.* Even those who were not interested in sports or recreations had to pay dues to the *Dopolavoro.*

Besides sports, an important activity of the *Dopolavoro* was the organization of popular shows. This was done through the "carri di Tespi" (Thespis' chariots), which toured the country putting on plays in open-air theatres.

Italian sport champions, trained and maintained at public expense, were for a while successful in international sport contests. In the Olympic games held in Los Angeles in 1932, Italy came second only to the United States.

The *Opera Nazionale Dopolavoro* has its headquarters in Rome. From 1927 on its directors, appointed by the prime minister, were placed under the direct control of the secretary general of the fascist party. The central directorate acts in each province through a local *Dopolavoro* office which is presided over by the provincial secretary of the fascist party.

Societies affiliated with the *Opera* obtain for their members, who pay an annual fee of a few lire, free entrance to museums, excavations, etc , considerable reductions on 3rd class railway rates for week-ends, holidays and excursions, reductions also on theatre and cinema tickets, discounts from booksellers, etc. Furthermore they enjoy the benefits of a special insurance which covers all risks in leisure hours and another insurance covering risks during matches.

The *Dopolavoro* occupies an important place within the frame of Italian Fascist institutions. It is a political and military weapon at the orders of Fascism. It facilitates the policing of millions of workers and employees, whose activities can be controlled by trusted members of the fascist party even after they have left the factories and the offices. Already in 1932, the leaders of important sections of the *Dopolavoro* inaugurated the practice of giving a reward in cash to the members of the organization who collaborated with the party in uncovering antifascist plots. After the introduction of racial laws in Italy (1938), the political tasks of the *Dopolavoro* (from which all Jewish members had been expelled) were even more important.

Outside Italy, *Dopolavoro* centres had been established in most localities containing a large number of emigrants. These centres were under the orders of the fascist consuls and represented an important element for the spreading of fascist influences among the emigrants. (M. W. S.)

DOPPLER, CHRISTIAN JOHANN (1803–1853), Austrian physicist, was born at Salzburg, on Nov. 29, 1803. He was educated at Salzburg and Vienna, and became, in 1850, director of the Physical Institute and professor of experimental physics at Vienna. He died at Venice on March 17, 1853. Doppler's earliest writings were on mathematics, but his name is associated with his work in physics. In 1842 he published a paper "über das farbige Licht der Doppelsterne," which contained what is now known as Doppler's principle *(see* LIGHT: *Waves and Interference).* He drew the analogy between the sound coming from a moving source and the light coming from a moving star; as the pitch of sound from a moving source varies, so Doppler thought the colour of the light from a star would be altered.

The principle was verified experimentally for sound by Buys-Ballot in 1845, but the correct explanatiop in the optical case was given by Fizeau in 1848.

Doppler's principle is applied to the motion of stars in the line of sight, and is used for the discovery of double stars (*see* STAR).

DOPPLER EFFECT, the change in the observed frequency of a vibration owing to relative motion between the observer and the source of the vibration. In sound (*q.v.*) this effect is an everyday experience; *e.g.,* on passing a ringing bell at any speed above about 10 m.p.h. the pitch of the note suddenly sounds lower.

The Doppler effect for light waves is evident in spectroscopy (*q.v.; see* also LIGHT: *Waves and Interference).*

DOPPLERITE, a naturally occurring organic substance found in amorphous, elastic or jelly-like masses, of brownish-black colour, in peat beds in Styria and in Switzerland. It is tasteless, insoluble in alcohol and ether, and is described by Dana as an acid substance, or mixture of different acids, related to humic acid.

DORAN, JOHN (1807–1878), English author, was born in London of Irish parentage. He succeeded Hepworth Dixon as editor of *The Athenaeum* for a short time in 1869, until he became editor of *Notes and Queries* in 1870. His most elaborate work, *Their Majesties' Servants, a* history of the English stage from Betterton to Kean, was published in 1860, and was supplemented by *In and About Drury Lane,* which was written for *Temple Bar* and was not published in book form till 1885. Among his other works may be mentioned *The History of Court Fools* (1858), *The Last Journals of Horace Walpole* (1859), *London in Jacobite Times* (1877), and *Memories of our Great Towns* (1878).

DORAT, CLAUDE JOSEPH (1734–1780), French man of letters, was born in Paris. He obtained a great vogue by his *Réponse d' Abailard à Héloïse,* and followed up this first success with a number of heroic epistles, *Les Victimes de l'amour, ou lettres de quelques amants célèbres* (1776). Besides light verse he wrote comedies, fables and novels. He was maladroit enough to draw down on himself the hatred both of the *philosophe* party and of their arch-enemy, Charles Palissot, and thus cut himself off from the possibility of academic honours. *Le Tartufe littéraire* (1777) attacked La Harpe and Palissot, and at the same time D'Alembert and Mlle. de Lespinasse. Dorat died in Paris on April 29, 1780.

See his Oeuvres complètes (20 vols., 1764–80); G. Desnoireterres, *Le Chevalier Dorat et les poètes légers au XVIIIe siècle* (1887). For the bibliographical value of his works, *see* Henry Cohen, *Guide de l'amateur de livres à figures et à vignettes du XVIIIe siècle* (editions of Ch. Mehl, 1876, and R. Portalis, 1887).

DORCHESTER, DUDLEY CARLETON, VISCOUNT (1573–1632), English diplomatist, son of Antony Carleton of Baldwin Brightwell, Oxfordshire, was born on March 10, 1573, and educated at Westminster school and Christ Church, Oxford, where he graduated M.A. in 1600. As secretary to the earl of Northumberland his name was associated with the Gunpowder Plot, but he succeeded in clearing himself. In 1610 he was knighted and was sent as ambassador to Venice, where he concluded the Treaty of Asti. In 1616 he was appointed ambassador to Holland. In his house at The Hague the unfortunate Elector Frederick and the princess Elizabeth took refuge in 1621. Carleton returned to England in 1625 with the duke of Buckingham, and was made vice-chamberlain of the household and a privy councillor. After an abortive mission to France he returned in 1626 and sought in the House of Commons (he had been a member since 1604) to defend his patron, the duke of Buckingham. Created Baron Carleton of Imbercourt, and, after another mission to The Hague, Viscount Dorchester (1628), he supported the conferences between Buckingham and Contarini for a peace with France on the eve of the duke's intended departure for La Rochelle, which was prevented by Buckingham's assassination. In December 1628 he was made principal secretary of State, and died on Feb. 15, 1632.

His voluminous correspondence, remarkable for its clear, easy and effective style and for the writer's grasp of the main points of policy, covers practically the whole history of foreign affairs during the period 1610–1628, and furnishes valuable material for the study of the Thirty Years' War. His letters as ambassador at The Hague, Jan. 1616 to Dec. 1620, were first edited by Philip Yorke, afterwards second earl of Hardwicke, with a biographical and historical preface, in 1757; his correspondence from The Hague in 1627 by Sir Thomas Phillipps in 1841; other letters are printed in the *Cabala* and in *T*. Birch's *Court and Times of James I. and Charles I.,* but by far the greater portion remains in ms. among the State papers.

DORCHESTER, GUY CARLETON, 1ST BARON (1724–1808), British general and administrator, was born at Strabane, Co. Tyrone, Ireland, on Sept. 3, 1724. He served in 1759 in America as quartermaster-general, under his friend Wolfe. He was wounded at the capture of Quebec, and promoted to the rank of brigadier-general. From 1766 to 1778 he was governor-general of Canada. His justice and kindliness greatly endeared him to the recently conquered French-Canadians, and did much to hold them neutral during the War of American Independence. He ordered the first codification of the civil law of the province, and was largely responsible for the passing of the Quebec Act. On the American invasion of Canada in 1775 he was compelled to abandon Montreal and narrowly escaped capture, but defended Quebec (*q.v.*) with skill and success. In October of the same year he destroyed the American flotilla on Lake Champlain. In 1777 he was superseded in his command of the military forces by Maj.-Gen. John Burgoyne, and asked to be recalled. He returned, however, to America in May 1782 as commander-in-chief, remaining till November 1783. In 1786 he was again sent to Canada as governor-general and commander of the forces, with the title of Baron Dorchester. Many important reforms marked his rule; he kept the country loyal to the British crown amid the ferment caused by the French Revolution. In 1791 the province was divided into Upper and Lower Canada by the Constitutional Act. Of this division Carleton disapproved, as he did also of a provision tending to create in the new colony an hereditary aristocracy. In 1796 he insisted on retiring. He died in England on Nov. 10, 1808. On the death in 1897 of the 4th baron (a grandson) the title became extinct, but was revived in 1899 for his cousin and co-heiress Henrietta Anne as Baroness Dorchester.

See J. C. Dent, *Canadian Portrait Gallery* (Toronto 1880); *A.* G. Bradley, *Life* of *Guy Carleton, Lord Dorchester* (1907). Most of his letters and state papers are calendared in Brymner's *Reports on Canadian Archives* (Ottawa, 1885, *seq.*).

DORCHESTER, a market town and municipal borough and the county town of Dorsetshire, England, in the Western parliamentary division, 135¼ mi. W.S.W. from London by the S.R. and also served by the Weymouth section of the G.W. Ry. Pop (est. 1938) 10,230. Area 2.6 sq.mi. It stands on an eminence on the right bank of the river Frome, within a wide open tract of beautiful views, 6 mi. N. of the English channel at Weymouth bay. St. Peter's church is a Perpendicular building with a fine tower. All Saints and Holy Trinity churches were rebuilt in the last century, but St. George's, Fordington, retains Norman and Transitional details. Of public buildings the principal are: the town hall, market house and corn exchange, shire hall, the interesting county museum, the county hospital and the former county, now government, prison. The grammar school, in modern buildings, was founded in 1569. A statue to Thomas Hardy, the poet and novelist, was unveiled in 1931. There is also a statue to William Barnes, the Dorsetshire poet (1801–1886). Hardy was born near Dorchester, which is the "Casterbridge" of the Wessex novels. A room containing part of his study and other memorabilia was opened in the museum in 1939. The town is noted also for its ale. It is a place of considerable agricultural trade, and large sheep and lamb fairs are held annually.

Durnovaria, at the intersection of a number of Roman roads, was a Romano-British country town of considerable size, probably successor to a British tribal centre of the Durotriges. The walls can be traced in part, and many mosaics, remains of houses, etc., have been found The notable remains of a Roman amphitheatre are seen at Maumbury Rings, near the town. Maiden castle, on a hill 2 mi. S.W., is a vast earthwork encircled by gigantic entrenchments and ramparts, the whole occupying 120 ac. Excavations in 1934 indicated that the hill was the site of an important town in Iron Age times. Another smaller encampment is at Poundbury close by, and barrows and numerous other remains have been found in the vicinity. Little mention of Dorchester *(Dornceaster, Dorcestre)* occurs in Saxon annals, but a charter from Aethelstan to Milton abbey in 939 is dated at *villa regalis quae dicitur Doracestria,* and at this period it possessed a mint. According to the Domesday survey it was a royal borough and had contained 172 houses, of which 100 had been totally destroyed since the conquest. Mention is made of a castle at Dorchester in records of the 12th and 13th centuries; and the Franciscan priory, founded some time before 1331, is thought to have been constructed out of its ruins. The latter was suppressed among the lesser monasteries in 1536. Edward II granted the borough to the bailiffs and burgesses at a fee-farm rent of £20 for five years.

The first charter of incorporation, granted by James I in 1610, established a governing council, which Charles I in 1629 enlarged, while also incorporating the freemen of the borough with power to make laws for the regulation of the markets and trade Dorchester returned two members to parliament from 1295 until the Representation of the People act (1868) reduced the number to one; in 1885 the representation was merged in the county. Edward III granted to the burgesses the perquisites from three fairs, and three weekly markets. Elizabeth granted an additional three days' fair at Candlemas. Markets are now held on Wednesdays and Saturdays and fairs in February, May, July, August, October and November. The cloth industry which flourished during the 16th century never recovered from the depression following the Civil War. The malting and brewing industries came into prominence in the 17th century, when there was also a considerable serge manufacture, which has since declined.

DORCHESTER, a large village in the Henley parliamentary division of Oxfordshire, England, 9 mi. S.S.E. of Oxford by road,

on the west bank of the river Thame, 1 mi. from its junction with the Thames. Pop. of civil parish (1931) 774. At Dike hill close to the present village there was a Roman station, and facing, across the Thames, the double isolated mound known as Wittenham Clumps (historically Sinodun), is the site of ancient earthworks. In Dorchester itself the chief point of interest is the abbey church of St. Peter and St. Paul. This consists of a nave of great length, primarily of the transitional Norman period; a choir with arcades of the finest Decorated work; north choir aisle of the close of the 13th century, south choir aisle (c. 1300) and south nave aisle (*c.* 1320). The tower (western) is an erection of the late 17th century. The eastern bay of the choir is considered to have been added as a Lady chapel, and the north window is a magnificent example of a "Jesse window," in which the tracery represents the genealogical tree of Jesse, the complete execution of the design being carried on in the glass. The ancient sedilia and piscina are very fine. The Decorated windows on the south side of the church form a beautiful series, and there are early monuments and brasses of great interest.

Dorchester (Dorcinia, *Dornacestre,* Dorchecestre) was conquered by the West Saxons about 560. It occupied a commanding position at the junction of the Thames and the Thame, and in 635 was made the seat of a bishopric which at its foundation was the largest in England, comprising the whole of Wessex and Mercia, Birinus, apostle of the West Saxons, becoming its first bishop. The witenagemot of Wessex was held at Dorchester three times in the 9th century, and in 958 Aethelstan held a council here. In the 11th century the town is described as small but remarkable for the majesty of its churches, and *c.* 1086 the bishop's stool was removed to Lincoln by Remigius, the 23rd bishop. According to Domesday, Dorchester was held by the bishop of Lincoln. In 1140 Alexander bishop of Lincoln founded the abbey of Black Canons at Dorchester, of which the only remains are the abbey church. The town declined in importance after the removal of the cathedral, but in 1939 it was made a see suffragan to Oxford.

DORCHESTER, a residential and manufacturing district of Bcston, Massachusetts, U.S.A., a separate town until 1870, between the Neponset river on the south and South Boston and Boston proper on the north. A ridge, with an average height of about 100 ft. above the sea, extends through the district from north to south and commands delightful views of Boston bay to the east and of the Blue hills to the south. Franklin field and Franklin park, one of the larger parks of the Boston park system, are in Dorchester. The Robert Pierce house, built in 1640, stands on its original site on Oakton avenue, and is one of Dorchester's landmarks. The Barnard Capen house, built about the same time, has been removed to Milton. The James Blake house (1648) maintained by the Dorchester Historical society, has a library and a museum. Not far away is the old Dorchester burying ground, which dates from 1634; it has many curious epitaphs, and contains the graves of Barnard Capen, who died in 1638 (probably the oldest marked grave in the United States); of William Stoughton (1631–1701), chief justice of the court which tried the Salem "witches" in 1692, and founder of the original Stoughton Hall, Harvard; and of Richard Mather.

Dorchester was founded by about 140 colonists from Dorsetshire, England, with whom the movement for planting the colony in Massachusetts Bay was begun under the leadership of Rev. John White. They organized as a church while at Plymouth, England, in March 1630, then embarked in the ship "Mary and John," arrived in Boston bay two weeks before Governor Winthrop with the rest of the fleet, and in June selected Savin Hill as the site for their settlement. At the time the place was known as Mattapanock, but they named it Dorchester. In Oct. 1633, a town Government was organized, and the example was followed by the neighbouring settlements; this seems to have been the beginning of the town-meeting form of government in America. Up to this time Dorchester was the largest town in the colony, but dissatisfaction arose with the location (Boston had a better one chiefly on account of the deeper water in its harbour), and in 1635–37 many of the original settlers removed to the valley of the Connecticut where they founded Windsor. New settlers, however, arrived at Dorchester and in 1639 that town establishecl a school supported by a public tax; this was the first free school in America supported by direct taxation or assessment on the inhabitants of a town. It was the fortification of Dorchester Heights, under orders from Gen. Washington, on the night of March 4–5, 1776, that forced the British to evacuate Boston.

See W. D. Orcutt, *Good Old Dorchester* (Cambridge, *1893)*; and The Dorchester Book (Boston, 1899).

DBRDOGNE, an inland department of south-western France, formed in 1790 from nearly the whole of Périgord, a part of Agenais, and small portions of Limousin and of Angoumois. Area 3,561 sq.mi. Pop. (1936) 386.963 It is bounded N. by Haute-Vienne, W. by Charente, Charente-Inférieure and Gironde, S. by Lot-et-Garonne, and E. by Lot and Corrèze. Situated on the western slopes of the Massif Central, Dordogne consists in the north-east and centre of sterile plateaus sloping towards the west, where they end in a region of pine forests known as the Double. The greatest altitudes are found in the highlands of the north, where many points exceed 1,300 ft. in height. Many beautiful river valleys, of the Dordogne, the Isle, with the Dronne and Auvézère, and the Vézère converge towards the southwest of the department. The climate is mild, but rather humid, especially in the north-east. Agriculture prospers in the south and south-west of the department, especially in the valleys of the Dordogne and Isle, but the rest of its surface is covered to a great extent by woods and heath. Pasture and forage amply suffice for the raising of large flocks and herds. The vine, cultivated mainly in the neighbourhood of Bergerac, and tobacco are important sources of profit. Wheat and maize are the chief cereals and potatoes are largely grown. The truffles of Périgord are famous for their abundance and quality. The plum and cider-apple yield good crops. In the forests the prevailing trees are the oak and chestnut. The chestnuts are much used as food by the people and for fattening hogs, reared in large numbers. The walnut is extensively grown for its oil. The department has mines of lignite, and produces freestone, lime, cement, mill-stone, peat, potter's clay and fireclay. The leather industry and the preparation of preserved foods are important, and there are brick and tile works, earthenware manufactories and iron works. Exports consist of truffles, wine, chestnuts and other fruit, live stock, poultry and minerals of various kinds. Dordogne is served by the Orléans railway; the Dordogne, the Isle and the Vézère furnish nearly 200 m. of navigable waterway. It is divided into the arrondissements of Périgueux, Bergerac. Nontron and Sarlat, with 47 cantons and 587 communes, and belongs to the ecclesiastical province of Bordeaux, to the académie (educational division) of Bordeaux and to the region of the XII army corps, which has its headquarters at Limoges. Its court of appeal is at Bordeaux

Périgueux, the capital, and the other principal towns are treated in separate articles. Bourdeilles has two finely preserved chbteaux, one of the 14th century, with an imposing keep, the other in 16th century Renaissance. Both buildings are contained within the same fortified enceinte. The chbteau of Biron (11th century and later) has a beautiful chapel of late Gothic and early Renaissance workmanship. The chbteau of Jumilhac-le-Grand is of the 15th century. Dordogne possesses several mediaeval bastides, the most perfect of which is Monpazier. At Cadouin there are the remains of a Cistercian abbey. Its church is a fine Romanesque building, while the cloister is excellent Flamboyant. St. Jean-de-Côle has an interesting Romanesque church and a château of the 15th, 16th and 18th centuries. In the rocks of the valley of the lower Vézère there are prehistoric caves of great importance for the study of Palaeolithic man. Troglodytic dwellings are to be found in many other places in Dordogne.

DORDOGNE, a river of central and south-western France, rising at a height of 5,640 ft. on the Puy-de-Saucy, a section of the volcanic core of the Plateau Central in the department of Puy-de-Dame, and flowing to the Garonne, with which it unites at Bec d'Ambès to form the Gironde estuary. It has a length of 295 m. and the area of its basin is 9,214 sq. miles. The Dordogne is a good example of a consequent stream of the

western section of the Plateau Central. In its course it cuts across a large number of geological formations, as do its two great right-bank tributaries, the Vézère and the Isle. The Dordogne descends rapidly from its source and enters deep gorges as it flows through the Archaean plateau-country, rich in granites, until it reaches Beaulieu (department of Corrèze) where it enters a wide fertile valley and is joined by the Cère. Entering the department of Lot, it abandons a south-westerly course for a westerly course. It now flows through limestone country, often in gorges with the Causses above on both sides. It traverses the department of Dordogne, where it receives the Vézère. The lower course of the latter is through a calcareous country, and its many caves have made it classic ground for the study of Palaeolithic man. Below the town of Bergerac the Dordogne enters the department of Gironde and is joined by the Isle at Libourne. The river is some 3,300 yd. wide at its union with the Garonne, 45 m. from the sea. In its lower course it flows over Tertiary material. There are important bridges at Cubzac-les-Ponts. There is much river traffic after the confluence with the Vézère over the last 112 m. of its course. The estuary of the Gironde is one of the most conspicuous features of the western coast of France, and the highest tides ascend the Dordogne as far as Pessac, a distance of approximately 100 m. from the ocean.

DORDRECHT (abbreviated *Dordt* or *Dort;* old name THUREDRECHT), in the province of South Holland, Holland, and a junction station 12½ mi. S.E. of Rotterdam. It is connected with Papendrecht and Zwijndrecht on the opposite shore. Pop. (1940) 62,007. Dordrecht was founded by Count Dirk III of Holland in 1018, becoming a town about 1200. One of the first towns in the Netherlands to embrace the reformed religion and to throw off the yoke of Spain, it was in 1572 the meeting-place of the deputies who asserted the independence of the United Provinces. In 1618 and 1619 it was the seat of the synod of Dort (*q.v.*). It fell to German troops in 1940.

Dordrecht presents a picturesque appearance with its busy quays and numerous canals and windmills, its quaint streets and curiously gabled houses. The Groote Kerk, of Our Lady, with a massive tower, dates from the 14th century and contains some finely carved stalls (1540) by Jan Terween Aertsz, and a remarkable pulpit (1759). In the town museum is an interesting collection of paintings, including pictures by some of the old masters, some of whom were natives of Dordrecht. Close to the museum is one of the old city gates, rebuilt in 1618, and now containing a collection of antiquities belonging to the Oud-Dordrecht Society. The harbour of Dordrecht still has a large trade, but much has been diverted to Rotterdam. Large quantities of wood are imported from Germany, Scandinavia and America. There are numerous saw-mills, shipbuilding yards, sugar refineries, etc.

DORÉ, PAUL GUSTAVE, (1832–1883), French artist, the son of a civil engineer, was born at Strasbourg on Jan. 6, 1832, and died in Paris on Jan. 23, 1883. In 1848 he came to Paris and secured a three years' engagement on the *Journal* pour *rire.* His facility as a draughtsman was extraordinary, and among the books he illustrated in rapid succession were Balzac's *Contes drolatiques* (1855), Dante's *Inferno* (1861), *Don Quixote* (1863), *The Bible* (1865), *Paradise Lost* (1866), the *Fables* of La Fontaine (1867), and the works of Rabelais (1873). He painted also many large and ambitious compositions of a religious or historical character, and had some success as a sculptor. Doré's illustrations had a great popular success over a long period of years, especially in England and America. *See* W. B. Jerrold, *Life of Gustave Doré* (1891).

DORIA, ANDREA (1466–1560), Genoese *condottiere* and admiral, was born at Oneglia of an ancient Genoese family. Being left an orphan at an early age, he became a soldier of fortune, and served first in the papal guard and then under various Italian princes. But it was as a naval captain that he became famous. For several years he scoured the Mediterranean in command of the Genoese fleet, waging war on the Turks and the Barbary pirates. In the meanwhile Genoa had been recaptured by the French, and in 1522 by the Imperialists. But Doria now veered round to the French or popular faction and entered the service of King Francis I., who made him captain-general; in 1524 he relieved Marseilles, which was besieged by the Imperialists, and helped to place his native city once more under French domination. But Francis was mean about payment, and he resented the king's behaviour in connection with Savona, which he delayed to hand back to the Genoese as he had promised; consequently on the expiry of Doria's contract we find him in the service of the emperor Charles V. (1528). He ordered his nephew Filippino, who was then blockading Naples in concert with a French army, to withdraw, and sailed for Genoa, where he expelled the French once more and re-established the republic under imperial protection. He reformed the constitution in an aristocratic sense, and put an end to the factions which divided the city. He refused the lordship of Genoa and even the dogeship, but exercised predominant influence in the councils of the republic until his death. He was given two palaces, many privileges, and the title of *Liberator et Pater Patriae.* As imperial admiral he commanded several expeditions against the Turks, capturing Corona and Patras, and co-operating with the emperor himself in the capture of Tunis (1535). Charles found him an invaluable ally in the wars with Francis, and through him extended his domination over the whole of Italy. Doria's defeat by the Turks at Preveza in 1538 was said to be not involuntary, and designed to spite the Venetians, whom he detested. He accompanied Charles on the ill-fated Algerian expedition of 1541, of which he disapproved, and by his ability just saved the whole force from complete disaster. For the next five years there was hardly an important event in Europe in which he had not some share. After the peace of Crépy between Francis and Charles in 1544 he hoped to end his days in quiet. But he had many enemies, and in 1547 the Fiesco conspiracy to upset the power of his house took place. His nephew Giannettino was murdered, but the conspirators were defeated, and Andrea showed great vindictiveness in punishing them. He was implicated in the murder of Pier Luigi Farnese, duke of Parma *(see* FARNESE), who had helped Fiesco. Other conspiracies followed, of which the most important was that of Giulio Cibb (1548), but all failed. Doria successfully opposed the emperor Charles's repeated attempts to have a citadel built in Genoa and garrisoned by Spaniards; neither blandishments nor threats could win him over to the scheme. Nor did age lessen his energy, for in 1550, when eighty-four years old, he again put to sea to punish the raids of his old enemies the Barbary pirates, but with no great success. War between France and the Empire having broken out once more, the French seized Corsica, then administered by the Genoese Bank of St. George; Doria was again summoned, and he spent two years (1553–1555) in the island fighting the French with varying fortune. He returned to Genoa for good in 1555, and gave over the command of the galleys to his great-nephew Giovanni Andrea Doria. Andrea Doria died on Nov. 25, 1560, leaving his estates to Giovanni Andrea. The family of Doria-Pamphilii-Landi (*q.v.*) is descended from him and bears his title of prince of Melfi. Doria was a man of indomitable energy and a great admiral. If he appears unscrupulous and even treacherous he did but conform to the standards of 16th century Italy.

See E. Petit, *Andrt Doria* (Paris, 1887) which is an accurate and documented biography, indicating all the chief works on the subject, but the author is perhaps unduly harsh in his judgment of the admiral; F. D. Guerrazzi, *Vita di Andrea Doria* (3rd ed., Milan, 1874). Among the earlier works L. Cappelloni's *Vita di Andrea Doria* (Italian edition, Genoa, 1863) and V. Sigonius's *Vita Andreae Doriae* (1576) may be mentioned; *see* also "Documenti ispano-genovesi del-l'Archivio di Simancas" in the *Atti della Società ligure di Storia patria,* vol. viii.; the *Archivio storico italiano* (serie iii. tome iv. parte i., 1866) contains a bibliography, but a great deal has been published since that date.

DORIANS. In classical times a fourfold division ran through the Greek world, linguistic and partially social. The Dorians represent one section of this division, the remaining three being Aeolians, Ionians and Arcado-Cyprians or Achaeans. They were settled in the Peloponnese where they were the dominant race, in the Sporades and in Crete, in south-western Asia Minor, and in a string of colonies along the eastern and southern coasts of Sicily. Between Mounts Parnassus and Oeta was a small district

called Doris, whose inhabitants in historic times spoke an Aeolic dialect. They were distinguished from other Greeks by their dialect, by a calendar of festivals. and by certain social and political institutions. The worship of Apollo and of Heracles was looked upon by the Greeks as being in some sense more particularly Dorian, though not confined to Dorian peoples.

The Doric dialect, of which there were several varieties, was allied with a group known as North-west Greek, spoken in Phocis, Locris and Elis, as opposed to Aeolic, Ionic, Attic and Arcado-Cyprian, which may be said to have formed loosely an eastern group. Some of its characteristics are the retention of τ where Attic shows σ in verbal endings such as $\delta\acute{\iota}\delta\omega\tau\iota$, in $-\kappa\alpha\tau\iota o\iota$ as the termination in the *hundreds* in place of $-\kappa o\sigma\iota o\iota$ etc.; the formation of the nominative plural of the article in $\tau o\acute{\iota}, \tau\alpha\acute{\iota}$; $\ddot{o}\kappa\alpha, \tau\acute{o}\kappa\alpha, \pi\acute{o}\kappa\alpha$ for $\ddot{o}\tau\epsilon, \tau\acute{o}\tau\epsilon, \pi\acute{o}\tau\epsilon$ etc.; the termination of the first person plural active in $-\mu\epsilon\varsigma$ instead of $-\mu\epsilon\nu$, *e.g.*, $\phi\acute{\epsilon}\rho o\mu\epsilon\varsigma$; the formation of the future in $-\sigma\epsilon\omega$; the lengthening of ϵ and o to η and ω in place of $\epsilon\iota$ and $o\upsilon$; the reduction of intervocalic σ to h and in some cases its complete disappearance. The Cretan dialects showed peculiarities of their own. The Doric dialects continued in use until displaced by the $\kappa o\iota\nu\acute{\eta}$ based upon Attic, which became the common language of Greece in Hellenistic times. The modern Tzakonian dialect spoken in the neighbourhood of Sparta exhibits characteristics which entitle it to be regarded as the descendant of an ancient Doric dialect, possibly Laconian. Within the Doric group Laconian inclined in certain respects to agreement with Aeolic where Corinthian and Argolic show rather more similarity to Ionic.

It is clear that the Dorians were a conquering stratum of the population in the Peloponnese. Beside the fact that a non-Doric dialect survived in Arcadia closely akin to the dialects of Cyprus, the social structure of the Doric cities provides evidence that the Dorians had conquered and were holding in subjection a former population. Sparta was the armed camp of a close aristocracy which alone possessed political rights. The majority of the population, known as Helots, were serfs, hostile to their masters and breaking into rebellion whenever opportunity presented itself. Between the Helots and the Spartiate families was a class known as Perioeci (*q.v.*) who were not slaves but did not enjoy Spartan rights. In the 8th and 7th centuries B.C., Sparta subjugated and annexed Messenia, the district that lay along the west coast of the Peloponnese, but there is no evidence as to whether the Messenians were Dorian or otherwise. They appear to have spoken a Doric dialect, but so probably did the Achaeans along the Peloponnesian shore of the Corinthian gulf, and the latter in other respects were definitely regarded as non-Doric. It is possible that the Doric dialects were the speech of the pre-Dorian inhabitants of the Peloponnese, the Homeric Achaeans, and that this was adopted by the conquerors. There is insufficient evidence to warrant a decision. The other Doric cities of the Peloponnese, notably Argos and Corinth, though their constitutions differed widely from that of Sparta, presented similar strata of population, between whom a social and political compromise had been reached. Sparta was not typical but peculiar. The so-called constitution of Lycurgus, however, under which she was governed, was closely reflected in Dorian Crete. The double kingship suggests prehistorical amalgamation. Owing to Sparta's dominant position in the Dorian world in historical times the rest of Greece was inclined to regard what was peculiarly Spartan as typically Dorian. The rivalry of race between Dorian and Ionian underlay the struggles of the Greek world until at least the 4th century, being prominent in the Peloponnesian War at the close of the 5th century.

When and from what direction did the Dorian invasion of the Peloponnese take place? Homer knew of Dorians only in Crete. The mainland of Greece was inhabited in Homeric times by a people called Achaeans, which was the general name for Greeks, afterwards replaced by the name Hellenes. In the Hesiodic genealogies Dorus appears as a son of Rellen beside Aeolus and Xuthus the father of Ion and Achaeus. It is evident that at that time (7th or 6th century) these four divisions were regarded as comprising together the whole Greek world. The Hellenes of Homer's time were a small Thessalian tribe, and the extension of their name illustrates the possibility of a similar process in the case of that of the Dorians. The inheritance of Dorus was in central Greece between that of Aeolus in Thessaly and of Xuthus in the Peloponnese. Under Aegimius, a descendant of Dorus, the Dorians acquired the country between Mounts Parnassus and Oeta, thenceforward known as Doris. An alliance took place between Aegimius and the Heracleidae, Hyllus son of Heracles being adopted by Aegimius. There followed the expeditions to the Peloponnese to assist the Heracleidae to recover their inheritance there. The route of the invasion was through Aetolia and Elis, the Corinthian Gulf being crossed at Naupactus. After several attempts the conquest of the Peloponnese was achieved. Thucydides dates the invasion 80 years subsequent to the Trojan War, and it was generally regarded as having taken place in the second half of the 12th or early in the 11th century. Megara and Corinth were conquered rather later. From the alliance between Aegimius and the Heracleidae dated the threefold Dorian division into Hylleis, Dymanes and Pamphyli.

A second tradition, current in the 4th century, brought the Argive Dorians to the eastern Peloponnese by sea. Their starting-point is not stated. It is assumed to be the Maliac gulf, which is the nearest sea-coast to Doris in central Greece. The Cretan Dorians were regarded as an offshoot of this expedition from which they were considered to have separated in Histiaeotis.

The facts of the Dorian overlordship in the Peloponnese show the invasion and conquest to have been historical, and light may be thrown upon the whereabouts of the former homes of the invaders by the names of the three Dorian tribes. Hylleis is the name of a large and widespread Illyrian tribe settled upon the Dalmatian coast of the Adriatic and centring around the promontory known anciently as Hyllis, now as Sabbioncello. Indeed the name Illyrii may be identical with that of the Hylleis except for an additional suffix. Again the tribal name Dymanes has a termination frequent in Epirus and exemplified in such names as Atintanes, Athamanes, Akarnanes, etc. Both these names point decisively to the north-west and confirm the tradition of an invasion across the Corinthian gulf from Aetolia to Elis, of an Illyrian or Epirote tribe. What of the Pamphyli? The second tradition, that the Dorian conquerors of Argolis reached the east coast of the Peloponnese by sea, has already been mentioned. Is it possible that it is wrongly assumed that the starting-point of this expedition was the Maliac gulf, and that such an invasion took place, but from Crete and the south-eastern Aegaean? Is it too bold to connect the name Pamphyli with the familiar Anatolian Pamphylia? In Homeric' times Dorians are recorded only in Crete. The constitution of Lycurgus at Sparta was traditionally derived from Crete. We know that the Achaeans were in pre-Homeric times in the eastern Aegaean and later in the Peloponnese and the Greek mainland. Thus a Dorian migration from east to west across the Aegaean would have merely followed in the wake of previous Achaean migrations, while Dorian attacks upon the Peloponnese from Crete would have been no more than repetitions of previous Minoan history. Thus an invasion of the Achaean Peloponnese by northern hordes was coincident with attacks from Crete and the Aegaean. It may well have been designedly coincident, one set of invaders calling in the other as allies, and such an amalgamation may well explain the double kingship at Sparta. If the name Dorian first applied to a small tribe in Crete and later became extended to the new masters of the Peloponnese as a whole, this fact is no stranger than the increase of scope of the name Hellenes, which underwent an even wider development. The Parnassian Doris was never in historical times the home of Dorians. It represents perhaps no more than a coincidence of name, which is not surprising and far from unparalleled, especially if it connects with the root of $\delta\rho\hat{\upsilon}\varsigma, \delta\acute{o}\rho\upsilon$, *tree*, etc. It is possible that the northern invaders occupied it for a time before their irruption into the Peloponnese.

A widely-held view would bring all Greek-speaking peoples by land to Greece from the north in three successive waves, Ionian, Achaean and Dorian, the first two being the promotors of Mycenean civilization. This presupposes an original "Helladic" popula-

tion of Greece, whose language is unknown and whose origin is unexplained. All Greek settlements in the Aegaean, Asia Minor and Cypress were on this view colonized from the mainland of Greece.

Doris was also in historical times the collective name of the Dorian cities in south-western Asia Minor, corresponding with Ionia and Aeolis. Whether or not Dorians had dwelt in this region since Homeric times, that is to say, since a date previous to their occupation of the Peloponnese, these cities had received an influx of population from the Peloponnese and looked to it in historical times as the home of their mother-cities.

See ACHAEANS; IONIANS; GREECE, History.

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DORIA-PAMPHILII-LANDI, a princely Roman family of Genoese extraction. The founder of the house was Ansaldo d'Oria, consul of Genoa in the 12th century, but the authentic pedigree is traced no further back than to Paolo d'Oria (1335). The most famous member of the family was Andrea Doria (*q.v.*). The marquisate of Civiez and the county of Cavallamonte were conferred on the family in 1576, the duchy of Tursi in 1594, the principality of Avella in 1607, the duchy of Avigliano in 1613. In 1760 the title of *Reichsfürst* or prince of the Holy Roman Empire was added and attached to the lordship of Torriglia and the marquisate of Borgo San Stefano, together with the qualification of Hochgeboren. That same year the Dorias inherited the fiefs and titles of the house of Pamphilii-Landi of Gubbio, patricians of Rome and princes of San Martino, Valmontano, Val di Toro, Bardi and Corupiano. The Doria-Pamphilii palace in Rome, a splendid edifice, was built in the 17th century, and contains a valuable collection of paintings. The Villa Doria-Pamphilii with its gardens is one of the loveliest round Rome. During the siege of 1849 it was Garibaldi's headquarters.

DORIC ORDER, in architecture, the simplest and earliest perfected of the Greek orders, adopted and developed in a modified form by the Romans, characterized by a simple, moulded capital, and the existence in the frieze of upright, grooved forms, known as triglyphs separated by squares, known as metopes (see ORDER).

DORION, SIR ANTOINE AIME (1816–1891), Canadian lawyer and statesman, was born at Sainte Anne de la Pérade on Jan. 17, 1816 of an old Liberal family. He studied law under Cherrier, was called to the bar in 1842, and rose rapidly in his profession. At the time that Dorion commenced the study of law, Canada was entering upon a new phase of her political life. The rebellion of 1837 had resulted in the suspension of the constitution of 1791 and the union of provinces, effected under the Imperial Act of 1840, was framed to compel the obedience of the refractory population. The elections of 1854 had brought new blood into the ranks of the Liberal party, young men eager to carry out measures of reform, and Dorion was chosen as leader. Under the coalition brought about by McNab between the Tories of Upper Canada and the Liberals of the lower province old abuses were removed, and, after the abolition of seigneurial tenure and clergy reserves, it appeared that the political atmosphere was clear. In 1856 the question of representation by population was again prominent. Upper Canada had increased, and it contributed a larger share to the revenue, and demanded proportionate representation. Macdonald, who became prime minister in 1856, and had formed a new government with Cartier in 1857, maintained that no amendment to the constitution was necessary; that existing conditions were satisfactory. Brown, on the opposite side of the House, declared that representation by population was imperative, with or without constitutional changes; and Dorion appears to have suggested the true remedy, when he gave notice of a motion in 1856:—

That a committee be appointed to inquire into the means that should be adopted to form a new political and legislative organization of the heretofore provinces of Upper and Lower Canada, either by the establishment of their former territorial divisions or by a division of each province, so as to form a federation, having a federal government and a local legislature for each one of the new provinces, and to deliberate as to the course which should be adopted to regulate the affairs of united Canada, in a manner which would be equitable to the different sections of the province.

Dorion was in advance of the time. He understood the true principle of federative union as applicable to Canada. But he did not pursue this idea. On Aug. 2, 1858 he formed an administration with Brown, but was forced to resign after being in office three days. When the question of confederation was discussed a few years later he opposed the scheme, believing there was nothing to justify the union at the time. In 1873 he became minister of justice in the Mackenzie government, and secured the passage of the Electoral Law of 1874 and the Controverted Elections Act. Dorion sat as a member of the assembly for the province of Canada for the city of Montreal from 1854 to 1861, for the county of Hochelaga from 1862 to 1867; as member of the House of Commons for the county of Hochelaga from 1867 to July 1872, and for the county of Napierville from Sept. 1872 to June 1874, when he was appointed chief justice of the province. In 1878 he was created a knight bachelor. He died at Montreal on May 31, 1891.

See Fennings Taylor, *Dorion, a Sketch* (Montreal, 1865); "Sir Antoine Aimé Dorion," by Sir Wilfrid Laurier, in *The Week* (1887).

DORIS, a small district in central Greece, between Mts. Oeta and Parnassus, containing the head-waters of the Cephissus. This little valley, which nowhere exceeds 4 m. in breadth and has but four small townships, owed its importance partly to its command over the road from Heracleia to Amphissa, but chiefly to its prestige as the alleged mother-country of the Dorian conquerors of Peloponnesus (see DORIANS). Its history is mainly made up of petty wars with Oetaeans and Phocians. In 457, the Spartans, admitting their claim to be the Dorian metropolis, sent an army to their aid, and again during the second Sacred War (356–346). Except for mention of its cantonal league in 196, Doris passed early out of history.

See Strabo, pp. 417, 427; Herodotus i. 56, viii. 31; Thucydides i. 107, iii. 92; Diodorus xii. 29, 33; W. M. Leake, *Travels in Northern Greece,* chap. xi. (1835).

DORISLAUS, ISAAC (1595–1649), Anglo-Dutch lawyer and diplomatist, was born at Alkmaar, Holland, the son of a minister of the Dutch Reformed Church. He was educated at Leyden, removed to England about 1627, and was appointed to a lectureship in history at Cambridge, where his attempt to justify the Dutch revolt against Spain led to his early resignation. In 1629 he was admitted a commoner of the College of Advocates. In 1632 he made his peace at court, and on two occasions acted as judge advocate, in the bishops' war of 1640 and in 1642 in the army commanded by Essex. In 1648 he became one of the judges of the admiralty court, and was sent on a diplomatic errand to the States General of Holland. He assisted in preparing the charge of high treason against Charles I., and, while negotiating an alliance between the Commonwealth and the Dutch republic, was murdered at The Hague by royalist refugees on May 10, 1649.

DORKING, a market town and urban district in the Reigate parliamentary division of Surrey, England, with three (including Box Hill, four) railway stations on the Southern railway, about 26 mi. S.S.W. of London. Pop. of urban district (1938) 17,110. Area 1 j sq mi. It lies at the edge of the North Downs in the sheltered valley of the river Mole, near the base of Box Hill. and is noted for the beauty of its countryside. It is the centre of an extensive residential district. The parish church of St. Martin's is a handsome edifice rebuilt in 1873. Lime of exceptionally good quality is burned in the neighbourhood and is derived from the Lower Chalk formation. Dorking gives its name to a well-known breed of fowl distinguished by its having five toes. Several fine mansions are in the vicinity of the town, notably that of Deepdene, containing part of a gallery of sculpture collected by Thomas Hope, the author of *Anastasius.* The Roman road of Stone street, which crossed from the Sussex coast to the Thames, passed near the present churchyard of St. Martin. The district has literary associations, including the names of George Meredith, who lived and is buried here, Fanny Burney, Malthus and others.

DORLEANS, LOUIS (1542–1629), French poet and political pamphleteer, was born in Paris. He studied under Jean Daurat, and after taking his degree in law began to practise at the bar with but slight success. After the League had arrested the royalist members of parliament, he was appointed (1589) advocate-general. His *Avertissement* des catholiques *anglais* aux *Français catholiques* went through several editions, and was translated into English. Dorléans was proscribed when Henry IV. entered Paris. He took refuge in Antwerp, but was amnestied nine years later, and returned to Paris, where he was soon imprisoned for sedition. The king, however, released him after three months in the Conciergerie.

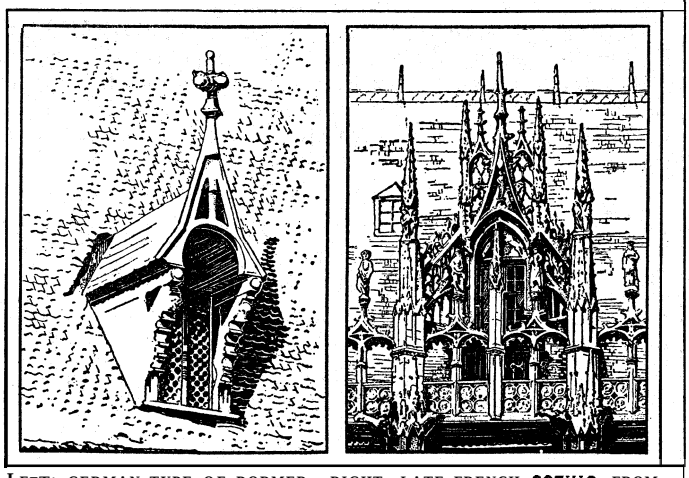
DORMAN, LONG AND COMPANY, LIMITED. This British joint stock company, which in 1928 had an issued share capital of £8,050,000 are manufacturers of iron and steel, constructional engineering and bridge building materials and colliery and mine owners. Founded in 1876 by Mr. (now Sir) Arthur Dorman, in partnership with the late Albert de Lande Long at West Marsh Ironworks, Middlesbrough, Yorkshire, the steel plant, together with the various auxiliary and by-product plants, now cover in the same district a very large area. In 1889 Bell Bros., Limited, ironmasters and colliery owners, became associated with Dorman, Long, and in 1903 the company acquired the ordinary share capital of the adjacent North Eastern Steel company.

In 1916, to meet the urgent needs of the World War, the Redcar steel works was laid down by the company's own department. Further additions were made in 1917 (Sir B. Samuelson and company—collieries and ironstone mines, blast furnaces, coke ovens and by-product plant) and in 1921 (the Carlton Iron company—manufacturers of ferro-manganese), so that in 1923, on the amalgamation of all these firms, Dorman, Long and Co., Ltd., became the largest coal, iron and steel undertaking under one management in Great Britain.

From Middlesbrough the company have extended their organization to London, Melbourne, Sydney, Calcutta, South Africa and Buenos Aires, where they have established shops and associated-companies for fabricating steel constructional work and where they carry large stocks of steel. They have agencies in New Zealand, Kenya Colony, Egypt, the Sudan and elsewhere.

In 1928, Dorman, Long jointly with Baldwins, Ltd., and Hosbins, Ltd., formed an Australian company named "Australian Iron and Steel, Ltd." with a capital of £5,000,000. (L. C. M.)

DORMER, in architecture, a projection from a sloping roof, containing a window. Dormers may occur either on the face of the wall or high up on the roof; their roofs may be gabled, hipped, flat or with one slope. Wherever steep, high roofs are common, dormers are common, in order to light the space within. Simple dormers, frequently in several rows, characterize the steep roofs of Teutonic countries, but in the late Gothic and early Renaissance periods, certain dormers, whose fronts were on the wall line of the building, were built in masonry and richly decorated. Similar elaborate dormers, usually with gabled roofs, are characteristic of the French châteaux from the time of Louis XII. to that of Louis XIV., and of Tudor work in England and Scotland; examples of dormers, ornamented with pinnacles, tracery and buttresses, occur in the Palais de Justice at Rouen (end of the 15th century). Heidelberg castle (1556), and the châteaux of Blois and Chambord (time of Francis I.) show characteristic Renaissance enrichment. The term "dormer" arose from the windows being those of sleeping-rooms. The phrase "dormer beam" is the equivalent of the modern "sleeper."



LEFT: GERMAN TYPE OF DORMER. RIGHT: LATE FRENCH GOTHIC, FROM PALAIS DE JUSTICE. ROUEN

DORMITORY, the name given in monasteries to the monks' sleeping apartment. It sometimes formed one long room, but was more generally subdivided into as many cells or partitions as there were monks. The dormitories were sometimes of great length; that of the monastery of S. Michele in Bosco near Bologna (now suppressed), is said to have been over 400 feet. In some of the larger Elizabethan mansions the space in the roof constitutes a long gallery, which in those days was occasionally utilized as a dormitory. The name "dormitory" is also applied to the large bedrooms with a number of beds, in schools and similar modern institutions, and also to any institutional building whose purpose is to furnish sleeping quarters for pupils or others, irrespective of whether or not they are divided into individual rooms.

DORMONT, a residential borough of Allegheny county, Pa., U.S.A., on the southern edge of Pittsburgh. The population was 13,190 in 1930 and 12,974 in 1940 by federal census.

DORMOUSE, a small rodent, *Muscardinus* avellanarius, is the sole representative of its genus, but belongs to a family—the Gliridae or Myoxidae—containing a small number of Old World species. All the dormice are small rodents, of arboreal habits, and for the most part of squirrel-like appearance; some of their most distinctive features being internal. In the more typical members of the group, forming the sub-family *Glirinae,* there are four pairs of cheek-teeth, which are rooted and have transverse enamel-folds. As the characters of the genera are given in the article RODENTIA it will suffice to state that the typical genus Glis is represented by the large European edible dormouse, G. *vulgaris* (or G. *glis*), a grey species with black markings known in Germany as Siebenschlafer; the genus ranges from continental Europe to Japan. The common dormouse *Muscardinus avellanarius,* ranging from England to Russia and Asia, is of the size of a mouse and mainly chestnut-coloured. The third genus is represented by the continental *lerot,* or garden-dormouse, *Eliomys guercinus,* which is a large parti-coloured species, with several local forms—either species or races. Lastly, *Graphiurus,* of which the species are also large, is solely African. In their arboreal life, and the habit of sitting up on their hind-legs with their food grasped in the fore-paws, dormice are like squirrels, from which they differ in being completely nocturnal. They live either among bushes or in trees, and make a neat nest for the reception of their young, which are born blind. The species inhabiting cold climates construct a winter nest in which they hibernate, waking up at times to feed on an accumulated store of nuts and other food. Before retiring they become very fat, and at such times the edible dormouse is a favourite article of diet on the Continent. The young are generally four in number, and are produced twice a year. They are born blind, but in a marvellously short period are able to cater for themselves; and their hibernation begins later in the season than with the adults. The fur of the dormouse is tawny above and paler beneath, with a white patch on the throat. A second sub-family is represented by the Indian *Platacanthomys* and the Chinese *Typhlomys,* in which there are only three pairs of cheek-teeth; thus connecting the more typical members of the family with the *Muridae.*

DORNBIRN is a township in the Austrian province of Vorarlberg, at the foot of the Bregenzerwald. The name is a collective appellation for four straggling villages—Dornbirn, Hatlerdorf, Oberdorf and Haselstauden—chiefly important as small centres manufacturing textiles and iron goods with motive power from the Dornbirner Ach, a tributary of the Rhine. Pop. (1939) 17,510. Germany annexed the township in 1938.

DORNBURG, a town of Germany, in the *Land* of Thuringia, situated 400 ft. above the Saale. 7 mi. N.E. of Jena. Population 918. Dornburg is chiefly famous for its three grand-ducal castles. The Altes Schloss is built on the site of an imperial stronghold (Kaiserpfalz), once a bulwark against the Slavs, often a residence of the emperors Otto II. and Otto III., and the place where the emperor Henry II. held a diet in 1005. Goethe was often a guest at the Neues Schloss, built (1728–48) in Italian style. The third castle is the so-called Stohmannsches Rittergut, purchased in 1824 and fitted as a modern palace.

DORNER, ISAAC AUGUST (1809–1884), German Lutheran divine, was born at Keuhausen, Württemberg on June 20, 1809. After studying at Tubingen, he travelled in England and Holland, and in 1837 became professor extraordinarius of theology at Tiibingen. His *Entwicklungsgeschichte der Lekre von der Person Christi* (1835–39), an indirect reply to Strauss' *Life* of *Jesus,* led to his being invited in 1839 to Kiel as professor ordinarius. There he wrote, among other works, *Das Princip unserer Kirche nach dem innern Verhältniss seiner zwei Seiten betrachtet* (1841). In 1843 he removed to Konigsberg, in 1847 to Bonn, in 1853 to Gottingen and in 1862 to Berlin. In 1867 appeared his valuable *Geschichte der protestantischen Theologie* (Eng. trans., 1871). His ultimate position as one of the "mediating" theologians is best seen in his *Christliche Glaubenslehre* (1879–81). The companion work *System der christlichen Sittenlehre* was published in 1886. He founded and for many years edited the *Jahrbücher für deutsche Theologie.* He died at Wiesbaden on July 8, 1884.

See Herzog-Hauck, *Realencyklopadie;* Pfleiderer, *The Development of Theology in Germany since Kant* (1890); *F.* Lichtenberger, *History of German Theology in the Nineteenth Century* **(1889)**; Carl Schwarz, *Zur Geschichte der neuesten Theologie* **(1869).**

DORNOCH, royal burgh and county town, Sutherlandshire, Scotland. Pop. (1938) 676. It lies on the north shore of Dornoch firth, an arm of the North sea, $7\frac{3}{4}$ m. S.S.E. of Mound station on the L.M.S.R. by light railway. Its dry and bracing climate and fine golf courses have made it a health resort. Before the Reformation it was the see of the bishopric of Caithness and Sutherland. The cathedral, built by Bishop Gilbert de Moravia (Moray) (d. 1245), the last Scot enrolled in the Calendar of Scottish saints, was damaged by fire in 1570, during a raid, and afterwards neglected till 1837, when it was restored, and has since been used as the parish church. It is the burying-place of the Sutherland family and contains the remains of sixteen earls. The ancient castle was also the bishop's palace; its west tower remains. the rest was destroyed in 1570. Dornoch became a royal burgh in 1628. It was the scene of the last execution for witchcraft in Scotland (1722). At Embo, 2 m. N.N.E., a sculptured stone commemorates the battle with the Danes in the 13th century, in which Richard de Moravia was killed. He was buried in the cathedral, where his effigy was found in the chancel. Skibo castle, about 4 m. W. of Dornoch, once a residence of the bishops of Caithness, was acquired in 1898 by Andrew Carnegie.

DOROHOI or **DOROGOI,** the capital of the department of Dorohol, Rumania; on the right bank of the river Jijia, which broadens into a lake on the north. Dorohoi is a market for the timber and farm produce of the north Moldavian highlands; merchants from the neighbouring States flock to its great fair, held on June 12. There is a church built by Stephen the Great (1458–1504). Population 15,375.

DOROTHEUS, a professor of jurisprudence in the law school of Berytus in Syria, and one of the three commissioners appointed by the emperor Justinian to draw up a book of Institutes to serve as an introduction to the *Digest* already completed. His colleagues mere Tribonian and Theophilus, and their work was accomplished in 533. Dorotheus later wrote a commentary on the *Digest,* which is called the *Index,* and was published by him in 542. Fragments of this commentary have been preserved in the *Scholia* appended to the *Basilica,* from which it seems probable that the commentary of Dorotheus contained the substance of a course of lectures on the *Digest* delivered by him in the law school of Berytus.

D'ORSAY, ALFRED GUILLAUME GABRIEL, COUNT (1801–1852), a famous dandy and wit, was born in Paris on Sept. 4, 1801, and was the son of General D'Orsay, from whom he inherited an exceptionally handsome person. In his youth he entered the French army and served as a *garde du corps* of Louis XVIII. In 1822, while stationed at Valence on the Rhone, he met the earl and countess of Blessington (*q.v.*) whose house he had visited when in London a little earlier. At the invitation of the earl he accompanied the party on their tour through Italy. In the spring of 1823 he met Lord Byron at Genoa. and the published correspondence of the poet at this period contains numerous references to the count's gifts and accomplishments, and to his peculiar relationship to the Blessington family. A diary which D'Orsay had kept during a visit to London in 1821–22 was much praised by Byron for the knowledge of men and manners and the keen faculty of observation it displayed. On Dec. 1, 1827, Count D'Orsay married Lady Harriet Gardiner, a girl of 15, the daughter of Lord Blessington by his previous wife. The union, if it rendered his connection with the Blessington family less ostensibly equivocal than before, was in other respects an unhappy one, and a separation took place almost immediately. After the death of Lord Blessington, which occurred in 1829, Lady Blessington returned to England, accompanied by Count D'Orsay, and her home, first at Seamore Place, then at Gore House, soon became a resort of the fashionable literary and artistic society of London. Count D'Orsay had been from his youth a zealous Bonapartist, and one of the most frequent guests at Gore House was Prince Louis Napoleon. In 1849 he went bankrupt, and the establishment at Gore House being broken up, he went to Paris with Lady Blessington, who died a few weeks after their arrival. His relations with Napoleon were less cordial after the *coup d'état* of 1851 of which he disapproved. His appointment to the post of director of fine arts was announced only a few days before his death which occurred on Aug. 4, 1852.

Count d'Orsay was the supreme dandy, and the list of his accomplishments is surprising. In addition to wit, charm, and taste in dress and furniture, he was a good shot, a good horseman, a good fencer and even a good boxer. He had considerable skill in painting and sculpture as well. It is more surprising, perhaps, to find him in the light of benefactor to distressed compatriots in England, and as the original founder of the *Société de Bienfaisance.*

Much information as to the life and character of Count D'Orsay is to be found in Richard Madden's *Literary Life and Correspondence of the Countess of Blessington* (1855).

DORSET, EARLS, MARQUESSES AND DUKES OF, English titles one or more of which had been borne by the families of Beaufort, Grey and Sackville. About 1070 Osmund, or Osmer, an alleged son of Henry, count of Séez, by a sister of William the Conqueror, is said to have been created earl of Dorset, but the authority is a very late one and Osmund describes himself simply as bishop (of Salisbury). William de Mohun of Dunster, a partisan of the empress Matilda, appears as earl of Dorset or Somerset, these two shires being in early times united under a single sheriff. In 1397 John Beaufort, earl of Somerset (d. 1410), the eldest son of John of Gaunt, duke of Lancaster, and Catherine Swinford, was created marquess of Dorset; two years later, however, he was reduced to his former rank of earl of Somerset. In 1411 his brother Thomas, afterwards duke of Exeter, was created earl of Dorset, and in 1441 his youngest son, Edmund, obtained the same dignity. Two years later Edmund was created marquess of Dorset and still later duke of Somerset. Edmund's son Henry, duke of Somerset and marquess of Dorset, was attainted during the Wars of the Roses, and was beheaded after the battle of Hexham in May 1363, when the titles became extinct. In 1475 Thomas Grey, 8th Lord Ferrers of Groby (1451–1501), a son of Sir John Grey (d. 1461) and a stepson of King Edward IV., having resigned the earldom of Huntingdon, which he had received in 1471, was created marquess of Dorset (*see* below). He was succeeded in this title by his son Thomas (1477–1530), and then by his grandson Henry (1510–54), who was created duke of Suffolk in 1551. When in Feb. 1554 Suffolk was beheaded for sharing in the rising

of Sir Thomas Wyat, the marquessate of Dorset again became extinct; but in 1604 Thomas Sackville (see the account of the family under SACKVILLE, 1ST EARL) was created earl of Dorset (see below), and his descendant, the 7th earl, was created duke in 1720. In 1843 the titles became extinct.

THOMAS GREY, 1ST MARQUESS OF DORSET (1451–1501), was the elder son of Sir John Grey, 7th Lord Ferrers of Groby (1432–61), by his wife, Elizabeth Woodville, afterwards queen of Edward IV. He fought for Edward at Tewkesbury; in 1475 he was created marquess of Dorset. After the death of Edward IV. Dorset and his brother, Richard Grey, supported their half-brother, the young Edward V., thus incurring the enmity of Richard duke of Gloucester, afterwards Richard III. Richard Grey was arrested and beheaded at Pontefract in June 1483, while the marquess saved his life by flight. Dorset was one of the leaders of the duke of Buckingham's insurrection, and when this failed he joined Henry earl of Richmond in Brittany, but he was left in Paris when the future king crossed to England in 1485. After Henry's victory at Bosworth the marquess returned to England and his attainder was reversed, but he was suspected and imprisoned when Lambert Simnel revolted; he had, however, been pardoned, had marched into France and had helped to quell the Cornish rising, when he died on Sept. 20, 1501.

Dorset's sixth son, Lord Leonard Grey (c. 1490–1541), went to Ireland as marshal of the English army in 1535, and in 1536 was appointed lord deputy in succession to Sir William Skeffington. He was accused, probably with truth, of favouring the family of the Geraldines, to whom he was related, and quarrelled fiercely with the rival family of the Butlers. Returning to England in 1540 he was condemned to death for treason. He was beheaded on July 28, 1541. (See R. Bagwell, Ireland under the Tudors, vol. i., 1885.)

THOMAS GREY, 2ND MARQUESS OF DORSET (1477–1530), the eldest son of the 1st marquess, fled to Brittany with his father in 1484. He spent some years in prison under Henry VII., but was highly favoured by Henry VIII., who gave him command in France in 1512, and in 1523 made him warder of the Scottish eastern and middle marches. He was famous for his skill in the tournament. He died on Oct. 10, 1530.

His eldest son, Henry Grey, 3rd marquess of Dorset, was in 1551 created duke of Suffolk (*q.v.*). A younger son, Lord Thomas Grey, was beheaded in 1554 for sharing in the rebellion of Sir Thomas Wyat; another son, Lord John Grey, was also sentenced to death for his share in this rising, but his life was spared by the efforts of his wife, Mary, daughter of Sir Anthony Browne. Under Elizabeth, Lord John, a strong Protestant, was restored to the royal favour. He died on Nov. 19, 1569. In 1603 his son Henry (d. 1614) was created Baron Grey of Groby, and in 1628 his great-grandson Henry was made earl of Stamford. (For the 1st earl of Dorset, see SACKVILLE, THOMAS.)

EDWARD SACKVILLE, 4TH EARL OF DORSET (1591–1652), son of the 2nd earl, succeeded his brother Richard, the 3rd earl (1590–1624), in 1624. He had attained much notoriety by killing Edward Bruce, 2nd Lord Kinloss, in a duel, and in 1620 he fought for James I.'s son-in-law, Frederick V., elector palatine of the Rhine, at White Hill, near Prague. In the House of Commons, where he represented Sussex, Sackville defended Bacon and advocated an aggressive policy for the recovery of the Rhenish Palatinate; twice he was ambassador to France, and he was interested in Virginia, and the Bermuda islands. Under Charles I. he was a privy councillor and lord chamberlain to Henrietta Maria. At the outbreak of the Civil War, he joined the king at York, but he endeavoured to secure peace. At Oxford he was lord chamberlain to the king and lord president of his council, but Charles did not altogether approve of his pacific attitude He died on July 17, 1652. His wife Mary (d. 1645), daughter of Sir George Curzon, was governess to the sons of Charles I., the future Charles II. and James II.

CHARLES SACKVILLE, 6TH EARL OF DORSET (1638–1706), English poet and courtier, son of Richard Sackville, 5th earl (1622–77), was born on Jan. 24, 1638, and succeeded to his father's estates and title in 1677. In Charles II.'s first parliament he sat for East Grinstead, Sussex. He won a reputation as courtier and wit at Whitehall, where he bore his share in the excesses for which Sir Charles Sedley and the earl of Rochester were notorious. In 1662 he and his brother Edward, with three others, were indicted for the robbery and murder of a tanner named Hoppy. The defence was that they were in pursuit of thieves, and mistook Hoppy for a highwayman. In 1665 he volunteered to serve under the duke of York in the Dutch war. His famous song, "To all you Ladies now at Land," was written, according to Prior, on the night before the victory over "foggy Opdam" off Harwich (June 3, 1665). Dr. Johnson, with the remark that "seldom any splendid story is wholly true," says that the earl of Orrery had told him it was only retouched on that occasion. In 1667 Pepys laments that he had lured Nell Gwyn away from the theatre, and that with Sedley the two kept "merry house" at Epsom. Next year the king was paying court to Nell, and her "Charles the First," as she called him, was sent on a "sleeveless errand" into France to be out of the way. His gaiety and wit did not especially recommend him to James II. He retired from court at the beginning of the new reign. Dorset concurred in the invitation to William of Orange, who made him privy councillor, lord chamberlain (1689), and knight of the Garter (1692). During William's absences in 1695–98 he was one of the lord justices of the realm.

He was a generous patron of men of letters. Dryden's "Essay on Satire" and the dedication of the "Essay on Dramatic Poesy" are addressed to him. Walpole (Catalogue of Noble *Authors,* iv.) says that he had as much wit as his first master, or his contemporaries, Buckingham and Rochester, without the royal want of feeling, the duke's want of principle or the earl's want of thought; and Congreve reported of him when he was dying that he "slabbered" more wit than other people had in their best health.

The fourth act of *Pompey the Great, a tragedy translated out of French by certain persons of honour,* is by Dorset. The satires for which Pope classed him with the masters in that kind seem to have been short lampoons, with the exception of *A Faithful Catalogue of o w Most Eminent Ninnies* (reprinted in *Bibliotheca Curiosa,* ed. Goldsmid, **1885**). *The Works of the Earls of Rochester, Roscommon and Dorset, the Dukes of Devonshire, Buckinghamshire, etc., with Memoirs of their Lives* (1731) is catalogued (No. **20,841**) by H. G. Bohn in **1841**. His *Poems* are included in Anderson's and other collections of the British poets.

LIONEL CRANFIELD SACKVILLE, 1ST DUKE OF DORSET (1688–1765), the only son of the 6th earl, was born on Jan. 18, 1688. He succeeded as 7th earl of Dorset in 1706, and was created duke of Dorset in 1720. He was twice lord steward of the household, twice lord-lieutenant of Ireland, and lord president of the council from 1745–51. His second viceroyalty of Ireland (1750–55) was stormy and ended in dismissal. The duke died on Oct. 10, 1765. He left three sons: Charles, the 2nd duke; John Philip (d. 1765); and George, who took the additional name of Germain in 1770, and in 1782 was created Viscount Sackville (*q.v.*).

CHARLES SACKVILLE, 2ND DUKE OF DORSET (1711–1769), an associate of Frederick, prince of Wales, was a member of parliament for many years and a lord of the Treasury under Henry Pelham; he died on Jan. 5, 1769. His nephew, John Frederick (1745–1799), 3rd duke, was ambassador in Paris from 1783 to 1789, and lord steward of the household from 1789 to 1799; he died on July 19, 1799, and was succeeded by his only son, George John Frederick (1793–1815). When the 4th duke died unmarried in Feb. 1815, the titles passed to his kinsman, Charles Sackville Germain (1767–1843), son and heir of the 1st Viscount Sackville, who thus became 5th duke of Dorset. When he died on July 29, 1843, the titles became extinct.

DORSET, a south-western county of England, bounded north-east by Wiltshire, east by Hampshire, south by the English Channel, west by Devon and north-west by Somerset. The area is 973 square miles.

In the centre of the county the chalk hills of the western downs sweep south-west from Cranborne Chase through Blandford, Milton Abbas and Frampton to Dorchester. Here the chalk outcrop narrows and turns south-eastward by Portisham and Bincombe to West Lulworth, whence it is continued eastward as the Purbeck hills. Within this rim of chalk is a fringe of Reading

beds and London clay which may be traced from Cranborne through Wimborne Minster, near Bere Regis and Puddletown, then southeastward through West Knighton, Winfrith and Lulworth, and along the northern side of the Purbeck hills to Studland. Bounded by this arc and occupying the eastern portion of the county is a low-lying region of sands, gravel and clay, probably an extension of the Hampshire basin. Denudation has revealed the Wealden beds in the vale between Lulworth and Swanage, and also near East Chaldon. The town of Shaftesbury stands upon a hill of Greensand, while the Upper Greensand also forms the high ground above Lyme Regis, Golden Cap and Pillesden and Lewesden Pens. It is thought that a stream following the syncline of the Frome valley, the Solent and the Spithead was at one time the chief feature of the drainage. Subsidence, however, has resulted in the tributaries of this stream now finding their way independently to the sea. The Stour rises in Wiltshire and flows with a general southeasterly course to join the Hampshire Avon near its mouth. It receives the Cale and Lidden, which drain the Vale of Blackmore, in its upper course, and breaches the western downs in its middle course between Sturminster Newton and Blandford.

The small river Puddle or Trent and the Frome flow across the eastern plain and almost unite their mouths in Poole harbour.

In the northwest the Yeo flows northward to join the Parret and so sends its waters to the Bristol channel. The Char, the Brit and the Bride drain the southwest. Lulworth Cove is an excellent example of differential marine erosion. Chesil Bank has been formed from debris accumulated there by up-channel currents.

Archaeology and History.—Several beakers indicate early settlement. One handled beaker found 3 mi. from Dorchester, on the Ridgeway hill, may imply influences from eastern England. (See Fox in Arch. *Camb.* vol. lxxx, pt. 1, p. 19.) Numerous interments of cremated bones (yielding many cinerary urns but few incense cups), disc-barrows resembling those of Wiltshire, unchambered barrows and ston circles, testify to the importance of Dorset in the Bronze age. The sheltered waters of Weymouth, with access to the well-drained chalk uplands of the interior, favoured maritime trade. At Wareham was found a palstave of a type largely confined to southern England and northern France, which has been considered as an indication of early intercourse with neighbouring parts of the continent. (See Crawford, in *L'Anthropologie,* tome xxiv, 1913, pp. 641–649.) The numerous earthworks, of which the best known is Maiden Castle, may have been constructed to guard the principal routes from the coast. The finding of La Tène brooches at Woodcuts, Iwerne, Blandford and Maiden Castle (Dorchester) suggests contacts with northwestern France during the Early Iron age. (See Fox, *Arch. Camb.,* vol. lxxxii, pt. 1, pp. 67–112.)

The kingdom of Wessex originated with the settlement of Cedric and his followers in Hampshire in 495. In 705 the West Saxon see was transferred to Sherborne, and many religious houses were founded later. In 787 the Danes landed at Portland, and in 833 they arrived at Charmouth and fought with Egbert. The shire is first mentioned by name in the Saxon Chronicle in 845. During the following $2\frac{1}{2}$ centuries Dorset was constantly ravaged by the Danes.

Several of the West Saxon kings resided in Dorset, and Aethelbald and Aethelbert were buried at Sherborne, and Aethelred at Wimborne. In the reign of Canute Wareham was the shire town. Dorset formed part of Harold's earldom, and its resistance to the Conqueror was punished by the devastation of Dorchester, Wareham, Shaftesbury and Bridport.

No Englishman retained important estates after the conquest, and at the time of the survey the bulk of the land, except 46 manors held by the king, was in the hands of religious houses, the abbeys of Cerne, Milton and Shaftesbury being the most wealthy. There were 272 mills, and nearly 80 men were employed in working salt along the coast. Mints existed at Shaftesbury, Wareham, Dorchester and Bridport, the three former having been founded by Aethelstan. King John frequently hunted in the county. In the time of Egbert, Wessex was divided into definite *pagi,* each under an ealdorman, which no doubt represented the later shires. The *Inquisitio Geldi,* drawn up two years before the Domesday survey, mentions the 39 pre-conquest hundreds of Dorset. The 33 hundreds and 21 liberties of the present day retain some original names, but boundaries have changed. Until the reign of Elizabeth, Dorset and Somerset were united under one sheriff. After the transference of the West Saxon see from Sherborne to Sarum, in 1075. Dorset remained part of that diocese until 1542, when it was included in the newly formed diocese of Bristol. The vast power and wealth monopolized by the Church in Dorsetshire tended to check the rise of any great county families.

The three finest churches are the abbey church of Sherborne (*q.v.*), Wimborne Minster (*q.v.*) and Milton Abbey church, a Decorated and Perpendicular structure erected on the site of a Norman church.

Dorset took no active part in the struggles of the Norman and Plantagenet period. In 1627 the county refused to send men to La Rochelle. On the outbreak of the Civil War the general feeling was in favour of the king, and in 1643 Lyme Regis and Poole were the only garrisons in the county left to the parliament. By 1644, however, parliament had gained the whole county except Sherborne and the Isle of Portland. The remains of Corfe castle (*q.v.*) and of Sherborne castle may still be seen. The general aversion of Dorset people to warlike pursuits is demonstrated at this period by the rise of the "clubmen," so called from their appearance without pikes or firearms at county musters, whose object was peace at all costs. In the 14th century Dorset produced much wheat and wool and had a prosperous clothing trade, which declined after the ravages of the plague in 1626. The hundred of Pimperne produced saltpetre in the 17th century, and the serge manufacture was introduced about this time. Portland freestone was first brought into use in the reign of James I, and after the Great Fire it was extensively used by Sir Christopher Wren. In the 18th century Blandford, Sherborne and Lyme Regis were famous for their lace. The county returned two members to parliament in 1290; in 1572 the county and nine boroughs returned a total of 20 members. Under the Reform Act of 1832 the county returned three members, and Corfe castle was disfranchised. Lyme Regis was disfranchised in 1868 and the remaining boroughs in 1885. Under the Representation of the People act, 1918, the county returns four members.

Agriculture and Industries.—The climate is mild, and in some sheltered spots semi-tropical plants flourish. Much fine timber appears in the richer soils, in some of the sheltered valleys of the chalk district, and more especially upon the Greensand, though many woods have been cleared. In 1939 there were only 97,525 ac. of arable land, but 318,198 ac. (76.5% of the total acreage under crops and grass) of permanent grass, including 69,173 ac. of rough grazing ground, the chalk downs being celebrated as sheep walks. The chief crops were oats (16,282 ac.), wheat (15,561 ac.) and turnips and swedes (11,204 ac.). Barley and mangolds followed, with 8,430 ac. and 3,017 ac. respectively. Devons, Shorthorns and Herefords are the most common breeds of cattle, and dairy farming is extensively carried on. The National Trust owned 9 ac. in the county in 1942.

The quarries of the Isles of Portland and Purbeck are important. The first supplies a much used white freestone. Purbeck marble was used for many of the most famous Gothic churches in England. A valuable product of Purbeck is a white pipeclay, exported to the potteries of Staffordshire from Purbeck. Some shipbuilding is carried on at Poole, and paper is made at several towns. Other small manufactures are those of flax and hemp in the neighbourhood of Bridport and Beaminster, of bricks, tiles and pottery in the Poole district, and of nets (braiding, as the industry is called) in some of the villages. There are silk mills at Sherborne and elsewhere. The chief ports are Poole, Weymouth, Swanage, Bridport and Lyme Regis. The harbour of refuge at Portland, under the admiralty, is an important fortified naval station.

The main line of the Southern railway serves Gillingham and Sherborne, in the north of the county. Branches of this system serve Wimborne, Poole, Swanage, Dorchester, Weymouth and

Portland. The last two towns, with Bridport, are served by the Great Western railway; the Somerset and Dorset line follows the Stour valley by Blandford and Wimborne; and Lyme Regis is the terminus of a light railway from Axminster on the Southern ry.

The population of the administrative county was, in 1938, 252,240. An increase in the county population of 3% between Sept. 1939 and Feb. 1941 was caused by wartime movements. The county contains eight municipal boroughs, and four urban districts. It and Poole each have a court of quarter sessions and there are nine petty sessional divisions. The dialect of the county, distinguishable from those of Wiltshire and Somersetshire, yet bearing many common marks of Saxon origin, is admirably illustrated in some of the poems of William Barnes (*q.v.*). Many towns, villages and localities are readily to be recognized from their descriptions in the "Wessex" novels of Thomas Hardy (*q.v.*).

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DORT, SYNOD OF. An assembly of the Reformed Dutch Church, with deputies from Switzerland, the Palatinate, Nassau, Hesse, East Friesland, Bremen, Scotland and England, called to decide the theological differences existing between the Arminians (or Remonstrants) and the Calvinists (or Counter-Remonstrants), was held at Dort or Dordrecht (*q.v.*) in 1618 and 1619. The government of Louis XIII. prohibited the attendance of French delegates. During the life of Arminius a bitter controversy had sprung up between his followers and the strict Calvinists, led by Francis Gomar, his fellow-professor at Leyden; and, in order to decide their disputes, a synodical conference was proposed, but Arminius died before it could be held. The essential contentions of the Arminians were the denial of irresistible predestination and the affirmation that Christ died for all men, not only for the "elect." In 1614, at the instance of the Arminian party, an edict was passed by the states general, in which toleration of the opinions of both parties was declared and further controversy forbidden; but this act only served, by rousing the jealousy of the Calvinists, to fan the controversial flame into greater fury. Gradually the dispute pervaded all classes of society, and religious questions became entangled with political issues; the partisans of the house of Orange espoused the cause of the stricter Calvinism, whereas the bourgeois oligarchy of republican tendencies, led by Oldenbarnevelt and Hugo Grotius, stood for Arminianism. In 1617 Prince Maurice of Orange committed himself definitely to the Calvinist party, found an occasion for throwing Oldenbarnevelt and Grotius into prison, and furthermore in 1617 called a synod intended to crush the Arminians. This synod, which assembled at Dort in November 1618, was strictly national — called by the national authority to decide a national dispute, and not intended to have more than a national influence. The foreign deputies were invited to attend, only to assist by their advice in the settlement of a controversy which concerned the Netherland church alone, and which the Netherland church alone could decide. At the fourth sitting it was decided to cite Simon Episcopius (*q.v.*) and other Remonstrants to appear within fourteen days before the synod, to state and justify their doctrines. It was also agreed to allow the Arminian deputies to take part in the deliberations, only on condition that they forebore to consult with, or in any way assist, their cited brethren, but this they refused. When Episcopius and the others cited appeared, the former surprised the deputies by a bold and outspoken defence of his views, and even went so far as to say that the synod, by excluding the Arminian deputies, could now only be regarded as a schismatic assembly. The Remonstrants were asked to file copious explanations of the points in dispute (*Sententia Remonstrantium*), but objecting to the manner in which they were catechized, they were dismissed from the synod. The synod then proceeded in their absence to judge them from their published writings, and came to the conclusion that as ecclesiastical rebels and trespassers they should be deprived of all their offices. The synodical decision in regard to the five points is contained in the canons adopted at the 136th session held on April 23, 1619; the points were: unconditional election, limited atonement, total depravity, irresistibility of grace, final perseverance of the saints. These doctrinal decisions and the sentence against the Remonstrants were, at the 144th sitting, read in Latin before a large audience in the great church. The Remonstrants were required to subscribe the condemnation, and many of them refused and were banished. "The canons of Dort represent the last effort of rigid Calvinistic orthodoxy to meet the difficulties and objections besetting their system, both from a popular and a theological point of view." (See REMONSTRANTS.)

See W. A. Curtis, art. "Confessions, Christian" in Hastings *Encyclopaedia of Religion and Ethics*, vol. iii., p. 868; H. C. Rogge in Herzog-Hauck, *Realencyklopadie*, vol. iv. p. 798; Schaff, *Creeds of Christendom*, p. 550 ff. (3rd ed., 1877); Hall, *Harmony of Protestant Confessions* (1842), p. 539 (positive and negative canons in English); for references to the sources and full Latin text, Müller, *Die Bekenntnisschriften der reformierten Kirche* (1903), and *Acta der Nationale Synode te Dordrecht* (Leiden, 1887).

DORTMUND, a town of Germany, in the Prussian province of Westphalia, on the Emscher, in a fertile plain, 50 m. E. from Düsseldorf by rail. Pop. (1939) 537,000.

Dortmund, the Throtmannia of early history, was already a town of some importance in the 9th century. In 1005 the emperor Henry II. held here an ecclesiastical council, and in 1016 an imperial diet. The town was walled in the 12th century, and in 1387–1388 successfully withstood the troops of the archbishop of Cologne for twenty-one months. About the middle of the 13th century it joined the Hanseatic League. In 1803 Dortmund lost its rights as a free town, and was annexed to Nassau. The French occupied it in 1806, and in 1808 it was made over by Napoleon to the grand-duke of Berg, and became the chief town of the department of Ruhr. Through the cession of Westphalia by the king of the Netherlands, on May 31, 1815, Dortmund became a Prussian town.

The old walls were abolished in 1863 but the centre of the town retains a mediaeval aspect. Its ancient buildings include Reinoldikirche, with fine stained-glass windows; Marienkirche, the nave of which dates from the 11th century; and Petrikirche, with a curious altar, and the Dominican church, with beautiful cloisters. The 13th-century town hall was restored in 1899 and now contains the municipal antiquarian museum. Dortmund owes its development to its situation in the centre of the Westphalian coal basin. In the immediate vicinity are also extensive beds of iron ore, and the town competes with Essen, Oberhausen, Duisburg and Hagen in the products of the iron industry. These in Dortmund include steel rails, mining plant, wire ropes, machinery, safes and sewing machines. Its airfield, oil tanks and factories were constant targets for British bombers in World War II. It is a railway centre and is also connected with the river Ems by the Dortmund-Ems canal, 170 mi, in length.

DOSITHEUS MAGISTER, Greek grammarian, flourished at Rome in the 4th century A.D. He was the author of a Greek translation of a Latin grammar, intended to assist the Greek-speaking inhabitants of the empire in learning Latin. The Latin grammar used was based on the same authorities as those of Charisius and Diomedes. Dositheus contributed very little of his own. Some Greek-Latin exercises by an unknown writer of the 3rd century, are of value as illustrating the social life of the period and the history of the Latin language. Of these *Hermeneumata*, the third book, containing a collection of words and phrases from every day conversation has been preserved. A further appendix consisted of anecdotes, letters and rescripts of the emperor Hadrian; fables of Aesop; extracts from Hyginus; a history of the Trojan War, and a legal fragment, De *manumissionibus*.

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DOSSAL (dorsal; Lat. dorsum, Fr. dos, back), an embroidered curtain hung behind the altar.

DOSSERET, or impost block, in architecture, the block of stone sometimes used in the Byzantine style above the capital (*q.v.*) of a column. It has the form of a truncated pyramid, with the large side up, and therefore furnishes ample bearing for carrying the arches and vaults above it.

DOSSO DOSSI, GIOVANNI (1479–1542), Italian painter, the head of the Ferrarese school in the 16th century. His real name was Giovanni de Lutero. His father, Niccolo de Lutero, a native of Trent, settled at Ferrara, and Giovanni and his brother Battista (d. 1549) were probably born at Dosso, a village near Mantua. Vasari does not mention the name of their master, but according to Scannelli they studied under Lorenzo Costa, while Morelli suggests that their first teacher was G. Panetti. We know by documentary evidence that Battista was in Rome in 1519; there is, however, no proof that Dosso studied in Rome. His work is Ferrarese, though his colour is under Venetian influence. From 1514 Dosso was in the service of Alfonso d'Este. He painted portraits of the Este family, he decorated the ducal palaces and executed designs for tapestries and majolica. The two brothers Dossi, though not always on good terms with one another, often co-operated, as in the decoration of the ducal palace of Ferrara, of the palace of the Gonzagas at Mantua (1512), of the Villa Imperiale near Pesaro, and of the bishop's palace at Trent (1532). Dosso died at Ferrara shortly before Aug. 27, 1542. He was a friend of his compatriot Ludovico Ariosto, and, like this great poet, loved to depict romantic scenes from pagan myths or from legends of Christian chivalry. His fantastic "Circe" in the Galleria Borghese might be an illustration of Ariosto's poetry. The admiration was reciprocal, for in the Orlando *Furioso* (xxxiii., 2) Dosso ranks with Leonardo, Michelangelo, Raphael, Titian, Bellini and Mantegna. Dosso was a poet in his colour schemes. His shadows are saturated with colour, his lights sparkling and strong. He was an innovator in landscape painting, for he made the scenery take part in the drama enacted by the figures. Thus the background in the "Adoration of the Magi" (National Gallery, London) is illuminated by a supernatural light. Nearly all the frescoes of Dosso are much damaged or have perished. However, a number of oil paintings have survived. Besides those mentioned above the following are his chief works: the altarpiece in the cathedral of Modena representing the "Madonna and Saints"; the altarpiece of the cathedral of Ferrara representing '(St. Bartholomew and John the Baptist" which has passed into the Chigi collection; the "Four Fathers of the Church" in the Dresden gallery; that gallery also contains several pictures from the ducal palace of Ferrara, some by Dosso and others designed by him and completed by his brother and Girolamo Carpi. The gallery at Modena contains some fine examples and several of his works are at Hampton Court Palace.

See Vasari *le Vite de pittori* (ed. Milanesi, vol. v.); Laderchi, *Storia pitt.* (1795); *I.* Lermolieff (Morelli), *Galleria Borghese* e *Doria Pamfili* and *Galleria a Dresden; E.* Gardner, *The Painters of the School of Ferrara* (1911); *C.* Zwanziger, *Dosso Dossi* (1911); *H.* Mendelsohn *Dosso Dossi* (1913). (I. A. R.)

DOST MOHAMMED KHAN (1793–1863), founder of the dynasty of the Barakzai in Afghanistan, was born in 1793. His elder brother, the chief of the Barakzai, Fateh Khan, took an important part in raising Mahmud to the sovereignty of Afghanistan in 1800 and in restoring him to the throne in 1809. But Mahmud secured his assassination in 1818, and thus incurred the enmity of his tribe. After a bloody conflict. Mahmud was deprived of all his possessions but Herat, the rest of his dominions being divided among Fateh Khan's brothers. Of these Dost Mohammed received Ghazni, to which in 1826 he added Kabul; he at once found himself involved in disputes with Ranjit Singh, the Sikh ruler of the Punjab, who used the dethroned Saduzai prince, Shuja-ul-Mulk, as his instrument. In 1834 Shuja made a last attempt to recover his kingdom. He was defeated by Dost Mohammed under the walls of Kandahar, but Ranjit Singh seized the opportunity to annex Peshawar. The recovery of this fortress became the Afghan amir's great concern. Rejecting overtures from Russia, he sought alliance with England, and welcomed Alexander Burnes to Kabul in 1837. But the governor general, Lord Auckland, did not respond to the amir's advances. Dost Mohammed was enjoined to abandon the attempt to recover Peshawar, and to place his foreign policy under British guidance. In return he was only promised protection from Ranjit Singh, of whom he had no fear. He replied by renewing his relations with Russia, and in March 1839 a British force under Sir Willoughby Cotton advanced through the Bolan Pass, and on April 26, it reached Kandahar. Shah Shuja was proclaimed amir, and entered Kabul on Aug. 7, while Dost Mohammed sought refuge in the Hindu Kush. On Nov. 4, 1840, he surrendered. He remained in captivity during the British occupation, during the disastrous retreat of the army of occupation in Jan. 1842, and until the recapture of Kabul in the autumn of 1842. (See INDIA: History.) He was then freed.

On his return from India Dost Mohammed was received in triumph at Kabul. From 1846 he renewed his policy of hostility to the British and allied himself with the Sikhs; but after the defeat of his allies at Gujrat on Feb. 21, 1849 he led his troops back into Afghanistan. In 1850 he conquered Balkh, and in 1854 he acquired control over the southern Afghan tribes by the capture of Kandahar. On March 30, 1855, Dost Mohammed concluded an offensive and defensive alliance with the British government. In 1857 he declared war on Persia in conjunction with the British, and in July a treaty was concluded by which the province of Herat was placed under a Barakzai prince. During the Indian Mutiny Dost Mohammed punctiliously refrained from assisting the insurgents. His later years were disturbed by troubles at Herat and in Bukhārā. These he composed for a time, but in 1862 a Persian army, acting in concert with Ahmad Khan, advanced against Kandahar. The old amir called the British to his aid, and, putting himself at the head of his warriors, drove the enemy from his frontiers. On May 26, 1863, he captured Herat, but on June 9 he died suddenly in the midst of victory, after playing a great rôle in the history of Central Asia for forty years. He named as his successor his son, Shere Ali Khan.

DOSTOIEVSKI, TKEODORE (FYODOR) MIKHAYLOVICH (1821–81), Russian writer, b. Moscow Oct. 30 (o.s.), 1821, his father of Ukrainian extraction, his mother of Moscow merchant stock. He was educated in Moscow, and at the School of Military Engineers in St. Petersburg (Leningrad). In 1841 he obtained a commission in the army, but three years later he left the service to devote himself to literature. In 1845 he completed his first novel, Poor Folk. Its publication, in the following year, was one of the great events which marked the coming of a new literary age in Russia. Dostoievski came to be regarded as the most promising of the young novelists. But his second novel, The Double, published before the end of the same year (18463 disappointed the critics, and his success began to wane. He continued, however, to work with great productivity for the next three years, producing a great number of novels and stories, among which the most important are Mr. *Prokharchin,* The Landlady and *Netochka Nezvanova.* These early works display the strong influence of Gogol, and to a less extent of Balzac. Unlike the later work they betray intense interest in problems of form, and a great variety and conscious originality of verbal expression. Passionate sympathy with the humiliated and the downtrodden, and intense interest in morbid psychology (*The* Double) are already very apparent. In Netochka Nezvanova (1849) appears for the first time that type of "proud girl" which was to play such a prominent part in the great novels of his maturity. Though Dostoievski had quarrelled with the liberal littérateurs owing to their failure to appreciate The Double and to their constant pinpricks, and his morbid self-consciousness suffered from the systematic teasing of some of them (especially Turgenev), he continued to be intimate with another circle of advanced young men who, under the guidance of Petrashevski, met to study the French socialists and discuss social and political reform in Russia.

The reactionary wave that followed 1848 brought with it the arrest (April 23, 1849) and trial of the Petrashevski circle.

Dostoievski and the other "conspirators" were condemned to deportation, but a bogus sentence of death was read to them and mock preparations for the execution were gone through, the real sentence being communicated to them only at the last moment before the expected volley (Dec. 21, 1849). These moments produced a fatal impression on Dostoievski and he alludes to them more than once in his later work. His epilepsy, the first traces of which go back to before the sentence, was greatly aggravated by it. For four years Dostoievski was a convict in the penal settlement of Omsk. These years profoundly changed his mind, and it was then that he evolved his new Christianity, which was essentially based on worshipping Christ *because* he was worshipped by the Russian people. Early in *1854* he was released from prison and transferred as a private to a unit stationed in Siberia. In *18*jj he had his commission restored to him, and in 1859 he was finally amnestied and allowed to live in the capitals. In Siberia he fell in love and married Marie Isaeva, a sensual and crude woman, who brought him no happiness. From *1856* onwards he was able to resume his literary work. His first novel after these seven years of enforced silence was the *Manor of Stepanchikovo* (English version—Tlze *Family Friend) (1859*), written in Siberia. Its central figure of Foma Opiskin is one of the greatest, and most repulsive, satirical character-creations in Russian literature. After his return to St. Petersburg he published *The House of Death* (1861), in which he embodied his prison impressions, and which remained till after his death the most generally popular of his works; and *The Insulted and the Injured* (1862), in which the influence of the more sentimental aspects of Dickens are plainly apparent.

At the same time he engaged in journalism, trying to steer an independent course between the conservatives and the freethinking radicals. His programme was a democratic and Christian nationalism, equally hostile to reaction and to atheistic radicalism, and inspired by a faith in the Russian peasant people, as the depositary of supreme spiritual values. With his brother Michael and several other valuable allies, he started a review, *Vremya (The Times*) which, in spite of hostility from both right and left, succeeded in winning the public ear and was financially a success. In *1863* it was, h'owever, suppressed by the Government on what soon proved a misunderstanding. The Dostoievskis were allowed to revive the review under a new name *(Epokha),* but the new publication failed to revive the success of its predecessor. Michael Dostoievski died (1864), and after a year and more of struggle against adverse circumstances Dostoievski succumbed, discontinued the review and found himself burdened with debts he was unable to pay, besides the obligation of keeping his brother's family.

This crisis coincided with a profound crisis of his inner life. His first wife died. Before her death he had already become intimate with Pauline Suslova, a young woman of sensual, proud and "demoniac" character. His brief intimacy with her appears to have been one of the crucial experiences of his life. In 1863 he travelled with Pauline abroad, strengthening his aversion from bourgeois civilization and contracting the gambling habit. In *1864* he published *Letters from the Underworld* which marks a turning-point in his work and from which we must date the final maturity of his genius. After the failure of *The Epoch* Dostoievski became a victim to the callous exploitation of publishers, for whom he had to work by writing with superhuman speed such works as *Crime and Punishment (1866)* and *The Gambler (1867).* While writing them he employed as secretary Anna Grigorievna Snitkina, whom in *1867* he married. This coincided with a complete financial collapse. He went abroad to escape his creditors, and for four years lived there, passing much of his time at the gambling house of Baden-Baden. Only gradually, by dint of hard work at the series of novels that have since made his name famous in the world was he able once again to support himself.

In 1871 he returned to Russia, and soon obtained a situation as editor of a conservative weekly (1873–74). After *1876* he published and edited a journal of his own, *An Author's Diary,* in which he continued the line of national and democratic Christianity started by the *Vremya.* He became influential as a journalist and his last years were spent in comparatively favourable circumstances. His contemporary fame reached its culminating point in 1880, after his address on the unveiling of the Purhkin memorial, the most characteristic and impassioned of his non-imaginative work. He died on Jan. *28, 1881.* His funeral was accompanied by an inspiring public demonstration.

The work that has made Dostoievski a world classic belongs to the last *17* years of his life. The series of his great novels is ushered in by *Letters from the Underworld* (1864) which may be considered as the central work of Dostoievski. It marks the crisis which changed him, from the humanitarian idealist and dreamer of his early years, into the tragic creator of his full maturity. As in his great novels, the main subject is the problem of human liberty and of the justification of God and the World Order. The great novels that followed were: *Crime and Punishment (1866); The Idiot* (1868–69); *The Demons (1871;* Eng. version *The Possessed)* and *The Brothers Karamazov* (1880); to which must be added *Tlze Gambler* (1867), *The Eternal Husband* (1870); *A Raw Youth* (1875) and some shorter pieces included in *An Autlzor's Diary.* These last, though much shorter, are sometimes of first-rate importance for the understanding of Dostoievski (especially *Bobok* and *The Dream of a Queer Fellow).* In these works Dostoievski gave his full measure as one of the greatest novelists of all times, and as a personality of exceptionally deep significance. For psychological imagination, for power of dramatic construction, for the convincingness and reality of his characters he has no equals. As a thinker, we have to distinguish between the "Christian and national" element of his journalistic writings and of the less inspired parts of his novels (viz., the preachings of Father Zosima in *The Brotlzers Karamazov*), and the profound Jobean and Promethean questioner of the main great novels, whose only peers in modern times are Pascal and Nietzsche. His influence on .Russian literature was greatest between 1895 and *1915.* His ideas always loomed larger than his imaginative creation. Europe began to show a passionate interest in him from about 1905. His influence on French, German and English literature within the last 20 years has been considerable.

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DOTHAN, a city in the extreme south-eastern part of Alabama, U.S.A.; the county seat of Houston county. It is on Federal highways *84* and 231, and is served by the Atlanta and St Andrews Bay, the Atlantic Coast Line, and the Central of Georgia railways. The population was 10,034 in 1920 (43% negroes) and was 17,194 in 1940 by the federal census Dothan is the centre of a fertile farming and stock-raising region, and has a large number of diversified manufacturing industries. The city was founded in 1884 and incorporated in 1885.

DOUAI, a town of northern France, capital of an arrondissement in the department of Nord, 20 m. S. of Lille on the Northern railway between that city and Cambrai. Pop. (1936), *33* 201 Douai, the site of which was occupied by a castle (*Castrum Duacense)* as early as the 7th century, belonged in the middle ages to the counts of Flanders, passed in *1384* to the dukes of Burgundy, and so in 1477 with the rest of the Netherlands to Spain. In *1667* it was captured by Louis XIV., and was ceded to France by the treaty of Ctrecht in 1713. Historically Douai is

important as the centre of the political and religious propaganda of the exiled English Roman Catholics. In 1562 Philip II. of Spain founded a university here, in which several English scholars were given chairs; and in connection with this William Allen (*q.v.*) in 1568 founded the celebrated English college. It was here that the "Douai Bible" was prepared. There were also an Irish and a Scots college and houses of English Benedictines and Franciscans. All these survived till 1793, when the university was suppressed. The modern university is at Lille. Douai stands in a marshy plain on the banks of the Scarpe which supplies water to a canal on the west. The old fortifications, of which the Porte de Valenciennes (15th century) survives are now boulevards and gardens. The industrial towns of Dorignies, Sin-le-Noble and Aniche are practically suburbs of Douai. The church of Notre Dame (12th and 14th centuries) possesses a fine altar-piece (early 16th century) of wooden panels painted by Jean Bellegambe of Douai. The handsome hôtel de ville, partly of the 15th century, has a lofty belfry. The Palais de Justice (18th century) was formerly the town house *(refuge)* of the abbey of Marchiennes. Houses of the 16th, 17th and 18th centuries are numerous. The municipal museum contains a good library, and a fine collection of sculpture and paintings but was damaged in World War I.

Douai is the seat of a court of appeal, a court of assizes and of a subprefect and has a tribunal of first instance, a board of trade-arbitrators, an exchange, a chamber of commerce and a branch of the Bank of France. There is an airfield. The educational institutions include a lycée, training colleges, a school of mines, an artillery school, schools of music, agriculture, drawing, architecture, etc. and a national school for instruction in brewing and other industries connected with agriculture. In addition to other iron and engineering works, Douai has a large cannon foundry and an arsenal; coal-mining and the manufacture of glass bottles and chemicals are carried on on a large scale in the environs; among the other industries are flax-spinning, ropemaking and the manufacture of farm implements, oil and sugar. Trade. which is largely water-borne, is in grain and agricultural products, coal and building material.

See F. Brassart, *Hist. du chciteau et de la chcitellenie de Douai* (Douai, 1877–87); C. Mine. *Hist. pop. de Douai (ib.* **1861**); *B.* Ward, *Dawn of the Catholic Revival* (London, 1909); Handecoeur, *Hist. du Collège anglais, Douai* (Reims, **1898**); Daucoisne, *Établissements britanniques à Douai* (Douai, **1881**).

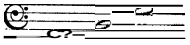
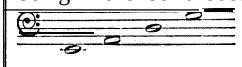
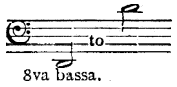
DOUARNENEZ, a fishing-port of western France, in the department of Finistère, on the southern shore of the Bay of Douarnenez, 15 mi. N.W. of Quimper by rail. Pop. (1936), 10,556. About 800 boats, and between 3,000 and 4,000 men, carry on the sardine fishery from June to December, and the preserving of the fish is an important industry. Mackerel and tunny fishing, boat-building and rope and net making also occupy the inhabitants. There is a lighthouse on the small island of Tristan off Douarnenez.

DOUBLE, twice as much, or large, having two parts, having a part repeated (from the Mid. Eng. *duble,* through the Old Fr. *duble,* from Lat. *duplus,* twice as much). The word appears as a substantive with the special meaning of the appearance to a person of his own apparition, generally regarded as a warning, or of such an apparition of one living person to another, the German *Doppelganger (see* APPARITIONS). "Double" is also used of a person whose resemblance to another is peculiarly striking or remarkable, so that confusion between them may easily arise.

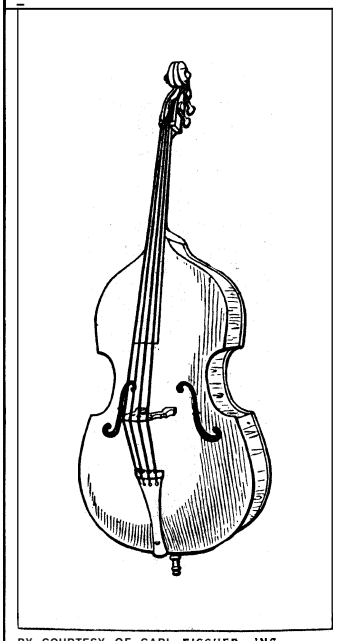
Double or doubles, in music, is an old and now obsolete term for instrumental variations, derived possibly from the fact that more often than not each succeeding variation "doubled" the notes of the preceding one, two quavers taking the place of one crotchet, and so on. The word "doubles" is also applied in bell-ringing terminology to a "change" in which two pairs of bells change places.

DOUBLE BASS, the largest member of the violin family and the lowest in pitch. (Fr. *contrebasse;* Ger. *Kontrabass, Gross Bass Geige;* Ital. *contrabasso, violone.*) The double bass differs slightly in construction from the other members of the family in that it has more slanting shoulders (one of the features of the *viola* da *gamba, see* VIOLIN) Formerly, too, the double bass was made with a flat back—another characteristic of the viol family—whereas now the back is as often found arched as flat.

The technique of the double bass presents certain difficulties inherent in an instrument of such large proportions. The stretches for the fingers are very great, almost double those required for the violoncello, and owing to the thickness of the strings great force is required to press them against the finger-board when they are vibrating.

The double bass sometimes has three strings tuned, in England and Italy in fourths:  ; in France and Germany in fifths:  the real sounds being an octave lower. Owing to the scoring of modern composers, however, it was focnd necessary to adopt an accordance of four strings in order to obtain the additional lower notes required, although this entailed the sacrifice of some beauty of tone, the three-stringed instrument being more sonorous. The four strings are tuned in fourths:  . The practical compass of the double bass extends from 

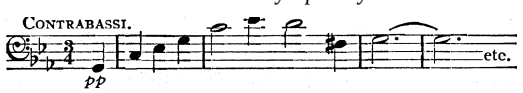
(real sounds) with all chromatic intervals. In order to avoid using numerous ledger lines the music is written an octave higher.



BY COURTESY OF CARL FISCHER, INC.
DOUBLE BASS, LAST SURVIVING REPRESENTATIVE OF THE EARLIER VIOLS

The quality of tone is very powerful .but somewhat rough, and varies greatly in its gradations. The tone of the *pizzicato* is full and rich owing to the slowness of the vibrations. Both natural and artificial harmonics are possible on the double bass, the former being best; but they are seldom used in orchestral works.

The technical capabilities of the double bass are necessarily somewhat more limited than those of the violoncello, but it is the foundation of the whole orchestra and therefore of great importance; it plays the lowest part, often, as its name indicates, only doubling the 'cello part an octave lower. It is only since the beginning of the 19th century that an independent voice has occasionally been allotted to it, as in the Scherzo of Beethoven's *Fifth Symphony:*—



These opening bars are played *soli* by 'cellos and double basses, a daring innovation of Beethoven's which caused quite a consternation at first in musical circles. Still more striking is the famous passage, suggesting the gambols of an elephant, which the double basses are called on to play at the opening of the trio of the same movement.

The remote origin of the double bass is the same as that of the violin. It was evolved from the bass viols, though whether the transformation took place simultaneously with that of the violin from the treble viol, or preceded it, has not been definitely proved.

Giovanni Bottesini (1822–89) was the greatest virtuoso on the double bass that the world has ever known. Before him, Domenico Dragonetti (1763–1846) also enjoyed great fame, while more recently Kussevitsky, who later exchanged the bow for the bbton and became a world-renowned conductor, was for some years a leading exponent of the instrument.

DOUBLE ENTRY: *see* BOOKKEEPING.

DOUBLE FUGUE, in music, a fugue with two subjects, norked together or interwoven (*See* FUGUE.)

DOUBLE JEOPARDY. The 5th Amendment to the U.S. Constitution provides no one shall be "twice put in jeopardy": no one punished or acquitted of an offense may be re-tried.

DOUBLE LIABILITY, in the United States, applies to the stockholders' liability in certain corporations, signifying that, in case of insolvency, the stockholders may not only lose the amount which they invested in their stock but may also be called upon ratably for the concern's indebtedness up to an additional amount equal to the full par value of the stock. This double liability does not apply to stocks of ordinary business corporations but to banking corporations. The laws of most States make State-chartered banks subject to double liability, and the national banking laws make double liability apply to the stock of national banks. The national bank act in providing for double liability on national bank stock provides: "except that shareholders of any banking association now existing under state laws having not less than five million dollars of capital actually paid in and a surplus of twenty per centum on hand, both to be determined by the Comptroller of the Currency, shall be liable only to the amount invested in their shares." At the time of the passage of the act, the National Bank of Commerce of New York city met the above requirements and so its stock became the exception to the double liability for national banks.

DOUBLE-NAME PAPER, notes, bills of exchange or acceptances bearing two names, each of which represents a separate interest and each of which is responsible for the payment. The names may represent a signature and an endorsement, or two signatures. The former class is often known as endorsed paper, and both classes are commonly known as two-name paper. Trade acceptances and bankers' acceptances necessarily have two or more names and both the drawer and the acceptor are liable for the payment. (See ACCEPTANCE; BILL OF EXCHANGE; NOTE; DRAFTS.)

DOUBLE REFRACTION, the resolution, on entering a non-isotropic medium, of light into two rays travelling with different velocities. (See LIGHT.)

DOUBLE STAR: see BINARY SYSTEM and STAR.

DOUBLE-STOPPING, a musical term signifying the playing of two notes simultaneously on a stringed instrument of the violin family. In strictness the term should not be applied when one of the notes is an "open" one and has therefore not entailed any "stopping," *i.e.,* pressing down of the string against the fingerboard by the finger, whereby its vibrating length is shortened; but in practice the distinction is not observed.

DOUBLET, a close-fitting garment, with or without sleeves, extending from the neck to a little below the waist, worn from the 14th century to the time of Charles II., when it began to be superseded by coat and waistcoat. The doublet was introduced into England from France, and was originally padded for defence or warmth. "Doublet" is also used of a pair or couple, as in philology, one of two words differing in form, but represented by an identical root, *e.g.* "alarm" or "alarum"; in optics, of a pair of lenses, combined to correct aberration. In the work of the lapidary a doublet is a counterfeit gem, made by cementing two pieces of plain glass or crystal on each side of a layer of glass (coloured to represent the stone counterfeited); a thin portion of a genuine stone may be cemented upon an inferior one, as a layer of diamond upon a topaz, or ruby on a garnet. In electricity, doublet is a term for two equal and opposite electrical charges situated extremely close together (see ELECTRICITY).

DOUBS, a frontier department of eastern France, formed in 1790 of the ancient principality of Montbéliard and of part of the province of Franche-Comté. It is bounded E. and S.E. by Switzerland, N. by the territory of Belfort and by Haute Saône, and W. and S.W. by Jura. Pop. (1936) 304.812. Area 2,031 sq.mi. The river Doubs traverses the department. Between the Ognon, which forms the north-western limit of the department, and the Doubs, runs a range of low hills known as "the plain." The rest of Doubs is mountainous, four parallel chains of the Jura crossing it from N.E. to S.W. The Lomont range, the lowest of these chains, dominates the left bank of the Doubs. The central region is occupied by hilly plateaux covered with pasturage and forests, while the rest of the department is traversed by the remaining three mountain ranges, the highest and most easterly of which contains the Mont d'Or (4.800 ft.). Besides the Doubs the chief rivers are its tributaries, the Dessoubre, watering the east of the department, and the Loue its south-western portion. The climate is in general cold and rainy, and the winters are severe. The soil is stony and loamy, and at the higher levels there are many peat-bogs. In its agricultural aspect the department may be divided into three regions. The highest, on which the snow usually lies from six to eight months in the year, is in part barren, but on its less exposed slopes is occupied by forests of fir trees, and affords good pasturage for cattle. In the second or lower region the oak, beech, walnut and sycamore flourish; and the valleys are capable of cultivation. The region of the plain is the most fertile, and produces all kinds of cereals as well as hemp, vegetables, vines and fruit. Cattle-rearing and dairy-farming receive much attention; large quantities of cheese, of the nature of Gruyère, are produced, mainly by the co-operative cheese factories or *fruitières*. The rivers of the department abound in gorges and falls of great beauty. The most important manufactures are watches, made chiefly at Besançon and Morteau, hardware (Hérimoncourt and Valentigney), and machinery. Large iron foundries are found at Audincourt (pop. 9,308) and other towns. Distilling and the manufacture of cotton and woollen goods, automobiles and paper are also carried on. Exports include watches, live-stock, mine, vegetables, iron and hardware; cattle, hides, timber, coal, wine and machinery are imported. Large quantities of goods, in transit between France and Switzerland, pass through the department. Among its mineral products are building stone, rock-salt and lime, and there are peat workings. Doubs is served by the Paris-Lyon railway, the line from Dôle to Switzerland passing, via Pontarlier, through the south of the department. The canal from the Rhône to the Rhine traverses it for 84 miles.

The department of Doubs is divided into the three arrondissements of Besanqon, Montbéliard and Pontarlier, with 27 cantons and 636 communes. It belongs to the *académie* (educational circumscription) and the diocese of Besancon, which is the capital, the seat of an archbishop and of a court of appeal, and headquarters of the VII. army corps. Besides Besançon the chief towns are Montbéliard and Pontarlier (*qq.v.*). Ornans, a town on the Loue, has a church of the 16th century and ruins of a feudal castle. Montbenoit on the Doubs near Pontarlier has the remains of an Augustine abbey (13th to 16th centuries), the cloisters are of the 15th century, and the church contains fine 16th century stalls. Morteau has the Maison Pertuisier, of the Renaissance period. Baume-les-Dames owes the affix of its name to a Benedictine convent founded in 763, to which only noble ladies were admitted. Numerous antiquities have been found at Mandeure (near Montbéliard), on the site of the Roman town of *Epomanduodurum*.

DOUBS, a river of eastern France, rising in the Jura at the foot of the Noirmont ridge, at a height of 3,074 ft., and flowing into the Saône. It is 269 m. long, though, owing to the fact that it doubles back upon itself, the distance from source to mouth in a direct line is only 56 miles. Its basin has an area of 3,020 sq. miles. The river begins by flowing north-east and traverses the Lake of St. Point and passes Pontarlier. Thenceforth its course lies chiefly through wooded limestone gorges of great grandeur. After skirting the town of Morteau, below which it expands into the Lake of Chaillexon and descends over the Fall of the Doubs (88 ft.), the river for about 28 m. forms the frontier between France and Switzerland. It flows in the latter country for some distance and then turns abruptly westward. Thus far the Doubs has been flowing between the folds of the Jura, but when it comes against the shattered southern face of the old block of the Vosges its course is rapidly altered. After turning westward it finds its way through this complicated country by turning north, and finally, at Voujeaucourt, south-west. Below that town the river is joined by the canal from the Rhone to the Rhine, to accommodate which its course has been canalized as far as Dôle. The Doubs passes Clerval and Baume-les-Dames to Besanqon. The lower section of its course is in the great

structural depression between the Côte d'or and the Jura. After passing Dôle it leaves the high ground and enters the plain of the Saône. Here it receives the waters of the Loue, which also has a complicated structural history, finding its way, like the Doubs, between the outer folds of the Jura—sometimes parallel with them and sometimes cutting across them, and finally falling into the great structural depression with the lower Doubs and Saône. The Doubs reaches the Saône at Verdun-sur-le-Doubs. The river is navigable only for approximately 8 miles above its mouth.

DOUCE, FRANCIS (1757–1834), English antiquary, was born in London. He interested himself in antiquities, and was for a short time keeper of manuscripts in the British Museum. He left his books, illuminated manuscripts, coins, etc., to the Bodleian library; his own manuscript works to the British Museum, but they were returned; and his paintings, carvings and miscellaneous antiquities to Sir Samuel Meyrick, who published an account of them, entitled *The Doucean Museum.* His published works are *Illustrations of Shakespeare and Ancient Manners* (2 vols., 1807), and *Dissertation on the Various Designs of the Dance of Death* (1833), the substance of which had appeared forty years before. He also contributed a considerable number of papers to the *Archaelogia* and *The Gentleman's Magazine.*

DOUGHBOY, in the 17th century, signified "dumpling." During the American Civil War it was applied to the mass buttons on uniforms and thence to infantrymen. At a period not exactly ascertained the word was supposed to come from the dough-like appearance of a uniform soiled by moistened pipe-clay. Again, infantrymen were said to march in "dough" during wet weather. "Adobe" furnishes a similar derivation, although it may be a "popular etymology," or wholesale transference of a foreign word to an English meaning and spelling. "Doughboys" was a favourite designation for the United States soldiers during the World War.

See J. H. Moss, *Officers' Manual* (1909); G. P. Krapp, The *English Language in America* (2 vols., 1925).

DOUGHERTY, PAUL (1877–), American painter, was born at Brooklyn (N.Y.), on Sept. 6, 1877. He was educated at the Brooklyn Polytechnic Institute and the New York Law school, where he took the degree of LL.B. in 1898. He then spent five years in Europe, devoting himself to the study of art. His first picture was exhibited at the Paris Salon in 1901. He was chiefly concerned with marine subjects, in which he achieved great success, being awarded the Osborne Prize (1905), the Inness Gold Medal and the Carnegie Prize, National Academy of Design (1913), the gold medal at the San Francisco exposition (1915), and the Altman Prize (1918). Among his more important pictures are "October Seas," "The Road to Cayey," and "Lake Louise," in the Metropolitan Museum, New York city; "The Land and the Sea," in the Corcoran gallery, Washington; "Flood Tide," in the Carnegie Institute, Pittsburgh; "Moonlight Cove," in the Toledo museum; "Sun and Storm," in the National gallery, Washington; and "A Freshening Gale," in the Albright Art gallery, Buffalo.

DOUGHTY, SIR ARTHUR GEORGE (1860–1936), Canadian historian and archivist, was born March 22. 1860, at Maidenhead, England; educated at Oxford, and Dickinson college, Carlisle, Pa. He went to Montreal as a journalist and private secretary, becoming in 1901 joint librarian of the provincial legislature, and in 1904 Dominion archivist and keeper of the records. He was appointed deputy minister in 1912, in which year he also became joint editor, with Adam Shortt, of the series, *Canada and its Provinces.* His chief works are *Tennyson* (1893); *Siege of Quebec* (6 vols., 1901); *Documents Relating to the Constitutional History of Canada* (1907–18); *The Cradle of New France* (1908); *The Acadian Exiles* (1915); and *The Canadian Archives and its Activities* (1924).

DOUGHTY, CHARLES MONTAGU (1843–1926), British traveller and writer, younger son of the Rev. C. M. Doughty of Theberton Hall, Suffolk, was born on Aug. 19, 1843. He was prevented by an impediment in speech from entering the navy, and his education was continued at King's college, London, and at Caius and Downing colleges, Cambridge, where he graduated in natural science in 186;. He turned then to independent travel and study, freely adventuring in his chosen fields of geology, archaeology and philology. And he did so in no half-hearted way: in Norway, Oxford, Leyden, Louvain, Italy, Spain, North Africa and Greece he served a long novitiate in wandering and scholarship which led him at last to Syria, Palestine and his adventures in Arabia.

In Nov. 1876 Doughty set out from Damascus with a pilgrim caravan. At Madâin Sâlih he left the Haj, and surveyed the Al Hajar monuments and inscriptions. He then decided to reach independently the aasis of Khaibar, and to this end attached himself to wandering Bedouins. Dependent on their movements, his dangers were now multiplied and his life was repeatedly endangered by the inevitable suspicion, fanaticism and treachery which on occasion broke through the respect and hospitality which Doughty's courageous personality compelled. He reached Khaibar from Taima in the summer of 1877, was sent back to Hail, thence to Al Qasim, Buraida and 'Anaiza. From there, after some months, he travelled southwards towards Mecca and reached safety at Jidda in Aug. 1878. The story of this great journey, which threw many fresh lights on the geology, hydrography and ethnology of Arabia, Doughty told in *Travels in Arabia Deserta* (1888, abridged edition 1926). Doughty was less concerned to produce a chronicle or work of information than to create, out of his unique experience, an unique monument of what he considered pure English prose. To him, this meant the achievement of an Elizabethan directness of utterance and the renunciation of all post-Elizabethan growths in syntax and vocabulary. He succeeded. His profound literary sense had told him aright when it inspired him to treat his remote and lonely adventuring in this bare, majestic styie.

The later years of Doughty's life, mostly spent in England, were given over to poetry. Essentially, indeed, he was always a poet, in his deep comprehension of the values of words no less than in his power of penetrating into the living past, whether of a country's physical structure or of its people and their life. Fourteen years' labour produced his epic, *The Dawn in Britain* (1906), his other long poems and poetic dramas including *The Cliffs* (1909), *The Clouds* (1912), *The Titans* (1916) and *Man-soul* (1920, new edition 1923). Like *Arabia Deserta,* the poems he wrote reflect his Elizabethan predilections. He died at Sissinghurst, Kent, on Jan. 20, 1926. (J. H. M.)

DOUGHTY-WYLIE, CHARLES HOTHAM MONTAGU (1868–1915), British soldier and consul, was born at Leiston, Suffolk, on July 23, 1868, and was educated at Winchester and Sandhurst, from which he passed into the Royal Welch Fusiliers in 1889. He was on active service in India in the Hazara (1891) and Chitral (1895) campaigns. He also served with great distinction in the Egyptian campaign of 1898, in the Boer War, in the China Field Force (1901), and as special service officer in Somaliland. But the field in which his remarkable force of character was most clearly shown was in the Near East. In Sept. 1906 Doughty-Wylie was appointed military consul at Konieh, in Anatolia, and in 1909 Cilicia was added to his area. In that year an attempted inassacre of the Christian population of Adana was stopped by his courage and quickness, when he collected a small group of Turkish regulars, and saved the Armenian quarter. The next four years were spent as consul at Addīs Ababa, Abyssinia, but the outbreak of war brought him back to England. He was attached to Sir Ian Hamilton's staff for the Gallipoli expedition, and went ashore with the first batch of troops on the "River Clyde." His gallant exploit on V. Beach on April 26, 1915, when he captured Hill 141 in hand-to-hand fighting, cost him his life. Doughty-Wylie was buried on the spot.

See an article, based on personal knowledge, by D. G. Hogarth, in the *Dict. Nat. Biog. Supp. 1912–21* (1927).

DOUGLAS, the name of a Scottish noble family, now represented by the dukes of Hamilton (Douglas-Hamilton, heirs-male), the earls of Home (Douglas-Home) who also bear the title of Baron Douglas of Douglas, the dukes of Buccleuch and Queensberry (Montagu-Douglas-Scott), the earls of Morton (Douglas), the earls of Wemyss (Wemyss-Charteris-Douglas),

and the baronets Douglas of Carr, of Springwood, of Glenbervie, etc. The marquessate of Douglas and the earldom of Angus, the historic dignities held by the two chief branches of the family, the Black and the Red Douglas, are merged in the Hamilton peerage. The name represented the Gaelic dubh glas, dark water, and Douglasdale, the home of the family in Lanarkshire, is still in the possession of the earls of Home. The first member of the family to emerge with any distinctness was William de Douglas, or Dufglas, whose name frequently appears on charters from 1175 to 1213. He is said to have been brother, or brother-in-law, of Freskin of Murray, the founder of the house of Murray. His second son, Brice (d. 1222), became bishop of Moray, while the estate fell to the eldest, Sir Archibald (died c. 1240).

SIR WILLIAM OF DOCGLAS (d. 1298), called *"le hardi,"* Archibald's grandson, first formally assumed the title of lord of Douglas. He gave a grudging allegiance to John de Baliol, and swore fealty to Edward I. in 1291; but when the Scottish barons induced Baliol to break his bond with Edward I. he commanded at Berwick Castle, which he surrendered after the sack of the town by the English in 1296. After a short imprisonment Douglas was restored to his Scottish estates on renewing his homage to Edward I., but his English possessions were forfeited. He joined Wallace's rising in 1297, and died in 1298, a prisoner in the Tower of London.

His son, SIR JAMES OF DOUGLAS (1286–1330), lord of Douglas, called the "Good," was educated in Paris. On his return he found an Englishman, Robert de Clifford, in possession of his estates. His offer of allegiance to Edward I. being refused, he cast in his lot with Robert Bruce, whom he joined before his coronation at Scone in 1306. From the battle of Methven he escaped with Bruce and the remnant of his followers, and accompanied him in his wanderings in the Highlands. In the next year they returned to the south of Scotland. He twice outwitted the English garrison of Douglas and destroyed the castle. One of these exploits, carried out on Palm Sunday, March 19, 1307, with barbarities excessive even in those days, is known as the "Douglas Larder." Douglas routed Sir John de Mowbray at Ederford Bridge, near Kilmarnock, and was entrusted with the conduct of the war in the south, while Bruce turned to the Highlands. He made many successful raids on the English border, which won for him the dreaded name of tbe "Black Douglas" in English households. Through the capture of Roxburgh Castle in 1314 by stratagem, the assailants being disguised as black oxen, he secured Teviotdale; and at Bannockburn, where he was knighted on the battlefield, he commanded the left wing with Walter the Steward. During the 13 years of intermittent warfare that followed he repeatedly raided England. He slew Sir Robert de Kevill, the "Peacock of the North," in single combat in 1316, and in 1319 he invaded Yorkshire, in company with Randolph, defeating an army assembled by William de Melton, archbishop of York, at Mitton-on-Swale (Sept. zo), in a fight known as "The Chapter of Myton." In 1322 he captured the pass of Byland in Yorkshire, and forced the English army to retreat. He was rewarded by the "Emerald Charter," granted by Bruce, which gave him criminal jurisdiction over the family estates, and released the lords of Douglas from various feudal obligations. In a daring night attack on the English camp in Weardale in 1327 Douglas came near capturing Edward III. himself. After laying waste the northern counties he retreated, without giving battle to the English. Before his death in 1329 Bruce desired Douglas to carry his heart to Palestine in redemption of his unfulfilled vow to go on crusade. Douglas set out in 1330, bearing with him a silver casket containing the embalmed heart of Bruce, but he fell fighting with the Moors in Spain on Aug. 25 of that year, and was buried in St. Bride's church, Douglas. Since his day the Douglases have borne a human heart in their coat of arms. Sir James was said to have fought in 70 battles and to have conquered in 57. His exploits, as told in Froissart's Chronicles and in John Barbour's *Bruce,* are familiar from Scott's Tales *of* a *Grandfather* and Castle Dangerous. His half-brother, Sir Archibald, defeated Edward Baliol at Annsn in 1332, and had just been appointed regent of Scotland for David II when he risked a pitched battle at Halidon Hill, where he was defeated and killed (1333), with his nephew William, lord of Douglas. The inheritance fell to his brother, a churchman, Hugh the "Dull" (b. 1294), who surrendered his lands to David II.; and a re-grant was made to William Douglas, next referred to.

WILLIAM DOUGLAS, 1ST EARL OF DOUGLAS (c. 1327–1384) had been educated in France, and returned to Scotland in 1348. In 1353 he killed in Ettrick forest his kinsman, William, the knight of Liddesdale (c. 1300–1353), known as the "Flower of Chivalry," a descendant of a younger son of the original William de Douglas. Some of the Liddesdale lands fell to his kinsman and murderer, who was created earl of Douglas in 1358. In 1357 his marriage with Margaret, sister and heiress of Thomas, 13th earl of Mar, eventually brought him the estates and the earldom of Mar. He was one of the securities for the payment of David II.'s ransom, and in consequence of the royal misappropriation of some moneys raised for this purpose, Douglas was for a short time in rebellion in 1363. In 1364 he joined David II. in seeking a treaty with England which should deprive Robert the Steward, formerly an ally of Douglas, of the succession by putting an English prince on the Scottish throne. The independence of Scotland was to be guaranteed, and a special clause provided for the restoration of the English estates of the Douglas family. On the accession of Robert II. he was nevertheless reconciled, becoming justiciar of southern Scotland, and the last years of his life were spent in making and repelling border raids. He died at Douglas in May 1384, and was succeeded by his son James. By his wife's sister-in-law, Margaret Stewart, countess of Angus in her own right, and widow of the 13th earl of Mar, he had a son George, afterwards 1st earl of Angus.

JAMES, 2ND EARL OF DOUGLAS AND MAR (c. 1358–1388), married Lady Isabel Stewart, daughter of Robert II. In 1385 he made war on the English with the assistance of a French contingent under John de Vienne. He allowed the English to advance to Edinburgh, wisely refusing battle. and contented himself with a destructive counter-raid on Carlisle. In 1388 Douglas captured Hotspur Percy's pennon in a skirmish near Newcastle. Percy sought revenge in the battle of Otterburn (Aug. 1388), which ended in a victory for the Scots and the capture of Hotspur and his brother, though Douglas fell in the fight. The struggle, narrated by Froissart, is celebrated in the English and Scottish ballads called "Chevy Chase" and "The Battle of Otterburn." The 2nd earl left no legitimate male issue. His natural sons William and Archibald became the ancestors of the families of Douglas of Drumlanrig (see QUEENSBERRY) and Douglas of Cavers. His sister Isabel became countess of Mar, inheriting the lands of Mar and his unentailed estates.

The earldom and entailed estates of Douglas reverted by the patent of 1358 to ARCHIBALD DOUGLAS, 3RD EARL OF DOUGLAS, called "The Grim" (c. 1328–*c.* 1400), a natural son of the "good" Sir James. He was warden of the western marches, lord of Galloway in 1369, increased his estates by his marriage with Joanna Moray, heiress of Bothwell, and by his purchase of the earldom of Wigtown in 1372. During the intervals of war with the English he imposed feudal law on the border chieftains, drawing up a special code for the marches. He was twice sent on missions to the French court. The power of the Black Douglas overshadowed the Crown under the weak rule of Robert III., and in 1399 he arranged a marriage between David, duke of Rothesay, the king's son and heir, and his own daughter, Marjory Douglas. A natural son of Archibald, Sir William of Douglas, lord of Nithisdale (d. 1392), married Egidia, daughter of Robert III.

Archibald the Grim was succeeded by his eldest son, ARCHIBALD, 4TH EARL OF DOUGLAS, 1st duke of Touraine, lord of Galloway and Annandale (1369?–1424), who married in 1390 Lady Margaret Stewart, eldest daughter of John, earl of Carrick, afterwards King Robert III. In 1400 March and Hotspur Percy had laid waste eastern Scotland as far as Lothian when they were defeated by Douglas (then master of Douglas) near Preston. With the regent, Robert, duke of Albany, he was suspected of complicity in the murder (March 1402) of David, duke of Rothesay, who was in their custody at Falkland Castle, but both were officially declared guiltless by the parliament. In that year Douglas raided England and was taken prisoner at Homildon Hill by the Percys. He

fought on the side of his captors at Shrewsbury (1403), and was taken prisoner by the English king, Henry IV. He became reconciled, during his captivity, with the earl of March, whose lands had been conferred on Douglas, but were now, with the exception of Annandale, restored. He returned to Scotland in 1409, but was in constant communication with the English court for the release of the captive king, James I. In 1412 he had visited Paris, when he entered into a personal alliance with John the Fearless, duke of Burgundy, and in 1423 he commanded a contingent of 10,000 Scots sent to the help of Charles VII. against the English. He was made lieutenant-general in the French army, and received the peerage-duchy of Touraine with remainder to his heirs-male. The new duke was defeated and slain at Verneuil (1424) with his second son, James; his persistent ill-luck earned him the title of the Tyneman (the loser).

ARCHIBALD, 5TH EARL OF DOUGLAS (*c.* 1391–1439), succeeded to his father's English and Scottish honours, though he never touched the revenues of Touraine. He fought at Baugé in 1421, and was made count of Longueville in Normandy.

His two sons, WILLIAM, 6TH EARL (1423?–1440), and David, though they were little more than boys at the time of their father's death in 1439, were summoned to court by Sir William Crichton, lord chancellor of Scotland, on Nov. 24, 1440, and, after a mock trial in the young king's presence, were beheaded forthwith in the courtyard of Edinburgh Castle. This murder broke up the dangerous power wielded by the Douglases. The lordships of Annandale and Bothwell fell to the Crown; Galloway to the earl's sister Margaret, the "Fair Maid of Galloway"; while the Douglas lands passed to his great-uncle JAMES DOUGLAS, 7TH EARL OF DOUGLAS, called the "Gross," of Balvany (1371–1444), lord of Abercorn and Aberdour, earl of Avondale (cr. 1437), younger son of the 3rd earl.

The latter's sons, WILLIAM (*c.* 1425–1452) and JAMES (1426–1488), became 8th and 9th earls respectively; Archibald became earl of Moray by marriage with Elizabeth Dunbar, daughter and co-heiress of James, earl of Moray; Hugh was created earl of Ormond in 1445; John was lord of Balvany; Henry became bishop of Dunkeld.

The power of the Black Douglases was restored by the 8th earl, who recovered Wigtown, Galloway and Bothwell by marriage (by papal dispensation) with his cousin, the Fair Maid of Galloway. He was soon high in favour with James II., and procured the disgrace of Crichton, his kinsmen's murderer, by an alliance with his rival, Sir Alexander Livingstone. In 1450 James raided the earl's lands during his absence on a pilgrimage to Rome; but their relations seemed outwardly friendly until, in 1452, the king invited Douglas to Stirling Castle under a safe-conduct, in itself, however, a proof of strained relations. There James demanded the dissolution of a league into which Douglas had entered with Alexander Lindsay, the "Tiger" earl (4th) of Crawford. On Douglas's refusal the king murdered him (Feb. 22) with his own hands, the courtiers helping to despatch him. The tales of the hanging of Sir Herbert Herries of Terregles and the murder of McLellan of Bombie by Douglas rest on no sure evidence.

JAMES DOUGLAS, 9TH EARL (and last), denounced his brother's murderers and took up arms, but was obliged by the desertion of his allies to submit. He obtained a papal dispensation to marry his brother's widow, in order to keep the family estates together. He intrigued with the English court, and in 1455 rebelled once more. Meanwhile another branch of the Douglas family, known as the Red Douglas, had risen into importance (*see* ANGUS, EARLS OF), and George Douglas, 4th earl of Angus (d. 1463), greatgrandson of the 1st earl of Douglas, took sides with the king against his kinsmen. James Douglas, again deserted by his chief allies, fled to England, and his three brothers, Ormond, Moray and Balvany, were defeated by Angus at Arkinholm on the Esk. Moray was killed, Ormond taken prisoner and executed, while Balvany escaped to England. Their last stronghold, the Thrieve in Galloway, fell, and the lands of the Douglases were declared forfeit, and were divided among their rivals, the lordship of Douglas falling to the Red Douglas, 4th earl of Angus. In England the earl of Douglas was employed by Edward IV. in 1461 to negotiate a league with the western highlanders against the Scottish kingdom. In 1484 he was taken prisoner while raiding southern Scotland, and was relegated to the abbey of Lindores, where he died in 1488.

The title of Douglas was restored in 1633 when WILLIAM, 11th earl of Angus (1589–1660), was created 1ST MARQUESS OF DOUGLAS by Charles I. In 1645 he joined Montrose at Philiphaugh and was imprisoned in 1646 at Edinburgh Castle, only obtaining his release by signing the Covenant. His eldest son, Archibald, created earl of Ormond, Lord Bothwell and Hartside, in 1651, predeceased his father; Lord James Douglas (c. 1617–1645) and his half-brother, Lord George Douglas (c. 1636–1692), created earl of Dumbarton in 1675, successively commanded a Scots regiment in the French service. William (1635–1694), created earl of Selkirk in 1646, became 3rd duke of Hamilton after his marriage (1656) with Anne, duchess of Hamilton in her own right. By the failure of heirs in the elder branches of the family the dukes of Hamilton (*q.v.*) became heirs-male of the house of Douglas.

JAMES DOUGLAS, 2ND MARQUESS OF DOUGLAS (1646-1700), succeeded his grandfather in 1660. His eldest son, John, by courtesy earl of Angus, raised a regiment of 1,200 men, first known as the Angus regiment, later as the Cameronians (26th Foot). He was killed at its head at Steinkirk in 1692. The younger son, ARCHIBALD, 3RD MARQUESS (1694–1761), was created duke of Douglas in 1703, but the dukedom became extinct on his death, without heirs, in 1761. He was a consistent supporter of the Hanoverian cause, and fought at Sheriffmuir. The heir-presumptive to the Douglas estates was his sister, Lady Jane Douglas (1698–1753), who in 1746 secretly married Colonel, afterwards Sir, John Steuart of Grandtully, by whom she had twin sons, born in Paris in 1748. These children were alleged to be spurious, and when Lady Jane and the younger of the two boys died in 1753, the duke refused to acknowledge the survivor as his nephew; but in 1760 he was induced, under the influence of his wife, to revoke a will devising the estates to the Hamiltons in favour of Lady Jane's son, Archibald James Edward Steuart (1748–1827), 1st baron Douglas of Douglas (cr. 1790) in the British peerage. The inheritance of the estates was disputed by the Hamiltons, representing the male line, but the House of Lords decided in favour of Douglas in 1769. Three of his sons succeeded Archibald Douglas as Baron Douglas, but as they left no male issue the title passed to the earls of Home, Cospatrick Alexander, 11th earl of Home, having married a granddaughter of Archibald, 1st Baron Douglas. Their descendants, the earls of Home, represent the main line of Douglas on the female side.

BIBLIOGRAPHY.—David Hume of Godscroft (1560?–1630), who was secretary to Archibald Douglas, 8th earl of Angus, wrote a *History of the House and Race of Douglas and Angus*, printed under his daughter's superintendence (Edinburgh, 1644). He was a partial historian, and his account can only be accepted with caution. Modern authorities are Sir William Eraser, *The Douglas Book* (4 vols., Edinburgh, 1885), and Sir H. Maxwell, *History of the House of Douglas* (2 vols., 1902). *See* also G. *E.* C(okayne)'s *Peerage*, and Douglas's *Scots Peerage; Calendar of State Papers, Scottish Series, The Hamilton Papers*, etc.

DOUGLAS, SIR CHARLES WHITTINGHAM HORSLEY (1850–1914), British general, was born on July 17, 1850, at the Cape of Good Hope. Entering the army when 19, he saw service with the 92nd Highlanders in the Afghan War of 1879–80, in the Boer War of 1881, in the Sudan campaign of 1884 and in the South African War of 1899–1901. In 1895 he had been made deputy assistant adjutant-general at Aldershot; in 1898 he became a colonel; in 1904 adjutant-general at the War Office and member of the new Army Council; in 1909 general officer commanding-in-chief, southern command; in 1910 full general; 1912 inspector-general, home forces, and in 1914 chief of the Imperial General Staff. Up to the time of his death on Oct. 25, 1914, he assisted Kitchener at the War Office.

DOUGLAS, DAVID (1798–1834), Scottish botanist, was born at Scone, Perthshire. After being a gardener at the botanical gardens of Glasgow, he went to Oregon in 1823 as a collector to the Royal Horticultural Society, in 1825 pushing on to British Columbia where he discovered many new plants, trees and birds, and in 1827 reaching Hudson Bay. Two years later he was sent

to California and the Fraser river. He died in the Sandwich islands on July 12, 1834. Douglas introduced into Britain many trees, shrubs and plants and gave his name to the Douglas spruce.

DOUGLAS, GAVIN (1474?–1522), Scottish poet and bishop, third son of Archibald, 5th earl of Angus (called the "great earl of Angus" and "Bell-the-Cat"), was born c. 1474, probably at one of his father's seats. He was a student at St. Andrews, 1489–94, and thereafter it is supposed at Paris. In 1496 he obtained the living of Monymusk, Aberdeenshire, and later he became parson of Lynton (mod. Linton) and rector of Hauch (*mod* Prestonkirk), in East Lothian; and about 1501 was preferred to the deanery or provostship of the collegiate church of St. Giles, Edinburgh, which he held with his parochial charges. From this date till the battle of Flodden, in Sept. 1513, he appears to have been occupied with his ecclesiastical duties and literary work. Indeed all the extant writings by which he has earned his place as a poet and translator belong to this period. After the disaster at Flodden he was completely absorbed in public business. Three weeks after the battle he, still provost of St. Giles, was admitted a burgess of Edinburgh, his father, the "Great Earl," being then civil provost of the capital. The latter dying soon afterwards (Jan. 1514) in Wigtownshire, where he had gone as justiciar, and his son having been killed at Flodden, the succession fell to Gavin's nephew Archibald (6th earl). The marriage of this youth to James IV.'s widow on Aug. 6, 1514 did much to identify the Douglases with the English party in Scotland, as against the French party led by Albany, and incidentally to determine the political career of his uncle Gavin. During the first weeks of the queen's sorrow after the battle, Gavin, with one or two colleagues of the council, acted as personal adviser, and it may be taken for granted that he supported the pretensions of the young earl. The first outcome of the new connection was his appointment to the abbacy of Aberbrothock by the queen regent, before her marriage, probably in June 1514. Soon after the marriage she nominated him archbishop of St. Andrews, in succession to Elphinstone, archbishop-designate. But Hepburn, prior of St. Andrews, having obtained the vote of the chapter expelled him, and was himself in turn expelled by Forman, bishop of Moray, who had been nominated by the pope. In the interval, Douglas's rights in Aberbrothock had been transferred to James Beaton, archbishop of Glasgow. The breach between the queen's party and Albany's had widened, and the queen's advisers had begun an intrigue with England, for the removal of the royal widow and her young son to Henry's court. In those deliberations Gavin Douglas took an active part, and for this reason stimulated the opposition which successfully thwarted his preferment.

In Jan. 1515 on the death of George Brown, bishop of Dunkeld, the queen nominated him to the see, which he ultimately obtained, though not without trouble. For the earl of Athole had forced his brother, Andrew Stewart, prebendary of Craig, upon the chapter, and had put him in possession of the bishop's palace. The queen appealed to the pope and was seconded by Henry VIII., and the pope's sanction was obtained on Feb. 18, 1515. Some of the correspondence of Douglas and his friends incident to this transaction was intercepted. When Albany came from France and assumed the regency, these documents and the "purchase" of the bishopric from Rome contrary to statute were made the basis of an attack on Douglas, who was imprisoned in Edinburgh Castle, thereafter in the castle of St. Andrews (under the charge of his old opponent, Archbishop Hepburn), and later in the castle of Dunbar, and again in Edinburgh. The pope's intervention procured his release, after nearly a year's imprisonment. The queen meanwhile had retired to England. After July 1516 Douglas appears to have been in possession of his see, and to have patched up a diplomatic peace with Albany.

On May 17, 1517 the bishop of Dunkeld proceeded with Albany to France to conduct the negotiations which ended in the Treaty of Rouen. He was back in Scotland towards the end of June Albany's longer absence in France permitted the party-faction of the nobles to come to a head in a plot by the earl of Arran to seize the earl of Angus, the queen's husband. The issue of this plot was the well-known fight of "Clear-the-Causeway," in which Gavin Douglas's part stands out in picturesque relief. The triumph over the Hamiltons had an unsettling effect upon the earl of Angus. He made free of the queen's rents and abducted Lord Traquair's daughter. The queen set about to obtain a divorce, and used her influence for the return of Albany as a means of undoing her husband's power. Albany's arrival in Nov. 1521, with a large body of French men-at-arms, compelled Angus, with the bishop and others, to flee to the Borders. From this retreat Gavin Douglas was sent by the earl to the English court, to ask for aid against the French party and against the queen, who was reported to be the mistress of the regent. Meanwhile he was deprived of his bishopric, and forced, for safety, to remain in England, where he effected nothing in the interests of his nephew. The declaration of war by England against Scotland, in answer to the recent Franco-Scottish negotiations, prevented his return. His case was further complicated by the libellous animosity of Beaton, archbishop of St. Andrews (whose life he had saved in the "Clear-the-Causeway" incident), who was anxious to thwart his election to the archbishopric of St. Andrews, now vacant by the death of Forman. In 1522 Douglas was stricken by the plague which raged in London, and died at the house of his friend Lord Dacre. During the closing years of exile he was on intimate terms with the historian Polydore Vergil, and one of his last acts was to arrange to give Polydore a corrected version of Major's account of Scottish affairs. Douglas was buried in the church of the Savoy, where a monumental brass (removed from its proper site after the fire in 1864) still records his death and interment.

Douglas's literary work, now his chief claim to be remembered, belongs, as has been stated, to the period 1501–13, when he was provost of St. Giles. He left four poems.

1. The *Palice* of *Honour,* his earliest work, is a piece of the later type of dream-allegory, extending to over 2,000 lines in nine-lined stanzas. The poem carries on the literary traditions of the courts of love, as shown especially in the "Romaunt of the Rose" and "The House of Fame." It is dedicated to James IV. No ms. of the poem is extant. The earliest known edition (c. 1553) was printed at London by William Copland; an Edinburgh edition, from the press of Henry Charteris, followed in 1579.

2. King Hart described King Heart in his castle, surrounded by his five servitors (the senses), Queen Plesance, Foresight and other courtiers. The poem runs to over goo lines and is written in eight-lined stanzas. The text is preserved in the Maitland folio ms. in the Pepysian library, Cambridge. It is not known to have been printed before 1786, when it appeared in Pinkerton's Ancient Scottish Poems.

3. Conscience is in four seven-lined stanzas. Its subject is the "conceit" that men first clipped away the "con" from "conscience" and left "science" and "na mair." Then they lost "sci," and had nothing but "ens" ("that schrew, Riches and geir").

4. Douglas's longest, last, and in some respects most important work is his translation of the Aeneid, the first version of a great classic poet in any English dialect. The work includes the 13th book by Mapheus Vegius; and each of the 13 books is introduced by a prologue. The subjects and styles of these prologues show great variety; some have little or no connection with the books which they introduce, and were perhaps written earlier and for other purposes. In the first, or general, prologue, Douglas attacks Caxton for his inadequate rendering of a French translation of the Aeneid. That Douglas undertook this work and that he makes a plea for more accurate scholarship in the translation have been the basis of a prevalent notion that he is a Humanist in spirit and the first exponent of Renaissance doctrine in Scottish literature. Careful study of the text will not support this view. Douglas is in all important respects even more of a medievalist than his contemporaries; and, like Henryson and Dunbar, strictly a member of the allegorical school and a follower, in the most generous way, of Chaucer's art. There are several early mss. of the *Aeneid* extant: (a) in the library of Trinity College. Cambridge, *c.* 1525, (b) the Elphynstoun ms. in the library of the University of Edinburgh, c. 152j, (c) the Ruthven ms. in the same collection, c. 1535, (d) in the library of Lambeth Palace, 1545–46. The first printed edition appeared in London in 1j53. An Edinburgh edition was

issued from the press of Thomas Ruddiman in 1710.

For Douglas's career *see*, in addition to the public records and general histories, Bishop Sage's *Life* in Ruddiman's edition, and that by John Small in the first volume of his edition of the *Works of Gavin Douglas* (4 vols., 1874, the only collected edition of Douglas's works). A new edition of the texts is much to be desired. On Douglas's place in Scottish literature see SCOTLAND: SCOTTISH LITERATURE, also G. Gregory Smith's *Transition Period* (1900) and chapters in the *Cambridge History of English Literature*, vol. ii. (1908). P. Lange's dissertation *Chaucer's Einfluss auf die Originaldichtungen des Schotten Gavin Douglas* (Halle, 1882) draws attention to Douglas's indebtedness to Chaucer. Further discussion of the question of Douglas's alleged Humanism will be found in Courthope's *History of English Poetry*, i. (1895), T. F. Henderson's *Scottish Vernacular Literature* (1898), and J. H. Millar's *Literary History of Scotland* (1903). For the language of the poems *see* G. Gregory Smith's *Specimens of Middle Scots* (1902). (G. G. S.)

DOUGLAS, SIR HOWARD, BART. (1776–1861), British general, younger son of Admiral Sir Charles Douglas, was born at Gosport in 1776. He was commissioned second lieutenant in the Royal Artillery in 1794. In 1795 he was shipwrecked while in charge of a draft for Canada, and lived with his men for a whole winter on the Labrador coast. In 1804 he was placed in charge of the senior department of the R.M.C. at High Wycombe, the forerunner of the Staff College. Douglas served in 1808–09 and again in 1812 in the Peninsula, but was recalled to the Royal Military College. In 1816 appeared his *Essay on the Principles and Construction of Military Bridges* (subsequent editions 1832, 1853); in 1819, *Observations on the Motives, Errors and Tendency of M. Carnot's System of Defence*, and in 1820 his *Treatise on Naval Gunnery*, which became a standard text-book, and indeed first drew attention to the subject of which it treated. From 1823 to 1831 Sir Howard Douglas was governor of New Brunswick, and had to deal with the Maine boundary dispute of 1828. He also founded Fredericton college. On his return to Europe he published *Naval Evolutions*, a controversial work dealing with the question of "breaking the line" (1832). Douglas was lord high commissioner of the Ionian islands (1835–40), and sat in Parliament from 1842 to 1847. His later works included *Observations on the Modern System of Fortification, etc.* (1859) and *Naval Warfare Under Steam* (1858 and 1860). He died on Nov. 9, 1861, at Tunbridge Wells. Douglas was a F.R.S., one of the founders of the R.G.S., and held many honours. He was created full general in 1851.

See S. W. Fullom, *Life of Sir Howard Douglas* (1862), and *Gentleman's Magazine*, 3rd series, xii. 90–92.

DOUGLAS, SIR JAMES (1803–1877), Canadian administrator, was born on June 5, 1803, in Lanarkshire, Scotland, where he was educated. In 1820 he went to Canada, and four years later became the organizer of the property of the Hudson's Bay company west of the Rockies. In 1830 he was transferred to Ft. Vancouver in the Oregon Territory, where he extended the company's forts. In 1843 he made Camosun, the place where Victoria now stands, the chief northern centre of the fur trade. After the north-west Boundary Treaty of 1846, which moved the British frontier back to the 49th parallel, Douglas was appointed senior officer of the western department, and in 1851 became governor of Vancouver. In 1859 his statesmanship made possible the joint occupation of the island of San Juan by an equal number of British and American troops. When British Columbia was made a Crown colony in 1858, Sir James Douglas held its governorship with that of Vancouver until 1863. He died at Victoria on Aug 1, 1877.

See Coats and Gosnell, *Sir James Douglas* (Makers of Canada Series, vol. ix., 1926).

DOUGLAS, SIR ROBERT KENNAWAY (1838–1913), English orientalist, was born in Devon. In 1858 he became attached to the Chinese Consular Service. Seven years later he returned to England and was made assistant in charge of the Chinese library in the British Museum and, in 1893, keeper of the Oriental books and manuscripts. He was also professor of Chinese in London. He died at Chippenham on May 20, 1913. His chief publications are *Life of Jenghiz Khan* (trans. from Chinese, 1877); *Confucianism and Taoism* (1879); *China* (1882); *Society in China* (1894); *Li Hung-Chang* (1895); and *Europe and the Far East* (1904).

DOUGLAS, STEPHEN ARNOLD (1813–1861), American political leader, was born in Brandon, Vt., on April 23, 1813. Left in infancy to the care of a widowed mother and a bachelor uncle, he became a cabinet-maker's apprentice in Middlebury and Brandon. He attended schools at Brandon and Canandaigua, N.Y., and began the study of law. In 1833 he went west and finally settled in Jacksonville, Ill., where he was admitted to the bar in March 1834. From the first he took an active interest in politics, and his rise was remarkably rapid. In Feb. 1835 he was elected public prosecutor of the first judicial circuit; in Dec. 1836 he became a member of the State legislature. In 1837 he was appointed by President Van Buren registrar of the land office at Springfield, which had just become the State capital. In 1840 he did much to carry the State for Van Buren; and for a few months he was secretary of State of Illinois. He was a judge of the supreme court of Illinois from 1841 to 1543. In 1843 he was elected to the national House of Representatives.

In Congress, though one of the youngest members, he at once sprang into prominence by his clever defence of Jackson for alleged contempt of court in New Orleans. He was soon recognized as one of the ablest and most energetic of the Democratic leaders. An enthusiastic believer in the destiny of his country and more especially of the West, and a thorough-going expansionist, he heartily favoured the measures which resulted in the annexation of Texas and in the Mexican War—in the discussion of the former foreshadowing his doctrine of "popular sovereignty." Taking an active share in the Oregon controversy, he opposed yielding "one inch" of the territory to Great Britain and advocated extending United States settlements under military protection. He was an advocate of the construction, by the aid of Government land grants, of a trans-continental railway, and the chief promoter (1850) of the Illinois Central. As chairman of the committee on territories, at first in the House, and then in the Senate, of which he became a member in Dec. 1847, he introduced the bills for admitting Texas, Florida, Iowa, Wisconsin, Minnesota, California and Oregon into the Union, and for organizing the Territories of Minnesota, Oregon, New Mexico, Utah, Washington, Kansas and Nebraska.

In the bitter debates concerning the keenly disputed question of slavery in the Territories, Douglas was particularly prominent. Against slavery itself he seems never to have had any moral antipathy; and his first wife and children were by inheritance the owners of slaves, though he himself never was. He did more, probably, than any other one man, except Henry Clay, to secure the adoption of the Compromise Measures of 1850. Nevertheless the bill for organizing the Territories of Kansas and Nebraska, which Douglas reported in Jan., 1854, and which in amended form was signed by the president on May 30, reopened the whole slavery dispute—wantonly, his enemies charged, for the purpose of securing Southern support—and caused great popular excitement. It repealed the Missouri Compromise, and declared the people of "any State or Territory" "free to form and regulate their domestic institutions in their own way, subject only to the Constitution of the United States"; that is, "popular sovereignty" or "squatter sovereignty" would determine the admission of slavery. The passage of this Kansas-Nebraska bill, one of the most momentous in its consequences ever passed by the Federai Congress, was largely a personal triumph for Douglas, who showed marvelous energy, adroitness and resourcefulness, and a genius for leadership, but was universally condemned in the free States. His hostility to "knownothingism" and his plea for religious toleration also caused him trouble, but in 1852 and again in 1856 he was a strong candidate for the presidential nomination in the National Democratic Convention.

In 1857 he broke with President Buchanan and the "administration" Democrats and lost much of his prestige in the South, but partially restored himself to favour in the North, and especially in Illinois, by his vigorous opposition to the method of voting on the Lecompton constitution, which he maintained to be fraudulent, and (in 1858) to the admission of Kansas into the Union under this constitution. In 1858, when the Supreme Court, after

the vote of Kansas against the Lecompton constitution, had decided that Kansas was a "slave" territory, thus quashing Douglas's theory of "popular sovereignty," he engaged in Illinois in a close contest for the senatorship with Abraham Lincoln, the Republican candidate, whom he met in a series of debates. Although in Illinois his followers did not poll so large a vote as Lincoln's, Douglas won the senatorship by a vote in the legislature of 54 to 46. In the senate he was not reappointed chairman of the committee on territories.

In 1860, in the Democratic national convention in Charleston, the adoption of Douglas's platform brought about the withdrawal from the convention of Alabama, Mississippi, Louisiana, South Carolina, Florida, Texas and Arkansas. The convention adjourned to Ealtimore, where the Virginia, North Carolina, Tennessee, Kentucky and Maryland delegations left it, and where Douglas was nominated for the presidency by the northern Democrats. He campaigned vigorously but hopelessly, boldly attacking disunion, and in the election, though his popular vote was 1,376,957, he received an electoral vote of only 12, against Lincoln's 180. Douglas urged the south to acquiesce in Lincoln's election, and he and his second wife, Adèle Cutts, were among the foremost to welcome the Lincolns to Washington. On the outbreak of the Civil War he denounced secession as criminal! and was one of the strongest advocates of maintaining the integrity of the union at all hazards. At Lincoln's request he undertook a mission to the border states and the northwest to rouse the spirit of unionism; he spoke in West Virginia, Ohio and Illinois. He died on June 3,1861, at Chicago, where he was buried on the shore of Lake Michigan.

In person Douglas was conspicuously small, being hardly five feet in height, but his large head and massive chest and shoulders gave him the popular sobriquet "The Little Giant." As a resourceful political leader, and an adroit, ready, skilful tactician in debate, he has had few equals in American history. His generosity in defeat, his courage and his capacity for inspiring warm personal friendships are among his most attractive qualities. It was regretted that his death came just when a new and great era of usefulness seemed opening before him.

One of the most sympathetic biographies is that by Allen Johnson (1908). Other biographies are by H. M. Flint (1860); J. W. Sheahan (1860); W. G. Broun (1902); Wm. Gardner (1905); C. E. Carr (1909); H. P. Willis (1910); and Louis Howland (1920). See also P. O. Ray, Repeal of *the* Missouri *Compromise* (1900), and an autobiographical sketch in the 111. State Hist. Soc. Journal (vol. v, Oct., 1912).

DOUGLAS, capital of the Isle of Man, municipal borough and favourite watering place. Pop. (1939) 20,014. Area, 1.9 sq.mi. It stands on a fine semicircular bay on the east coast of the island, at the common mouth of two streams, the Dhoo and Glass, 54 mi. W.N.W. of Fleetwood, and 70 mi. N.W. of Liverpool. The older streets are irregular and narrow, but the town has greatly extended in modern times, with numerous terraces of good dwelling houses. A fine parade sweeps round the bay, which, from Derby castle (north) to Douglas Head (south), has a circuit exceeding 2 mi. Low hills, penetrated by the valleys of the Dhoo and Glass, encircle the town on the north, west and south, the southern spur forming Douglas Head. The harbour, in the river mouth, lies immediately north of this; vessels drawing g ft. may enter it during neap tides, and those drawing 13 ft. during spring tides. A castellated building (Tower of Refuge, 1832), marks the dangerous Conister rocks, north of the harbour entrance. The harbour is protected by three piers, the Battery pier, the Red pier and the Victoria pier (at which passengers can load and embark at all tides). There is regular daily communication with Liverpool, and during the season there are connections with Fleetwood, Heysham, Barrow, Dublin, Belfast and Glasgow. Douglas is connected by electric tramway northward with Laxey, the summit of the mountain of Snaefell and Ramsey, and southward with Port Soderick; while the Isle of Man railway runs to Peel in the west, and Castletown and Port Erin in the southwest. The various popular attractions include theatres, dancing halls, a racecourse and two golf links. The shore of the bay is of firm sand, and the sea bathing is good. Among buildings and institutions are the legislative buildings (1893), the town hall (1899), the free library, the courthouse and the Isle of Man hospital. St. George's church, oldest in Douglas, dates from 1780. Douglas was incorporated in 1895.

DOUGLAS, village and parish, Lanarkshire, Scotland. Pop. (1931) 2,948. It is on Douglas water, 4 mi. from Douglas station and 1¼ mi. from Douglas West station, on the branch line of the L.M.S.R. from Carstairs to Ayr, S.S.W. of Lanark. It is the original home of the Douglas family. Of the old castle, Scott's Castle Dangerous, only a tower exists; it repeatedly changed hands during the wars of Edward I. The modern castle is the seat of the earl of Home. Only choir and spire remain of the 12th-century church of St. Bride, patron saint of the Douglases. The vault beneath the choir was, until 1761, the burial place of the family, and it contains a silver case said to hold the ashes of the heart of the "good Sir James" (1286–1330). In 1879 the choir was restored and the tombs (including that of Sir James Douglas) repaired. On the hill of Auchensaugh, 2½ mi. S.E., the Cameronians assembled in 1712 to renew the Solemn League and Covenant.

DOUGLAS, a city of Cochise county, Arizona, U.S.A., 25 mi. S.E. of Bisbee, on the Mexican border line. It is on federal highway 80 and the Southern Pacific railway. The population was 9,916 in 1920 (29% foreign-born white), and it was 8,623 in 1940 by the federal census. Cattle raising and copper-smelting are the main occupations of this part of Arizona, and the Sonora mining region of Mexico lies directly south. The city has immense copper smelters, to which carloads of ore are brought daily from the mines at Bisbee and other points in Arizona and in Mexico. There is a U.S. army post (Camp Harry J. Jones) at Douglas. The Coronado national forest, within which is the Chiricahua national monument, is 55 mi. north. Douglas was settled about 1904 and incorporated as a city in 1905.

DOUGLAS-FIR (Pseudotsuga *taxifolia*), an important North American timber tree of the pine family (Pinaceae), called also red-fir, yellow-fir and Douglas-spruce. Botanically it exhibits some of the characteristics of the firs and the hemlock, although it most closely resembles the spruces. It is found from South Dakota to British Columbia and southward to Texas and Mexico, but attains its maximum development in Washington and Oregon, where it forms immense forests, furnishing the valuable structural timber known also in the lumber trade as yellow-fir, Oregon-fir or Oregon-pine. In the forests of Washington it commonly reaches a height of 180 ft. or 190 ft. with a trunk diameter of 3½ ft. to 6 ft. and sometimes attains a height of 250 ft. and a trunk diameter of 10 ft. or 12 ft. Among North American trees it is exceeded in height and massiveness only by the giant sequoias of California. According to the U.S. department of agriculture, the lumber cut of Douglas-fir in 1940 amounted to 7,121.-000,000 bd.ft., with a value at the mill exceeding $140,000,000, in footage more than one-fourth of the total lumber cut of the United States during that year. Of this production of Douglas-fir lumber the states of Washington and Oregon contributed more than 90%. The closely related bigcone-spruce (P. *macrocarpa*), a much smaller tree, native to southern California, with large cones sometimes 3 in. thick and 7 in. long, hanging from the widely spreading branches, is of value chiefly as cover on arid mountain slopes. (E. S. HR.)

DOUGLASS, FREDERICK (1817–1895), American orator and journalist, was born in Tuckahoe, Md., probably in Feb. 1817. His mother was a Negro slave of exceptional intelligence, and his father was a white man. Until nearly eight years of age, he was under the care of his grandmother; then he lived for a year on the plantation of Col. Edward Lloyd, of whose vast estate his master, Capt. Aaron Anthony, was manager. After a year he was sent to Baltimore, where he lived in the family of Hugh Auld, whose brother, Thomas, had married the daughter of Capt. Anthony; Mrs. Auld treated him with marked kindness and without her husband's knowledge began teaching him to read. With money secretly earned by blacking boots he purchased his first book, *The Columbian Orator;* he soon learned to write "free passes" for runaway slaves Upon the death of Capt. Anthony in 1833, he was sent back to the plantation to serve Thomas Auld, who hired him out for a year to one Edward Covey, who had a

wide reputation for disciplining slaves, but who did not break Frederick's spirit. Although a new master, William Freeland, who owned a large plantation near St. Michael's, Md., treated him with much kindness, he attempted to escape in 1836, but his plans were suspected, and he was put in gaol. From lack of evidence he was soon released, and was then sent to Hugh Auld in Baltimore, where he was apprenticed as a ship caulker. He learned his trade in one year, and in Sept. 1838, masquerading as a sailor, he escaped by railway train from Baltimore to New York city. For the sake of greater safety he soon removed to New Bedford, Mass., where he changed his name from Frederick Augustus Washington Bailey to Frederick Douglass, "Douglass" being adopted at the suggestion of a friend who greatly admired Scott's *Lady of the Lake*. For three years he worked as a day labourer in New Bedford. An extempore speech made by him before an anti-slavery meeting at Nantucket, Mass., in Aug. 1841 led to his being appointed one of the agents of the Massachusetts Anti-Slavery Society, and in this capacity he delivered during the next four years numerous addresses against slavery, chiefly in the New England and middle states. To quiet the suspicion that he was an impostor, in 1845 he published the *Narrative of the Life of Frederick Douglass, an American Slave*. Fearing his recapture, his friends persuaded him to go to England, and in 1845–47 he lectured in Ireland, Scotland and England, and did much to enlist the sympathy of the British public with the Abolitionists in America. Before his return a sum of £150 was raised by subscription to secure his legal manumission, thus relieving him from the fear of being returned to slavery in pursuance of the Fugitive Slave law. From 1847 to 1860 he conducted an anti-slavery weekly journal, known as *The North Star*, and later as *Frederick Douglass's Paper*, at Rochester, N.Y., and, during this time, also was a frequent speaker at anti-slavery meetings. At first a follower of Garrison and a disunionist, he allied himself after 1851 with the more conservative political abolitionists, who, under the leadership of James G. Birney, adhered to the national Constitution and endeavoured to make slavery a dominant political issue. He disapproved of John Brown's attack upon Harper's Ferry in 1859, and declined to take any part in it. During the Civil War he was among the first to suggest the employment of negro troops by the United States Government, and two of his sons served in the Union army. After the war he was for several years a popular public lecturer. In 1871 he was assistant secretary of the Santo Domingo commission, appointed by President Grant. He was marshal of the District of Columbia in 1877–81, was recorder of deeds for the district in 1881–86, and from 1889 to 1891 was the American minister resident and consul-general in the Republic of Haiti. Douglass was widely known for his eloquence, and was one of the most eifective orators whom the negro race has produced in America. He died in Anacostia Heights, D.C., on Feb. 20, 1895.

His autobiography appeared, after two revisions, as *The Life and Times of Frederick Douglass* (1882). *See* F. M. Holland, *Frederick Douglass, the Colored Orator* (1891); *C. W.* Chesnutt, *Frederick Douglass* (Boston, 1899); and Booker T. Washington, *Frederick Douglass* (Philadelphia, 1907), in the series of American Crisis Biographies.

DOUKHOBORS, a name given by the Russian Orthodox clergy to a community of nonconformist peasants. The word signifies "spirit-fighters," and was intended by the priesthood to convey that they fight against the Spirit of God; but the Doukhobors themselves accepted it as signifying that they fight, not against, but for and with the Spirit, though later they decided to give up this name and call themselves "Christians of the Universal Brotherhood." The community was first heard of in the middle of the 18th century; by the beginning of the 19th their doctrine had become so clearly defined, and the number of their members had so greatly increased, that the Russian government and Church, considering the sect to be peculiarly obnoxious, started an energetic campaign against it. The foundation of the Doukhobors' teaching consists in the belief that the Spirit of God is present in the soul of man, and directs him by its word within him. They understand the coming of Christ in the flesh, His works, teaching and sufferings, in a spiritual sense. The object of the sufferings of Christ, in their view, was to give an example of suffering for truth. Christ continues to suffer in us even now when we do not live in accordance with the behests and spirit of His teaching. The whole teaching of the Doukhobors is penetrated with the Gospel spirit of love; worshipping God in the spirit, they affirm that the outward Church and all that is performed in it and concerns it has no importance for them; the Church is where two or three are gathered together, *i.e.*, united in the name of Christ. They pray inwardly at all times; an fixed days they assemble for prayer-meetings, at which they greet each other fraternally with low bows, thereby acknowledging every man as a bearer of the Divine Spirit. Their teaching is founded on tradition, which is called among them the "Book of Life," because it lives in their memory and hearts. It consists of sacred songs or chants, partly composed independently, partly formed out of the contents of the Bible, which, however, has evidently been gathered by them orally, as until lately they were almost entirely illiterate and did not possess any written book. They found alike their mutual relations and their relations to other people and to all living creatures exclusively on love, and therefore they hold all people equal and brethren. They extend this idea of equality also to the government authorities, obedience to whom they do not consider binding upon them in those cases when the demands of these authorities are in conflict with their conscience; while in all that does not infringe what they regard as the will of God they willingly fulfil the desire of the authorities. They consider killing, violence, and in general all relations to living beings not based on love as opposed to their conscience and to the will of God. They are industrious and abstemious in their lives, and when living up to the standard of their faith present one of the nearest approaches to the realization of the Christian ideal which has ever been attained. In many ways they have a close resemblance to the Quakers.

For these beliefs and practices the Doukhobors long endured cruel persecution. Under Nicholas I., in 1840 and 1850, when, on religious grounds, they refused to participate in military service, they were banished from the government of Tauris — whither they had been previously deported from various parts of Russia by Alexander I. — to Transcaucasia, near the Turkish frontier. But neither the severe climate nor the neighbourhood of wild and warlike hillmen shook their faith, and in the course of half a century, in one of the most unhealthy and unfertile localities in the Caucasus, they transformed a wilderness into flourishing colonies, and continued to live a Christian and laborious life, making friends with, instead of fighting, the hillmen. But the wealth to which they attained in the Caucasus weakened for a time their moral fervour, and little by little they began to depart somewhat from the requirements of their belief. As soon, however, as events happened among them which disturbed their outward tranquillity, the religious spirit which had guided their fathers immediately revived within them. In 1887, in the reign of Alexander III., universal military service was introduced in the Caucasus; and even those for whom, as in the case of the Doukhobors, it had formerly been replaced with banishment, were called upon to serve. This measure took the Doukhobors unawares, and at first they outwardly submitted to it. About the same time, by the decision of certain government officials, the right to the possession of the public property of the Doukhobors (valued at about £50,000) passed from the community to one of their members, who had formed out of the more demoralized Doukhobors a group of his own personal adherents, which was henceforth called the "Small Party." Soon afterwards several of the most respected representatives of the community were banished to the government of Archangel. This series of calamities was accepted by the Doukhobors as a punishment from God, and a spiritual awakening of a most energetic character ensued. The majority (about 12,000) resolved to revive in practice the traditions left them by their fathers, which they had departed from during the period of opulence. They again renounced tobacco, wine, meat and every kind of excess, many of them dividing up all their property in order to supply the needs of those who were in want, and they collected a new public fund. They also renounced all participation in acts of violence, and therefore refused military service. In confirmation of their sincerity, in the summer of 1895 the Doukhobors of the

"Great Party," as they were called in distinction from the "Small Party," burnt all the arms which they, like other inhabitants of the Caucasus, had taken up for their protection from wild animals, and those who were in the army refused to continue service. At the commencement of the reign of Nicholas II., in 1895, the Doukhobors became the victims of a series of persecutions, Cossack soldiers plundering, insulting, beating and maltreating both men and women in every way. More than 400 families living in the province of Tiflis were ruined and banished to Georgian villages; of 4,000 thus exiled, over 1,000 died in the course of the first t o years from exhaustion and disease; and more would have perished had not information reached Tolstoy, and through him the Society of Friends in England, and funds were immediately raised for alleviating their sufferings. At the same time an appeal, written by Tolstoy and some of his friends, requesting the help of public opinion in favour of the oppressed Doukhobors, was circulated in St. Petersburg and sent to the emperor and higher government officials. The Doukhobors themselves asked for permission to emigrate, and the Society of Friends petitioned the emperor to the same effect. In March 1898 the desired permission was granted, and the first party (1,126) in the summer were able to sail for Cyprus, which was originally chosen for their settlement because at that time funds were not sufficient for transferring them to any other British territory. Later it was found possible to send two parties of over 4,000 to Canada, whither they arrived in Jan. 1899. They were joined in the spring of the same year by the Cyprus party, and some 2,000 from the Caucasus, and in all about 7,500 Doukhobor immigrants arrived in Canada, the government allotting them land in the provinces of Assiniboia near Yorktown and of Saskatchewan near Thunder Hill and Prince Albert. They were very cordially received by the population of the Canadian port towns. In April 1901, in the Canadian House of Commons. the minister of justice made a statement about them in which he said that "not a single offence had been committed by the Doukhobors; they were law-abiding, and if good conduct was a recommendation, they were good immigrants. . . . The large tracts of land demanded population, and if they were not given to crime, the conclusion was that they would make good citizens" Nevertheless the Canadian government has had difficulties with the sect owing to their objection to acknowledge any allegiance except to their leader Verigin, who, however, proved himself an eminently practical man.

See V. Tchertkoff, *Christian Martyrdom in Russia (1897)*; Aylmer Maude, *A Peculiar People (N.Y.,* 1904); and reff. in article "Doukhobors," by **A. A.** Stambouli, in Hastings, *Encyclopaedia of Religion and Ethics.*

DOULLENS, a town of northern France, capital of an arrondissement in the department of Somme, on the Authie, 27 mi. N. of Amiens by rail. Pop. (1936) 4,429. Doullens, the ancient *Dulincum,* was an important stronghold in the middle ages. In 1475 it was burnt by Louis XI. for openly siding with the house of Burgundy. In 1595 it was besieged and occupied by the Spaniards, but was restored to France by the treaty of Vervins (1598). It was an important British centre in the war of 1914–18. It has a citadel of the 15th and 16th centuries, now a girls' school. The old hôtel de ville has a fine belfry and dates from the 15th to the 17th century. The town is the seat of a subprefect and has a tribunal of first instance; it has trade in phosphates, of which there are workings in the vicinity, and carries on cotton-spinning and the manufacture of leather and paper.

DOULTON, SIR HENRY (1820–1897), English inventor and manufacturer of pottery, was born in Vauxhall on July 25, 1820, and died in London on Nov. 18, 1897. From the age of 15 he was employed in the pottery works of his father, John Doulton, at Lambeth. One of the first results of his experiments was the production of good enamel glazes. In 1846 he initiated in Lambeth the pipe works for the manufacture of the drainage and sanitary appliances which have helped to make the firm of Doulton famous. In 1870 the manufacture of "Art pottery" was begun at Lambeth, and in 1877 works were opened at Burslem, and later at Rowley Regis, Smethwick, St. Helens, Paisley and Paris. After the Paris exhibition of 1878 Henry Doulton was made a chevalier of the Legion of Honour. In 1872 the "Art department" was instituted in the Doulton works, giving employment to both male and female artists, amongst whom George Tinworth and the Misses Barlow obtained a reputation outside their immediate sphere. In 1885 Doulton was awarded the Albert medal by the Society of Arts, and was knighted in 1887.

DOUMER, PAUL (1857–1932), French statesman, was born at Aurillac on March 22, 1857, and entered the Chamber of Deputies in 1888. As minister of finance in the Bourgeois cabinet (Nov. 3, 1895, to April 21, 1896), he tried without success to introduce an income-tax. In Jan. 1897 he became governor of Indo-China, where he carried out important public works. In 1902 he returned to France and to the Chamber of Deputies. He refused to support the Combes ministry, and formed a Radical dissident group, which eventually caused the fall of the ministry. Doumer was elected president of the chamber in Jan. 1905, being re-elected in Jan. 1906. Senator in 1921, he was minister without portfolio in the Painlevé Government, and in 1921–22 and 1925–26 was minister of finance. In 1932, shortly after his election as president of the Republic, he was assassinated by a Russian. Doumer wrote *L'Indo-Chine française* (1903).

DOUMERGUE, GASTON (1863–1937), 12th president of the Third French Republic, was born at Aigues-Vives on Aug. 1, 1863, and was educated at the Lycée at Nimes. He studied law, became a barrister, and, after holding magisterial appointments in Cochin China and Algiers, was elected deputy for Nimes in 1893. In the Chamber he spoke with authority on colonial questions and was minister for the colonies in the Combes Government, 1902–05, being elected vice-president of the Chamber when this administration fell. In 1936 he was minister of commerce in the Sarrien cabinet, retaining his portfolio in the succeeding Clemenceau Government. When M. Clemenceau reconstituted his cabinet, M. Doumergue became minister of education and held the same post in the Briand ministry (July 1909 to Nov. 1910). In the latter year he became senator for the Gard Department and strongly advocated the Three Years' Military Service Bill.

On the fall of M. Barthou's administration in Dec. 1913, M. Doumergue formed a cabinet in which he himself took charge of foreign affairs. He was forced to resign, however, after the general elections of May 1914, which resulted in a majority in the Chamber opposed to the Three Years' Military Service law. On the outbreak of the World War he again became minister for the colonies in the Viviani Government of national defence. In 1917 he left the Government, and was sent on a mission of inquiry into conditions in Russia. On his return he re-entered the senate. After the resignation of M. Léon Bourgeois on Feb. 22, 1923, M. Doumergue was elected to succeed him as president of the senate. He supported the policy of M. Poincaré with regard to Germany and the Ruhr. On June 13, 1924, he was elected president, and remained in office until 1931 He was prime minister of a National Government from February to November, 1934.

DOUMIC, RENÉ (1860–1937), French critic and Academician. was born in Paris, and after a distinguished career at the École Normale began to teach rhetoric at the Collège Stanislas. He was a contributor to the *Moniteur,* the *Journal des Débats* and the *Revue bleue,* but was best known as the independent and uncompromising literary critic of the *Revue des Deux Mondes.* Many of his critical essays are reprinted in *Etudes sur la littérature française* (5 vols. 1896–1905); *Les Hommes et les idées du XIX^e siècle* (1903), etc. He died in Paris, Dec. 2, 1937.

DOUNE, police burgh, Perthshire, Scotland, $8\frac{3}{4}$ m. N.W. of Stirling by the L.M.S.R. Pop. (1931) 822. It is on the left bank of the Teith, here crossed by the bridge built in 1535 by Robert Spittal, tailor to James IV. The town was once famous for pistols and sporrans. Doune castle, in a commanding position on the Teith, is believed to have been built by Murdoch, 2nd duke of Albany (d. 1425). A nephew of Rob Roy held it for Prince Charlie, and it figures in Scott's *Waverley.* It belongs to the earl of Moray (Murray). The braes of Doune lie to the north-west of the town and extend towards Uam Var. Deanston, 1 m. S.W. of Doune, on the right bank of the Teith, has cotton mills, and was the scene of James Smith's (1789–1850) agricultural experi-

ments in deep ploughing and machine-design.

DOURO (Span. *Duero*, Port. *Douro*, anc. *Durius*), a river of the Iberian peninsula. The Douro rises south of the Sierra de la Demanda in the Pico de Urbion, an isolated mass 7,389 ft. high. It curves past Soria and then flows westward across Old Castile. It passes south of Valladolid and proceeds westward to the Portuguese frontier. The numerous tributaries have been most important influences in the growth of Castile's power in the middle ages. The northern tributaries, especially the Pisuerga, Valderaduey and Esla, come from the region of heavy rainfall. The tributaries from the south, of which the Adaja, Tormes and Yeltes are the most important, come from the drier Meseta.

From the great highland basin the Douro turns south-west, forming from a point east of Paradella to Barca d'Alva a section of the boundary between Spain and Portugal. This marked north-east to south-west line of the middle Douro has some relation to the general direction of the old mountain ribs of the Meseta. The river leaves the ancient plateau in a series of deep gorges in the difficult country of northern Portugal. In this country it receives the Aqueda, Côa and Paiva from the left, and the Sabor, Tua and Tamega from the right. The river enters the Atlantic 3 m. below Oporto at São Jõao da Foz. The probable length of the river is about 485 m., and the area of its basin upwards of 37,500 sq. miles. The rapids *(pontos)* and gorges of the Portuguese section of the river seriously impede navigation. The lower reaches of the river are also liable to heavy floods. The difficulty of navigation is compensated for by the railway that follows the valley through most of the Portuguese section. The mouth of the river is partly blocked by a sand-bar, which only allows small ships to enter. The large vessels have to be accommodated at Leixões, an artificial harbour to the north of the estuary. The Douro is the outlet for the important wine-producing region of the Paiz do Vinho. The Douro yields an abundance of fish.

DOURBUCOULI, the native name of a small group of American monkeys ranging from Nicaragua to Amazonia and eastern Peru, and forming the genus *Nyctipithecus*. In addition to the absence of prehensile power in their tails, douroucoulis are distinguished by their large eyes. The ears are short, and the hair round the eyes forms a disc. Douroucoulis live in parties, and are nocturnal. They feed on insects and fruit and, when excited, utter piercing screams.

DOUSA, JANUS (JAN VAN DER DOES), lord of Noordwyck (1545–1604), Dutch statesman and scholar, was born at Noordwyck on Dec. 6, 1545, and studied at Delft, Louvain, Douai and Paris. His name stood first on the list of nobles who in 1565 formed a league against Philip II. of Spain. He was living at Leyden at the time of the famous siege, and took a gallant and leading part in the defence against the Spaniards. William the Silent made him first curator of the new university in Leyden, a post which he held for nearly 30 years. After the assassination of William, Dousa went to England to persuade Queen Elizabeth to support the cause of the States. The rest of his life was devoted to literary work. His position of keeper of the State archives put within his reach the materials for his valuable *Annals of Holland*. He also wrote commentaries on Horace, Plautus and Catullus. He died at Noordwyck on Oct. 8, 1604.

DOUVILLE, JEAN BAPTISTE (1794?–1837), French traveller, was born at Hambye (Manche), and is said to have been murdered in 1837 on the banks of the São Francisco in Brazil. He received the gold medal of the Paris Société de Géographie for his *Voyage au Congo* (1832), but his account of his travels was proved to be fictitious and there is no evidence that he went beyond the coast. His narrative was based on unpublished Portuguese sources.

DOUW (or Dow), **GERRIT** (GERARD) (1613–1675), Dutch painter, was born at Leyden on April 7, 1613. His first instructor was Bartholomew Dolendo, an engraver; and he afterwards learned the art of glass-painting under Peter Couwenhorn. In 1628 he became a pupil of Rembrandt, from whom he acquired his skill in colouring, and in the more subtle effects of lighting; and the style of Rembrandt is reflected in several of his earlier pictures, notably in a portrait of himself at the age of 22, in the Bridgewater House gallery, London, and in the "Blind Tobit going to meet his Son," at Wardour castle, Wiltshire, England. His more mature manner was in some respects antagonistic to that of his master. He cultivated a minute treatment of his subjects, but notwithstanding his meticulous style, the general effect was harmonious and free from stiffness, and his colour was always admirably fresh and transparent. He was fond of representing subjects in lantern or candle light, the effects of which he reproduced with a fidelity and skill which no other master has equalled. He frequently painted by the aid of a concave mirror, and to obtain exactness looked at his subject through a frame crossed with squares of silk thread. His practice as a portrait painter, which was at first considerable, gradually declined, sitters being unwilling to give him the time that he thought necessary. His pictures were always small in size, and represented chiefly subjects in still life. Upwards of aoo are attributed to him, and specimens are to be found in most of the great public collections of Europe. Among his more famous works are: the "Woman sick of the Dropsy," in the Louvre, the "Evening School," in the Amsterdam gallery; the "Poulterer's Shop," and a portrait of himself in the National Gallery, London. Douw's pictures brought high prices, and it is said that President Van Spiring of The Hague paid him 1,000 florins a year simply for the right of pre-emption. Douw died in Leyden in Feb. 1675. His most celebrated pupil was Francis Mieris.

See W. Martin, ***Het leven en de werken van Gerrit Douw*** (1901).

DOVE, ALFRED (1844–1916), German historian, was born on April 4, 1844, in Berlin, and studied medicine and science at Heidelberg and Berlin. From 1870 he edited *Grenzboten* and then *Im Neuen Reich*. In 1874 he became professor of history at Breslau and in 1884 at Bonn. In 1890 he edited the *Sämtliche Werke* of von Ranke, whose posthumous manuscript completing the *Weltgeschichte* he had already published and in 1891 the final volumes of Bismarck's speeches. Dove also wrote *Deutsche Gesch. im Zeitalter Friedrichs des Grossen u. Joseph 11.* (1883); *Kaiser Wilhelms geschichtl. Gestalt* (1888); *Grossherzog Friedrich von Baden als Landesherr und deutscher Fürst* (1902). He died at Freiburg on Jan. 19, 1916.

DOVE, HEINRICH WILHELM (1803–1879), German meteorologist, was born at Leignitz, Silesia, on Oct. 6, 1803. He studied mathematics and physics at Berlin and Breslau. He was professor of physics at Konigsberg (1826–29), supplementary professor (1829–45), and finally, professor of physics at Berlin. He made an exhaustive and exact study of the distribution of temperature over the surface of the earth, giving many of his results in carefully drawn maps. This work has been of great importance to geographers and geologists. He also carried out a series of investigations on winds and phenomena allied with winds; he was considerably hampered in this work by the fact that the barometers in use at the time did not give reliable readings. Dove was a foreign member of the Royal Society. He died at Berlin on April 6, 1879. Among his publications were *Über Mass* und *Messen* (1835); *Meteorologisclze Untersuchungen* (1837); and *Klimatologische Beitriige* (1857–69).

See H. Newmann, ***H.*** W. *Dove* (1925).

DOVE, a river of England, tributary to the Trent, rising in Axe Edge, Derbyshire, and through almost its entire course forming the boundary of that county with Staffordshire. In its upper course it traverses a fine narrow valley, where the limestone hills exhibit many picturesque cliffs, gullies and caves. Dovedale, that part between Dove Holes and Thorpe Cloud, is especially famous. Below Thorpe Cloud the Dove receives on the west the Manifold, which, like its tributary, the Hamps, and other streams in the limestone district, has part of its course below ground. Near the village of Rocester the Churnet joins the Dove on the west, and then its course, hitherto southerly, bends nearly easterly on passing Uttoxeter, and, winding through a widening valley, joins the Trent below Burton-on-Trent at Newton Solney. The length of the valley is about 40 m. and the total fall of the river about 1,450 feet. The Dove is well known for trout-fishing, and Beresford Dale, below Hartington, has a special interest for fishermen through its associations with Izaak Walton and Charles Cotton, whose fishing-house stands near the Pike Pool.

DOVE, a name applied to the smaller members of the order Columbae, but no sharp distinction can be drawn between pigeons (*q.v.*) and doves.

The English ring-dove or wood-pigeon (*Columba palumbus*) is a common bird in most parts of Europe, where it is the largest species. It may be recognized by the large white patches on the wings and the white spot (sometimes absent, however) on either side of the neck, whence it gets its name. Its familiar cooing song is remarkable for its abrupt close. It makes a slight platform of slicks on the horizontal bough of a tree and thereon lays two white eggs. In the wild state, it is very wary and the flight is strong and rapid.

The stock-dove (C. aenus) is smaller and breeds in hollow trees or rabbit-holes. It is darker than the ring-dove, lacking the white on the wings and neck, and is locally distributed.

The rock-dove (C. *livia*) is the parent stock of our domestic pigeons. In the wild state it haunts the rocky coasts of Europe. Domestic pigeons have been classified by Darwin (Variation of *Animals* and Plants under *Domestication*) in four groups:

I. The "Pouters," having the gullet of great size, barely separated from the crop and capable of inflation.

II. Three races: (1) "Carriers," with a long bill and eyes surrounded by bare skin. (2) "Runts," with a long massive bill and large body. (3) "Barbs," with a short bill and bare skin round the eyes. There are numerous sub-races.

III. An artificial group, comprising five races: (1) "Fan-tails," whose tail may consist of 42 rectrices, instead of the normal 12. (2) "Turbits" and "Owls," with the feathers of the throat diverging and a short thick bill. **(3)** "Tumblers," which tumble backwards during flight. (4) "Frill-backs," in which the feathers are reversed. (5) "Jacobins," with the neck-feathers forming a hood.

IV. Resembling the normal form and including two races: (1) "Trumpeters," with a tuft of feathers at the base of the neck, curling forward, and a peculiar voice. (2) Pigeons scarcely differing from the wild stock.

The differences extend to every part of the body. Doves have from time immemorial been employed as messengers (*e.g.,* Gen. viii. 8–12).

The headquarters of the Columbidae are the Papuan sub-region (see PIGEON).

The turtle-dove of Europe (Turtur *auritus*) is a summer visitor to the northern parts of the Continent. The collared or Barbary dove (T. risorius) is distinguished by its cream-coloured plumage and black necklace.

In North America the name is given to the very widely distributed mourning dove (*Zenaidura* macroura); the white-fronted dove (Leptotila *fulviventris* brachyptera), from southern Texas to Guatemala; the Mexican ground dove (*Columbigallina passerina* pallescens), and the Inca dove (*Scardapella inca*) of Texas and Mexico.

DOVEKIE, the common name in North America for the little auk (*Alle alle*). (See AUK.) The name is applied by sailors to the black guillemot. (See GUILLEMOT.)

DOVER, GEORGE JAMES WELBORE AGARELLIS, BARON (1797–1833), English man of letters, was the only son of the 2nd Viscount Clifden. He secured the grant of £57,000 to purchase John Julius Angerstein's collection of pictures, which formed the foundation of the National Gallery. He was president (1832) of the Royal Society of Literature, a trustee of the British Museum and of the National Gallery, and a commissioner of public records.

Lord Dover edited the *Ellis* Correspondence (1829) and *Walpole's* Letters to Sir Horace Mnnn (1833), and he was the author of some historical works.

DOVER, ROBERT (1575–1641), English captain and attorney, is known as the founder and director for many years of the "Cotswold Games," which he originated as a protest against the growing Puritanism of the day. These sports, which were referred to by contemporary writers as "Mr. Robert Dover's Olimpick Games upon the Cotswold Hills," consisted of cudgel-playing, wrestling, running at the quintain, jumping. casting the bar and hammer, hand-ball, gymnastics, rural dances and games and horse-racing, the winners in which received valuable prizes. They continued from about the year 1604 until three years after the death of Dover, which took place in 1641. They were revived for a brief period in the reign of Charles II.

DOVER, a seaport and municipal borough in the Dover Parliamentary division of Kent, England, one of the Cinque Ports, 76 mi. E.S.E. of London by the Southern railway. Pop. (est. 1938) 39,950. Area, 5.7 sq.mi. It is situated at the mouth of a small stream, the Dour, whose valley here breaches the high chalk cliffs which fringe the coast on either hand. The dominant object is the castle, on the east height, 375 ft. above sea level. Within its precincts are a Roman pharos or lighthouse, still exhibiting the Roman masonry; the ancient fortress church (St. Mary in Castro); some remains of the Saxon fort; and the massive keep and subsidiary defenses (such as the Constable's, Avranche's, and other towers) of the Norman building. The church, substantially unaltered, forms an almost unique Christian relic. It has been called Roman, but is later. It is cruciform in shape, and the walls are built mainly of flint, but jambs and arches are formed of Roman bricks. At the end of the 12th century it was remodelled and given an Early English character. In the beginning of the 18th century it was dismantled and turned into a storehouse; and so continued until 1863, when, having been restored by Sir G. G. Scott, it was again opened for divine service, and is now the chapel of the castle garrison.

The castle is probably of extremely early origin. The earthworks on the line of the outer curtain may be British, or even Roman, or may possibly represent the Saxon "burg" which Harold is said to have constructed. To these early banks and ditches. with perhaps stockades and wooden towers the conqueror added according to William of Poitiers, such additional "firmamenta" as were needful. This probably means a Norman "motte and bailey"; and a moat, and in part a bailey, still remain inside the earlier *castrum.* The moat is unusually big, and the bailey, south of it, had an unusual loop to the southeast apparently to include the already extant church and pharos. Henry II is responsible for the first stone fortification. He encircled the Norman moat with a wall and crowned it with a keep. Finally the outer rampart was translated into stone, with a line of at least 17 towers at intervals in the time of Henry III, perhaps by Hubert de Burgh. The small inner ward, on the moat, has an area of about two acres; the Norman bailey about four; the whole *castrum* enclosing about 34 acres. Though the castle has suffered many alterations for modern military requirements, especially during the scare of a Napoleonic invasion, which have much obliterated the walls of the middle ward, the remainder of the castle stands substantially as it stood in the time of Henry III. With the exception of the Tower of London, it is probably at once the largest, most complete and most complex example of mediaeval fortification. Nine wards named in a list of Dover wards and their fees, dated 1211–12, in the Red Book of the exchequer, are all reproduced in names still attached to towers. These names had become fixed probably not later than the reign of Henry II. The constableship was attached to the honour of Haughley, known in consequence as the honour of the constable. It reverted to the crown on the forfeiture of Henry of Essex in 1163. At the time of Domesday it was held by Hugh de Montfort. The constableship later was held jointly with the lord wardenship of the Cinque Ports.

Reniains were discovered in 1854 of a round church of the Templars (Holy Sepulchre), 32 ft. in diameter, which has been restored; the church, doubtless, in which King John made his submission to the papal nuncio in 1213. Archcliffe fort lies to the southwest of old Dover. There is a remnant of the Saxon collegiate church of the canons of St. Martin. The remains of the splendid foundation of St. Martin's priory, of the 12th century, include the great gate, the house refectory, with campanile, and the spacious strangers' refectory, now incorporated in Dover college. The college of St. Martin for 22 secular canons, which had been established in the castle before 640, was removed to the church of St. Martin in the town in 696 and in 1136 became a Bene-

dictine priory under the jurisdiction of that at Canterbury, to which see the lands are still attached. The interior of the refectory is very fine and on its east wall are remains of a 12th century mural painting of the Last Supper; some of the nimbi surrounding the heads may still be made out. King Stephen is said to have died in the priory guesthouse, which is the chapel of the modern college The gatehouse, now the library of the college is a good piece of Decorated work, and has a fine open fireplace In High street may be seen the noble hall and truncated fabric of the Maison Dieu founded by Hubert de Burgh in the 13th century for the reception of pilgrims of all nations. From the time of Henry VIII to 1830 it was used as a crown victualling office, but was subsequently purchased by the corporation and adapted as a town hall The new town hall adjoining the old hall of the Maison Dieu was opened in 1883 The museum (1849) contains an interesting collection of local antiquities and a natural history collection. A bell taken from Antwerp by the Germans during World War I and used as an air-raid warning at Zeebrugge was presented to Dover by the king of the Belgians and hung in a turret outside the town hall.

During World War II Dover suffered from constant "hit-and-run" air raiding, as well as shelling from Cape Gris Nez. To the end of 1941 about 9,000 houses had been damaged, also the parish church of St. Mary the Virgin (rebuilt and enlarged in 1843–44, but preserving the three bays of the Saxon church with its western narthex, on which was superimposed the Norman tower, whose rich front faced the street; the rest of the building mas Norman and Early English), and the churches of St. James-the-Less (originally Norman, but vigorously restored) and St Barnabas.

Among various charitable institutions are the National Sailors' home and the Gordon Boys' and Victoria Seaside orphanages. Among educational establishments is Dover college, occupying the site and remaining buildings of St. Martin's priory, with additional modern buildings. It was instituted in 1871, and educates about 220 boys. There is a separate junior school.

Dover is the only one of the Cinque Ports which is still a great port. It is one of the principal ports for passenger communications across the channel, steamers connecting it with Calais and Ostend The Admiralty pier was completed to a length of about 2,000 ft in 1871- The construction of a new commercial harbour was begun in 1893. The works included the east pier ("Prince of Wales's pier" completed, 1902), running parallel to the general direction of the Admiralty pier, and in conjunction with it enclosing an area of sheltered water of 75 ac. The Admiralty harbour, begun in 1896, has an area of 610 ac., of which 322 ac. have a depth of not less than 30 ft. at low water. It comprises three enclosing breakwaters—on the west an extension of the Admiralty pier in a southeasterly direction for 2,000 ft.; on the south an isolated breakwater, 4,200 ft. long, curving round shoreward at its eastern end to accord with the direction of the third breakwater, on the east, which runs out from the shore in a southerly direction for 3,320 ac. These three breakwaters, with a united length of more than $1\frac{3}{4}$ mi., are each built of massive concrete blocks in the form of a practically vertical wall rising to a quay level of 10 ft. above high water. There are two entrances, one 800 ft. and the other 600 ft in width, with a depth of about seven fathoms at low water. In 1919 the naval base was given up and in 1923 the Admiralty harbour was transferred to the Dover harbour board for commercial purposes. Near the Admiralty pier is the train ferry dock, completed in 1936, the English terminal of a train ferry service between Dover and Dunkirk, which enabled a through service to be operated between London and Paris. Besides the mail service and harbour trade, Dover has a trade in ship supplying, and there are paper and flour mills and an iron foundry. Dover is a bishopric suffragan in the diocese of Canterbury. The town returned two members to parliament until 1885, when the number was reduced to one, and it was disfranchised in 1918.

Dover (*Dubris*) was one of the ports for continental traffic in Roman times. In the 4th century it was guarded by a fort lying down near the harbour. and forming part of the defenses of the Saxon shore (*Litus Saxonicum*). As a Cinque Port, Dover *(Dofra, Dovorra)* contributed 20 of the quota of ships furnished by those ports. A charter of liberties was granted to the ports as a body by Edward I in 1278, confirming charters of Henry II and John. which in the case of Dover had confirmed privileges enjoyed by the town in the time of Edward the Confessor and later kings Edward I's charter was confirmed by subsequent kings, with additions, down to James II. During the middle ages Dover castle was an object of contention both in civil wars and foreign invasions, and was considered the key to England. It was successfully defended in 1216 against the French under the dauphin Louis by Hubert de Burgh. In 1685 Charles II confirmed to the inhabitants of Dover a fair beginning on Nov. 11, which had been held of old in the town, and granted two others on April 23 and 24 and on Sept. 25 and 26. After the decay of Richborough harbour the passage from Dover to Whitsand, and later to Calais, became the accustomed route to France, and by a statute of 1465 no one might ship for Calais except at Dover. The guardians of the harbour were incorporated by James I in 1607.

See S. P. *H.* Statham, *History of the Castle, Town and Port of Dover* (1899); and *Dover Charters and Other Documents* (1902).

Battle of Dover.—This famous and important naval victory was won off the town of Dover by the ships of the Cinque Ports on Aug. 21, 1217, during the minority of King Henry III The barons, who were in arms against his father King John, had called Louis, son of Philip Augustus, king of the French, to their aid. Having been recently defeated in Lincoln, they were hard pressed, and reinforcements were sent to them from Calais in a fleet commanded by a pirate and mercenary soldier called Eustace the Monk. He passed the Straits of Dover with a numerous flotilla laden with military machines and stores, and also carrying many knights and soldiers. The Monk's fleet was seen from Dover, where the regent, Hubert de Burgh, lay with the naval force of the Cinque Ports, said to have been very small. Sixteen vessels, large for that time, and a number of smaller craft, is said to have been their total strength It put to sea, and by hugging the wind gained the weather gage of the French adventurer.

Eustace is said to have been under the impression that they meant to attack Calais in his absence, and to have derided them because he had left the town well guarded. When they were to windward of his fleet the Cinque Port ships bore down on the enemy. As they approached they threw unslaked lime in the air and the wind blew it in the faces of the French. This form of attack, and the flights of arrows discharged by the English (which flew with the wind), produced confusion in the crowded benches of the French vessels, which in most cases must have been little more than open boats. The Monk was defeated, and his fleet was entirely scattered, sunk or taken. His own vessel was captured. Eustace, who had concealed himself in the bilge, was dragged out. In answer to his appeals for quarter and promises to pay ransom, he was told by Richard, the bastard son of King John, that he was a traitor who would not be allowed to deceive more men. His head was struck off by Richard, and was sent round the ports on a pike. The Cinque Port seamen returned in triumph, towing their prizes, after throwing the common soldiers overboard, and taking the knights to ransom according to the custom of the age. The political importance of the battle was great, for it gave the deathblow to the cause of the barons who supported Louis, and it secured Henry III on his throne. But the defeat and death of the Monk was widely regarded as in a peculiar sense a victory over the powers of evil. The man became within a few years after his death the hero of many legends of piracy and necromancy.

Ascertainable fact is less picturesque, but enough is known to show that he was an adventurous and unscrupulous scoundrel In his youth he was a monk, and left the cloister to claim an inheritance from the count of Boulogne. Not having received satisfaction he became a freebooter on land and sea, and mercenary soldier. He is frequently mentioned in the Pipe, Patent and Close Rolls. For a time he served King John, but when the king made friends with the count of Boulogne, he fled abroad, and entered the service of the French prince Louis and his father

Philip Augustus. Chroniclers lavish on him the titles of *"archipirata,"* *"vir flagitiosissimus et nequissimus,"* and poets made him an associate of the devil.

The evidence concerning Eustace is collected by Herren Wendelin Förster and Johann Trost, in their edition of the French poem "Wistasse le moine" (Halle, 1891). *See* for the battle Sir N. Harris Nicolas, *History of the Royal Navy* (London, 1847).

The Dover Patrol.—Dover harbour provided the headquarters of the Dover Patrol during World War I. The area of the Patrol extended roughly from the North Foreland to Beachy Head, including both sides of the Channel. The functions of the Patrol were, primarily, to keep the narrows of the Channel open to traffic. London could not be fed by rail alone. Had sea traffic to London been stopped it would have been necessary at once to transport one third of the population to the west coast. The traffic had to be protected from mines, submarine boats and destroyer attacks. On an average 66 trawlers were used for minesweeping and traffic duties; approximately 100,000 merchant vessels passed during 1915–17 inclusive, and of these only 48 were mined and 7 torpedoed; the percentage loss for the three years was .035, .08 and .066 respectively; 5,614,500 troops were transported between Folkestone and Boulogne without a single casualty or accident. Nine and a half million mail bags were sent without the loss of a single letter or parcel.

The next important duty of the Patrol was hunting submarines. At first these vessels passed down the straits on the surface, diving only when they were sighted. It was then simple to attack them. After 1915 they dived when well to the eastward and passed the narrows entirely submerged. Many schemes were tried to defeat them, and as soon as mines became available a barrage of lines of mines moored at various depths was laid between Folkestone and Gris Nez. This was nearly completed by January 1918 and the first submarine was destroyed in it in December 1917. This in the end completely stopped the passage of submarines and destroyed a considerable number of them.

At the commencement of the war the Dover Patrol force operated with the army in checking the German advance through Belgium by their gun fire and made the shore road difficult for the Germans to use. Subsequently the Patrol was called on to defend the sea flank of the army and by feints of landings to draw troops from the main offensive to the coast. To assist in the advance which was contemplated in 1917 three 12 in. guns, seven 9.2 and eight 7.5 in. guns were landed and mounted, at the same time arrangements were made for landing 20,000 men on the coast between Ostend and Westend. Pontoons 55 feet long loaded with men and accessories were constructed to be pushed ahead of the monitors on to the beach. This landing was never carried out, as the commander-in-chief did not consider it advantageous to land troops until the army had reached Roulers. It never pushed on beyond the Passchendaele Ridge. The only attacks by the enemy prior to 1918 on the Dover defenses were those made by destroyers at night. Darkness and surprise coupled with the meagre allowance of destroyers for Dover made these raids very difficult to cope with, but the damage done was insignificant, the total lcsses being two merchant vessels (one empty), two destroyers and six drifters. During the fourth raid the *Broke* and *Swift* sank two German destroyers, and for a time the raids ceased. During 1918 a last raid was made on the vessels protecting the mine barrage and several were sunk.

An examination service for the detection of contraband was established in the Downs. All North and South going traffic had to anchor and be examined. This work was largely undertaken by Naval Reserve officers under a post captain. In 1917, when raids by German destroyers threatened the safety of the vessels in the Downs, the Northern examination service was moved inside the Thames shoals.

Vessels at Dover were also called on to undertake bombardments of the dockyard at Ostend and the submarine base at Zeebrugge. The result of these operations was that the dockyard was made untenable and the destroyers and submarines forced up the canal to Bruges. In 1916 the aircraft were used for spotting with successful results, several of the bombardments being carried out without the Belgian coast being sighted by the ships. The force of destroyers available at Dover before 1917 was very small having regard to the duties they were called on to perform, only six mounted 4-in. guns. During the latter year they were augmented. Of the 12 Tribal class half were mined or torpedoed. A constant patrol was kept up eight miles off the Belgian coast during the summer months of 1916–17. This was made possible by first laying down the barrage of mines and mined nets seven miles from the coast to protect the ships from attack on the shore side. The only ship damaged while on patrol was the monitor Terror which was struck by a boat controlled electrically from the shore.

Blocking operations were carried out during 1918 when Zeebrugge was attacked and blocking ships skilfully sunk in the Channel which however owing to its physical formation was not, and could not be, effectively blocked. A similar attempt on Ostend failed, though attempted with great gallantry. The drifters like the trawlers were invaluable in the English Channel, first drifting nets to entangle submarines, then watching the barrages. On the Belgian coast they laid 12 miles of armoured mine nets for two years in succession. The motor launches also were of considerable value for sundry services, specially burning smoke screens to hide the ships bombarding. These screens were necessary since the effective range of the monitors' guns was only about 75% that of the shore batteries. The French naval armaments on the north coast of France were under the orders of the Admiral of the Dover Patrol and did excellent service throughout the war. The air service at Dunkirk was also one of the arms of the Patrol and was invaluable both on the coast and also in assisting the army, notably at the battle of the Somme when the army was very deficient in aircraft. Without the breakwater and harbour facilities at Dover the protection of the straits would have been impossible, and the evacuation of the wounded most difficult. Practically the whole of the wounded at the front were safely landed at the Admiralty Pier and from there despatched to the various hospitals.

DOVER, the capital city of Delaware, U.S.A., and the count)? seat of Kent county, on the St. Jones river, in the central part of the State. It is on federal highway 13, and is served by the Pennsylvania railroad. The population was 4.042 in 1920 (26% Negroes) and was 5,517 in 1940 by the federal census. The state house, built about 1722 for a courthouse and remodelled in 1791 for its present purpose, is a beautiful building of dignified colonial architecture, set in a spacious green. Near Dover still stands the home of Caesar Rodney (1728–1784), who rode to Philadelphia through the night of July 3, 1776, in order to be present at the roll call on the Declaration of Independence, and thus made possible a unanimous vote of the 13 Colonies in favour of its adoption. Dover is a shipping point for the strawberries, apples, peaches, grapes, poultry, vegetables and other products of the fertile surrounding country, and has many canneries and packing plants, including one of the oldest and largest in the country (established 1855). The State college for Negro students (1892) is near the city. Dover was laid out in 1717, by order of William Penn. In 1777 it replaced New Castle as the capital of the State. It was incorporated as a town in 1829, and re-incorporated as a city in 1925 with an area almost double its former size.

DOVER, a city of southeastern New Hampshire, on the Cocheco river, 10 mi. N.W. of Portsmouth; the county seat of Strafford county. It is served by the Boston and Maine Railroad and motorbus lines. The population was 13,029 in 1920 (80% native white), and was 13,573 in 1930 and 14,990 in 1940 by the federal census. It has abundant water power and large manufacturing industries, with an output in 1937 valued at $12,-162,901.

Leading products are cotton sheeting, woollen goods, leather belting, machinery and shoes. A settlement was established in 1623 by Edward Hilton on Dover Point, 5 mi. S.E. of the Cocheco falls, and in 1633 several families under Captain Thomas Wiggin settled on Dover Neck (on the Piscataqua river, 1 mi. above Dover Point) which for the first century, while shipbuilding was the important occupation, was the business centre of the town. With the

development of manufacturing, business and population shifted to the Cocheco river, which is now the centre. For nearly half a century after 1641 the plantation (by will of the majority) was under the jurisdiction of Massachusetts. Between 1675 and 1725 the town suffered greatly from attacks by the Indians, notably on June 28, 1689.

Dover was chartered as a city in 1855. At Durham, 5 mi. southwest, is the University of New Hampshire, established as an agricultural college in 1866, at Hanover; moved to Durham in 1893, following the death of Benjamin Thompson, a farmer of that town, who left to the college almost his entire estate; and incorporated as a university in 1923.

DOVER, a town of Morris county, New Jersey, on the Rockaway river, 40 mi. W.N.W. of Jersey City, at an altitude of 570 ft. It is served by the Central of New Jersey and the Lackawanna railways. The population was 9,803 in 1920; in 1930 it was 10,031 and in 1940, 10,491. Iron is mined in the vicinity, and the town has large railroad shops and important manufactures, including hosiery, silk, bar iron, furnaces and ranges, boilers, bridges, drills and air compressors. Dover was settled as early as 1748 and was separately incorporated in 1869.

DOVER, a city of Tuscarawas county, Ohio, U.S.A., on the Tuscarawas river, 82 mi. S. by E. of Cleveland. It is on federal highway 21, and is served by the Baltimore and Ohio and the Pennsylvania railways and excellent highways. The population was 8,101 in 1920 (87% native white); it was 9,716 in 1930 and 9,691 in 1940 by the federal census. The city lies on a plateau 884 ft. above sea level, commanding diversified views. Iron ore, coal, fireclay and limestone abound in the vicinity. The manufactures include electric irons, sweepers, stearic acid, bronze tubes, steel, flour and wall tile. A town was laid out in 1807. It was on the Ohio canal (opened 1832) and was formerly called Canal Dover, but "Canal" was dropped in 1915. It was incorporated as a village in 1842, reincorporated in 1867 and became a city in 1903.

DOVER, TREATY OF. A secret treaty concluded on May 22, 1670 between Charles II. of England and Louis XIV. of France, whereby Charles II. agreed to embrace the Roman Catholic faith and the king of France to assist him in this with a large sum of money and the use of 6,000 troops. It was agreed that the two countries should declare war jointly on the United Provinces, and also that England should support the claim of Louis, should he "acquire new titles and rights to the Spanish Monarchy." The treaty was negotiated through Henrietta, Duchess of Orleans and sister of Charles II. *(See* CHARLES II.)

The treaty did not however become operative as such owing to the religious controversy involved; in a later version (Dec. 1670) the proposed conversion of the English king was omitted. and a date fixed for the declaration of war against the United Provinces

DOVERCOURT, a watering place and parish in the borough of Haruich, Essex, England, with a station on the L N.E.R., 70 mi. E.N.E. from London. The esplanade and sea-wall front the North sea, and there is a fine expanse of sand. Much attention has been given to laying out public walks and gardens and providing recreation facilities. There is also a chalybeate spa. The scenery of the neighbouring Orwell and Stour estuaries is pleasant. The church, which stands inland in the old village distinguished as Upper Dovercourt, is Early English; it formerly possessed a miraculous rood which became an object of pilgrimage. It is said to have been stolen and burned in 1532, three of the four thieves being subsequently taken and hanged.

DOW, NEAL (1804–1897), American temperance reformer, was born at Portland, Me., March 20, 1804. He drafted the Maine prohibitory law of 1851. He was mayor of Portland, 1851, 1855, a member of the Maine legislature, 1858–59, and in the Civil War colonel of the 13th Maine Volunteer Infantry.

He served in General B. F. Butler's New Orleans expedition, was commissioned brigadier-general of volunteers in April 1862, and commanded for a time the department of Florida. After the war he devoted a great part of his time to the extension of prohibition in America and England. Through his exertions the prohibitory amendment was added to the Maine Constitution in 1884. He died at Portland, Oct. 2, 1897.

His *Reminiscences* were published *at* Portland in 1898.

DOWAGER, strictly, a widow in the enjoyment of dower. "Dowager" is also applied to widows of high rank to distinguish them from the wives of their sons, as queen-dowager, dowager-duchess, etc. The title was first used in England of Catherine of Aragon, widow of Arthur, prince of Wales, who was styled princess dowager till her marriage with Henry VIII. By transference the word is used of an elderly lady.

DOWAGIAC (dō-waw′-jăk), a city of Cass county, Michigan, in the south-western part of the State, on the Michigan Central railroad. Population 5,440 in 1920 (86% native white) and was 5,007 in 1940 bv federal census. It is in a fertile region of many lakes. The city manufactures furnaces and fish-bait; ships wheat, corn, fruit, celery, peppermint and other agricultural products; and is a summer resort and touring centre. It was founded about 1838 and incorporated in 1852.

DOWDEN, EDWARD (1843–1913), Irish critic and poet, was born at Cork and educated at Queen's college, Cork, and Trinity college, Dublin. He became professor of English literature at Trinity college in 186;. His first book, *Shakespeare, his Mind and Art* (1875), a revision of a course of lectures, was translated into German and Russian, and his *Poems* (1876) went into a second edition. His *Shakespeare Primer* (1877) was also translated into Italian and German. Later works by him in Shakespearean criticism were his *Shakespeare's Sonnets* (1881), *Passionate Pilgrim* (1883), *Introduction to Shakespeare* (1893), and editions of *Hamlet* (1899), *Romeo and Juliet* (1900) and *Cymbeline* (1903). His *Studies in Literature* (1878), *Transcripts and Studies* (1888), *New Studies in Literature* (1895), and other works, many of them biographical, showed a profound knowledge of the currents and tendencies of thought in various ages and countries; but it was his *Life* of *Shelley* (1886) that made him best known to the public at large. In 1900 he edited an edition of Shelley's works. In 1889 he became the first Taylorian lecturer at Oxford, and from 1892 to 1896 was Clark lecturer at Trinity college, Cambridge.

DOWER, in law, the life interest of the widow in a third part of her husband's lands. There were originally five kinds of dower: (1) at common law; (2) by custom; (3) *ad ostium ecclesiae,* or at the church porch; (4) *ex assensu patris;* (5) *de la plus belle.* The last was a conveyance of tenure by knight service, and was abolished in 1660, by the act which did away with old tenures. Dower *ad ostium ecclesiae,* by which the bride was dowered at the church porch (where all marriages used formerly to take place), and dower *ex assensu patris,* by the father of the bridegroom, though long obsolete, were formally abolished by the Dower act 1834. Dower was governed in Great Britain, so far as women married after Jan. 1, 1834 were concerned, by the Dower act 1834, and under it only attached on the husband's death to the lands which he actually possessed for an estate of inheritance at the time of his death. It did not attach to any land actually disposed of by him in his lifetime or by his will, or to any land from which he declared by deed or will his wife should not be entitled to dower. Dower was finally abolished by the Administration of Estates act 1925. The right to dower still obtains in some colonies, while in others it has been superseded by Homestead acts, or the acts dealing with devolution of property *(see* Burge's *For. and Col. Laws,* vol. iv. pt. ii. Wyndham A. Bewes ed.)

In the United States, in such States as have not enacted statutes to the contrary, dower continues as at common law. Some statutes are in effect which declare the principles of the common law. In most States, however, the common law doctrines of dower have been very greatly modified by statute. In some States dower either has been abolished or a different right or interest has been substituted therefor. Even where it has been abolished, the term often popularly is used. Where dower is abolished the interest substituted may be in one of several forms, perhaps a certain portion of the husband's property or of the community property of both or of a life estate in a portion of his realty.

DOWIE, JOHN ALEXANDER (1847–1907), founder of the "Christian Catholic Apostolic Church in Zion," born in Edin-

burgh, and went as a boy to Australia with his parents. He returned in 1868 to study for the Congregationalist ministry at Edinburgh University, and subsequently became pastor of a church near Sydney, Australia. Imbued with belief in his powers as a healer of disease by prayer, he moved to Melbourne, where he founded "The Divine Healing Association of Australia and New Zealand." In 1888 he went to America, preaching and "healing," and in spite of opposition and ridicule attracted a number of adherents. In 1896 he established "The Christian Catholic Apostolic Church in Zion," with himself as "First Apostle"; and in 1901, with money liberally contributed by his followers, he founded Zion City, on a site covering about 10 sq.m. on the west shore of Lake Michigan, with a central Zion Temple. In 1903 and 1904, in the course of a visit to the branches of the Christian Catholic Church throughout the world, he appeared in London, but was mobbed. In April 1906 a revolt against his domination took place in Zion City. He was charged with peculation and with practising polygamy, and was deposed, with the assent of his own wife and son. Dowie was now broken in health and unmistakably insane; he was struck with paralysis and died in Zion City in March 1907 Dowie was succeeded by Wilbur Glenn Voliva.

DOWLAS, plain cloth, similar to sheeting, but usually coarser. It is made in several qualities, from line warp and weft to two warp and weft, and is used chiefly for aprons, pocketing, soldiers' gaiters, linings and overalls. The finer makes are sometimes made into shirts for workmen, and occasionally used for heavy pillow-cases. The word is spelt in many different ways, but the above is the common way of spelling adopted in factories, and it appears in the same form in the first part of Shakespeare's *Henry IV.*, Act III. scene 3. The modern dowlas is a good strong and closely woven linen fabric.

DOWN, a maritime county of Ireland, occupying the most easterly part of the island, bounded north by Co. Antrim and Belfast Lough, east and south by the Irish sea, and west by Co. Armagh. The land area is 952 sq.mi. Pop. (1937) 210,687.

The foundation of this county is Silurian rock throughout, the slates and sandstones striking as a whole north-east, but giving rise to a country of abundant small hills. The granite that appears along the same axis in Armagh continues from Newry to Slieve Croob, furnishing an excellent building stone. South of it, the Eocene granite of the Mournes forms a group of rocky summits, set with scarps and tors, and divided by valleys, which are not yet choked by the detritus of these comparatively youthful mountains (Slieve Donard 2,796 ft.). Lower lands occupy the east, north and large portions of the west of the county. Basalt dykes abound. being well seen along the coast south of Newcastle. At the head of Strangford Lough, the basalt, possibly as intrusive sheets, has protected Triassic sandstone, which is quarried at Scrabo hill. A strip of marine Permian occurs on the shore at Holywood. The north-west of the county includes, at Moira, a part of the great basaltic plateaux, with Chalk and Trias protected by them. The chief drainage is to the river Lagan in the north, and to the Bann and the Newry on the west. The period at which Down was constituted a county is not certain. A district, however, appears to have borne this name before the beginning of the 14th century, but little is known of it even later than this. However, when in 1535 Sir John Perrot undertook the shiring of Ulster, Down and Antrim were excepted as already settled counties. That some such settlement would have been attempted at an early period is likely, as this coast was a place of Anglo-Norman colonization, and to this movement was due the settlement of the baronies of Lecale, the Ards and others.

At Slidderyford, near Dundrum, there is a group of ten or twelve pillar stones in a circle, about 10 ft. in height. A cairn on the summit of Slieve Croob is 80 yds. in circumference at the base and 50 at the top, where is a platform on which cairns of various heights are found standing. Cromlechs, or altars, are numerous, the most remarkable being the Giant's Ring, which stands on the summit of a hill near the borders of Antrim. This altar is in the centre of an enclosure about a third of a mile in circumference, formed of a rampart about 20 ft. high, and broad enough on the top to permit two persons to ride abreast. Near Downpatrick is a rath, or encampment, three-quarters of a mile in circumference. In its vicinity are the ruins of Saul Abbey, said to have been founded by St. Patrick, and Inch Abbey, founded by Sir John de Courcy in 1180. The number of monastic ruins is also considerable. The most ancient and celebrated is the abbey or cathedral of Downpatrick. Dundrum Castle, attributed to the de Courcy family, stands above that town, and affords an unusual example (for Ireland) of a donjon keep. The castle of Hillsborough, seat of the marquesses of Downshire, is of Carolean date. There are three round towers in the county, but all are fragmentary.

The predominating soil is a loam of little depth, in most places intermixed with considerable quantities of stones of various sizes, but differing materially in character according to the nature of the subsoil. Clay is mostly confined to the eastern coast, and to the northern parts of Castlereagh. Of sandy soil the quantity is small; it occurs chiefly near Dundrum. Moor grounds are mostly confined to the skirts of the mountains. Bogs, though frequent, are scarcely sufficient to furnish a supply of fuel to the population. Agriculture is in a fairly satisfactory condition. The bulk of the labouring population dwells in reasonably good circumstances. Tillage land declines somewhat in favour of pasture land. Oats, potatoes and turnips are the principal crops; flax, formerly important, is almost neglected. Some of the best racehorses in Ireland have been bred in this county. The native breed of sheep is confined to the mountains. The various other kinds of sheep have been much improved. Pigs are reared in great numbers, chiefly for the Belfast market. Poultry farming is a growing industry. The fisheries, of less value than formerly, are centred at Donaghadee, Newcastle, Strangford and Ardglass. The chief industries in the county generally are linen manufacture and bleaching, and brewing.

The haematite of Deehommed, near Banbridge, is well spoken of. Topaz and aquamarine occur in hollows in the granite of the Mournes. The Mourne granite is quarried above Annalong, and an ornamental dolerite is worked at Rosstrevor.

The Great Northern railway has an alternative branch to its main line by Portadown, from Lisburn through Banbridge to Scarva, with a branch from Banbridge to Ballyroney and Newcastle. Newry is on a branch from the Dublin-Belfast line to Warrenpoint on Carlingford Lough. The main line between Lisburn and Portadown touches the north-western extremity of the county. The eastern part of the county is served by the Belfast and County Down railway with its main line from Belfast to Newcastle, and branches from Belfast to Bangor, Comber to Newtownards and Donaghadee, Ballynahinch Junction to Ballynahinch, and Downpatrick to Ardglass and Killough. The Newry Canal skirts the west of the county, and the Lagan Canal intersects the rich lands in the Lagan valley to the north.

Newry (Pop. 1937, 12,738) is the largest town, Downpatrick is styled the county town. Other towns include Banbridge and Bangor, and there are popular watering-places on the coast and residential villages on Belfast Lough. Co. Down returns eight members to the parliament of Northern Ireland and two members to the parliament of Great Britain and Northern Ireland.

DOWN, an expanse of high rolling ground destitute of trees; occasionally used for a smooth rounded hill. The system of chalk hills in England is known as "The Downs" *(see* DOWNS). The usual English word "dune" is taken directly from the French. Low sandy tracts north and south of Yarmouth, Norfolk, are known as the "Dunes." The adverb "down," meaning, from above, had an earlier form "adown," *i.e.*, off the hill.

DOWNES (D[o]UNAEUS), **ANDREW** *(c.* 1549–1628), English classical scholar, was born in Shropshire. He did much to revive the study of Greek at St. John's college, Cambridge, and was elected fellow in 1571. In 1585 he was appointed regius professor of Greek. According to Simonds d'Ewes (*Autobiography,* ed. J. O. Halliwell, i. pp. 139, 141), who attended his lectures, Downes was accounted "the ablest Grecian of Christendom." He edited Lysias *Pro caede Eratosthenis* (1593); *Praelectiones in Philippicam de pace Demosthenis* (1621), dedicated to King James I.; some letters (in Greek) to Isaac Casaubon,

printed in the *Epistolae* of the latter; and notes to St. Chrysostom, in Sir Henry Savile's edition. Downes was also one of the seven translators of the *Apocrypha* for the "authorized" version of the Bible, and one of the six learned men appointed to revise the new version after its completion.

DOWNING, SIR GEORGE, BART. (*c.* 1624–1684), English soldier and diplomatist, son of Emmanuel Downing, barrister, and of Lucy, sister of Governor John Winthrop, was born in England. His family joined Winthrop in America in **1638,** settling in Salem, Mass., and Downing studied at Harvard. In **1645** he sailed for the West Indies as a preacher and instructor of the seamen, and arrived in England some time afterwards, becoming chaplain to Colonel John Okey's regiment. In **1650** he was scout-master-general of Cromwell's forces in Scotland; in Cromwell's parliament of 1654 he represented Edinburgh, and Carlisle in those of **1656** and 1659 In 165j he was sent to France to remonstrate on the massacre of the Protestant Vaudois. Later in 1657 he was appointed resident at The Hague, to effect a union of the Protestant European powers, to mediate between Portugal and Holland and between Sweden and Denmark, to defend the interests of the English traders against the Dutch, and to inform the government concerning exiled royalists.

He was maintained in his post during the interregnum after the fall of Richard Cromwell, and in April **1660** made his peace with Charles II., to whom he communicated Thurloe's despatches, and declared his abandonment of "principles sucked in" in New England, of which he now "saw the error." Downing was knighted in **1660.** He showed indecent zeal in arresting in Holland and handing over for execution the regicides Barkstead, Corbet and Okey. In **1663,** he was created a baronet. Downing had from the first been hostile to the Dutch as the commercial rivals of England. He had strongly supported the Navigation Act of **1660,** and he now deliberately drew on the fatal and disastrous war. During its continuance he took part in the management of the treasury, introduced the appropriation of supplies, and in May **1667** was made secretary to the commissioners, his appointment being welcomed by Pepys. He sat in parliament for Morpeth from **1660** till his death, and spoke with ability on financial and commercial questions. He was appointed a commissioner of the customs in **1671.** The same year he was sent to Holland to replace Sir William Temple, to break up the policy of the Triple Alliance and incite another war between Holland and England in furtherance of the French policy. After three months' residence Downing fled to England, in fear of the fury of the mob. For this unauthorized step he was sent to the Tower for some weeks. Downing Street, London, is named after him, while Downing College, Cambridge, derived its name from his grandson, the 3rd baronet. The title became extinct when the 4th baronet, Sir Jacob G. Downing, died in **1764.**

Downing's great talents were rarely employed for the advantage of his country and his character was marked by treachery, servility and ingratitude. "A George Downing" became a proverbial expression in New England to denote a false man who betrayed his trust. He published many declarations and discourses, mostly in Dutch, enumerated in Sibley's biography, and wrote also "A True Relation of the Progress of the Parliament's Forces in Scotland" (1651), *Thomason Tracts,* Brit. Mus., E **640 (5).**

See J. L. Sibley, *Biographical Sketches of Harvard* vol. i. (Cambridge, 1873); J. Beresford, *The Godfather of Downing Street, Sir G. Downing* **(1927).**

DOWNINGTOWN, a borough of Chester county, Pa., U.S.A., on Brandywine creek, **33** mi. W. of Philadelphia. It is on federal highways 30 and 322, and is served by the Pennsylvania and the Reading railways. The population was **4,548** in 1930, and was **4,645** in 1940 by the federal census. The principal manufacturing industries are paper and woollen mills, brick yards, boiler factories and machine works. Downingtown was settled about 1714 and incorporated in 1859. Valley Fcrge and the Brandywine battlefield are near by.

DOWNMAN, JOHN (1750–1824), English portrait painter. His pencil portrait drawings, slightly tinted in colour, usually from the reverse, are many of them of remarkable beauty. Several volumes of sketches for these drawings are still in existence. Downman is believed to have been "pressed" for the navy as a young man, and on his escape settled down for a while in Cambridge, eventually coming to London, and later (1804) going to reside in Kent in the village of West Malling. He afterwards spent some part of his life in the west of England, especially in Exeter, and then travelled all over the country painting his dainty portraits.

See G. C. Williamson, *John Downman, his Life and Works* (1907).

DOWNPATRICK, market town and county town of Co. Down, Ireland, **28** m. S.S.E. of Belfast by rail. Pop. (1926), 3,147. It stands near the south-west extremity of Strangford Lough. It is the seat of the Roman Catholic and Protestant dioceses of Down. St. Patrick founded the see about 440, but the present Protestant cathedral dates from 1790, the old structure having been in ruins for 250 years. A round tower adjoining it was destroyed in 1790. The rath or dun, from which the town is named, remains as one of the finest in Ireland. It was called Rath-Kaltair and covers 10 acres. In the vicinity are remnants of the monastery of Saul, a foundation ascribed to St. Patrick, and of Inch abbey (1180), founded by Sir John de Courcy. Three miles south is a stone circle and to the south-east are the wells of Struell. The town was called *doun-leth-plas,* the fort of the broken fetters, from the deliverance from bondage of two sons of Dichu, prince of Lecale, and the first convert of St. Patrick. It is the Dunum of Ptolemy and was the residence of the kings of Ulster. It was already incorporated early in the 1jth century.

A small trade is carried on at Strangford Lough, the quay being below the town. Linen manufacture, brewing, tanning and soap-making are the chief industries.

DOWNS, the name of a system of chalk hills in the south-east of England. It is most familiar in its application to the two ranges of the North and South Downs. Of these the North Downs are in the counties of Surrey and Kent, and the South in Sussex. Each forms a well-defined long range springing from the chalk area of Dorsetshire and Hampshire, to which latter the general name of the Western Downs is given. The Downs enclose the rich district of the Weald (*q.v.*).

The North Downs extend for **95** m. from Farnham to the English channel between Dover and Folkestone. The crest is not continuous, as the hills are breached by a series of deep gaps, through which northward flowing rivers, roads and railways pass. The entrances to these gaps are the locations of important town sites. The South Downs show similar characteristics, the rivers flowing southward. The river system of the Weald is an excellent example of a drainage system consequent upon an anticlinal structure. The western end of the North Downs is the Hog's Back, a narrow ridge, altitude **489** ft., a quarter of a mile broad on the top and sloping sharply north and south. At the west end is a depression, once occupied by the Blackwater, the head-waters of which have been captured by the Wey. In this depression lies Farnham. The Wey, flowing south of the Hog's Back, breaches the Downs at the Guildford gap. The next gap is that of the Mole, in which Dorking lies. Between Guildford and Dorking the main line of the Downs reaches **712** ft., but a lateral depression, followed by the railway, marks off on the south a loftier range of lower Greensand, in which Leith hill is 965 ft. in height. East of the hfole the northward slope of the Downs is deeply cut by narrow valleys and the depression between Redhill and Croydon was once traversed by a stream subsequently beheaded by the Mole. A height of **868** ft. is attained east of Caterham. The next river to break through is the Darent, but here another lateral depression marks off the Ragstone ridge, south of Sevenoaks, reaching 800 feet. The lateral depression is continued eastward, so that as far as Ashford the Downs consist of two parallel ranges; but the Medway itself breaches both, Maidstone lying in the gap. The elevation now begins to decrease, and **682** ft. is the extreme height east of the Medway. The final breach is made by the Great Stour, between Ashford and Canterbury. but the valley of the Little Stour offers a well-marked pass followed by the Folkestone-Canterbury railway. The North Downs end in the white cliffs between Dover and Folkestone.

The South Downs present similar characteristics on a minor

scale. Springing from the main mass of the chalk, south of Petersfield, they have their greatest elevation (889 ft. in Butser hill), and extend for 65 m. to the English channel at Beachy Head. Here also a succession of rivers breach the hills, and towns mark the gaps. These are, from east to west, the Arun, with the town of Arundel, the Adur, with Shoreham, the Ouse, with Lewes and Newhaven and the Cuckmere, with no considerable town. The steep slope of the South Downs is northward. The southern slopes reach the coast east of Brighton, but west of this town a flat coastal belt, the Hampshire basin, intervenes, widening westward. Apart from the complete breaches, the South Downs, scored on the south with many deep vales, are generally more easily penetrable than the North Downs, and the coast is less continuous.

Smooth convex curves are characteristic of the Downs; their graceful and striking outline gives them an importance in the landscape in excess of their actual height; their flanks are well wooded, their summits covered with close springy turf.

"THE DOWNS" is also the name of a roadstead in the English Channel off Deal between the North and the South Foreland. It forms a favourite anchorage during heavy weather, protected, except during severe southerly gales, by the Goodwin Sands. It has depths down to 12 fathoms.

DOWNSHIRE, WILLS HILL, 1ST MARQUESS OF (1718–1793), son of Trevor Hill, 1st Viscount Hillsborough, was born at Fairford in Gloucestershire on May 30, 1718. He became a member of parliament in 1741. In 1751 he was created earl of Hillsborough in the Irish peerage, and in 1756 a peer of Great Britain as Baron Harwich. For nearly two years he was president of the Board of Trade and Plantations under George Grenville, and after a brief period of retirement he filled the same position. and then that of joint postmaster-general, under the earl of Chatham. From 1768 to 1772 Hillsborough was secretary of State for the Colonies and also president of the Board of Trade, becoming an English earl on his retirement; in 1779 he was made secretary of State for the northern department, and he was created marquess of Downshire seven years after his final retirement in 1782. Both in and out of office he opposed all concessions to the American colonists, but he favoured the project for a union between England and Ireland. He died on Oct. 7, 1793.

DOWRY, the property which a woman brings with her or is given to her at her marriage, a wife's marriage portion *(see* SETTLEMENT).

DOWSER and **DOWSING,** one who uses, or the art of using, the dowsing-rod or "striking-rod" to find subterranean minerals or water (from the Cornish "dowse," M.E. *duschen,* to strike or fall. *See* DIVINING-ROD). More commonly with the spelling "douse" the verb is also used, especially in nautical parlance, with the meaning to lower or strike sail suddenly, as well as to quench or extinguish, as a light; or to close, as a port-hole.

DOWSON GAS PRODUCER: *see* GAS MANUFACTURE.

DOXOLOGY, an ascription of glory to God (Gr. δοξολογία, a praising). The name is applied specially to the *Gloria in excelsis Deo* (known as the Greater Doxology) and the *Gloria Patri* (the Lesser Doxology, usually called "the doxology" simple); but also, more generally, to the *Tersanctus* ("Holy, Holy, Holy," often called *Trisagion,* though that is strictly the name of the Greek invocation beginning Ἅγιος ὁ θεός), to the Alleluia of Rev. xix. and of many of the Psalms, to the last clause of the Lord's Prayer as found in Matt. vi. 13, and to such passages of glorification as Rom. xvi. 27, Eph. iii. 21, etc.

The Greater Doxology, in a slightly different form from that now used in the Greek Church, is given in the 4th century *Apostolical Constitutions* (vii. 47); and a very similar form is found in the Alexandrine Codex (jth century). The translation into Latin is traditionally attributed to St. Hilary of Poitiers (d. 367). The date of its introduction into the public services of the church cannot be determined precisely. In the Eastern Church it was used in the morning office apparently as early as the 4th century, but has never formed part of the Liturgy. In the West, where it is used in the Mass, Pope Symmachus (498–514) is said in the Liber Pontificalis to have ordered it to be sung on Sundays and festival days; it is mentioned in the Gregorian Sacramentary, but not in the Gelasian. Until the 11th century its use was confined to bishops, and to priests at Easter and on their installation. In the English prayer book it comes near the end of the communion office, but is not in either the morning or evening service. It is also used in the Protestant Episcopal and Methodist Episcopal churches of America, as indeed in most Protestant churches at the Eucharist.

The Lesser Doxology, or *Gloria Patri,* in its present form, is the result of the Arian controversies concerning the nature of Christ. There is no trace of its use in the first three centuries; and the second clause, "As it was in the beginning," etc., first appears in A.D. 529, when the and council of Vaison asserted its use as already established in the East *propter haereticorum astutiam,* and ordered its adoption throughout the West. In the Western Church the *Gloria Patri* is repeated at the close of every psalm, in the Eastern Church at the close of the last psalm. This last is the optional rule of the American Episcopal Church.

Metrical doxologies are often sung at the end of hymns, and the term has become especially associated with the stanza beginning "Praise God from whom all blessings flow," with which Thomas Ken, bishop of Bath and Wells, concluded his morning and evening hymns.

See J. Bingham, *Biog. eccles.* xiv. 2; Siegel, *Christl. Alterthümer,* i. 515, etc.; F. Procter, *Book of Common Prayer,* p. 212; *W.* Palmer, *Orig. Liturg.* iv. § 23; art. "Liturgische Formeln" (by Drews) in Hauck-Herzog, *Realencyk. für prot. Theol.* xi. *547; Cath. Encycl.*

DOYEN, GABRIEL FRANÇOIS (1726–1806), French painter, was born at Paris in 1726. He became in his 12th year a pupil of Vanloo, obtained at 20 the Grand Prix, and in 1748 set out for Rome. Among his greatest works are counted the "Miracle des Ardents," painted for the church of Ste Geneviève at St. Roch (1773); the "Triumph of Thetis," for the chapel of the Invalides; and the "Death of St. Louis," for the chapel of the Military School. In 1776 he was appointed professor at the Academy of Painting. Soon after the beginning of the Revolution he accepted the invitation of Catherine II. and settled at St. Petersburg, where he died on June 5 1806.

DOYLE, SIR ARTHUR CONAN (1859–1930), English novelist, knighted in 1902, eldest son of the artist Charles Doyle, was born on May 22, 1859. He was educated at Stonyhurst College, in Germany, and at Edinburgh University where he graduated M.B. in 1881 and M.D. in 1885. He was practising as a doctor in Southsea when he published *A Study in Scarlet* in 1887. *Micah Clarke* (1888), a tale of Monmouth's rebellion, *The Sign of Four* (1889), and *The White Company* (1891), a romance of Du Guesclin's time, followed. In *Rodney Stone* (1896) he drew an admirable sketch of the prince regent; and he collected a popular series of stories of the Napoleonic wars in *The Exploits of Brigadier Gerard* (1896). In 1891 he attained immense popularity by *The Adventures of Sherlock Holmes,* which first appeared in *The Strand Magazine.* These ingenious stories of the success of the imperturbable Sherlock Holmes, who had made his first appearance in *A Study in Scarlet* (1887), in detecting crime and disentangling mystery, found a host of imitators. The novelist himself returned to his hero in *The Memoirs of Sherlock Holntes* (1893) *The Hound of the Baskervilles* (1902), and *The Return of Sherlock Holmes* (1905). Other books by him include numerous novels; plays, *The Story of Waterloo* (1894), in which Sir Henry Irving played the leading part, *The Fires of Fate* (1909), *The House of Temperley* (1909), *The Poison Belt* (1913); two books in defence of the British army in South Africa—The *Great Boer War* (1900) and *The War in South Africa; its Causes and Conduct* (1902). During the World War Doyle wrote propaganda for the Allies. His *Cause and Conduct of the World War* appeared in 12 languages besides English. In his later years Doyle was a convinced spiritualist and a lecturer and writer on spiritualism. He died on July 7, 1930.

Among his later works were; *History of the British Campaign in France and Flanders* (vols. i. to vi., 1915–20); *A New Revelation* (1918); *History of Spiritualism* (2 vols., 1926); and *My Memories and Adventures* (1924).

DOYLE, SIR FRANCIS HASTINGS CHARLES, 2ND BARONET (1810–1888), man of letters, the son of Sir F. H.

Doyle, chairman of the board of excise, was born at Nunappleton, Yorkshire. Doyle published several volumes of verse, and was a fellow of All Souls and professor of poetry at Oxford from 1867 to 1877. He also held various positions in the customs department. Doyle is remembered for a few spirited pieces, among them "The Loss of the Birkenhead" and "The Private of the Buffs."

See his *Reminiscences and Opinions* (1886).

DOYLE, JOHN ANDREW (1844–1907), English historian, the son of Andrew Doyle, editor of the *Morning Chronicle*, was born on May 14, 1844, and died on Aug. 4, 1907. He was educated at Eton and at Balliol college, Oxford, and was a fellow of All Souls from 1870 until his death. His principal work is *The English Colonies in America* (5 vols. 1882–1907), dealing with the history of the colonies from 1607 to 1759.

DOYLE, RICHARD (1824–1883), English artist, son of John Doyle, the caricaturist known as "H.B." (1797–1868), was born in London in Sept. 1824, and died there on Dec. 11, 1883. His father's political sketches took the town by storm in the days of Lord Grey and Lord Melbourne. The son, who was extremely precocious, had no art training outside his father's studio, where he was not allowed to draw from the model, the result being that he never attained a higher position that than of an extremely skilful amateur. He was possessed, however, of an extraordinary power of fanciful draughtmanship and a keen sense of the grotesque. He was on the staff of *Punch* from 1843 to 1850 and the design of the cover is by him. After his resignation from that paper his work was mainly that of book illustration and water colour painting. He illustrated three of the *Christmas Books* of Charles Dickens and The *Newcomes* by Thackeray. His *Comic English Histories*, published after his death, and his *Manuscript Journal*, now in the British Museum and published in facsimile in 1886, were both executed when he was only 1 j.

See G. Everitt, *English Caricaturists* (1886); *M.* H. Spielmann, *The History of "Punclz"* (1895); *F.* G. Kitton, *Dickens and his Illustrators* (1899).

DOZSA, GYORGY (d. 1514), Hungarian revolutionary, was a Szekler squire and soldier of fortune, who won such a reputation for valour in the Turkish wars that the Hungarian chancellor, Tamás Bákocz, on his return from Rome in 1514 with a papal bull preaching a holy war against the Muslims, appointed him to organize and direct the movement in Hungary. In a few weeks he collected thousands of so-called *Kuruczok* (a corruption of *Cruciati*), consisting largely of the most oppressed portion of the community, to whom alone a crusade against the Turk could have the slightest attraction. They assembled in their counties and by the time Dozsa had drilled them into some sort of discipline and self-confidence, they began to air the grievances of their class. No measures had been taken to supply the volunteers with food or clothing; at harvest time the landlords ordered them to return to reap the fields, and when they refused to do so, maltreated their wives and families and set their armed retainers upon the half-starved multitudes. Instantly the movement was changed into a war of extermination against the landlords. Dozsa had lost control of the rabble, who were led by a socialist parson of Szegled, Lorincz Mészáros. Hundreds of manor-houses and castles were burnt and thousands of the gentry done to death by impalement, crucifixion and other unspeakable methods. The rising soon attained the dimensions of a revolution; the feudal levies of the kingdom were called out against it, and mercenaries were hastily hired from Venice, Bohemia and the emperor. At first it seemed as if the Government were incapable of coping with Dozsa and his bands. In the summer he took the fortresses of Arad, Lippá and Világos, and one of his bands got within five leagues of the capital. But at last his peasants were overmatched by the mail-clad nobles. Dozsa, too, had become demoralized with success. He was finally routed at Temesvár by the combined forces of János Zápolya and István Báthory, taken prisoner and afterwards put to death with the most unspeakable barbarities.

See Sandor Marki, *Dozsa Gyorgy* (Budapest, 1884); and a novel by Eotvos trans. into German as *Der Bauernkrieg in Uugarn* (1850).

DOZY, REINHART PIETER ANNE (1820–1883), Dutch Arabic scholar of French (Huguenot) origin, was born at Leyden. His monumental *Histoire des Mussulmans d'Espagne, jusqu'à la conquête de l' Andalousie par les Almoravides, 711–1110* (Leiden, 1861; 2nd ed., *ibid.*, 1881; Eng. trans. 1913), a graphically written account of Moorish dominion in Spain, which shed new light on many obscure points, has remained the standard work on the subject. Dozy's *Rechcrches sur l'histoire et la littérature de l'Espagne pendant le moyen âge* (Leiden, 2 vols., 1849; recast edns. in 1860 and 1881) forms a trenchant addition to his *Histoire*. His *Supplément aux dictionnaires arabes* (Leiden, 1877–1881, 2 vols.), a work full of research and learning, a storehouse of Arabic lore, followed, and to the same class belongs his *Glossaire des mots espagnols et portugais, dérivés de l'Arabe*, edited with Dr. W. H. Engelmann of Leipzig (Leiden, 1866; 2nd ed., 1868). Dozy also edited many Arabic texts. *Het Islamisme (Islamism;* Haarlem, 1863, 2nd ed., 1880; French translation) is a popular exposition of Mohammedanism, of a more controversial character; and *De Israelieten te Mekka* ("The Israelites at Mecca," Haarlem, 1864) became tbe subject of discussion in Jewish circles. Dozy died at Leiden, where he was a professor of history for thirty years, in May 1883.

See J. de Goeje, *Biographie de Reinhart Dozy* (1883); and biographical introduction to F. G. Stokes's English translation of Dozy's *Histoire des Mussulmans d'Espagne, Spanish Islam* (1913).

DRACAENA, a genus of the family Liliaceae, containing about 50 species in the warmer parts of the old world. They are trees or shrubs with long, generally narrow leaves, panicles of small whitish flowers and berried fruit. The most remarkable species is *Dracaena draco*, the dragon tree of the Canary Isles, which reaches a great size and age. The famous specimen in Teneriffe, which was blown down by a hurricane in 1868, when measured by Alexander von Humboldt, was 70 ft. high, with a circumference of 45 ft. several feet above the ground, and was supposed to be 6,000 years old. A resin exuding from the trunk is known as dragon's blood (*q.v.*). D. *fragrans* and *D. goldieana* are common greenhouse plants.

Some of the cultivated Dracaenas belong to the closely-allied genus *Cordyline*. They are grown for the beauty of form, colour and variegation of their foliage and are extremely useful as decorative house or greenhouse plants and for table decoration. A large number of the garden species of Dracaena are varieties of *Cordyline terminalis* of eastern Asia.

DRACHENFELS, a mountain of the Siebengebirge range, situated above the Rhine near Königswinter. It occupies a magnificent position overlooking Bonn at an altitude of 1.066 feet. The ruins of a mediaeval castle are at the summit.

DRACHM: *see* DRAM.

DRACHMA. The monetary unit of Greece, divided into 100 lepta. Until 1936 it was nominally equivalent to the franc, the par of exchange with London being Dr. 25.22 to the pound, while at par in New York it exchanged for 19·295 cents.

Greece entered the Latin Union in 1875, following on the law of 1867, but the currency in circulation has always been paper, and even before the World War was quoted at a discount to gold. During the War, Greece occupied what was in one respect a favourable position, as the presence of the Allied forces at Salonika was the cause of a steady demand for drachmae by the Allied Governments. Foreign exchanges, consequently, were well maintained, and this favourable position continued for a year or so after the Armistice.

The outbreak of war with Turkey dealt the first blow to the drachma, and by the end of 1920, it had fallen in New York to 7.56 cents, while the note issue had risen to Dr. 1,508,000,000 from Dr. 245,000,000 in 1913. Defeat in the field and its consequences led to further depreciation, and from 1921 to 1927 the drachma remained between one and two cents. In 1924 the Greek Refugee Loan was issued under League of Nations' auspices, and ineffective steps towards stabilization were taken at the end of 1927. In Sept. 1936 stabilization was finally achieved by the linking of the drachma to sterling, the buying price being fixed within the limits of 540 to 550 to the £ and the price of other currencies

on the basis of their parity to sterling.

See also CURRENCY and GREECE: *Economy and Finance.*

DRACHMANN, HOLGER HENRIK HERBOLDT (1846–1908), Danish poet and dramatist, son of Dr. A. G. Drachmann, a physician of Copenhagen, whose family was of German extraction, was born in Copenhagen on Oct. 9, 1846. At various periods he travelled very extensively in England, Scotland, France, Spain and Italy, and his literary career began by his sending letters about his journeys to the Danish newspapers. After returning home, he settled for some time in the island of Bornholm, painting seascapes. He now issued his earliest volume of poems, *Digte* (1872), and joined the group of young Radical writers who gathered under the banner of Brandes. By this time he had enjoyed a surprising experience of life, especially among sailors, fishermen, students and artists, and the issues of the Franco-German War and the French Commune had persuaded him that a new and glorious era was at hand. His volume of lyrics, *Daempede Melodier* ("Muffled Melodies," 1875), proved that Drachmann was a poet with a real vocation, and he began to produce books in prose and verse with great rapidity. *Ungt Blod* ("Young Blood," 1876) contained three realistic stories of contemporary life. But he returned to his true field in his magnificent *Sange ved Havet; Venezia* ("Songs of the Sea; Venice," 1877), and won the passionate admiration of his countrymen by his prose work, with interludes in verse. called *Derovre fra Graensen* ("Over the Frontier there," 1877), a series of impressions made on Drachmann by a visit to the scenes of the war with Germany. During the succeeding years he visited most of the principal countries of the world, and familiarized himself by protracted voyages with the sea and with the life of man in maritime places. In 1879 he published *Ranker og Roser* ("Tendrils and Roses"), love lyrics in which he showed a great advance in technical art. To the same period belongs *Paa Somands Tro og Love* ("On the Faith and Honour of a Sailor," 1878), a volume of short stories in prose. About this time Drachmann broke with Brandes and the Radicals, and led a "nationalist" or popular-Conservative party in Denmark. He continued to celebrate the life of the fishermen and sailors in books, whether in prose or verse, which were the most popular of their day. *Paul og Virginie* and *Lars Kruse* (both 1879); *Östen for Sol og vesten for Maone* ("East of the Sun and West of the Moon," 1880); *Puppe og Sommerfugl* ("Chrysalis and Butterfly," 1882); and *Strandby Folk* (1883) were among these. In 1882 Drachmann published his fine translation, or paraphrase, of Byron's *Don Juan.* In 1885 his romantic play called *Der var en Gang* ("Once upon a Time") had a great success on the boards of the Royal theatre, Copenhagen; and his tragedies of *Volund Smed* ("Wayland the Smith") and *Brav-Karl* (1897) made him the most popular playwright of Denmark. He published in 1894 a volume of exquisitely fantastic *Melodramas* in rhymed verse, a collection which contains some of Drachmann's most perfect work. His novel *Med den brede Pensel* ("With a Broad Brush," 1887) was followed in 1890 by *Forskrevet,* the history of a young painter, Henrik Gerhard, and his revolt against his bourgeois surroundings. With this novel is closely connected *Den hellige Ild* ("The Sacred Fire," 1899), in which Drachmann speaks in his own person. There is practically no story in this autobiographical volume, which abounds in lyrical passages. In 1899 he produced his romantic play called *Gurre;* in 1900 a brilliant lyrical drama, *Hallfred Vandraadeskjald;* and in 1903, *Det grönne Haab.* He died in Copenhagen on Jan. 14, 1908.

See an article by K. Gjellerup in *Dansk Biografisk Lexikon* vol. iv. (1890). (E. G.)

DRACO (DRACON) (7th century B.C.), Athenian statesman, was Archon Eponymus (but *see* Sandys, *Const. of Athens,* p. 12, note) in 621 B.C. He codified the laws, which had previously been unwritten and administered arbitrarily by the Eupatrids. The fixing of the law was a great boon to the people, although later ages regarded Draco's code, in which "for nearly all crimes there was the same penalty of death" (Plut. *Solon),* as barbarously severe. For the institution of the 51 Ephetae and their relation to the Areopagus in criminal jurisdiction, *see* GREEK LAW.

But in 1891 appeared Aristotle's treatise on the constitution of Athens, the 4th chapter of which credits to Draco the construction of an entirely new constitution for Athens, the main features of which were: (1) extension of franchise to all who could provide themselves with a suit of armour; (2) the institution of a property qualification for office (archon 10 minae, strategus 100 minae); (3) a council of 401 members *(see* BOULĒ); (4) magistrates and councillors to be chosen by lot; further, the four Solonian classes are said to be already in existence.

But the passage is now generally considered spurious on the following grounds: (1) It is ignored by every other ancient authority, except an admittedly spurious passage in Plato;[1] whereas Aristotle says of his laws "they are laws, but he *added the laws to an existing constitution"* (Pol. ii. 9. 9). (2) It is inconsistent with other passages in the *Constitution of Athens.* It embodies some of the most advanced features of Solon's constitution, yet, according to ch. vii., Solon repealed all laws of Draco except those relating to murder. (3) Its ideas are alien to the 7th century. That the qualification of the strategus should be ten times that of the archon is reasonable in the 5th but preposterous in the 7th century. Again it is unlikely that, had a wealth qualification for citizenship been established, Solon, a democratic reformer, would have reverted to an aristocratic birth qualification. (4) The terminology of Draco's constitution is that of the 5th century, whereas the chief difficulty of Solon's laws is the obsolete 6th century phraseology. (5) Lastly, the "Draconian Constitution" (hoplite census, nobody to hold office a second time until all duly qualified persons had been exhausted, fine for non-attendance in Boulē), embodies the ideals of Theramenes and the moderate oligarchs, which they expressed by the phrase ἡ πάτριος πολιτεία.

Criticism of the text supports the hypothesis that ch. iv. is an interpolation. Chapter iv. breaks the connection of thought between iii. and v. Moreover, an interpolator has inserted phrases to remove obvious contradictions: thus *(a)* in ch. vii., where we are told that Solon divided the citizens into four classes the interpolator adds "according to the division formerly existing," which was necessary in view of the statement that Draco gave the franchise to the Zeugites; *(b)* in ch. xli., the words "the Draconian" (ἡ ἐπὶ Δράκοντος) are inserted in the list of constitutions, though the subsequent figures are not accommodated to the change. Solon is also here spoken of as the founder of democracy, whereas the Draconian constitution of ch. iv. contains several democratic innovations. Two further points may be added, namely, that whereas Aristotle's account mentions a money fine, Pollux quotes a law of Draco in which fines are assessed at so many oxen; secondly, that though the treatise was widely read in antiquity there is no reference to Draco's constitution except the two quoted above. In any case, whatever were Draco's laws, Solon abolished all of them (Plut. *Solon)* except those dealing with homicide.

See J. E. Sandys, *Aristotle's Constitution of Athens* (2nd ed. 1912); G. Gilbert, *Constitutional Antiquities* (Eng. trans. 1895) and works, quoted in article CONSTITUTION OF ATHENS; Grote, *Hist. of Greece* (ed. 1907), pp. 9–11, with references; and histories of Greece published after 1894.

DRACO ("the Dragon"), in astronomy, a constellation of the northern hemisphere. The Greeks had many fables concerning this constellation; one is that when Heracles killed the dragon guarding the Hesperian fruit, Hera transferred the creature to heaven as reward for its services. The star γ Draconis has acquired historic interest because from his observations of it Bradley discovered the phenomenon of aberration of light *(see* ABERRATION). It enjoyed this distinction because it chances to be the brightest star that passes close to the zenith of Greenwich. so that errors of observation arising from refraction are minimized.

DRACONTIUS, BLOSSIUS AEMILIUS, of Carthage (according to the early tradition, of Spanish origin), Christian poet, flourished in the latter part of the 5th century A.D. He belonged to a family of landed proprietors and practised as an advocate in his native place. After the conquest of the country by the Vandals, Dracontius was at first allowed to retain his

[1] A passage (long overlooked) in Cicero, De *republica,* shows that, by the 1st century B.C. the interpolation had already been made; the quotation is evidently taken from the list in ch. xli. of the *Constitution,* which it reproduces.

estates but was later thrown into prison by the Vandal king. He addressed an elegiac poem to the king, asking pardon and pleading for release. The result is not known, but it is supposed that Dracontius obtained his liberty and migrated to northern Italy. This is consistent with the discovery at Bobbio of a 15th century ms., now in the Museo Borbonico at Naples, containing a number of poems by Dracontius (the *Carmina minora).* The most important of his works is the *De laudibus Dei* or *De Deo* in three books, wrongly attributed by ms. tradition to St. Augustine. The account of the Creation, which occupies the greater part of the first book, was at an early date edited separately under the title of *Hexaemëron,* and it was not till 1791 that the three books were edited by Cardinal Arevalo. The apology *(Satisfactio)* consists of 158 elegiac couplets; it is generally supposed that the king addressed is Gunthamund (484–496). The *Carmina minora,* nearly all in hexameter verse, are school exercises and rhetorical declamations. It is also probable that Dracontius was the author of the *Orestis tragoedia,* a poem of some 1,000 hexameters, which in language, metre and general treatment resembles the other works of Dracontius. His works show considerable vigour of expression and a remarkable knowledge of the Bible and of Roman classical literature.

BIBLIOGRAPHY.—De *Deo* and *Satisfactio,* ed. Arevalo, reprinted in Migne's *Patrologiae cursus,* lx.; *Carmina minora,* ed. *F.* de Duhn (1873); Baehrens 1879 in *Poetae Latini Minores* vol. v., re-ed. F. Vollmer 1910. On Dracontius generally, *see* A. Ebert, *Allgemeine Geschichte* der *Lit. des Mittelalters im Abendlande,* i. (1874); C. Rossberg, *In* D. *Carmina Minora* (1878); *H.* Mailfait, *De Dracontii poetae lingua* (1902); E. Provana, *Blossio Emilio Draconzio,* in Memorie della Reale Accademia delle Scienze di Torino (Turin, 1912) vol. lxii. On the *Orestis tragoedia, see* editions by *R.* Peiper (1875) and C. Giarratino (Milan, 1906); pamphlets by C. Rossberg (1880, on the authorship; 1888, materials for a commentary).

DRAFT. A written order drawn on a banker or other holder of funds for the payment of money to a third person; thus a cheque (*q.v.*) is a draft. **A** special form of draft is a banker's draft, an instruction by one bank to another bank, or to a branch of the bank making the instruction, to pay a sum of money to the order of a certain specified person.

The term is also used to describe an outline, plan or sketch, or a preliminary drawing-up of an instrument, measure, document, etc., which, after alteration and amendment, will be embodied in a final or formal shape; an allowance made by merchants or importers to those who sell by retail, to make up a loss incurred in weighing or measuring; and a detachment or body of troops "drawn off" for a specific purpose, usually a reinforcement from the depôt or reserve units to those abroad or in the field. For draft in compulsory military service, *see* CONSCRIPTION.

DRAFTED MASONRY, in architecture, masonry formed of large stones, dressed or cut round the edge to a single plane, with the face between left as it came from the quarry. Many notable Roman examples exist, such as that of the Porta Maggiore, at Rome (period of the emperor Claudius, c. A.D. 50). It was also particularly common in the Near East, being found from the time of Cyrus, in the platform at Pasargadae *(c.* 530 B.C.), up to the time of the castles built by the crusaders. In the Renaissance drafted masonry was used occasionally for decorative purposes, as in the Riccardi palace at Florence by Michelozzi (c. 1430). When so used it is sometimes loosely termed "rustication."

DRAG. The term is applied to a harrow for breaking up clods of earth, or to an apparatus, such as a grapnel, net or dredge, used for searching water for drowned bodies or other objects. As a name of a vehicle, "drag" is sometimes used as equivalent to "break," a heavy carriage without a body used for training horses, and also a large kind of wagonette, but is more usually applied to a privately-owned four-horse coach for four-in-hand driving. The word is also given to the "shoe" of wood or iron placed under the wheel to act as a brake, and also to the "drift" or "sea-anchor," usually made of spars and sails, employed for checking the lee-way of a ship when drifting. In fox-hunting, the "drag" is the line of scent left by the fox, but more particularly the term is given to a substitute for the hunting of a fox by hounds, an artificial line of scent being laid by the dragging of a bag of aniseed or other strong smelling substance which a pack will follow.

DRAGASHANI (Rumanian *Dragaşani*), a town of Rumania, near the right bank of the river Olt, and on the railway between Caracal and Râmnicu Vâlcea.

The vineyards on the neighbouring hills produce some of the best Walachian wines. Dragashani stands on the site of the Roman Rusidava. In 1821 the Turks routed the troops of Ypsilanti near the town.

DRAGO DOCTRINE. The government of every state, declared Lord Palmerston in 1848, is entitled by diplomatic methods to take up the complaint of any of its subjects against the government of another state, and if well founded, to demand redress. It has been the policy of the British Government not to encourage its subjects to hazard their capital by investing in foreign loans, and consequently it has usually refused to interfere when foreign governments have failed to meet their obligations. Lord Palmerston, however, added that in certain circumstances the Government might be prepared to go to the length of using force. To this statement Lord Salisbury subsequently gave his assent in 1880. In 1902 Venezuela having failed to comply with the demands made by Great Britain, Germany and Italy to make good its default in respect of its external loans, was called upon by these Powers to honour its obligations. Failing to obtain satisfaction, a blockade of certain Venezuelan ports was instituted. This led to the despatch of a note from Dr. Drago, foreign minister of the Argentine Republic, to the Argentine minister at Washington declaring that the principle should be accepted that for the common safety of the South American Republics, just as the Monroe doctrine is a principle enforced by the United States for the preservation of the territorial *status quo* throughout the American Continent against European aggression, the collection of pecuniary claims of citizens of any country against the Government of any South American Republic should not be effected by armed force. This proposal, however, did not find general acceptance, but by the Hague Convention (1907), the contracting Powers agreed not to have recourse to armed force for the recovery of contract debts claimed from the Government of one state by the Government of another state as due to its nationals. This agreement, however, does not apply if the debtor state refuses or neglects to accept an offer of arbitration, or after accepting the offer, prevents any *compromis* being reached, or after an award, fails to carry it out. *See* Sir T. Barclay, *Problems of International Law and Diplomacy* (1907); Phillimore, *International Law,* vol. II. (1854–61).

(H. H. L. B.)

BY COURTESY OF E. G. MORSE

DRAGOMAN OF CAIRO, EGYPT, WHO ACTS AS INTERPRETER AND GUIDE

DRAGOMAN, a comprehensive designation applied to anyone who acts as an intermediary between Europeans and Orientals, whether as hotel tout or travellers' guide, or as the chief dragoman of a foreign embassy whose functions may include the carrying on of important political negotiations. (Ar. *terjuman,* an interpreter, cf. Heb. *targum.*)

The original employment of dragomans by the Turkish government arose from its religious scruples to use the language of any peoples which had not adopted Islam, while its political relations compelled the sultan's ministers to make use of interpreters, who rapidly acquired considerable influence. The first chief dragoman of the Porte was Panayot Nikousia, who held his office from 1665 to 1673. His successor, Alexander Mavrocordato (*q.v.*), Exaporritos, was charged by the Turkish government with the delicate and arduous negotiation of the treaty of Carlowitz, and succeeded in becoming the factotum of Ottoman policy. From that time until 1821 the Greeks monopolized the management of Turkey's foreign relations, and soon established the regular system whereby the chief dragoman passed on as a matter of course to the dignity of hospodar (*q.v.*) of one of the Danubian principalities.

In the same way, the foreign representatives accredited to the

former sultan of Turkey, found it necessary, in the absence of duly qualified countrymen of their own, to engage the services of natives, Greek, Armenian or Levantine, more or less thoroughly acquainted with the language, laws and administration of the country, who became the confidential go-betweens of the foreign missions and the Porte. But the disadvantages of the system soon became apparent, and as early as 1669 the French government decided on the foundation of a school for French dragomans at Constantinople, for which in later years was substituted the *École des langues orientales* in Paris; most of the great powers eventually took some similar step, England also adopting in 1877 a system, since modified, for the selection and tuition of a corps of British-born dragomans.

The functions of the first dragoman are mainly political and connected with diplomatic negotiations, while the subordinate dragomans transact the less important business comprising in general all the various matters in which the interests of foreign subjects may be concerned. The high estimation in which the dragomans are held by most foreign powers is shown by the fact that they are promoted to the most important diplomatic posts. In the Russian, Austrian and German services more than one ambassador began his career as a junior dragoman, and the French chief dragoman usually attains the rank of minister plenipotentiary. The more important consulates in the provinces of Turkey are also provided with one or more dragomans, whose duties, *mutatis mutandis,* are of a similar though less important nature. In the same way banks, railway companies and financial institutions employ dragomans for facilitating their business relations with Turkish officials.

DRAGOMIROV, MICHAEL IVANOVICH (1830–1905), Russian general and military writer, was born on Nov. 8, 1830. He entered the Guards in 1849 and from 1854 to 1859 studied military science first at the Russian staff college (Nicholas Academy) and then abroad. On his return to Russia he became professor of tactics at the staff college. He played a leading part in the reorganization of the educational system of the army, and acted as instructor to several princes of the imperial family. He took part in the suppression of the Polish insurrection of 1863–64. During the Austro-Prussian War of 1866, Dragomirov was attached to the headquarters of the II. Prussian army. He was present at the battles on the upper Elbe and at Koniggratz, and his comments on the operations which he witnessed are of the greatest value to the student of tactics and of the war of 1866.

In the Russo-Turkish war of 1877–78 he commanded the 14th division, which led the way at the crossing of the Danube at Zimnitza. Later, after the reverses before Plevna, he, with the tsarevich and Generals Todleben and Milutine, strenuously opposed the suggestion of the Grand Duke Nicholas that the Russian army should retreat into Rumania, and the demoralization of the greater part of the army was not permitted to spread to Dragomirov's division. He was wounded at the Shipka pass, and further disabled for active service. For 11 years thereafter General Dragomirov was chief of the Nicholas Academy. He collated and introduced into the Russian army all the best military literature of Europe, and improved the morale and technical efficiency of the Russian officer-corps, especially of the staff officer. In 1889 Dragomirov became commander-in-chief of the Kiev military district, and governor-general of Kiev, Podolsk and Volhynia, retaining this post until 1903. He was promoted to the rank of general of infantry in 1891. During the Russo-Japanese War of 1904–05 he was consulted by the general headquarters at St. Petersburg (Leningrad), and while he disagreed with General Kuropatkin in many important questions of strategy and military policy, they both recommended a repetition of the strategy of 1812, even though the total abandonment of Port Arthur was involved. General Dragomirov died at Konotop on Oct. 28, 1905.

His larger military works were mostly translated into French and German, and his occasional papers, extending over a period of nearly 50 years, appeared chiefly in the *Voienni Svornik* and the *Razoiedschik;* his later articles in the last-named paper were, like the general orders he issued to his own troops, attentively studied throughout the Russian army. His critique of Tolstoi's *War and Peace* attracted even wider attention. Dragomirov was, in formal tactics, the head of the "orthodox" school. He inculcated the "offensive at all costs," and the combination of crushing short-range fire and the bayonet charge. He carried out the ideas of Suvarov to the fullest extent, and many thought that he pressed them to a theoretical extreme unattainable in practice.

DRAGON, a fabulous monster, usually conceived as a huge-winged, fire-breathing lizard or snake. The word is derived through the French and Latin from the Greek δράκων, connected with δέρκομαι "see," and interpreted as "sharp-sighted." The equivalent English word "drake" or "fire-drake" is derived from Anglo-Saxon *draca.* In Greece the word δράκων, was used originally of any large serpent, and the dragon of mythology, whatever shape it may have assumed, remains essentially a snake. For the part it has played in the myths and cults of various peoples and ages *see* the article SERPENT-CULTS. Here it may be said, in general, that in the East, where snakes are large and deadly (Chaldaea, Assyria, Phoenicia, to a less degree in Egypt), the serpent or dragon was symbolic of the principle of evil. Thus Apophis, in the Egyptian religion, was the great serpent of the world of darkness vanquished by Ra, while in Chaldaea the goddess Tiāmat, the female principle of primeval Chaos, took the form of a dragon. Thus, too, in the Hebrew sacred books the serpent or dragon is the source of death and sin, a conception which was adopted in the New Testament and so passed into Christian mythology. In Greece and Rome, on the other hand, while the oriental idea of the serpent as an evil power found an entrance and gave birth to a plentiful brood of terrors (the serpents of the Gorgons, Hydra, Chimaera and the like), the *dracontes* were also at times conceived as beneficent powers—sharp-eyed dwellers in the inner parts of the earth, wise to discover its secrets and utter them in oracles, or powerful to invoke as guardian genii. Such were the sacred snakes in the temples of Aesculapius and the *sacri dracontes* in that of the Bona Dea at Rome; or, as guardians, the Python at Delphi and the dragon of the Hesperides.

In general, however, the evil reputation of dragons was the stronger, and in Europe it outlived the other. Christianity, of course, confused the benevolent and malevolent serpent deities of the ancient cults in a common condemnation. The very "wisdom of the serpent" made him suspect; "the devil," said St. Augustine, "is a lion and a dragon; a lion because of his rage and a dragon because of his wiles." The dragon myths of the pagan East took new shapes in the legends of the victories of St. Michael and St. George; and the kindly snakes of the "good goddess" lived on in the *immanissimus draco* whose baneful activity in a cave of the Capitol was cut short by the intervention of the saintly pope Silvester I. In this respect indeed Christian mythology agreed with that of the pagan north. The similarity of the northern and oriental snake myths seems to point to a common origin in remote antiquity. Whatever be the origin of the northern dragon, the myths, when they first appear, show him to be in all essentials the same as that of the south and east. He is a power of evil, guardian of hoards, the greedy withholder of good things from men; and the slaying of a dragon is the crowning achievement of heroes—of Siegmund, of Beowulf, of Sigurd, of Arthur, of Tristram—even of Lancelot, the *beau idéal* of mediaeval chivalry. Nor were these dragons anything but very real terrors. In the works of the older naturalists, even in the great *Historia animalium* of so critical a spirit as Conrad Gesner (d. 1564), they still figure as part of the fauna known to science.

As to their form, this varied from the beginning. The Chaldaean dragon Tiāmat had four legs, a scaly body, and wings. The Egyptian Apophis was a monstrous snake, as were also, originally at least, the Greek *dracontes.* The dragon of the Apocalypse (Rev. xii. 3), "the old serpent," is many-headed, like the Greek Hydra. The dragon slain by Beowulf is a snake (worm), for it "buckles like a bow"; but that done to death by Sigurd, though its motions are heavy and snake-like, has legs, for he wounds it "behind the shoulder." On the other hand, the dragon seen by King Arthur in his dreams is, according to Malory, winged and active, for it "swoughs" down from the sky. The belief in dragons

and the conceptions of their shape were undoubtedly often determined by the discovery of the remains of the gigantic extinct saurians.

The qualities of dragons being protective and terror-inspiring, and their effigies decorative, they were early used as warlike emblems. Thus, in Homer *(Iliad,* xi. 36 *seq.),* Agamemnon has on his shield, besides the Gorgon's head, a blue three-headed snake, just as ages afterwards the Norse warriors painted dragons on their shields and carved dragons' heads on the prows of their ships. From the conquered Dacians, too, the Romans in Trajan's time borrowed the dragon ensign which became the standard of the cohort as the eagle was that of the legion; whence, by a long descent, the modern dragoon. Under the later East Roman emperors the purple dragon ensign became the ceremonial standard of the emperors, under the name of the δρακόντειον. In England before the Conquest the dragon was chief among the royal ensigns in war. Its origin, according to the legend preserved in the *Flores historiarum,* was as follows: Uther Pendragon, father of King Arthur, had a vision of a flaming dragon in the sky, which his seers interpreted as meaning that he should come to the kingdom. When this happened, after the death of his brother Aurelius, "he ordered two golden dragons to be fashioned, like to those he had seen in the circle of the star, one of which he dedicated in the cathedral of Winchester, the other he kept by him to be carried into battle." From Uther Dragonhead, as the English called him, the Anglo-Saxon kings borrowed the ensign, their custom being, according to the *Flores,* to stand in battle "between the dragon and the standard." The dragon ensign which was borne before Richard I. in 1191, when on crusade, "to the terror of the heathen beyond the sea," was that of the dukes of Normandy; but even after the loss of Normandy the dragon was the battle standard of English kings, and was displayed, *e.g.,* by Henry III. in 1245 when he went to war against the Welsh. Not till the 20th century was the dragon officially restored as proper only to the British race of Uther Pendragon, by its incorporation in the armorial bearings of the prince of Wales. Thus the dragon and wyvern (*i.e.,* a two-legged snake, M.E. *wivere,* viper) took their place as heraldic symbols *(see* HERALDRY).

In the East the dragon is the national symbol of China and the badge of the imperial family, and as such plays a large part in Chinese art. Chinese and Japanese dragons, though regarded as powers of the air, are wingless. They are among the deified forces of nature of the Taoist religion, and the shrines of the dragon-kings, who dwell partly in water and partly on land, are set along the banks of rivers. *(See* also DRACO.)

See J. B. Panthot, *Histoire des dragons et des escarboucles* (Lyons, 1691); C. V. Daremberg and E. Saglio, *Dictionnaire des antiquitds grecques et romaines (1886,* etc.), *s.v.* "Draco"; Pauly-Wissowa, *Realencyklopadie, s.v.* "Drakon"; Du Cange, *Glossarium, s.v.* "Draco"; *La Grande Encyclopddie, s.v.* "Dragon." *See* also the articles EGYPT: *Religion;* and BABYLONIAN AND ASSYRIAN RELIGION. (W. A. P.)

The term "dragon" has no zoological meaning, but by the lay public it has been applied to two groups of existing lizards. The genus *Draco* includes a number of species of small lizards, found in the Indo-Malayan region, which are characterized by the possession of wing-like folds of skin projecting from the sides of the body and supported by the greatly elongated ribs. These structures do not involve the legs and cannot be used as actual wings for flight; they serve merely as gliding planes which extend the distance over which the animal can leap from one to another of the trees in which it lives. The largest form is only about 10 in. in length.

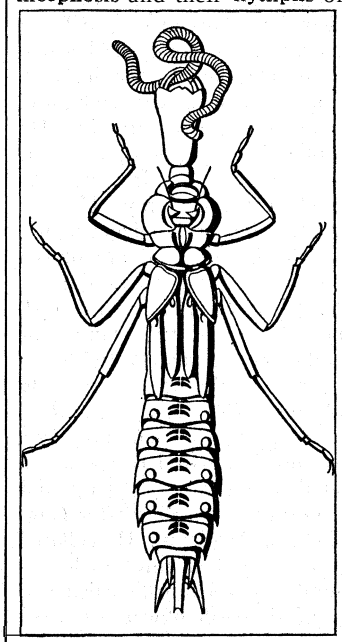
The other lizard to which the name is popularly applied is the giant monitor, *Varanus komodensis,* recently discovered in Komodo, one of the Dutch East Indies. It is a heavily built lizard of dull colour and reaches a length of at least 10 ft, thus vastly exceeding all other living lizards, although the extinct *Varanus priscus* of Australia attained perhaps twice the length.

In military use the name was applied to the musket—ornamented with the head of a dragon—from which the dragoons derive their name; and to-day it is given to a mechanical tractor for drawing guns, propelled by an internal combustion engine and running on caterpillar tracks. This machine, a variant of the steam tractor for heavy guns in use in most European armies before and during the World War, and of the war-time tank, has recently replaced teams of horses for the traction of guns and limbers in certain British field artillery brigades. *(See* further ARTILLERY.)

DRAGONET (*Callionymus lyra),* a small marine fish of the coasts of Europe, with slender naked body and large eyes close together on top of the flattish triangular head. The male is larger and more ornamental than the female, the body and the large dorsal fins having blue spots and bands on an orange ground. There is courtship and pairing, the male and female swimming upwards in an embrace.

DRAGONETTI, DOMENICO (1763–1846), Italian double-bass player, was born in Venice on April 7, 1763, and died in London on April 16, 1846. Dragonetti was a virtuoso of the first rank, and one of the best-known figures in the musical life of his day. His first appearance in London was in 1794. In London he met Lindley, with whom he played regularly from that time. In 1798 he visited Haydn at Vienna, and in 1808–09, on another visit to Vienna, he met Beethoven, whom he worshipped. In 1845, at the age of 82, he led the double-basses in the Beethoven Festival at Bonn.

DRAGON-FLY, the popular English name applied to members of a remarkable group of insects forming the order Odonata (or Paraneuroptera). They are sometimes known among country folk as "devils' darning needles" or "horse stingers," though they are incapable of stinging. Dragon-flies are easily recognized by their large eyes, minute antennae, two pairs of very similar narrow, glassy wings, the forward position of the legs, and their very elongated abdomen. They pass through an incomplete metamorphosis and their nymphs or naiads are aauatic. They attract notice by their rapid, skilful flight and the beauty of their form and coloration: none of the species is very small, and they are often large insects, the female of *Megaloprepus coerulatus,* for example, has a wing-expanse of 7½in., while the Carboniferous fossil *Meganeura* measures 2ft. across the wings.



BY COURTESY OF W. J. LUCAS

DRAGON-FLY NYMPH. WITH MASK EXTENDED, SEIZING ITS PREY

The female lays its eggs near or below the water, and, after they are hatched, the nymphs spend their lives in the water until full development

General Structure.—The head is large and very mobile, being capable of turning almost as on a pivot. Correlated with the great size of the eyes the antennae are correspondingly reduced and represented by very short 3- to 8-jointed bristle-like organs. The mouth-parts are adapted for biting, the mandibles being armed with powerful teeth while the labium is broad and plate-like. The wings are elongate, sub-equal and membranous with a complex network of veinlets between the principal veins, the wing-membrane being thus divided up into numerous cells which may exceed 3,000 in a single wing. The legs, being placed near together and far forward are little used for walking and are mainly employed for alighting and grasping. The abdomen is elongate and often extremely slender, and the male intromittent organ is placed beneath the second segment instead of at the apex as in other insects.

Classification.—Dragon-flies are divided into two principal sub-orders—the *Anisoptera* and the *Zygoptera.*

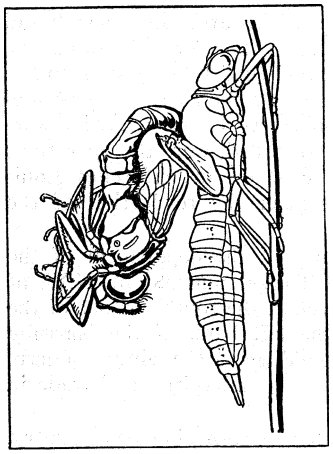
The *Anisoptera* hold their wings open when at rest and the hind wings are broader at their bases than are the fore wings. Included here are all the larger and stouter species to which the

name dragon-fly is commonly applied. There are five families, and well known genera are Libellula, Aeschna and Sympetrum.

The Zygopteru hold their wings closed in the vertical plane above the body when at rest, both pairs being closely alike with very narrow bases. The weaker, slow-flying species, often called damsel-flies, belong here: the sub-order includes nine families, and among common genera are Agrion, Ischnura and Calopteryx.

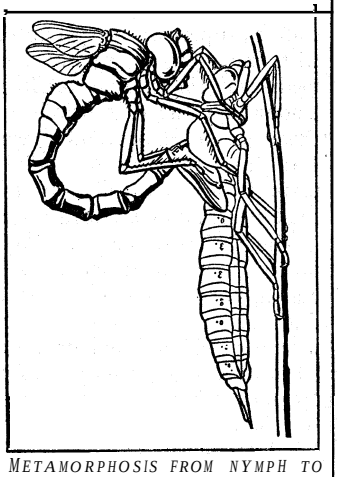
A third sub-order—the Anisozygoptera—includes a number of fossil dragon-flies and the single living genus *Epiophlebia* from Japan and India.

Reproduction and Development.—The pairing habits of dragon-flies are of a remarkable nature. Since the opening of the ducts from the testes lie on the ninth abdominal segment, and the male intromittent organ is situated on the second segment, this organ has to become charged with spermatozoa before mating occurs. The male when flying seizes the female across the prothorax using its claspers at the extremity of the body for the purpose: the abdomen of the female is then curved forwards so as to bring the genital orifice on the under side of her eighth abdominal segment in contact with the organ on the second segment of the male, so that insemination can take place. Most of the Anisoptera lay rounded eggs, which are either dropped freely in the water, or attached to aquatic plants: the Zygoptera and some Anisoptera have elongated eggs which they insert by means of slits cut by the ovipositor of the female in aquatic plants etc., near or beneath the water. In some cases the female (alone, or accompanied by the male) descends beneath the water for this purpose. The nymphs upon hatching spend their whole lives in water and are predacious, devouring various forms of aquatic life: those of the larger species will attack tadpoles and even small fish. Their mouth-parts are specially adapted for predatory habits, the labium (or mask) being modified into an organ for seizing the prey. When at rest it is folded away between the bases of the fore-legs, and, upon the appearance of a victim, it is rapidly extended and shot forward, impaling the prey upon the raptorial palpi which retain it while it is being devoured. In conformity with their aquatic life dragon-fly nymphs are supplied with special respiratory modifications in the form of gills. In most Zygoptera these take the form of three leaf-like lamellae at the caudal end of the body, but in the Anisoptera there is a very elaborate system of gills within the rectum or terminal chamber of the gut. In both sub-orders the gills are penetrated by tracheae and are covered by a thin membrane which allows of the inward passage by osmosis of oxygen dissolved in the water: in the Anisoptera water is alternately taken in and expelled from the rectum, and, in this way, the gills are kept aerated.



METAMORPHOSIS FROM **NYMPH** TO DRAGON-FLY

On leaving the water, the final change takes place, the anterior portion of the dragon-fly being liberated through the nymph-cuticle as shown in the drawing



METAMORPHOSIS FROM NYMPH TO **DRAGON-FLY**

The second stage shows the tail being extricated from the nymph-cuticle

Dragon-fly nymphs undergo frequent moults which probably range between about 11 and 15 in number. The length of life in nymphs of different species is subject to wide variation: in the smaller forms it does not exceed one year, but in some species it is probable that two, three or more years are spent in the water. Certain structural changes occur during growth, and in the later stages the developing wings becoming evident on the dorsal side of the body. When a nymph has attained its full growth it ceases to feed, leaves the water and often wanders some distance before it comes to rest for the final change: the latter is effected by the longitudinal splitting of the thoracic cuticle through which fissure the perfect insect gradually emerges. The figures illustrate the process in the common British Aeschna cyanea.

METAMORPHOSIS FROM NYMPH TO DRAGON-FLY

The third stage shows the whole body extricated from the nymph-cuticle

Geographical **Distribution.**—Over 2,500 species of dragon-flies are known and the whole group is very widely distributed. The largest number of species occur in Central and South America: Europe and northern Asia together have much fewer representatives than North America and rather more than 40 species occur in the British Isles. New Zealand is very poor in these insects, only 13 kinds being known, while just over 200 species are found in Australia. The species *Pantala flavescens* is one of the widest distributed of all insects, being found throughout the tropics, the Pacific islands, Australia, in Asia as far north as Kamchatka, and in South America as far south as Chile, but not in Europe

Geological **Distribution.**—Dragon-flies occupy an important place as fossils and occur in all the main geological periods from the Carboniferous onwards. In strata of Carboniferous age at Commentary, France, C. Brongniart has brought to light several gigantic fossil forms which differ sufficiently from those of today to require a separate order (the Protodonata) for their reception. These great insects extend into the Permian age where they seem to die out. The earliest true dragon-flies occur in the lower Permian rocks of Kansas and, although very rare in the Trias, they become more frequent in Liassic times when the Anisozygoptera flourished—a sub-order which is almost extinct today. In the Jurassic rocks of Siberia dragon-fly nymphs have been found: the Purbeck and Stonesfield-slate beds of England and the Solenhofen slates of Bavaria have all yielded dragon-fly remains. Coming to Tertiary times, the Miocene beds of Colorado and of Oeningen (Switzerland) have yielded abundant remains, including *Libellulid* nymphs from the latter locality. Scarcely any dragon-flies have been found in amber; probably such insects could release themselves if entrapped in the resin.

Natural History.—Although dragon-flies are aquatic in their early stages, the perfect insects are by no means confined to the vicinity of water, and many species seldom frequent such situations except for pairing and egg-laying. They are essentially sun-loving insects although some oriental species are known only to fly at night: many are exceedingly swift on the wing, and a speed of nearly 60m. an hour is recorded in the case of one species. Dragon-flies are predatory insects, capturing their prey upon the wing and holding it by their prehensile legs while devouring it. Most orders of winged insects are preyed upon including smaller species of their own kind. Although most, species seldom wander far and have often been noted returning again and again to a particular twig or other chosen spot, there are some with strong migratory instincts. Great swarms of the common European *Libellula quadrimaculata* have often been recorded, sometimes travelling far out to sea, and an Australian species has occasionally been noted to behave in a like manner.

Probably no order of insects rivals Odonata in the beauty of their coloration. In some species a whitish or bluish pruinescence

is often present over the usual body colours, appearing as a kind of bloom as on some fruits. It is abraded by age or wear and is most frequent in the male. The coloration of the two sexes is commonly very different—the males in some species may be unicolorous and their females bicolorous: in other species the females exist in two colour forms, one of which closely resembles that of the male. Most dragon-flies have hyaline wings, but in

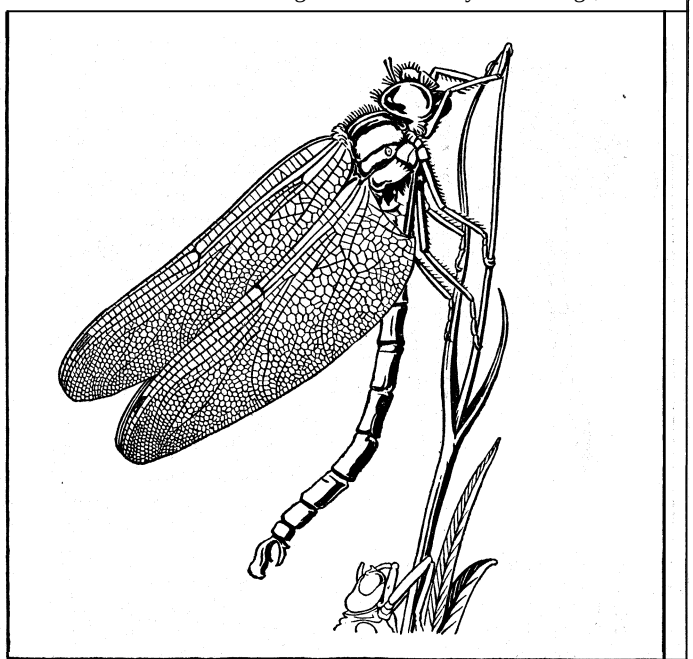


FIG. 5.—THE PERFECT DRAGON-FLY. ITS METAMORPHOSIS COMPLETE
The wings have acquired their full dimensions. The dragon-fly is seen resting to dry itself, before the wings are horizontally extended

species of *Calopteryx,* and other genera. the males have deep metallic green or blue wings: in certain tropical forms the wings exhibit a combination of glistening metallic green, purples, bronzes etc., that almost baffles description.

Economic Importance.—Dragon-flies are to be regarded as beneficial since they devour many noxious insects such as flies and mosquitoes. Their nymphs are active consumers of mosquito larvae and are themselves an important food for fishes.

BIBLIOGRAPHY.—The best general work on Odonata is R. J. Tillyard, *The Biology of Dragon-flies* (1917 bibl.). The British species are dealt with by W. J. Lucas, *British Dragon-flies* (1900); and an account of the European species is given by F. Ris, in *Süsswasserfauna Deutschlands* (1909), and by R. Tumpel, *Die geradflügler Mitteleuropas (1922).* For habits and transformations *see* L. C. Miall, *Natural History of Aquatic Insects* (1912). Keys to the North American genera and their nymphs are given in H. B. Ward and G. C. Whipple, *American Freshwater Biology* (1918). (A. D. I.)

DRAGON'S BLOOD, a red-coloured resin obtained from several species of plants. *Daemonorops draco,* one of the rotang or rattan palms, which produces much of the dragon's blood of commerce, is a native of Further India and the Eastern Archipelago. The fruit is round, pointed, scaly, and the size of a large cherry, and when ripe is coated with the resinous exudation known as dragon's blood. The substance in commerce is dark red-brown, nearly opaque and brittle, contains small shell-like flakes, and gives when ground a fine red powder: it is soluble in alcohol, ether and fixed and volatile oils. If heated it gives off benzoic acid. In Europe it was once valued as a medicine on account of its astringent properties, and is now used for colouring varnishes and lacquers; in China, where it is mostly consumed, it is employed to give a red facing to writing paper. The drop dragon's blood of commerce is still one of the products of Socotra, and is obtained from *Dracaena cinnabari.* The dragon's blood of the Canary Islands is a resin procured from the surface of the leaves and from cracks in the trunk of *Dracaena draco.* The hardened juice of a euphorbiaceous tree, *Croton draco,* a resin resembling kino, is the dragon's blood of the Mexicans, used by them as a vulnerary and astringent.

DRAGOON, originally a mounted soldier trained to fight on foot only. *(See* CAVALRY and MOUNTED INFANTRY.) This mounted infantryman of the late 16th and early 17th centuries, like his comrades of the infantry who were styled "pike" and "shot," took his name from his weapon, a species of carbine or short musket called the "dragon." Dragoons were organized not in squadrons but in companies, like the foot, and their officers and non-commissioned officers bore infantry titles. The invariable tendency of the old-fashioned dragoon, who was always at a disadvantage when engaged against true cavalry, was to improve his horsemanship and armament to the cavalry standard. Thus "dragoon" came to mean medium cavalry, and this significance the word has normally retained since the early wars of Frederick the Great. The light cavalry of the British army in the 18th and early 19th centuries was for the most part called light dragoons. The phrases "to dragoon" and "dragonnade" bear witness to the mounted infantry period, this arm being the most efficient and economical form of cavalry for police work and guerrilla warfare. The "Dragonnades," properly so called, were the operations of the troops (chiefly mounted) engaged in enforcing Louis XIV.'s decrees against Protestants after the revocation of the edict of Nantes.

DRAGUIGNAN, the chief town of the department of the Var in S E. France; 51 m. N E. of Toulon, and 28½ in. N.W. of Fréjus by rail; 679 ft. above sea-level, at the southern foot of the wooded heights of Malmont, on the left bank of the Nartuby river; pop. (1936) 10,257. The buildings are mainly modern. There are manutactures of leather, soap and spirits and trade in olive oil and grapes.

DRAINAGE, ARTERIAL. Rivers form, in every country, the natural system of arterial drainage, but it is often necessary to supplement them by artificial means to prevent land in the low-lying districts from becoming water-logged. In some countries, notably Holland, large areas lie near to, and in some cases below, the sea-level so that a complete system of arterial drainage, depending for its efficiency on continuous pumping operations, is essential to enable the land to be cultivated or, indeed, to be inhabited.

In England a large part of the country was originally marshland which was gradually reclaimed and brought into agricultural use. It could only be prevented from reverting to its primitive state by a permanent system of drainage, combined, on the coast, with embankments against the inroads of the sea. Where, as in mediaeval times, vast territories were controlled by individual landowners, the responsibility for executing such work fell upon them, as the improvement would accrue solely to their benefit. But where interests were divided, disputes as to liability would naturally arise. In this way, it may be surmised, the need for the establishment of authorities armed with legal powers arose.

The earliest drainage authority of which there is record was set up in the reign of Henry III., with jurisdiction over Romney marsh, but the first public statute dealing generally with arterial drainage was the Bill of Sewers passed in 1531, "sewer" then meaning only a canal or water-course. That statute, on which all later legislalion on the subject was founded, provided for the appointment of commissioners of sewers with extensive powers for the prevention of floods and the improvement of rivers. The Land Drainage Act, 1861, defined more clearly the powers and duties of commissions of sewers (*i.e.,* drainage), and also provided, for the first time, for elective drainage boards having all the powers of the old commissioners (who were appointed by the Crown) but were elected by the ratepayers of the area over which they had jurisdiction. Such a board could be established for any "bog, moor or other area of land that requires a combined system of drainage, warping or irrigation," on the petition of the proprietors of not less than one-tenth of the area concerned, provided that the owners of two-thirds of the area were in favour of it. The provisions of this act were extended and amended by legislation in 1918 and 1926, which gave certain powers to the ministry of agriculture and to county councils and county boroughs.

In 1927 there were 361 drainage authorities of various types in England and Wales, viz., 49 commissions of sewers, 198 drainage authorities under special acts and 114 elective drainage boards. In addition, county and county borough councils have certain powers under the Land Drainage Act, 1926, and the county councils of Middlesex, Lancashire, Yorkshire (West Riding) and Surrey have powers under private acts.

The multiplication by the spasmodic legislation of 500 years of authorities having varied powers and functions and exercising jurisdiction over areas of all sorts and sizes has resulted in an imperfect system of arterial drainage, while it is estimated that the productive value of 4,362,000 acres of agricultural land in England and Wales depends on its efficiency. Of this area one-third is not included in the district of any drainage authority, and it is stated that over $1\frac{1}{4}$ million acres are in immediate need of considered and more or less extensive systems of arterial drainage.

The lack of a comprehensive and effective system for Great Britain is largely attributable to the fact that principles of legislation and administration which were applicable to the conditions existing when they were first laid down are not applicable to modern conditions. In the first instance the liability to take action to prevent the flooding and waterlogging of land was regarded as falling on the owners of the land, and it was granted that any depreciation in value was the natural result of its situation, and a normal incident of its tenure for which no other person was responsible or by which they were affected. But as time went on new conditions arose; improvements in agriculture led to the extensive adoption of land drainage on farms (see DRAINAGE, LAND) which had the effect of sending water from the uplands into the valleys much more rapidly and effectively and so contributing to the flooding of the lower levels, and, in addition, the growth of towns along the rivers, and particularly at their outfall to the sea, tended to obstruct the escape of flood-water. By their systems of water-supply—in some cases drawn from far-distant sources—and of sewerage. the towns also increase the difficulty and complicate the problem confronting authorities responsible for arterial drainage; whence it appears evident that the old principle of charging the whole cost of arterial drainage on the land directly affected—in practice on that lying at approximately the level of the highest recorded flood—has become inequitable.

In 1927 a royal commission was appointed to consider and report whether "any amendment of the law is needed to secure an efficient system of arterial drainage without any undue burdens being placed on any particular section of the community." They recommended the repeal of all existing public acts relating to arterial drainage and the enactment of a single comprehensive statute. They suggested that where drainage problems exist the country should be divided into "catchment areas."

Catchment Areas.—This term denotes "the whole of the land which directs the drainage towards one river" discharging into the sea, though a tributary stream, especially when it joins the main river near the estuary, may be of sufficient magnitude and importance as to constitute a separate one. It was proposed to constitute 101 catchment areas with a responsible authority for each, such authority to consist of representatives of the county councils, and county boroughs lying wholly or partly within the area and of other persons elected by any drainage authorities within the area, or, if none exist, of persons directly interested in the drainage of the lowlands. The complexity of the problem is fairly indicated by the fact that the suggested catchment areas varied in size from 4,133 to 24 square miles, the largest being that of the Yorkshire Ouse, and the next in order the catchment areas of the Trent, Thames, Severn and Great Ouse.

On the long-disputed question of chargeability the royal commission recommended that rating for drainage purposes should be based, like rates for all other purposes, on annual value. By a wide interpretation of the established principle of "benefit" they proposed that rates should be levied on the whole of a catchment area, but that the rate on the uplands should be proportionately less than that on the lowlands, the precise amount in each case being determined by the authority subject to confirmation by the ministry of agriculture and fisheries.

One of the difficulties of adjusting the chargeability for works of arterial drainage on a comprehensive and uniform basis is the existence over large areas of a liability ratione tenurae. This in some cases was imposed under old inclosure acts and awards and in other cases dates from time immemorial. These obligations are often very difficult to trace, and the land on which they were originally charged cannot now be identified. It is proposed that catchment area authorities should be empowered and directed to commute all such liabilities within their districts either by way of a capital sum or an annual payment. There already exists a precedent for this course of action in the Somersetshire Drainage Act, 1877.

The subject of arterial drainage overlaps that of the reclamation of land. Great operations, such as that of the conversion of the Fens in the 17th century, from an immense swamp into a tract of fertile agricultural land, involved the establishment of an elaborate system of arterial drainage. This, like that of Holland, depended for its efficiency on continuous pumping and on effective embankments against the inroads of the sea. Many other areas have been similarly reclaimed and added to the agricultural area, and in all these cases, after the initial operations, reversion to their original condition is only prevented by the maintenance of a system of drainage, combined very frequently with the upkeep of sea defence works as the new nodes of the Netherlands in the Zuider Zee. (See also RECLAMATION OF LAND; CATCHMENT AREAS.) (*R. H. R.*)

DRAINAGE, HOUSE: *see* SANITATION OF BUILDINGS.

DRAINAGE *OF* LAND. Agricultural or field drainage consists in freeing the soil from stagnant and superfluous water by means of surface or underground channels. Surface drainage is usually effected by ploughing the land into convex ridges off which the water runs into intervening furrows and is conveyed into ditches.

The presence of stagnant water in the soil is the source of many evils. Wet pasture land produces only the coarser grasses, and many subaquatic plants and mosses, which are of little or no value for feeding; its herbage is late in spring, and fails early in autumn; the animals grazed upon it are unduly liable to disease, and sheep, especially, to foot-rot and liver-rot. In the case of arable land the crops are poor and moisture-loving weeds flourish. Tillage operations on such land are easily interrupted by rain, and the period is limited in which they can be prosecuted at all; the compactness and toughness of the soil render each operation more arduous, and its repetition more necessary than in the case of dry land. The best seed time is often missed, and this usually proves the prelude to a scanty crop, or to a late and disastrous harvest. The cultivation of root crops, which require the soil to be wrought to a deep and free tilth, either becomes altogether impracticable and must be abandoned for the safe but costly bare fallow, or is carried out with great labour and hazard; and the crop, when grown, can neither be removed from the ground, nor consumed upon it by sheep without damage to the soil by "poaching."

The Water-table.—The roots of plants require both air and warmth. A deep stratum through which water can percolate, but in which it can never stagnate, is therefore necessary. A waterlogged soil is impenetrable by air, and owing to the continuous process of evaporation and radiation, its temperature is much below that of drained soil. The surface of the water in the supersaturated soil is known as the "water-table" and is exemplified in water standing in a well. Above the "water-table" the water is held by capillarity, and the percentage of water held decreases as we approach the surface, where there may be perfect dryness. Water will rise in clay by capillarity to a height of 50in.; in sand to 22in. Draining reduces the "surface tension" of the capillary water by removal of the excess, but the "water-table" may be many feet below.

In setting about the draining of a field, or farm, or estate, the first point is to secure a proper outfall. The lines of the receiving

drains must next be determined, and then the direction of the parallel drains. The former must occupy the lowest part of the natural hollows, and the latter must run in the line of the greatest slope of the ground. In the case of flat land, where a fall is obtained chiefly by increasing the depth of the drains at their lower ends, these lines may be disposed in any direction that is found convenient; but in undulating ground a single field may require several distinct sets of drains lying at different angles, so as to suit its several slopes.

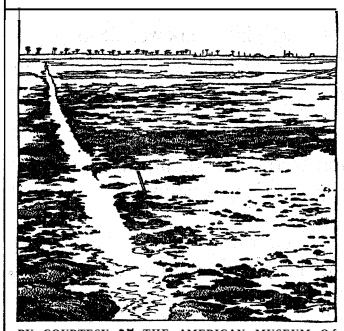
The depth and distance apart of the parallel drains have been the subject of much controversy. At one time a minimum depth of 4 feet was considered necessary in all cases. This was frequently proved unsatisfactory because the distance apart was too great. It has been laid down as a general rule in Britain that in clay soils the drains should be 16 to 24ft., in medium soils 26 to 32ft. and in light soils 40 to 60 feet apart, assuming that the depth in all cases is 4 feet.

The desirability of drawing stagnant water from the land was apparent to the earliest cultivators of the land, but the methods of so doing were primitive. Surface drainage by the ridge and furrow and open ditches were practically the only means adopted. Walter Blith in the middle of the 17th century advocated the removal of the excess of stagnant water on or near the surface by mears of channels filled with faggots or stones, but his teaching was little regarded. In the latter half of the 18th century Joseph Elkington, a Warwickshire farmer, invented a plan of draining sloping ground that is drowned by the outbursting of springs When the higher-lying portion of such land is porous, rain falling upon it sinks down until it is arrested by clay or other impervious matter, which causes it again to issue at the surface and wet the lower-lying ground. Elkington showed that by cutting a deep drain through the clay, aided when necessary by wells or auger holes, the subjacent bed of sand or gravel in which a body of water is pent up by the clay, as in a vessel, might be tapped and the water conveyed in the covered drain to the nearest ditch or stream. In the circumstances to which it is applicable, and in the hands of skilful drainers, Elkington's plan, known as "sink-hole drainage," by bringing into play the natural drainage furnished by porous strata, was often successful.

Essential Principles. — During the subsequent 30 or 40 years most of the draining that took place was on this system. About 1823 James Smith of Deanston, Perthshire re-discovered those principles of draining so long before indicated by Blith and proceeded to exemplify them in his own practice, and to expound them to the public in a way that speedily effected a revolution in the art of draining, and marked an era in agricultural progress. He insisted on the necessity of providing every field that needed draining with a complete system of parallel underground channels, running in the line of the greatest slope of the ground, and so near to each other that the whole rain falling at any time upon the surface should sink down and be carried off by the drains. A main receiving drain was to be carried along the lowest part of the ground, with sub-drains in every subordinate hollow that the ground presented. The distances between drains he showed must be regulated by the greater or less retentiveness of the ground operated upon, and gave 10 to 40ft. as the limits of their distance apart. The depth which he prescribed for his parallel drains was 30in., and these were to be filled with 12in. of stones small enough to pass through a gin. ring. Josiah Parkes, engineer to the Royal Agricultural Society, advocated a greater distance apart for the drains, and a depth of at least 4ft.

The sound principles promulgated by Smith were speedily adopted and extensively carried into practice. The great labour and cost incurred in procuring stones in adequate quantities, and the difficulty of carting them in wet seasons, soon led to the substitution of "tiles," and soles of burnt earthenware. The limited supply and high price of these tiles for a time impeded the progress of the new system of draining; but the invention of tile-making machines removed this impediment, and gave a stimulus to this fundamental agricultural improvement. The substitution of cylindrical pipes for the original horse-shoe tiles has still further lowered the cost and increased the efficiency and permanency of drainage works.

The drainage of land is an obligation falling on the owners, being part of the permanent equipment of a farm. If the farm is let the tenant is entitled under the Agricultural Holdings Acts to carry out any necessary drainage operations himself and to claim compensation on quitting the holding provided he has before executing the work notified the landlord and given him the opportunity of doing it himself. A very large amount of capital has been expended by landowners on the drainage of land and special legislation was passed in the last century to enable them to obtain loans for the purpose and charge the cost on their property on a sinking fund basis. In recent years, especially since the World War, little has been done and although no trustworthy statistics are available there is little doubt that much agricultural land is deteriorating and its productivity being reduced by lack of effective-field drainage. This takes no account of the necessity in many districts for arterial drainage, which is the subject of another article (see DRAINAGE, ARTERIAL). (X.)



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

MARSH FLOODED WITH STAGNANT WATER BEFORE BEING DRAINED

THE UNITED STATES

Drainage of land by means of small open ditches was probably practised by individual owners in the seaboard States at an early date, but there are no records of such work prior to the 19th century. The first recorded use of tiles for underdraining farm lands was in 1835. Co-operative reclamation began in 1850, when Congress passed the swamp act. Under this law such of the public lands as were too wet to cultivate were granted to the States in which they lay with the understanding that the States were to drain and sell them. The real era of land drainage began about 1885 with the invention of the dipper dredge, which made it possible to construct large ditches at small cost. The invention of machines for making both clay and concrete tiles in large quantities at a reasonable cost made underdrainage practicable and profitable.

The census of 1930 showed that of the 1,903,21j 360 ac. of land in the United States, 986,771,016 ac were in farms. Of the latter area, 44,523,685 ac. were reported as having been provided with underdrainage by the individual farm onners, and 18,173-703 ac. as in need of underdrainage. The census also showed that 84 408.093 ac. of land had been included in operating drainage enterprises. More than 88% of this drainage work was done after 1890 Drainage enterprises in most instances merely provide outlet facilities for the tile drains of the individual land owners. Undoubtedly most of the 44,523,685 ac. mentioned are included in drainage enterprises.

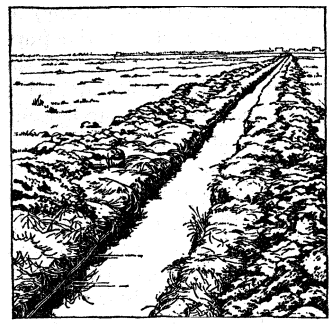
To facilitate land reclamation on a large scale, practically all the States have passed drainage laws under which a majority of land owners or the owners of a major portion of the land proposed to be reclaimed can organize a drainage district and compel the minority owners to join them in paying for the improvement. These districts have corporate powers and are managed by commissioners. Funds are raised by special assessments, proportional to the benefits received. The assessments are paid in from ten to 15 annual instalments, and are a lien against the land until paid. Serial bonds are sold to meet the construction costs and are retired annually as the assessments are paid.

Along the flood plains of large streams, each of tht districts may construct (1) levees to keep out the flood waters, (2) ditches to convey the run-off to the pumping station, (3) a pumping station to pump the interior drainage water over the levee, and sometimes (4) a diversion ditch at the foot of the high ground to intercept the drainage from the high ground and to carry it around the lower end of the district. The tile underdrains are laid by the individual land owners.

Along smaller streams, drainage involves channel cleaning and

straightening and the construction of small ditch or large tile laterals to serve as outlets for the small tile underdrains. The drainage of large upland areas is accomplished by one or more main ditches and as many lateral ditches as are necessary. The laterals are generally spaced at either half mile or mile intervals, so that no land in the district will be more than half a mile from an outlet. Drainage districts range in size from small tile districts of a few hundred acres to large outlet districts of 500,000 acres.

Underdrainage is effected by systems of parallel tile drains laid at a customary depth of $2\frac{1}{2}$ to 4 ft. and spaced 60 to 150 ft. apart. The present practice is to use 4- or 5-in. tiles for these laterals.



BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE SAME MARSH AFTER BEING DRAINED BY CHANNELS

In 1922, the bureau of public roads, U.S. Department of Agriculture, made a compilation of the unreclaimed swamp, overflowed, and tidal marsh lands in the United States, and found 95 million ac. of such lands divided as follows: Swamp and periodically swamp lands, $56\frac{2}{3}$ million ac.; periodically overflowed lands, $30\frac{2}{3}$ million ac.; and tidal marsh lands, 75 million acres.

See G. W Pickels, *Draznage and Flood-Control Engineering* (1925); C. G. Elliott, *Engineering for Land Drainage* (1919); W. L Powers and T. A H. Teeter, *Land Drainage* (1932); B A. Etcheverry, *Land Drainage and Flood Control* (1936). (G. W. P.)

DRAKE, SIR FRANCIS (*c.* 1545–1596), English admiral, was born near Tavistock, Devonshire, about 1545 according to most early authorities, but possibly as early as 1539 (*see* Corbett, vol. i., Appendix A). His father, a yeoman and a zealous Protestant, took refuge in Kent during the reign of Queen Mary. Young Drake was educated at the expense and under the care of Sir John Hawkins, who was his kinsman; he was apprenticed on a coasting vessel, and at 18 was purser of a ship trading to Biscay. At twenty he made a voyage to Guinea; and at twenty-two he was made captain of the "Judith." He fought his ship gallantly in the Gulf of Mexico under Sir John" Hawkins, and returned with him to England, having acquired great reputation, though with the loss of all the money which he had embarked in the expedition. In 1570 he obtained a regular privateering commission from Queen Elizabeth, and embarked on a cruise in the Spanish Main. He planned an attack against the Spaniards in the West Indies to indemnify himself for his former losses, and set sail in 1572, with two small ships named the "Pasha" and the "Swan." He was afterwards joined by another vessel; and with this small squadron he took and plundered the Spanish town of Nombre de Dios. He penetrated across the isthmus of Panama, and committed great havoc among the Spanish shipping. From the top of a tree on the isthmus he obtained his first view of the Pacific, and resolved "to sail an English ship in these seas." In these expeditions he was assisted by the Maroons, descendants of escaped negro slaves. Having filled his ships with plunder, he bore away for England, and arrived at Plymouth on Aug. g, 1573.

Having fitted out three frigates at his own expense, he sailed to Ireland, and served as a volunteer, under Walter, earl of Essex. After his patron's death he returned to England, where he was well received by Queen Elizabeth. The first proposal he made to her was a voyage into the South Seas through the straits of Magellan, which no Englishman had hitherto ever attempted. The queen furnished him with means; and his own fame quickly attracted the men. The fleet with which he sailed consisted of only five small vessels, manned in all by 166 men. Starting on Dec. 13, 1577, he laid his course by the west coast of Morocco and the Cape Verde Islands. He reached the coast of Brazil on April 6, and entered the Rio de la Plata, where he parted company with two of his ships; but having met them again, and taken out their provisions, he turned them adrift. On June 19 he entered the port of St. Julian's, where he remained two months, partly to lay in provisions, and partly delayed by the trial and execution of Thomas Doughty, who had plotted against him. On Aug. 21 he entered the Straits of Magellan. The passage of the straits took sixteen days, but then a storm carried the ships to the west; on Oct. 7, having made back for the mouth of the strait, Drake's ship and the two vessels under his vice-admiral Captain Wynter were separated, and the latter, missing the rendezvous, returned to England. Drake went on, and came to Mocha Island, off the coast of Chile, on Nov. 2j. He thence continued his voyage along the coast of Chile and Peru, taking all opportunities of seizing Spanish ships, and attacking them on shore, till his men were satiated with plunder; and then coasted along the shores of America, as far as 48° N. lat, in an unsuccessful endeavour to discover a passage into the Atlantic. He named the country New Albion, and took possession of it in the name of Queen Elizabeth. He sailed on July 26, 1579, for the Moluccas. On Nov. 4 he got sight of those islands, and, arriving at Ternate, was extremely well received by the sultan. On Dec. 10 he made the Celebes, where his ship unfortunately struck upon a rock, but was taken off without much damage. On March 11 he arrived at Java, whence he intended to have directed his course to Malacca; but he found himself obliged to alter his purpose, and to think of returning home. On March 26, 1580, he again set sail; and on June 15 doubled the Cape of Good Hope, having then on board only 57 men and three casks of water. He passed the line on July 12 and on the 16th reached the coast of Guinea, where he watered. On Sept. 11 he made the Island of Terceira, and on Sept. 26 (?) he entered Plymouth harbour. This voyage round the world, the first accomplished by an Englishman, was thus performed in two years and about ten months.

The queen hesitated for some time whether to recognize his achievements or not, on the ground that such recognition might lead to complications with Spain, but she finally decided in his favour. She went on board his ship at Deptford and there conferred upon him the honour of knighthood. She likewise gave directions for the preservation of his ship, the "Golden Hind," that it might remain a monument of his own and his country's glory. After the lapse of a century it decayed and had to be broken up. Of the sound timber a chair was made, which was presented by Charles II. to the university of Oxford.

In 1581 Drake became mayor of Plymouth; and in 1585 he married a second time, his first wife having died in 1583. In 1585 hostilities having commenced with Spain, he again went to sea, sailing with a fleet to the West Indies, and taking the cities of Santiago (in the Cape Verde Islands), San Domingo, Cartagena and St. Augustine. In 1587 he went to Lisbon with a fleet of thirty sail; and having received intelligence of a great fleet being assembled in the bay of Cadiz, and destined to form part of the Armada, he entered the port on April 19, and there burnt upwards of 10,000 tons of shipping—a feat which he afterwards called "singeing the king of Spain's beard." In 1588, when the Spanish Armada was approaching England, Sir Francis Drake was appointed vice-admiral under Lord Howard, and made prize of a very large galleon, commanded by Don Pedro de Valdez, who struck at once on learning his adversary's name.

In 1589 Drake commanded the fleet sent to restore Dom Antonio, king of Portugal, the land forces being under the orders of Sir John Norreys; but they had hardly put to sea when the commanders differed, and thus the attempt proved abortive. But as the war with Spain continued, an expedition was fitted out, under Sir John Hawkins and Sir Francis Drake, against their settlements in the West Indies. Here, however, the commanders again disagreed about the plan; and the result disappointed public expectation. These disasters were the principal cause of his death, which took place on board his own ship, near the town of Nombre de Dios, in the West Indies, on Jan. 28, 1596.

The older Lives by Samuel Clarke (1671) and John Barrow, junr. (1843), have been superseded by Julian Corbett's two admirable volumes on *Drake and the Tudor Navy* (1898), the best source of information on the subject, which were preceded by the same author's *Sir Francis Drake* in the "English Men of Action" series (1890). *See* also E. J. Payne's edition of *Voyages of the Elizabethan Seamen to America: Thirteen original narratives from the collection*

of Hakluyt (new ed., 1893); *A.* Brereton, *Sir Francis Drake* (1917); Sir Walter Hunciman, *Drake, Nelson and Napoleon,* etc. (1919); E. F. Benson, *Sir Francis Drake* (1927); and *Sir Francis Drake's Voyage round the World, 1577–1580: Two contemporary maps* (Brit. Mus. printed books, 1927).

DRAKE, NATHAN (1766–1836), English essayist and physician, son of Nathan Drake, an artist, was born at York. He was apprenticed to a doctor in York in 1779, and in 1786 proceeded to Edinburgh University, where he took his degree as N.D. in 1789. In 1790 he set up as a general practitioner at Sudbury, Suffolk, where he found an intimate friend in Dr. Mason Good. In 1792 he removed to Hadleigh, Suffolk, where he died in 1836. His most important production was *Shakespeare and his Times, including the Biography of the Ppet; Criticisms on his Genius and Writings; a new Chronology of his Plays; a Disquisition on the Object of his Sonnets; and a History of the Manners, Customs and Amusements, Superstitions, Poetry and Elegant Literature of his Age* (1817).

DRAKENBERG or **KAHLAMBA,** the highest portion of the great eastern scarp of the South African plateau.. It forms the eastern boundary of Basutoland and Orange Free State.

DRAM or **DRACHM,** a weight approximately equal to that of the ancient Greek coin; in apothecaries' weight one-eighth of an ounce, or 60 grains *(3.888* grams); in avoirdupois weight one-sixteenth of an ounce, or *27·34375* grains (1·772 gram). For short the term is used for a fluid dram (drachm), a measure of capacity equal to one-eighth of a fluid ounce.

DRAMA is a transliteration of the Greek δρᾶμα, which means a thing done; theatre is a transliteration of the Greek θέατρον, which means a seeing-place. The word audience, meaning those who listen, is derived from the Latin and therefore represents a later idea of play-going. From this use of two Greek words and one Latin a useful hint is given us as to the first dramatic values. Drama begins with action and spectacle; the deed comes before the word, the dance before the dialogue, the play of body before the play of mind. The audience is subsequent to the spectators. The history of drama is largely a history of changing dramatic values. Gradually the presentation of thought becomes as important as the representation of emotion, which was the main element of theatrical origins. Nowadays a person who talks about the drama may actually be thinking of a literary form and of something that will be read and discussed but will rarely or never live up to the original meaning of its name and be "done." Modern drama includes work in which the discussion of ideas is the whole purpose of the play. Of the play it is sometimes permissible to observe that it is just as effective in book-form as when "done." Indeed, in the first decade of the 20th century the drama of the intellectuals definitely revolted so far from the idea of "four boards and a passion" that Granville-Barker could describe it in this way: "Plays grew so austerely intellectual that their performance seemed a profanation, and we saw the actors moving apologetically through their parts as if they had been told that they were rather vulgar people with no real right there at all." This was a paradoxical fate to befall the men of action in "the seeing-place," but those who read or listen to the political and philosophical discussions in Bernard Shaw's "metabiological pentateuch" *Back to Methuselah* will appreciate the point of this and realize how great is the change from the simple conception of a drama as a thing done to the later use of "the seeing-place" as a school-room for the continued instruction and entertainment of the adult who is hungry for ideas. If we are to find a definition of drama which will cover all theatrical manifestations from the wordless ritual and mummery of primitive man to the actionless dialectic of a modern philosopher that definition will be so loose as to be almost useless. It is more profitable to ask and answer two simple questions about the thing which is done. They are: Why is it done, and how is it done?

The Laws of Aristotle.—To the query "Why?" the answers fall into two main groups. It is possible to reply from a psychological or a historical point of view. It is also possible to combine the two kinds of reply. Such a combination is made in the *Poetics* of Aristotle, Owing to the classical domination over Western thought which has prevailed since the Renaissance, Aristotle's *Poetics* has had an enormous influence on academic views of drama, He laid down laws of drama in general and of various types of drama in particular. Horace presented the Aristotelian lore to Rome (whose theatre was almost entirely derivative from Greek models), and the French classicists carried on the tradition of a dramatic discipline expounded in Greek lecture-rooms as a small part of Aristotle's encyclopaedic survey of all human problems. So diligent mas the pursuit of the classic ideal that Aristotle's hints about observing the three Unities of Time, Place and Action are incorporated and strengthened in the great French curriculum, being expanded and expounded by Chapelain, Richelieu, Corneille and Boileau. A last echo of the Aristotelian authority was to be heard in the dramatic criticism of A. B. Walkley who used to complain of Bernard Shaw that he did not keep to the familiar classical rules. The critic was twitted in turn by Shaw for his obeisance to "the immortal Stagirite" (see *Fanny's First Play,* Introduction). During the first decades of the 20th century the revolt against classical authority in the art of the theatre was finally driven home.

Imitation in Drama.—Aristotle gave both a brief historical explanation of the rise of Greek drama from ritual choruses and a psychological interpretation of the dramatic impulse. Of the latter he said *(Poetics,* 4). "Imitation is natural to man from childhood, one of his advantages over the lower animals being this, that he is the most imitative creature in the world, and learns at first by imitation. And it is also natural for all to delight in works of imitation." That is true. Man is a natural mimic as birds and beasts have been before him, and anthropologists who examine the origin of drama and seek all manner of esoteric causes for acting are seriously mistaken if they omit to allow also for the simple impulse to dress up and play at "let's pretend." But, however much the world's first player may have enjoyed his primitive masquerade or mischievous apeing of a neighbour, as soon as the fun becomes regularized in a ritual a great change occurs. We soon discover that acting has become immensely serious and is directed by prudential considerations. Possibly the first "thing done" was done for a joke, as Aristotle suggested when he cited the universal delight in works of imitation. But, undeniably, when the things done became seasonal rites, they were carried on for serious and sacred purposes. The idea of going to the play as a form of relaxation or holiday treat belongs to the civilized and not to the primitive state. It is true that as early as Roman times Terence, an adroit adapter of the Greek New Comedy, complained of the rivalry of jugglers and rope walkers in the Roman entertainment market, which shows how far the secular notion of playgoing had prevailed over the primeval concept of dramatic ritual. Comedy had naturally lost its religious significance before tragedy. But the essential fact about early drama, both comic and tragic, is that, all over the world, the primitive peoples have regarded it as a utility and an obligation. It is only after civilization has firmly established itself that the atmosphere of a religious service no longer surrounds the thing mimed and is replaced by the less strenuous air of an entertainment for an idle occasion. Thus the development of drama presents us with a double change. On the one hand physical action directed towards an emotional climax is no longer the supreme quality of drama, since the mind insists that the mental march may be movement of the dramatic kind; on the other hand secularization sets in and what had been in its infancy a propitiation of gods and heroes becomes in its mellower years a popular show and source of mundane merriments and excitements. Drama did quite literally begin with song and dance and the most popular form of drama to-day is still mainly compact of song and dance. But the difference in purpose and temper of the old dithyramb as offered to the gods and the new musical comedy "number" as projected at the stalls and gallery is, by its very immensity, indicative of a change that is fundamental. But by no means is the change final, since it is continually the object of theatrical reformers to recapture the drama for the exalted social purposes towards which, in other circumstances, its childhood was directed.

The Origin of Dramatic Rites.—It is not necessary to discuss at this point the rival theories as to the origin of dramatic rites. These theories fall into two main groups. It is claimed by one party that the song and dance from which drama sprang were a celebration of the life-force in the natural world and that the traditional dramatic conflict is a repetition or a restatement of the old battle between the New Year and the Old which is fought out with ubiquitous regularity in the folk-lore of races. The other party, of which Prof. Ridgeway was an active and important protagonist, surveyed the primitive folk dances and mummings of the world and found the significant common factor to be a tomb-ritual. The "thing done" was inspired by a wish to honour the great departed and to help him to immortality in order that he might, from his place of influence in the next world, continue to guide and protect his kinsmen and his tribesmen in this world. There is much evidence which both parties can fruitfully exploit. For the believers in a vegetation-cult there are the old mummers' plays which have survived in many countries and in which a slaying of Age or Winter and a resurrection of Youth or Spring are constant features. For the other side there appears in the witness-box the constant presence of the mask which is traditionally associated with the impersonation of departed spirits. The world-wide researches of anthropology have, as Ridgeway demonstrated in his collection of far-flung testimony, proved a continual connection of early mimings, dances and choruses with the sites of tombs and occasions of remembrances. One cause of drama is certainly to be found in that pursuit of immortality which has been the devouring passion of man from his first rough struggles for existence down to the ceaseless quest of civilized thought into human origins and human destiny. Acting in the first form was a species of prayer. You imitate a thing in order that the gods may take the hint and do likewise. You leap round the growing corn that the corn may also leap in a large fertility; you pour out water as a sign to the god who controls the rain; you act the hero rising from the tomb or portray his sufferings and services that he may be strengthened in his immortality and pass on some of his grace and greatness and succour to mortals here below. From such ritual an art of drama was developed, from that art an entertainment.

A Birth in Holy Places.—Thus, what we must conceive, if we wish to understand the vigour and variety of drama in the light of its history, is a birth in holy places. The performer was no playboy, but a priest or servant of the priests. He was also a social worker engaged, as much as any prelate or politician, in saving the tribe. By sympathetic magic he might prevail for the common good; by his persuasive arts the sun might shine and the rain might fall in their proper seasons. Dionysos, to give the fertility-god his Greek name, might leap amid the leapers and pour out his power in appropriate response to the dithyramb or vigorous incantation of his cult. Or else the rite at the tomb might save from a black oblivion the vanished leader and keep him in ghostly power to help the tribe amid its difficulties and dangers. So we pass from Dionysos, the god, to the Greek Dionysia, the festival for which the tragedian wrote, and so out on to that winding highway of secular art and amusement whose final tributaries and turnings are Broadway and Drury lane.

Along such lines as these the many replies must be made to the question "Why is there drama, why is there a thing done?" Naturally the answers will vary according to the particular circumstances of time and place. Civilizations make drama according to their needs and develop it according to their capacities. To the second question "How?" the answers will be equally numerous and various. Drama may be purely communal or purely individual, poetical or prosaic, acted by individuals and by teams or presented through the medium of the puppet or the marionette. Here it borders on ballet, there it borrows from the library. Its literary form will be found to be conditioned by the particular stage or platform for which it was written and the particular social object at which it was originally aimed. There are no inclusive theatrical formulae Nor can a simple definition be found by use of the word "imitation." Many of the earliest forms of drama and some of the later are not representative in the sense that the players are trying to mimic the life they know. Instead of copying they are creating and their performance is a statement and not a simulation. It is true that some kind of imitation remains, but it is imitation tempered by traditional symbolism. The Greek actor, to take the most obvious instance, did not try to imitate a man; he attempted to present something larger than life. Accordingly he wore a mask, propped himself up on buskins, and was padded out to superhuman size. This made realistic acting, as we understand it, impossible, but created a suitable mouthpiece for the superb rhetoric of Greek tragedy and also assisted the atmosphere of religious ceremonial in which the play was produced. Similarly in the mystery plays of the middle ages the actor often wore the conventional symbol of his part as though that sufficed. The symbol announced what could not be imitated. A gilt beard, for example, was the traditional decoration of St. Peter, just as in the circus we may know the clown by his colour long before he has begun his antics. The clown is an actor, but he is not, in any close sense of the word, an imitator. He works in his own world of fancy free. The history of the theatre has contained every kind of presentation and representation from the purely fantastic and symbolic to the actualities of our modern stage on which producers will lavish infinities of care in order to get a trifling detail "correct," *i.e.*, as closely imitative of life as possible.

Varieties of Drama.—Accordingly, as our eyes range up and down the whole cycle of "things done," from the vast ritual of the resurrection-play of Osiris, the god-hero of Egypt, to the 20th century comedy with its cynical chatter and realistic cocktails and cigarettes, we find it difficult indeed to lay down boundaries and to make exclusive or inclusive definitions. After the broadcasting of plays had become a popular practice one could not even insist that drama must be a thing seen, and from its very beginning the silent mummery, the thing seen but not heard, has been an essential form of the theatre. But, if we rule out broadcasting, we can say that drama consists of emotions and opinions and occurrences presented in three dimensions with more or less approach to imitation by human agency. (It is true that one medium may be the marionette but that is controlled by the human hand and mind.) There may be as much or as little music, as much or as little scene, and as much or as little mechanical aid as the circumstance offers. The acting company may be a civic community, as in a pageant, or a single individual, like a modern reciter or the first Greek ὑποκρίτης who answered the chorus and so originated dialogue. A great amount of human ingenuity has been wasted on laying down rules for drama as though it were a small and single thing. But such law-giving either ends in academic and abstract formulae which are belied by the history and practice of the stage or else makes classifications which are so vague as to be valueless. The much discussed "dramatic conflict" is itself a widely inclusive term since the conflict may be of the mind as well as of the body; argument is simply mental action. In short, as we come to survey the various dramas of the various nations and cultures, we can only conclude that the techniques of drama are as widely divergent as the racial tendencies and individual qualities of mankind and that to lay down lists of rules and to impose conditions is only a vanity of the academic brain, against which all the diversity of performance stands in a complete and crushing defiance. (I. BR.)

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INDIAN DRAMA

The Indian drama was almost certainly a native growth, and, in spite of some points of resemblance, there is no real evidence for assuming any influence of Greek examples at any stage of its progress. On the other hand, it had passed into its decline before the dramatic literature of modern Europe arose.

The Hindu writers ascribe the invention of dramatic entertainments to an inspired sage Bharata, or to the communications made to him by the god Brahma himself concerning an art gathered from the Vedas. Three kinds of entertainments, of which the *nātya* (defined as a dance combined with gesticulation and speech) comes nearest to the drama, were said to have been exhibited before the gods by the spirits and nymphs of Indra's heaven, and to these the god Śiva added two new styles of dancing.

The ultimate source of the Indian drama, thus traditionally believed to have been religious, has indeed been traced by some scholars to certain hymns in the *Rigveda,* which took the form of dialogue. There is, however, no direct evidence of such a source, and the existence in Vedic times of popular mimes has been inferred from certain references in Vedic texts. Some features of modern plays and the so-called *yātrās* of Bengal, representing mythical scenes (especially the Kṛishṇa legend), may possibly point to the drama's originating from an ancient pantomimic art. The 12th century *Gīta-govinda,* in which three characters engage in lyrical monologues, is the earliest literary specimen of this primitive type of play. On the other hand there is no doubt that the influence of epic recitations was of continuous importance. Keith rejects the evidence for a secular origin and concludes *(Sanskrit Drama,* p. 45) that the Sanskrit drama was probably evolved by "the combination of epic recitations with the dramatic movement of the Kyishqa legend, in which a young god strives against and overcomes enemies."

Nothing certain is known of the history of the actual drama before about A.D. zoo, when it had already reached its zenith. We know it only in its glory, in its decline and in its decay.

To **the 11th** Century **A.D.**—This is the classical period of the Hindu drama, and includes the works of its two greatest masters.

The earliest dramatist of whose work we possess specimens is Aśva-ghosha, the Buddhist teacher (2nd century A.D.). Fragments of his drama, the *Sāriputra-prakarana,* which correspond closely with the classical type, have been found at Turfan in Central Asia, with parts of two other Buddhist dramas.

Kālidāsa, the brightest of the "nine gems" of genius in whom the Indian drama gloried, lived at the court of Ujjain. He is the author of *Śakuntalā*—the work which, in the translation by Sir William Jones (1789), first revealed to the Western world of letters the existence of an Indian drama, since reproduced in innumerable versions in many tongues. This heroic comedy, in seven acts, takes its plot from the first book of the *Mahābhārata.* It is a dramatic love-idyll of surpassing beauty, and one of the masterpieces of the poetic literature of the world. Another drama by Kālidāsa, *Vikrama and Urvaśī (The Hero and the Nymph),* though unequal as a whole to *Śakuntalā,* contains one act of incomparable loveliness; and its enduring effect upon Indian dramatic literature is shown by the imitations of it in later plays. (It was translated into English in 1827 by H. H. Wilson.) His third, and probably earlier play, *Mālavika and Agnimitra,* is inferior to the other two.

Kālidāsa had a famous predecessor, Bhāsa. Thirteen plays, supposed to have been his long lost works, were published in 191 2, but their genuineness, about which there has been much controversy, is most doubtful.

Probably not far removed in date from Kālidāsa is the pathetic *Mṛichchhakatikā (The Toy Cart),* attributed to King Śūdraka, but perhaps written by a court poet. It is a comedy of middle-class life, treating of the courtship and marriage of a ruined Brahman and a rich courtesan.

To Harshadeva, king of northern India, are ascribed three extant plays of considerable merit, including the famous *Ratnāvalī (The Pearl Necklace),* a court-comedy with a half-Terentian plot.

The palm of pre-eminence is disputed with Kālidāsa by Bhavabhiiti, who flourished in the earlier part of the 8th century. While he is considered more artificial in language than his rival, and in general more bound by rules, he can hardly be deemed his inferior in dramatic genius. Of his three extant plays, *Mahāvīra-Charita* and *Uttara-Rāma-Charita* are heroic dramas concerned with the adventures of Rāma (the seventh incarnation of Vishnu); the third, the powerful melodrama of *Mālatī and Mādhava,* has love for its theme, and has been called the *Romeo and Juliet* of the Hindus. It is considered by their critical authorities the best example of the *prakaraṇa,* or drama of domestic life. Bhavabhūti's plays are devoid of the element of humour.

The popular Veṇī-samhāra, by Bhaṭṭa-Nārāyana, must be dated before the year A.D. 800. Its main incident is derived from the Māhābhārata. The play is marred by too much detail and adherence to rule. More interesting is Viśākhadatta's *Mudrārākshasa (Rakshasa and the Seal),* a lively drama of political intrigue, in which Chandragupta appears as the founder of a dynasty. The plot turns on the gaining-over of the prime minister of the *ancien régime.*

The plays of Rājaśekhara, who lived about the end of the 9th century, deal, like those of Harshadeva, with harem and court life. One of them, *Karpūra Manjarī (Camphor Cluster),* is stated to be the only example of the *saṭṭaka* or minor heroic comedy, written entirely in Prakrit. Among the remaining chief works of the period are the favourite, but hyperbolical, *Anargharāghava* by Murāri, and the long and rambling *Hanumannaṭaka,* or *Mahānāṭaka,* both of which deal with the adventures of Rāma.

The Period of Decline.—This may be reckoned from about the 11th to the 14th century, the beginning roughly coinciding with that of a continuous series of Mohammedan invasions of India. Kṛishṇamiśra's remarkable allegorical play, *Prabodha-Chandrodaya (c.* 1100) is a glorification of the cult of Vishnu. This style of drama had many followers, mostly very inferior. Of the remaining plays of this period, as compared with the first, the general characteristics seem to be an undue preponderance of narrative and description, and an affected and over-elaborated style.

Isolated plays remain from centuries later than the 14th. These, which chiefly turn on the legends of Kṛishṇa (the last incarnation of Vishnu), exhibit the Indian drama in its decay. The latest of them, *Chitra-Yajna,* which was composed about A.D. 1820, is imperfect in its dialogue, which (after the fashion of Italian improvised comedy) it is left to the actors to supplement. Besides these there are farces or farcical entertainments, often indelicate, of uncertain dates.

The number of plays which have descended to us from so vast an expanse of time is still comparatively small. Nevertheless, Schuyler's bibliography (1906) enumerates over 500 Sanskrit plays. To these have to be added the plays in Tamil, about roo in number, and some in other vernaculars.

There is among the Hindus no dearth of dramatic theory. The sage Bharata, the reputed inventor of dramatic entertainments, was likewise revered as the father of dramatic criticism. The

commentators constantly cite his supposed *sūtras,* or aphorisms. (From *sūtra,* thread, was named the *sūtra-dhāra,* thread-holder, carpenter, a term applied to the architect and general manager of sacrificial solemnities, or of theatrical performances.) By the 10th century dramatic criticism had reached an advanced point; and the *Daśa-Rūpa* distinctly defines the ten main forms of drama. Other critical works followed, exhibiting a rage for subdivision unsurpassed by the efforts of Western theorists, ancient or modern.

Species of Drama. — The Indian drama is a Brahmanical production, aiming not at delineation but at the awakening of sentiment, and making its appeal to the cultured minority. This elevated disregard of popularity accounts for much that is characteristic of the higher class of Indian plays. It explains both their relative paucity and their great length, renders intelligible the chief peculiarity in their diction, and furnishes the key to their most striking ethical and literary qualities. Connected in their origin with religious worship, they were only performed on solemn occasions, more especially at seasons sacred to some divinity. They were always originally written for one particular representation. Again, the greater part of every one of the plays of northern India is written in Sanskrit, which ceased to be a popular language by 300 B.C., but continued the classical and learned form of speech. Sanskrit is spoken by the principal personages of the plays, while the female and inferior characters use varieties of the Prakrits. Hence, part at least of each play cannot have been fully understood by the general audience. It is, then, easy to see why the Hindu critics should make demands upon the art, into which only highly-trained and refined intellects were capable of entering. The general public could not be expected to appreciate the sentiments *(rasas)* expressed.

The Hindu critics know of no precise distinction between tragedy and comedy, still less of any determined by the nature of the close of a play. They dislike an unhappy ending, arid a positive rule prohibits a fatal conclusion in their dramas. The general term for all dramatic compositions is *rūpaka* (from *rūpa,* visible form), those of an inferior class being distinguished as *uparūpakas.* Of the various subdivisions of the *rūpaka,* in a more limited sense, the *nāṭaka,* or play proper, represents the most perfect kind. Its subject should always be celebrated and important — heroism or love — and the hero should be a demigod or divinity or a king. The *prakaraṇas* agree in essentials with the *nāṭakas* but are less elevated, their stories being taken from life in a respectable class of society (e g., *Mrichchhakatikā; Mālatī* and *Mādhava*). Among the species of the *uparūpaka* may be mentioned the *troṭaka,* in which the personages are partly human, partly divine, and of which a famous example remains — Vikranza *and Urvaśi.* The *bhāṇa* was a monologue of low life, and the *prahasana* a farce. These trifles represent the lower extreme of the dramatic scale, to which the principles that follow only partially apply.

Construction. — Unity of action is enjoined by theory, though not invariably observed. Episodical or prolix interruptions are forbidden; but the story of the play is sometimes carried on by narratives spoken by actors or "interpreters," something after the fashion of the Chorus in *Henry* V., or of Gower in *Pericles.* "Unity of time" is liberally understood by the later authorities as limiting the duration of the action to a single year; and even this is exceeded. The single acts are to confine the events occurring in them to "one course of the sun." "Unity of place" is unknown, by reason of the absence of scenery; for the plays were performed in the palace courts or in the open air. Hence change of scene is usually indicated in the texts.

Not only must a play end happily, but death and all deeply tragical incidents are excluded, while such operations as biting, scratching, kissing, eating and sleeping should never take place on the stage. Yet such rules are occasionally broken. The charming love-scene in the *Śakuntalā* (at least in the earlier recension) breaks off just as the hero is about to act the part of the bee to the honey of the heroine's lips (act iii.; cf. Nāgānanda, act iii.). But later writers are less squeamish, or less refined.

Indian plays usually open after a benediction with a prologue, in which the manager, with one or more actors, discusses the play which is to follow. This is divided into acts *(ankas)* and scenes; of the former seven is a common number; "the great *nātāka*" reaches 14. Thus the length of the higher class of Indian plays is considerable — about that of an Aeschylean trilogy. Comic plays are restricted to two acts. It is a characteristic merit that the business is rarely concluded before the last act. The piece closes with a prayer. Within this framework room is found for situations as ingeniously devised and highly wrought as those in any modern Western play. Recognition — especially between parents and children — frequently gives rise to scenes of a pathos which Euripides has not surpassed (*Śakuntalā; Uttara-Rdma-Charito).* The device of a "play within the play" is employed with great success by Bhavabhūti. On the other hand, miraculous metamorphosis *(Vikmma and Urvaśī,* act iv.) and, in a later play (*Ratnāvali),* vulgar magic are introduced. With scenes of strong effectiveness contrast others of the most delicate poetic grace — such as the charming episode of the two damsels of the god of love helping one another to pluck the red and green bud from the mango tree; or of gentle domestic pathos. For the *dénouement* the expedient of the *deus ex machina* is often employed.

Characters. — Every species of drama having its appropriate kind of hero or heroine, theory here again amuses itself with an infinitude of subdivisions. Among the heroines, of whom not less than 384 types have been distinguished, are to be noticed the courtesans, whose social position somewhat resembles that of the Greek *hetaerae.* In general, the Indian drama indicates relations between the sexes freer than those which Mohammedan example introduced into India. Male characters are frequently drawn with skill. Prince Samsthanaka (*Mrichchhakatīkā*) is a type of royal selfishness worthy to rank beside figures of the modern drama; elsewhere (*Mudrā-Rakshasha*) the characters and principles of action of intriguing ministers are judiciously discriminated. Among the lesser personages two are especially worth noticing: the *vita,* or parasite, and the *vidlshaka,* the buffoon and humble associate of the prince. He is always a Brahman, or the pupil of a Brahman — perhaps a survival from a purely popular phase of the drama. His jokes are generally harmless and pointless.

With its mingling of prose and lyrical verse, and its highly ornate and figurative diction, the Indian drama essentially depended upon its literary qualities, and upon the familiar sanctity of its themes for its effects. Its scenic apparatus was scanty. Propriety of costume, on the other hand, seems always to have been observed.

Companies of actors seem to have been common in India at an early date. The player's social status shows a gradual rise, and in later times individual actors enjoyed a widespread reputation. The managers or directors were usually highly-cultured Brahmans. Female parts were in general, though not invariably, represented by females.

Summary. — The Indian drama would, if only for purposes of comparison, be invaluable to the student of this branch of literature. But from the point of view of purely literary excellence it holds its own against all except the very foremost dramas of the world. It cannot be described as national in the broadest and highest sense of the word; but, as the drama of a literary class, it exhibits many of the noblest as well as of the most characteristic features of Hinduism. Its ethics are lofty, but they are those of a scholastic system of religious philosophy, self-conscious of its completeness. To the power of Fate is occasionally ascribed a supremacy, to which gods as well as mortals must bow *(Vikrama and Urvaśī);* but, if man's present life is merely a phase in the cycle of his destinies, the highest of moral efforts at the same time points to the summit of possibilities, and self-sacrifice is the supreme condition both of individual perfection and of the progress of the world. Such conceptions as these seem at once to enfold and to overshadow the moral life of the Indian drama. The affections and passions forming part of self it delineates with fidelity; on the other hand, the freedom of the picture is restricted by conditions which to us may seem intolerable, but which it was impossible for the Indian poet to ignore. The sheer self-absorption of ambition or love appears inconceivable for these poets; and their social philosophy is based on the system of caste. On the other hand, they are

masters of many of the truest forms of pathos, above all of that which blends with resignation. In humour of a delicate kind they are by no means deficient; to its lower forms they are generally strangers. Of wit—as distinct from the play on words—Indian dramatic literature furnishes few examples intelligible to Western minds.

The distinctive excellence of the Indian drama is to be sought in the poetic robe which envelops it. In its nobler productions, at least, it is never untrue to its half religious, half rural origin; it weaves the wreaths of idyllic fancies in an unbroken chain of ever fresh beauties from an inexhaustible garden. Nor is it unequal to depicting the grander aspects of nature. A close familiarity with its native literature can here alone follow its figurative diction, listen with understanding to the hum of the bee as it hangs over the lotus, and contemplate with Śakuntalā's pious sympathy the creeper as it winds round the mango tree. But the poetic beauty of the Indian drama reveals itself in the mysterious charm of its outline, even to the untrained; nor should the study of it be omitted by any lover of literature.

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CHINESE DRAMA

Like the Indian drama, the Chinese arose from the union of the arts of dance and song. To the ballets and pantomimes out of which it slowly developed, and which have continued to flourish by the side of its more advanced forms, the Chinese ascribe a primitive antiquity of origin; many of them originally had a symbolical reference to such subjects as the harvest, and war and peace. A very ancient pantomime is said to have symbolized the conquest of China by Wu-Wang.

There are traditions which carry back the characters of the Chinese drama to the 18th century before the Christian era. Others declare the emperor Wan-Te (*fl.* about A.D. 580) to have invented the drama; but this honour is more usually given to the emperor Yuen-Tsung (A.D. 720).

The Classical Age.—Four periods may be discovered. The first is that of the dramas coinposed under the T'ang dynasty, from A.D. 720 to 907. These pieces, called *Tchhouen-Khi,* were a species of heroic drama.

The second period is that of the Sung dynasty, from 960 to 1119 The plays of this period are called *Hi-Khio,* and presented a principal personage *who sings.*

The Middle Age.—The third and best-known age of the Chinese drama was under the Kin and Yuen dynasties, from 1125 to 1367. The plays of this period are called *Yuen-Pen* and *Tsa-Ki;* the latter seem to have resembled the *Hi-Khio.* .The *Yuen-Pen* are the plays from which our literary knowledge of the Chinese drama is mainly derived; the short pieces called *Yen Kia* were in the same style, but briefer. In 1735 the Jesuit missionary Prémare first revealed to Europe the existence of the tragedy *Tchao-Chi-Cu-Eul (The Little Orphan of the House of Tchao),* which was founded upon an earlier piece treating of the fortunes of an heir to the imperial throne, who was preserved in a mysterious box like another Cypselus or Moses. Voltaire seized the theme of the earlier play for a rhetorical tragedy, *L'Orphelin* de *la Chine.*

The justly famous *Pi-Pa-Ki (The Story of the Lute)* was composed towards the close of the 14th century by Kao-Tong-Kia, and reproduced in 1404, under the Ming dynasty, with the alterations of Mao-Tseu, a commentator of learning and taste. *Pi-Pa-Ki,* as *a* domestic drama of sentiment, possesses very high merit, and is regarded as the masterpiece of the Chinese theatre. The fourth period, under the Ming dynasty (1368–1644), developed little that was new.

Varieties of Drama.—In theory, no drama could be more consistently elevated in purpose and in tone than the Chinese, but. in practice, it falls short of this ideal. The Chinese classify their plays according to subjects in twelve categories The historical drama is not unknown to the Chinese; and although a law pro. hibited the bringing on the stage of "emperors, empresses, and the famous princes, ministers and generals of former ages," no such restriction was observed in practice. In *Han-Kong-Tseu (The Sorrows of Han),* which treats of a national historic legend strangely recalling in parts the story of Esther and the myth of the daughter of Erechtheus, the emperor Yuen-Ti (the representative, to be sure, of a fallen dynasty) plays a part, and a sufficiently sorry one. The favourite virtue is filial piety, of a formal or a practical kind; their favourite interest lies in the discovery of hidden guilt, and the vindication of persecuted innocence.

Free in its choice of themes, the Chinese draina is likewise remarkably unrestricted in its range of characters. Chinese society, it is well known, is not based, like Indian, upon the principle of caste; rank in China is determined by office, and this again depends on the results of examination. The *Tchoang-Yuen,* or senior classman on the list of licentiates, is the flower of Chinese society, and the hero of many a drama. But of mere class the Chinese drama is no respecter, painting with noteworthy freedom the virtues and the vices of nearly every phase of society.

The conduct of the plays exhibits much ingenuity, and an aversion from restrictions of time and place. The plays are divided into acts and scenes—the former being usually four in number, at times with an induction or narrative prologue spoken by some of the characters *(Sie-Tsen).* Favourite plays were, however, allowed to extend to great length; the *Pi-Pa-Ki* is divided into 24 sections, and in another recension apparently comprised 42.

One peculiarity of the Chinese drama remains to be noticed. The chief character of a play represents the author as well as the personage; he or she is hero or heroine and chorus in one. He or she *sings* the poetical passages, or those containing maxims of wisdom and morality. If this personage dies in the course of the play, another sings in his place. In these lyrical or didactic passages are to be sought those flowers of diction which, as Julien has shown, consist partly in the use of a metaphorical phraseology of infinite nicety in its variations. These features constitute the literary element *par excellence* of Chinese dramatic composition. A careful study of the Chinese drama will show that it possesses merits of constructional ingenuity and variety of character well presenting pathos, grace and delicacy of treatment, humour and burlesque. Scenic decorations of any importance were always out of question in the Chinese theatre. The costumes, on the other hand, are magnificent; they are traditionally those worn before the 17th century, in accordance with the historical colouring of most of the plays. The actor's profession was not a respectable one in China, but under the Republic conditions are changing rapidly.

JAPANESE DRAMA

The Japanese drama seems to remain what in substance it has always been—an amusement passionately loved by the lower orders, but hardly dignified by literature deserving the name. Apart from its native elements of legendary or historical narrative and pantomime, it is clearly to be regarded as a Chinese importation; nor has it in its more advanced forms apparently even attempted to emancipate itself from the reproduction of the conventional Chinese types. As early as the close of the 6th century Hada Kawatsu, a man of Chinese extraction, is said to have been ordered to arrange entertainments for the benefit of the country, and to have written as many as thirty-three plays. The Japanese, however, ascribe the origin of their drama to the introduction of the dance called *Sambāso* as a charm against a volcanic depression of the earth which occurred in 805. In 1108 lived a woman called Iso no Zenji, who is looked upon as "the mother of the Japanese drama." But her performances seem to have been confined to dancing or posturing in male attire (*otokomai*); and the introduction of the drama proper is universally attributed to Saruwaka Kanzaburō, who in 1624 opened the first theatre at Yedo.

The subjects of the serious popular plays are mainly mythological. The famous narrative of the feudal fidelity of the forty-seven *ronins,* who about the year 1699 revenged their chiefs judicial suicide upon the arrogant official to whom it was due,

is stirring rather than touching in its incidents, and contains much bloodshed, together with a tea-house scene which suffices as a specimen of the Japanese comedy of manners. Besides tragic (Nō) plays *(see* JAPANESE LITERATURE), the Japanese have middle-class domestic dramas of a very realistic kind. The language of these, unlike that of Chinese comedy, is often gross and scurrilous Fairy and demon operas and ballets, and farces and *intermezzos,* form an easy transition to the interludes of tumblers and jugglers. *(See* JAPAN.)

BIBLIOGRAPHY.—*See* Tchêng *Ki-Tong, Le Théâtre des Chinois* (1886); H. A. Giles, *History of Chinese Literature* (1901); C. Florenz, *Geschichte der Japanischen Literatur,* vol. i. (1905).

PERSIAN AND OTHER ASIATIC DRAMA

Such dramatic examples of the drama as may be discoverable in Siam will probably have to be regarded as belonging to a branch of the Indian drama. The drama of the Malay populations of Java and the neighbouring island of Sumatra also resembles the Indian, to which it may have owed its development. The Javanese distinguish among the lyrics sung on occasions of popular significance the *pantun,* a short simile or fable, and the *tcharita,* a more advanced species, taking the form of dialogue sung or recited by actors proper. From the *tcharita* the Javanese drama, which in its higher forms treats the stories of gods and kings, appears to have been derived.

The originally Aryan Persians exhibit no trace of the drama in their ample earlier literature, but later two species, widely different from one another, of the religious drama or mystery and of the popular comedy or farce, made their appearance.

Of the Persian *téaziés* (lamentations or complaints) the subjects are invariably derived from religious history, and more or less directly connected with the "martyrdoms" of the house of Ali. The plays are frequently provided by the court or by other wealthy persons, by way of pleasing the people or securing divine favour, and are performed, usually by natives of Isfahan, in courtyards of mosques, palaces and inns.

It would seem that, no farther back than the beginning of the 19th century, the *téaziés* were still only songs or elegies in honour of the martyrs, occasionally chanted by persons actually representing them. The *Miracle Play of Hasan and Hosain,* as we may call it, has now come to be a continuous succession of dramatic scenes The performance is usually opened by a prologue delivered by the *rouzékhán,* a personage of semi-priestly character claiming descent from the Prophet, who edifies and excites the audience by a pathetic recitation of legends and vehement admonitions in prose or verse concerning the subject of the action. It is thus a kind of Oberammergau play and complaint of the Nibelungs in one.

The other kind of Persian drama is the *témacha* (=spectacle), a kind of comedy or farce, sometimes called *teglid* (disguising), performed by wandering minstrels. A favourite and ancient variety of the species is the *karaguez* or puppet-play, of which the protagonist is called *kétchel péhlévan* (the bald hero).

The modern Persian drama seems to have admitted Western influences, as in such comedies as *The Pleaders of the Court.*

Dramatic elements are apparent in two of the books of the Hebrew scripture—the *Book of Ruth* and the *Book of Job,* of which latter the author of *Everyman,* and Goethe in his *Faust,* made so impressive a use.

BIBLIOGRAPHY.—*See A.* Chodzko, *Théâtre persan* (1878); E. *Montet, Le Théâtre en Perse (1888).*

POLYNESIAN AND PERUVIAN DRAMA

From Polynesia and the more civilized races of aboriginal America we also have isolated traces of drama. Among these are the performances, accompanied by dancing and intermixed with recitation and singing, of the South Sea Islanders, first described by Captain Cook, and reintroduced to the notice of students of comparative mythology by W. Wyatt Gill. Of the so-called Inca drama of the Peruvians, the unique relic, *Apu Ollantay,* said to have been written down in the Quichua tongue from native dictation by Spanish priests shortly after the conquest of Peru, has been translated by Spilsbury. With it may be contrasted the ferocious Aztec dramatic ballet, *Rabinal-Achi* (translated by Brasseur de Bourbourg), of which the text seems rather a succession of warlike harangues than an attempt at dramatic treatment of character. But these are mere isolated curiosities.

DRAMATIC ELEMENTS IN EGYPTIAN CULTURE

The civilization and religious ideas of the Egyptians so vitally influenced the people of whose drama we are about to speak that a reference to them cannot be altogether omitted. The doctrine of the immortality of the soul found in Egypt its most solemn expression in mysterious recitations connected with the rites of sepulture, and treating of the migration of the soul from its earthly to its eternal abode. These solemnities, whose transition into the Hellenic mysteries has usually been attributed to the agency of the Thracian worship of Dionysus, undoubtedly contained a dramatic element. The ideas to which they sought to give utterance centred in that of Osiris, the vivifying power or universal soul of nature, whom Herodotus identifies with Dionysus. The same deity was likewise honoured by processions among the rural Egyptian population, which, according to the same authority, in nearly all respects except the absence of choruses resembled the Greek phallic processions in honour of the wine-god.

(X.)

GREEK DRAMA: (A) ORIGIN

Modern drama, from Shakespeare onwards, is confessedly an entertainment. Its true intent is for our delight, and if it does not entertain it has difficulty in justifying its existence. Also each play as a general rule is, or affects to be, a piece of free fiction, with imaginary characters and invented plot. Greek drama in its origin was a ritual performed for a religious purpose. Its object was not to entertain the spectators, though it might do that incidentally, but to obtain certain blessings for the community. Tragedy was never a piece of free fiction: it was an acted representation of the *πάθος* or death of some hero; and comedy, though it used fictitious characters, followed certain fixed ritual forms. When dramas, or *ludi scenici,* were introduced *(361* B.C.) from Etruria into Rome, their object was to check a plague.

A series of researches by different scholars (*see* at end) during the past 30 years enables us now to understand much more clearly the real nature of the Dionysiac ritual which took form in tragedy and comedy.

1. Religious Origin.—The drama in both its forms is a performance connected with Dionysus. It is produced at his festival, in his theatre, under the presidency of his priest, by performers who are technically known as *Διονύσου τεχνῖται.* In Aristophanes' *Frogs* Dionysus, the god presiding over drama, is the hero of the play.

Drama (*δρᾶμα*) means "a thing done" or "performed"; and the drama is a performance in honour of Dionysus. One may compare the *δρώμενα* or "things done" and the *δείκηλα,* "tableaux" or "things shown" in the mysteries at Eleusis and elsewhere (*cf.* Lobeck, *Aglaophamus,* pp. 50, 688 *seq.*); and even more helpfully the ecclesiastical plays of the middle ages. These were sometimes tableaux, sometimes extracts from the liturgy made dramatic and divided between performers, sometimes they were developed into plays in the full sense, representing such subjects as the Passion or the Massacre of the Innocents. Such plays sometimes included characters outside the Gospel, *e.g.,* the *unguentarius* from whom Mary Magdalene buys cosmetics. Sometimes they left both the Bible and the Liturgy aside and dealt with the adventures of saints. In the original plays of the nun, Hroswitha. again, we find a performance completely detached from the Church ritual, and standing on its own feet.

Thus we see that the mediaeval religious plays were gradually extended both in subject and treatment far beyond the original limits. And the same process seems to have taken place in Athens. The extant plays are mostly concerned with non-Dionysiac legends; and the Greek proverb *οὐδὲν πρὸς τὸν Διόνυσον* ("nothing to do with Dionysus") is supposed to refer to this extension of the field of drama. Yet it would be rash to suppose that all Attic drama dealt originally with Dionysus and thence spread to other cults. It is more likely that *dranzata* existed in many rituals of the Mediterranean religion from the earliest times.

Aristotle in his account of drama remarks that man is "by nature imitative"; extremely ancient χοροί, or dancing grounds, like those from which the drama developed, have been found in Thera, Crete, etc.; they are assumed as an ordinary institution in the Homeric poems; while in the dialogue *Minos* (attributed to Plato) it is remarked that tragedy was "ancient in Athens." There is also sufficient, though not abundant, evidence of the use of tableaux and acting in other cults besides the Dionysiac to justify this hypothesis. However, it remains certain that in classical Greek times the drama was the *sacer ludus* of Dionysus.

2. Tragedy and Comedy.—Drama took two forms, distinct and never combined, κωμῳδία and τραγῳδία, *kômos*-song and *tragos-song* respectively. The first name is transparent, a *kômos* being a revel, and almost every extant comedy ending with a revel scene. The second is obscure, and must be considered more carefully below.

To begin with comedy, we find in it almost always a kômos and associated therewith, as habitually on Greek drinking vases, a γάμος (*gamos*) or union of the sexes. Of the 11 plays of Aristophanes eight end in a *gamos: Ach.* 1,198 *seq.; Equ.* 1,389 *seq.; Vesp.* 1,342 *seq.; Pax* 1,316; *Av.* 1,728; *Lys.* 1,275 *seq.; Eccl.* 876 *seq.; Plut.* 1,042 *seq.* And we may note that in the first three of these it is dragged in and not naturally deduced from the plot. That is to say, it probably comes from the underlying ritual.

Also, all through the classical period, the chorus and the performers in comedy wear artificial *phalli, i.e.,* visible representations of the male organ of generation. This was of course contrary to normal manners, and was to some extent disguised in the 5th century, except in the bird or beast choruses. This feature also is usually (except *e.g.,* in the *Lysistrata*) quite irrelevant to the plot. It comes from the ritual, and the ritual is a well-known fertility ritual connected with the vegetation-spirit or year-daemon.

In its historical development we may notice how comedy moves further and further away from a mere phallic fertility rite, becoming more intellectual, literary and, incidentally, decent. Aristophanes boasts more than once how he has raised the tone of comedy, but amid all refinements the ritual *phalli* were still retained, in inconspicuous form, even in plays like the *Frogs* and the *Birds.* By the time of Menander they had disappeared (cf. *Nub.* 537 *seq.; Vesp.* 1,015 *seq.; Pax* 736 *seq*).

Thus Comedy is a perfectly intelligible performance of *kômos* and *gamos* in the ritual of the vegetation or fertility spirit, Dionysus. It represents, we may say, the triumph and marriage of the year-daemon.

3. Essentials of Tragedy.—If we seek for some similar constant feature in tragedy, we find generally *(a)* an Αἴτιον (*aition*) *i.e.,* the explanation or cause of some rite or custom. Thus the *Prometheus* trilogy explained the festival Prometheia, the *Ajax* explains the ritual of the Aianteia, the *Eumenides* explains the origin of the worship of the Eumenides at the Areopagus, the *Hippolytus* the worship of that hero by maidens, the *Iphigenia in Tauris* the curious ritual of Artemis at Brauron, the *Medea* the lamentation for Medea's children, etc. We find *(b)* that the *aition* is almost always a death, and the ritual to be explained a tomb worship: *e.g.,* that of Alcestis, Hippolytus, Eurystheus *(Hclid)* Neoptolemus, Peleus and Thetis *(Androm.),* Rhesus, etc. Some tragedies indeed seem to be taken more from the epic tradition than from any ritual. The *Septem* is a treatment of the old siege-motive, found in very early Minoan paintings as well as in the *Iliad* and the *Thebais;* but the trilogy to which it belongs is based on the regular year-king sequence, in which the Old King is killed by the Young King helped by the Queen. Some of the plays about Orestes *(e g.,* Soph. *Electra)* become epic rather than religious, but they also are rooted in the year-king ritual. And even the most definitely epic or heroic stories seem always to have in them a dirge or a sacred tomb, *e.g., Troades, Antigone, Persae.*

Thus it seems essential to tragedy to contain a dirge or a tomb ritual, and to act the *aition* of it: *i.e.,* the story from which the observance is supposed to be derived. It is also noticeable that the death of the hero or heroine is normally not enacted, but, as in the year-ritual of Osiris, Adonis, Pan, etc., regularly related by a messenger.

4. **Death** and Resurrection.—Thus, as comedy gives the *kômos-gamos,* so tragedy gives the πάθος-θρῆνος ("violent death and lamentation") of its hero or heroine.

Now a marriage-revel plus a slaying and lamentation is the content of the traditional pre-Christian religious drama once prevalent all over the Mediterranean world, and still not quite extinct under the name of "the Mummers' Play." It celebrates the birth and growth, the victorious battle and marriage; the lost battle and death, and sometimes the resurrection, of a hero representing the year, or the annual revivification of the world, first new and then old. And Dionysus was just such a being, akin, as Sir James Frazer has shown, to Attis, Adonis and Osiris. Comedy gives the triumph and marriage of the hero, tragedy his defeat and death, narrated always by a messenger. As for his birth and growth, we have that described in the *Hymn to Hermes,* the *Zchneutae* and the *parodos* of the *Bacchae;* and it is possible that this was properly the content of the dithyramb. At least Plato says that the dithyramb was Διονύσου γένεσις, οἶμαι ("the birth of Dionysus, I imagine") *(Laws* 700B).

There is one further element commonly, though not always, present in the mummers' play, viz., the resurrection of the slain hero. This resurrection or renewal motive occurs in many myths (Cook, *Zeus,* ii. 210 *seq.)* and is common in comedy *(Knights, Gêras, Amphiaraus,* cf. *Clouds, Wasps: see* Cornford, *Attic Contedy,* pp. 87–93; cf. also *Bacchae* 184 *seq.; Hclid.* 786 *seq.; Andr.* 548–765). It seems possible that this was represented in the satyr play, which normally followed the third tragedy, and represented the arrival of Dionysus with his attendant daimones (*Themis* p. 344 *seq.*; Cook, *Zeus,* i. pp. 680, 696 *seq.).* .At any rate a trace of it seems to exist in the constantly recurring deification or heroization of the chief characters: Alcestis, Hip. polytus, Heracles, etc.

Thus it seems that in dithyramb, comedy, tragedy and satyr play we have traces of the birth and growth, the marriage, the death and the resurrection of the year-daemon, which formed the subject of a complete ancient mummers' play. We may notice that the tragic hero is never Dionysus himself but regularly some hero who in some way takes his place.

5. The Goat **Song.**—We have seen above that the *tragôdia* or goat-song, with its enigmatic name, describes the πάθος or violent death of the hero, generally by some form of ritual slaying and particularly by *sparagmos* or dismemberment. When we observe that a goat was the animal commonly sacrificed to Dionysus, and particularly was so at Icaria, where tragedy is said to have been invented by Thespis, it seems reasonable to suppose that the goat-song was the song sung over the sacrificed and often dismembered goat. It is certain that in Graeco-Roman tradition generally the goat was specially associated with Dionysus, and practically certain that the dismembered kid or goat, of which we hear so often, was the representative or the embodiment of the god. (Farnell, *Cults,* v. pp. 165 *seq.* 302e, 303.) In particular the *sparagmos* or διασπασμός of the kid, whose blood the worshippers sacramentally drank, tells its own tale. The goat-song is the song of the dismembered goat, which is really the god. *(Cf.* Eratosthenes' "The Icarians then first danced around a goat.") In the lists of typical sacrifices we find: "a pig to Ceres, a goat to Liber (Dionysus) (Serv. Aen. 3, 18; *id. zb.* 8, 343; other passages in Farnell, *Cults,* p. 393). Also when the Gods disguised themselves, *proles Semeleia capro . . . latuit* (Ov. *Met.* v. 329); so *Baccho caper omnibus aris caeditur; caper Bacchi mactatur ad aras,* etc. For the sacramental *sparagmos* of small animals *cf.* the horrible word νεβρίζειν and lines such as Aesch *Eum.* 26 (λαγὼ δίκην Πενθεῖ καταρράψας μόρον) and the many examples of animals, children, etc. alleged or supposed to be torn in Dionysiac rites (Farnell, *Cults,* v. p. 301). These victims, it is generally agreed, are torn as surrogates or substitutes for the god himself.

When, therefore, Herodotus tells us (v. 67) that at Sicyon they used to honour Adrastus instead of Dionysus, celebrating

his "sufferings" (πάθεα) with tragic choruses, we may naturally suppose that other people in their tragic choruses celebrated the "sufferings" of Dionysus. What were these "sufferings"?

6. The Dismemberment. — It is commonly argued that the accounts we possess of the *sparagmos* or dismemberment of Dionysus are "late," occurring mainly in Plutarch and the Christian fathers. As a matter of fact they occur in Eratosthenes *(cf.* 240 B.C.). But further we have the express testimony of Herodotus, a contemporary of the bloom of tragedy, that the characteristic worship of Dionysus was "in almost all respects the same" as that of Osiris (see *Themis,* p. 342; Hdt. ii. 48: τὴν δὲ ἄλλην ἀνάγουσι ὁρτὴν τῷ Διονύσῳι οἱ Αἰγύπτιοι, πλὴν χορῶν, κατὰ τἀυτὰ σχέδον *ahvra* Ἕλλησι). Ordinarily Herodotus simply uses the name Dionysus for Osiris (as here, *cf.* ii. 144 "Osiris is Dionysus in Greek"; *cf.* ii. 42, etc). That is to say, Dionysus *is* Osiris, and the ritual is, apart from the dramatic choruses, almost exactly the same. We know the ritual of Osiris; and must therefore conclude that the ritual of Dionysus also contained a *sparagmos,* mourning, search, discovery and resurrection. It seems at first sight extraordinary that, if this was so, there is no mention of this ritual in classical times. The explanation is given by Herodotus. When there is mention of Osiris's death and lamentation he has a religious scruple against mentioning Dionysus' name in such a connection (ii., 61, "They lament but whom they lament I must not say"; *cf.* ii. 132, "When the Egyptians lament the god whom I may not name in this connection," so ii. 170, 86). It was forbidden to speak of the death of the god who was the life of the world. It was ἄρρητον (ineffable), and, in the manner of ancient religion, a surrogate took the god's place. We find a frequent *sparagmos* of beings who have committed some sin against Dionysus or other gods: of Pentheus by Maenads, Orpheus by Maenads, Lycurgus by horses, Hippolytus by horses, Dirce by a bull, Actaeon by hounds, etc. This use of a surrogate was made easier by the fact that both at Eleusis (Lobeck, *Aglaophamus,* pp. 50, 688 *seq.)* and in the Osiris rite (Hdt. ii. 171) the myth was conveyed by tableaux, not words. Thus the death of Pentheus, wearing Dionysiac dress, would be shown by exactly the same tableau as that of Dionysus. The truth could be shown to the wise and at the same time veiled from the unknowing. Such facts help to explain the charge of "profaning the mysteries" which was brought against Aeschylus.

Aristotle's two statements, that tragedy arose "from the leaders of the dithyramb" and comedy "from those of the phallic [songs]" are thus intelligible. The dithyramb *(see* above) is perhaps used for the whole birth and death story of Dionysus; the *exarchontes* are the actors as opposed to the chorus. Τὰ φαλλικά form that part of the year ritual which is concerned with the *gamos,* and perhaps also, as in the Osiris rite, with re-birth or resurrection.

In the remains of tragedy that we possess a few plays, like the *Bacchne,* and Aeschylus' *Edoni,* show the full Dionysus ritual almost unaltered; its influence is visible in others, such as the *Hippolytus* and *Andromache,* which have a sequence of scenes showing *agon, pathos* or *sparagmos,* messenger, *threnos,* theophany. Rut elsewhere we find that other rituals have left almost equally clear traces: the regular earth-and-year sequence —Old King, Young King who with the help of the Queen slays him, Third King who avenges or saves—in the *Oresteia,* the *Prometheus* and the Laius-Jocasta-Oedipus story. The rite of supplication at an altar occurs in a great number of plays, from Aeschylus' *Supplices* onwards. One can see also great influence exerted by the idea of the theophany or resurrection. Not only do most of Euripides' plays end with the appearance of a divine being, and a large number of comedies with the rejuvenescence of an old man, but most tragedies end with the quasi-deification of some hero or heroine, or at least the foundation of some worship. Most influential of all these ritual types is the figure of the *pharmakos,* the old polluted year, the sin-bearer, who has to be stoned or cast out, to suffer for his people. Oedipus and Orestes are typical; but almost every tragic hero has the traces of the *pharmakos* about him, he bears some pollution and he dies for the sake of others.

Thus, while we must allow for the influence of epic legends and heroic sagas upon tragedy, and of mere stories upon comedy, in the main Greek drama grows from a dramatization of ritual, and almost always of some ritual connected with the cult of the year spirit or vegetation spirit. When drama was put specially under the charge of Dionysus the specific Dionysus ritual, resembling that of Osiris, with its *sparagmos* and search and discovery, became prominent; but it was not exclusive, and through the earlier part of the 5th century other themes were fully as common. It is the year-religion in general which provides tragedy with its main scheme and exhibits life in the tragic pattern as a thing which, like the corn and flowers, like the young animals, like the sun and earth themselves, begins gentle and gracious, grows gradually great and commits the sin of *hubris* (pride), and at last in payment of that sin must fall and die.

Development of the Present View.—The researches referred to above have, after much controversy, arrived at something like a firm and generally accepted result, which is really a restatement of the traditional doctrine better understood. That doctrine, as stated in old books like Müller and Donaldson's *History of Greek Literature* (1858) regarded tragedy as a performance developing from the cult of Dionysus, the god of wine, ecstasy, and the forces of nature, especially the joy of the spring. It was obviously a little difficult to get from this god to tragedy, though to comedy the way was easy enough. In Haigh's *Tragic Drama of the Greeks* (1896) this difficulty is felt but not solved. The first bold stroke at a solution was made by the late Prof. Ridgeway, who simply denied the Dionysiac origin of drama, and explained tragedy as a funeral performance at the grave of a warrior. ("Origin of Tragedy," in *Quarterly Review,* 1908; also a book, same title, 1910.) These were followed in 191j by *Dravzas and Dramatic Dances of Non-European Races.* Part of Ridgeway's theory was obviously true. Tragedy is a *Trauerspiel,* a ritual lamentation over a death, and almost every tragedy contains a sacred or "heroic" tomb. On the other hand all the ancient testimony describes tragedy as a Dionysiac celebration, and no one had properly emphasized the words of Dionysius, Hal. *Roman Antiquities,* ii. 19, about "black-robed festivals, with beatings of the breast and lamentation over the disappearance (or death) of gods, as for the rape of Persephone and the sufferings of Dionysus."

Meantime the real nature of Dionysus was made much clearer by Frazer's *Attis, Adonis, Osiris,* which emphasized the element of death and mourning in this type of cult; and Farnell's account of Dionysus in *Cults,* vol. v. Farnell rightly (chap. v.) derived tragedy from the contest between the Fair and the Dark, *ie.,* day and night or summer and winter, using a hint of Usener's in the *Archiv für Religionswissenschaft,* 1904 (vii. pp. 303–313), while Dieterich in a remarkable article in the same *Archiv* (1908, vii.) developed the conception of tragedy as a *sacer ludzis,* for the purpose of averting the disasters which it portrayed. The connection between the Dionysus cult, dithyramb, tragedy, etc.. and the wide-spread year-celebration known as the mummers' play, with its sequence of birth, growth, victory, marriage, defeat, death and (sometimes) resurrection, was first brought out by Dawkins, *A Modern Carnival in Thrace and the Cult of Dionysus,* in the *Journ. Hell. Stud.* xxvi. (1906). Gilbert Murray in a chapter contributed to the late Dr. Jane Harrison's book *Themis* (1912, revised 1927), pointed out the knowledge by Herodotus of a Dionysus cult practically identical with the mourning-cult of Osiris; and the regular presence in tragedy of a ritual death, together with the traces in many tragedies of the regular sequence of scenes which is known to be characteristic of the Osiris cult—Agon, Pathos, Messenger, Thrênos, Theophany. Finally, F. M. Cornford in *The Origin of Attic Comedy* (1914) combined with this conception of Tragedy as the death and lamentation of the year daemon the observation that Comedy represented his victory, revel and marriage. An attempt to deny all these results is made by Pickard-Cambridge, *Dithyramb, Tragedy and Comedy* (1927)

(G. G A. M)

GREEK DRAMA: (B) HISTORY

Tragedy.—Archilochus said that he could lead the dithyramb

as well drunk as sober, which is not true of tragedy; and neither with him (c. 650 B.C.) nor with the (*c.* 600) chorus of 50 of Arion of Lesbos at Corinth can tragedy legitimately be considered to have begun. Ancient tradition, which there is no valid reason to challenge, states that in Attica, at the Dionysia of 534 B.C. one Thespis, of the Icarian deme, produced a chorus of which he was himself leader (κορυφαῖος). But instead of merely exchanging dialogue with the chorus he had included a person called the Answerer (ὑποκρίτης, afterwards the word for actor—but the word is also interpreted as "the poet's spokesman," see Bywater's ed. of Arist. Poet., p. 136) with whom also he spoke. He now had the materials from which he constructed rude tragedies; narrative, and some very limited action were possible, but the entertainment was still chiefly lyrical. From his day the history of Greek tragedy is purely Attic. His chief successors, Choerilus, Pratinas and Phrynichus, produced plays of a similar character; Phrynichus is credited with the introduction of female characters, and with especially charming lyrics. His two most famous pieces, the Capture of *Miletus* and the Phoenician *Women,* dealt with contemporary events.

Greek tragedy enters upon its classical and greatest period with the appearance of Aeschylus (525–456) about 500 B.C. Under GREEK LITERATURE, and more briefly under CLASSICS will be found a study of the content and style of his plays and of those of his successors: further reference should be made to their respective biographies. Under THEATRE are discussed the various technical devices of the Greek stage—the "buskins," the masks, the scenery, etc. Here we shall merely indicate briefly the changes introduced by each of the more important authors. The greatest innovator of all was without doubt Aeschylus. He introduced a second answerer, or actor. Each actor might "double" parts as much as he could, so that, with the chorus and its leader taking an active part, a developed drama was now possible. The limitations of a small cast were less felt than they would be to-day owing to the conditions of performance. The plays were presented out of doors at the Great Dionysia before unmanageably huge audiences, consisting of the whole population, citizens, slaves, women, children, visitors; the writer had necessarily to rely very largely upon the music and upon the "mass effects" provided by the chorus. To the conditions of performance was due also the typical Aeschylean arrangement of the trilogy or tetralogy (though the words are of later, probably Alexandrian, date). The trilogy is the day's sequence of three plays, forming one vast play, though each section is a comprehensible and if necessary detachable unit. Of a trilogy we have one example, the Oresteia (*Agamemnon, Choephori, Eumenides*) dealing with the story of Orestes. A tetralogy is the trilogy with the addition of a fourth play, the "satyric drama," which, as might be expected after so long a performance, was of a light character, contained much comic relief and had a happy ending. The one surviving example, Euripides' Cyclops (large parts of Sophocles' Ichneutae have also recently been discovered) does not suggest that by the disappearance of these dramas much has been lost. Aeschylus left a further profound trace on Greek drama by his lavish use of "Homer" for his subject matter, and his modelling of the language of tragedy upon the solemnity of the Homeric verse. He called his plays "dry scraps from Homer's banquet." By "Homer" he meant not the Iliad and Odyssey so much as the vast mass of myth contained in the cyclic poems generally (see HOMERIC POEMS).

With Sophocles (495–405) the associate of Pericles, Greek tragedy reaches, if not its highest, at least its most characteristic development; appreciation of his plays is a cultivated taste. He released Greek drama from certain of the limits accepted by Aeschylus. He provided a third actor, thus enlarging the author's field, he began to abandon the trilogical connection of plays, he increased the numbers of the chorus, and brought the language nearer to that of everyday life. He further introduced the use of scenery, states Aristotle (*Poet.* 1449a 18, σκηνογραφίαν; the exact meaning of this has been somewhat fruitlessly disputed). Euripides (480–406) increased still more the flexibility of the drama. He separated the chorus from the action—the first step to its complete destruction—he used the prologue openly as an introduction and explanation to the play, and his language, subjects and sentiments seemed to his contemporaries excessively realistic. He was, however, charged with an intemperate use of the *deus* ex *machina* device, by which a god is brought in abruptly at the end of a play to set right a confusion which is beyond human powers.

These three great writers in their life-time and even more since have towered above all others. But there were many other playwrights, of whom Ion and Agathon appear to have been of outstanding merit. The latter used a very florid style, invented his subjects if necessary, and allotted to his chorus *embolima,* "inserted numbers," which had no connection with the play. After them came numerous poets, all of whose works are also lost; we may mention Euphorion. Aeschylus's son. Iophon the son of Sophocles, and Euripides, his namesake's nephew. The conquests of Alexander spread theatres all over the East, and shortly afterwards the rise of Alexandria attracted from Athens to that city the remaining dramatic talent. The productions of this age are lost. There is little reason to believe that the loss is a very serious one, though the Alexandrian theatre survived till the days of the Roman empire.

Comedy.—The Thespis of comedy was Susarion of Megara (*fl.* 580–562 B.C.) who added broad jokes (possibly practical jokes) and rustic satire to the phallic song. Epicharmus (c. 500 B.C.) and Sophron (c. 430 B.C.) of Syracuse must also be counted among the earliest exponents of comedy, which thus appears to have a Dorian origin. The character of Epicharmus' comedies is uncertain: Sophron's mimes were dramatic recitations of everyday Sicilian life, classed as for "male" or "female" characters (μῖμοι ἀνδρεῖοι καὶ γυναικεῖοι). But Athens soon asserted her dominion with the trinity of *Eupolis* atque *Cratinus Aristophanesque poetae,* of whom the last alone has had the fortune to survive. To these poets of the Old Comedy should be added the names of Magnes, Pherecrates, Crates, Phrynichus and Plato comicus. Comedies, though some were presented at the Great Dionysia, were chiefly played at the Lenaea, in Gamelion (the month January–February) at a time when the Athenians were isolated by winter and were free to indulge in the most intimate comedy and self-criticism. The poets presented but one comedy, and were not subject to the artistic restrictions of tragedy, or indeed, as for Old Comedy, to restrictions of matter at all The phallic element survived; the comedies were grossly indecent, either incidentally or as in the case of one of the best (Lysistrata), organically. Political attacks of the freest kind were permitted nearly till the end of the Peloponnesian War. Their chief vehicle was the parabasis, a break in the middle of the play when the chorus moved towards the audience (παραβαίνω), faced it and delivered a long speech in the name of the poet dealing with current events.

From 414, when a law was passed checking this free comment, Old Comedy was doomed and from the end of the century till about 338 (Macedonian conquest) we have what is conventionally called Middle Comedy. The *Plutus* of Aristophanes is an example of it. The vitality of comedy has been impaired, the *parabasis* has vanished, the chorus is dying and conventional types begin to appear. In reality, the division between Middle and New Comedy is an unhelpful one and one not countenanced by the Alexandrians. The characteristics of New Comedy (from 338 onwards) are merely exaggerations of the characteristics of Middle Comedy. The chorus has vanished, and the play is merely an 'imaginary story of the events occurring to certain typical figures—the Rich Miser and so forth. They may best be studied in the plays of Plautus and Terence, their imitators (see below). The reputation of Menander, the most famous of New Comedy writers, has been injured rather than enhanced by the recent discovery of considerable fragments. A successor of Sophron the mime writer may be found in the Alexandrian Herodas, whose *Mimes* are a purely literary production.

See A. E. Haigh. *The Attic Theatre* (rev. ed, 1907); L. Matthaei, *Studies in Greek Tragedy* (1918); *T.* D. Goodell, *Athenian Tragedy* (New Haven, U.S.A., 1920); R. C. Flickinger, *The Greek Theatre and its Drama* (Chicago, 1922); and the *Cambridge Ancient History,* vol. v., ch. v. (1927, bibl.). (R. W. P.)

ROMAN DRAMA

Early Dramatists. — The art of the drama was at Rome a res *peregrina,* and, according to Livy (vii. 2), took its rise from the performances of the Etruscan ludii who were summoned to Rome in 364 B.C. to avert by their dancing and playing the wrath of the gods who had sent a plague. Livy is, no doubt, following the accepted antiquarian view of contemporary scholars, such as Varro, and too much reliance must not be placed upon his details; but that Roman drama came under Etruscan influence at an early stage is proved by the Etruscan origin of the words hister (player), and (probably) persona (a player's mask). Rome had been in contact with the Italian Greeks much earlier than the middle of the 4th century and must have been aware through them of the existence of dramatic exhibitions; and the "Fescennine verses" were germs out of which the art of dramatic representation might have been developed. Further, the Oscan town of Atella from an early time had possessed (possibly under Greek influence) a rude native drama, afterwards developed at Rome into a distinctive form under the name of the *fabula* Atellana. Under the combined influence of the Etruscan *ludii* and the rude jesting of the Fescennine verses there developed (according to Livy) a form of drama called the *satura,* with full musical accompaniment by a flute and an appropriate style of acting: but the details of the development are obscure and the very existence of the dramatic *satura* is doubtful.

It was not till the Punic Wars that Rome possessed a regular drama. Livius Andronicus, a Greek captured at Tarentum and afterwards a schoolmaster at Rome, translated a Greek tragedy and comedy for production at the Roman games of 240 B.C. The titles of nine tragedies and three comedies of his survive; the skill with which Greek metres are handled in his extant fragments. and the success with which the Latin language is adapted to their use, are so remarkable as to cause hesitation in accepting the current view that he was absolutely the pioneer of verse translation from the Greek. His contemporary Cn. Naevius inclined more towards comedy than tragedy; we have the titles of 34 comedies of his as against seven tragedies: he was the first to choose as subjects for tragedies traditional Roman legends (*e.g.,* Romulus) or contemporary events such as the battle of Clastidium (222 B.c.) : this type of tragedy was known as *fabula* praetextata. The fragments of his comedies contain references to contemporary life and manners worked into the framework of his Greek original: one of his most famous comedies was the *Tarentilla,* which turned upon the adventures of two young men detected by their fathers living with two girls in Tarentum and haled back to respectability. Naevius thus pointed the way for the later type of comedy which found its subject matter in Roman (or Italian) life, the *fabula* togata. The work of the two pioneers was continued by Q. Ennius who was born in Calabria in 239 and lived till 169 B.C. We know by name only two comedies of his, but there are fragments of 22 tragedies, and two *fabulae* praetextatae. He seems to have been especially attracted by Euripides: his translation of the Medea was famous and his *Andromache* in Captivity was well known and appreciated as late as the time of Cicero.

Plautus and Terence. — After Ennius no one attempted both branches of the drama; indeed the practice had already been abandoned by his elder contemporary T. Maccius Plautus, a native of Sarsina in Umbria, whose dramatic career began during the later years of the Second Punic War. Plautus confined himself to comedy, and is the great representative of the *fabula palliata,* the comedy translated or adapted from the Greek masters of the Middle or New Comedy, Menander, Philemon, Diphilus and their fellows. Of the poet himself we know next to nothing: the only certain dates in his career are those of his death (184 B.C.) and of the production of the *Stichus* (200 B.C.) and the *Pseudolus* (191 B.C.). The name Plautus may be a nickname ("flat-foot"), and Maccius may be derived from the name of one of the stock characters in the fabula *Atellana* (v. *infra*) in which he may have appeared during his youth. The detsils of his life given by later writers are either inventions or inferences, or modelled upon stories in Greek biographies. The twenty complete comedies which we possess along with the *Vidularia,* extant only in fragments, were all that Varro recognized as genuine out of the 130 attributed to Plautus in his day (hence known as the *fabulae Varronianae*). Besides these we have insignificant fragments of 32 of the plays rejected by Varro. Of the prologues to the extant plays some are certainly (and all may be) post-Plautine.

Though Plautus invariably adapted a Greek original he preserved his independence, fitting in upon occasion scenes from other plays where they served his purpose (a method known to subsequent critics as *contaminatio*): he introduced quite freely allusions to Roman legal procedure, manners and customs; he abandoned the previous convention with regard to the metres of dialogue; his boisterous humour breaks through the artistic restraint imposed by tradition upon his Greek masters. One of the greatest masters of the Latin language, Plautus riots and gambols in dialogues in which everything is sacrificed to the desire to raise a laugh: but the nimbleness and suppleness of his diction are extraordinary. His high spirits and his mastery of dialogue remained unique in Roman comedy.

Plautus's younger contemporary, Statius Caecilius, who died in 168 was by some later critics regarded as the chief of Roman comedians. Mastery of plot and *grauitas* were regarded as his principal merits; following the advice of his friend Ennius he avoided *contaminatio.* His chief model was Menander, to whom he owed the plots of 16 out of his 42 known comedies, and his fragments show that (in spite of Cicero's *malus* latinitatis *auctor* est) he had caught something of Menander's happy brevity A new movement which roused the hostility of the dominant school of comedy was represented by P. Terentius Afer, who, coming to Rome from Carthage as a slave, became a literary friend of Scipio and his circle and died at an early age in 159 B.C. Of Terence's six plays the first (the *Andria*) was produced in 166 B.C., and the last (the *Adelphi*) in 160 B C. Terence avoided the boisterous mirth of his predecessors, and lacks the rich vocabulary of Plautus: he excelled in the portrayal of character: his style is choice and correct without formality: he avoids the anachronisms and carelessness of Plautus, and simplifies his medium by confining himself practically to two metres and by omitting the lyrical passages in irregular verse known as *cantica.* His prologues wage war upon the popular taste and the views of his critics. Without the strength and vigour of Plautus, Terence is superior to him in dramatic construction and deftness of phrase, and became the acknowledged model of cultivated Latin speech. After Terence the comedy modelled upon Greek originals declined; amid a number of writers Sextus Turpilius who died in 103 B.C , alone deserves mention. He represents the extreme reaction from the fine correctness of Terence to the vocabulary of the crowd. But the public taste was turning to other forms of comedy, though *palliatae* continued to be produced and earlier plays were revived and imitated. It is to this period that many of the plays afterwdrds attributed to Plautus can be assigned, including (perhaps) the *Asinaria.*

Later Developments. — Roman tragedy after Ennius was continued by his nephew and pupil M. Pacuvius, born at Brundisium about the beginning of the Second Punic War. He was regarded down to the time of Quintilian as the chief Roman tragedian, though Cicero finds fault with his style. We possess fragments of one *praetextata* and 13 tragedies modelled on the Greek. His plays continued to be performed till the first century AD., the most famous being the Teucer, the *Antiopa* and the *Niptra,* parts of which Cicero preferred to Sophocles's play on the same subject. Pacuvius's metre conformed closely to Greek models, and he was noted for his copious, flowing style and his love for compounds, and unusual grammatical forms His technical competence was contrasted by later critics with the spirited and lofty genius of L. Accius (born 170 B.c.), whom Ovid seems to have rated higher than Pacuvius. Fragments survive of 43 of his tragedies and of two pmetextatae. His plays cover the whole of Greek mythology and his favourite master is Sophocles. His first tragedy, the *Atreus,* was produced in 139 and. though Pacuvius, to whom it was read, found it somewhat harsh and immature

in spite of its stately and sonorous style, it remained a favourite acting piece. His style shows the influence of rhetoric, and he provided models for more than one of Seneca's plays. Quintilian considered him a master of dialectic.

By the last century B.C. the comedy borrowed from Greece was supplanted by the *fabula* togata, the subject of which was the life of country towns and obscure people. Its chief writers were the plebeian Titinius, a younger contemporary of Terence. T. Quinctius Atta (d. 77 B.C.) and L. Afranius (b. about 150 B.C.). The last brought the togatae to the highest finish and his plays were popular till the Augustan Age. Sulla's predilection for the *fabula Atellana* gave it a vogue during the same century. These farces originally dealt with stock characters (Maccus, the simpleton, Pappus, the old fellow, Dossennus, hunchback, etc.), but later were assimilated to the *fabula* fogata. The same century witnessed the rise of the *mimus,* which by the time of Cicero had ousted the *Atellana* as an *exodium.* The principal writers of these, generally licentious, plays were Dec. Laberius (105–143) and his contemporary Publilius Syrus, a liberated slave from Antioch; the fame of the latter rests mainly on the collections, dating from the second century A.D., of *sententiae* or pithy sayings from his works.

During this century the tragedies of the earlier masters were frequently reproduced, but there was no tragedian of repute until the reign of Nero, when Seneca composed his tragedies, whether for the theatre or not is uncertain. He borrowed freely from his predecessors, Greek and Latin, and produced nine tragedies, in which plot and character were subordinated to declamation and expositions of Stoic morality: but as models of tragic composition they long exercised great influence. The *praetextata* entitled *Octavia* which is included in the list of his plays is of later date.

Production of Plays.—The early Roman drama laboured under great restrictions: plays were produced only at the great festivals, such as the *ludi* Komani, the *Megalesia,* etc., or at funerals, triumphs and dedications of temples. The theatre was a temporary structure of wood and for long no seats were permitted. An attempt in 154 B.C. to build a stone theatre was prevented by the consul Scipio Nasica: Pompey's stone theatre was not built till 55 B.C.: though wooden seats for the spectators had been provided a century before. There were three stock changes of scene, and the only music was provided by a flute player (*tibicen*). At first authors acted in their own plays but later a manager (such as Ambivius Turpio who produced for Terence) with a troupe of actors (*grex*) brought out the play, engaging their services to the magistrate who had charge of the festival. These actors were generally slaves, though the Atellan farces were for long produced by freeborn citizens: in course of time (however) great actors like Roscius and Aesopus had a certain social position, though the actor in a mime (*planipes*) was despised until Imperial times

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(R. M. HE)

DOWNFALL OF THE CLASSICAL DRAMA

The end of the ancient classical drama has been already foreshadowed The elements of dance and song, never integrally united with the dialogue in Roman tragedy, were now altogether separated from it. While it became customary simply to recite trsgedies to the small audiences who continued (or, as a matter of courtesy. affected) to appreciate them. the *pantomimus* commended itself to the heterogeneous multitudes of the Roman theatre and to an effete upper class by confining the performance of the actor to gesticulation and dancing, a chorus singing the accompanying text. The species was developed with extraordinary success already under Augustus by Pylades and Bathyllus; and so popular were these entertainments that even eminent poets, such as Lucan (d. A.D. 65), wrote the librettos for these *fabulae salticae* (ballets), of which the subjects were generally mythological, only now and then historical, and chiefly of an amorous kind. Comedy more easily lost itself in the cognate form of the *mimus,* which survived all other kinds of comic entertainments because of its more audacious immorality and open obscenity. Women took part in these performances, by means of which, as late as the 6th century, a *mima* acquired a celebrity which ultimately raised her to the imperial throne, and perhaps occasioned the removal of a disability which would have rendered her marriage with Justinian impossible.

Meanwhile, the regular drama had lingered on, enjoying in all its forms imperial patronage in the days of the literary revival under Hadrian (117–138); but the perennial taste for the spectacles of the amphitheatre, which was as strong at Byzantium as it was at Rome, and which reached its climax in the days of Constantine the Great (306–337), under whom the reaction set in, determined the downfall of the dramatic art. It was not absolutely extinguished even by the irruptions of the northern barbarians; but a bitter adversary had by this time risen into power. The whole authority of the Christian Church had, without usually caring to distinguish between the nobler and the looser elements in the drama, involved all its manifestations in a consistent condemnation (as in Tertullian's De *spectaculis,* 200 c.), comprehended them all in an uncompromising anathema. When the faith of that Church was acknowledged as the religion of the Roman empire, the doom of the theatre was sealed. At Rome the last mention of *spectacula* as still in existence seems to date from the sway of the Ostrogoths, in the earlier half of the 6th century. In the capital and provinces of the Eastern empire the decline and fall of the stage cannot be similarly traced; but its end is authoritatively assigned to the period of Saracen invasions which began with the Omayyad dynasty in the 7th century. Gradually, however, as they lost all footing in the centres of civic life, the mimes and their fellows became a wandering fraternity, who doubtless appeared at festivals when their services were required, and vanished again into the depths of the obscurity which has ever covered the strollers' life. It was thus that these strange intermediaries of civilization carried down such traditions as survived of the acting drama of pagan antiquity into the succeeding ages.

MEDIAEVAL

In the midst of the condemnation with which the Christian Church visited the stage, we find such works as the Χριστὸς πάσχων (*Passion of* Christ), formerly attributed to St. Gregory Nazianzen, and the *Querolus,* long fathered upon Plautus himself, which were doubtless mostly written for educational purposes. The same was probably the design of the famous "comedies" of Hroswitha, the 10th century Benedictine nun of Gandersheim, in Eastphalian Saxony. While avowedly imitated in form from the comedies of Terence, these religious exercises derive their themes—martyrdoms (*Gallicanus,* part ii.; *Sapientia*), and miraculous or otherwise startling conversions (*Gallicanus,* part i.; *Callimachus;* Abraham; *Paphnutius*)—from the legends of Christian saints. Thus, from perhaps the 9th to the 12th centuries, Germany and France, and through the latter, England, became acquainted with the literary monastic drama. Thus the *Play of St. Katharine* was acted at Dunstable about the year 1110 in 'copes" by the scholars of Geoffrey, the Norman, afterwards abbot of St. Albans, and was certainly not regarded as a novelty.

From about the 6th to the 11th century the Latin and the Teutonic elements of mediaeval "minstrelsy," more or less imperceptibly, coalesced. The traditions of the disestablished *mimus* combined with the "occupation" of the Teutonic *scôp,* who is found under this name or that of the "gleeman," in Anglo-Saxon literature, before it fell under the control of the Christian Church. How far these *joculatores* kept alive the usage of entertainments more essentially dramatic than the minor varieties of their performances, we cannot say. In different countries these entertainers suited themselves to different tastes, and to different literary tendencies The literature of the *troubadours* or Prov-

ence, which communicated itself to Spain and Italy, came only into isolated contact with the beginnings of the religious drama; in northern France the *jongleurs*, as the *joculatores* were now called, were confounded with the *trouvères* (*q.v.*). As appointed servants of particular households they were here, and afterwards in England, called nzenestrels (from *ministeriales*) or minstrels. In England such accomplished minstrels enjoyed the favour of the Norman, Angevin and Plantagenet kings. But here, as elsewhere, the humbler members of the craft spent their lives in strolling from castle to convent, from village-green to city-street, exhibiting their skill as dancers, tumblers, jugglers proper, and as masquers and conductors of bears and other dumb contributors to popular wonder and merriment.

Pagan Elements. — From the days of Gregory the Great, the Western Church tolerated and even attracted to her own festivals popular customs, which were in truth relics of heathen ritual. Such were the Mithraic feast of Dec. 25, or the egg of Eostre-tide, and a multitude of Celtic or Teutonic agricultural ceremonies of a semi-dramatic nature — such as processions of beasts or men in beast-masks, dressing trees with flowers, and the like, but above all ceremonial dances, often in disguise. The sword-dance, recorded by Tacitus, of which an important feature was the symbolic threat of death to a victim, endured (though it is rarely mentioned) till the later middle ages, by which time it had attracted to itself a variety of additional features, and of characters familiar as pace-eggers, mummers, morris-dancers (probably of distinct origin). The dramatic "expulsion of death," or winter, by the destruction of a lay-figure — common through western Europe about the 8th century — seems connected with a more elaborate rite, in which a disguised performer (who perhaps originally represented summer) mas slain and afterwards revived (the *Pfingstl*, Jack in the Green, or Green Knight). This representation, after acquiring a comic complexion, was annexed by the character dancers, who about the 15th century took to adding still livelier incidents from songs treating of popular heroes, such as St. George and Robin Hood; which latter found a place in the festivities of May Day with their central figure, the May Queen. The feast of fools (or asses), which enjoyed the greatest popularity in France (though protests against it are on record from the 11th century till the 17th), was well known from London to Constantinople. It was probably derived from the ancient Kalend feasts. In the 16th century the feast of fools was combined with the elaborate festivities of the 12 Christmas-feast-days — the season when throughout the previous two centuries the "mummers" especially flourished, who in their disguising and "*viseres*" began as dancers gesticulating in dumb-show, but ultimately developed into actors proper.

Christian Elements. — Thus the literary and the professional element, as well as that of popular festive usages, had survived to swell the main stream of the early Christian drama, which had its direct source in the liturgy of the church itself. The service of the Mass contains in itself dramatic elements, and at a very early period — certainly already in the 5th century — it was usual on special occasions to illustrate the Gospel narrative by living pictures accompanied by songs. The insertion, before or after sung portions of the service, of tropes, originally one or more verses of texts, usually serving as introits and in connection with the gospel of the day, and recited by the two halves of the choir, led to dialogue chanting; and this was frequently accompanied by illustrative action, such as drawing down the veil from before the altar.

This practice of interpolations in the offices of the church, which is attested by texts from the 9th century onwards (the so-called "Winchester tropes" belong to the 10th and 11th), progressed till the *liturgical* mystery — the earliest form of the Christian drama — was gradually called into existence. As early as the 10th century on great ecclesiastical festivals the priests performed in the churches these offices (as they were called). The whole Easter story, from the burial to Emmaus, was thus presented, the Maries and the angel adding their lyrical *planctus;* while the surroundings of the Nativity — the Shepherds, the Innocents, etc. — were linked with the Shepherds of Epiphany by a recitation of "Prophets," including Virgil and the Sibyl. Before long, from the 11th century onwards, *mysteries*, as they were called, were produced in France on scriptural subjects such as the Wise and Foolish Virgins, Adam (mith the fall of Lucifer), Daniel, Lazarus, etc. These mysteries and miracles being as yet represented by the clergy only, the language in which they were usually written is Latin, the earliest example in the vernacular being the 11th century mystery of the Resurrection.

Mysteries, Miracles and Moralities. — The productions of the mediaeval religious drama, it is usual technically to divide into three classes. The *mysteries* proper deal with scriptural events only, and set forth, with the aid of the prophetic history of the Old Testament and the fulfilling events of the New, the central mystery of the Redemption of the world, as accomplished by the Nativity, the Passion and the Resurrection. But in fact these were not kept distinctly apart from the miracle-plays, or miracles, which are strictly speaking concerned mith the legends of the saints. Thirdly, the moralities, or nzoral-plays, teach and illuslrate the same truths allegorically, their characters being personified virtues or qualities.

As the plays grew more elaborate, and their spectators more numerous, they began to be represented outside as well as inside the churches, at first in the churchyards, and in the vulgar tongue. A Beverley Resurrection play (c. 1220) and some others are bilingual. Miracles were less dependent on this connection with the church services than mysteries proper; and lay associations, guilds in particular, soon began to act plays in honour of their patron saints in or near their own halls. Lastly, as some of these characters came to be depended on by the audiences for conventional extravagance or fun, every new Herod seeking to out-Herod his predecessor, and the devils asserting themselves as indispensable favourites, the comic element in the religious drama increased, and that drama itself grew more profane. The endeavour to sanctify the popular tastes to religious uses, which connects itself with the institution of the great festival of Corpus Christi (1264, confirmed 1311), when the symbol of the mystery of the Incarnation was borne in solemn procession, led to the closer union of the dramatic exhibitions (hence often called *processus*) with this and other religious feasts; but it neither limited their range nor controlled their development.

France. — In France, where dramatic performances had never fallen entirely into the hands of the clergy, the progress was speediest and most decided towards forms approaching those of the modern drama. The earliest play in the French tongue, however, the 12th-century Adam, supposed to have been written by a Norman in England (as is a fragmentary *Résurrection* of much the same date), still reveals its connection with the liturgical drama. Jean Bodel of Arras' niiracle-play of St. *Nicolas* (before 1205) is already the production of a secular author, and has some realistic features. On the other hand, the *Theophilus* of Rutebeuf (d. c. 1280) treats its Faust-like thenie in a rather lifeless form but in a highly religious spirit, and belongs to the cycle of niiracles of the Virgin, of which examples abound throughout this period. Easter or Passion plays were fully established in the towns of France by the end of the 14th century; and in 1402 the *Confrérie* de la Passion obtained a royal privilege for their performance. Of these series of religious plays perhaps the most notable (c. 1450) is that by Arnoul Greban, a canon of Le Mans. Its revision, by Jean Michel (first performed at Angers in 1486), was very popular. Still more elaborate is the Rouen Christmas mystery of 1474, and the celebrated *Mystère du* vieil testament, produced at Abbeville in 1458, and performed at Paris in 1500. Most of the Provençal Christmas and Passion plays date from the 14th century, as well as a miracle of St. Agnes. The miracles of saints were popular in all parts of France, and the diversity of local colouring contributed materially to the growth of the early French drama.

The earliest known secular plays presented by university students in France were moralities, performed in 1426 and 1431. These plays, depicting the struggle between good and evil in the human soul, become more frequent from about this time. Now it is (at Rennes in 1439) the contention between *Bien-avisé* and

Mal-avisé; now, one between *l'homme juste* and *l'homme mondain.* Political and social problems are likewise similarly treated; the *Mystère du Concile* de Rile—an historical morality—dates back to 1432, and in 1507 we even meet with a hygienic or abstinence morality (by N. de la Chesnaye) in which "Banquet" enters into a conspiracy with "Apoplexy," "Epilepsy" and the whole regiment of diseases.

From the beginning of the 14th century onwards the famous fraternity of the Basoche (clerks of the Parlement and the Châtelet) had been entrusted with the conduct of popular festivals at Paris, and had performed plays. But after the *Confrérie* de la Passion had monopolized the religious drama, the basochiens confined themselves to moralities and farces, in which political satire found a place. A third association, the *Enfants* sans *souci,* had, apparently also early in the 15th century, acquired celebrity by their performances of short comic plays called soties, not very distinct from the farces of the Basoche. Other confraternities and associations readily took a leaf out of the book of these devil-may-care good-fellows, and interwove their religious and moral plays with comic scenes and characters from actual life, thus unconsciously preparing the transition to the regular drama.

The earliest known example of a serious secular play written in the French tongue is the Estoire de Griseldis (1393), which is largely indebted to Petrarch. The *Mystère du siège d'Orléans,* on the other hand, written about half a century later, in the epic tediousness of its manner comes near to a chronicle history, and interests us chiefly as the earliest of many efforts to bring Joan of Arc on the stage. Jacques Milet's celebrated mystery of the *Destruction* de Troye la grant (1452) seems to have been addressed to readers and not to hearers only. The beginnings of the French regular comic drama are more difficult to ascertain. But there is ample evidence that the most famous of all mediaeval farces, the immortal *Maistre* Pierre *Pathelin* (otherwise *L'Avocat Pathelin*), was written before 1470 and acted by the *basochiens;* and we may conclude that this delightful story of the biter bit and the profession outwitted typifies a multitude of similar comic episodes of real life, dramatized for the delectation of clerks, lawyers and students, and of all lovers of laughter.

Other Countries.—In the neighbouring Netherlands many Easter and Christmas mysteries are noted from the middle of the 15th century, and with them the celebrated series of the Seven Joys of Mary. To about the same date belongs the small group of abele *spelen* (as who should say plays easily managed), chiefly on chivalrous themes. The moralities were specially cultivated during this century by the *Rederijkers* (rhetoricians)—civic associations which cultivated learned poetry and took an active share in the festivals that formed one of the most characteristic features of the life of the Low Countries. Among these moralities was that of Elckerlijk (printed 1495) which is regarded as the original of the finest of English moralities, *Everyman.*

In Italy traces of the liturgical drama are few, and confined to the north-east. The collective mystery, so common in other Western countries, is represented by a single example only—a *Passione* di *Gesù* Cristo, performed at Revello in Saluzzo in the 15th century; though there are some traces of other cyclic dramas of the kind. The Italian religious plays, called figure when on Old, vangeli when on New, Testament subjects, differ from those of northern Europe chiefly by the less degree of coarseness in their comic characters, and seem largely to have developed from the processional element in the festivals of the church. Besides such processions as that of the Three Kings at Epiphany in Milan, there were the penitential processions and songs (laude), which at Assisi, Perugia and elsewhere already contained a dramatic element; and at Siena, Florence and other centres these again developed into the so-called (*sacre*) *rappresentazioni.* Such a piece was the *San Giovanni* e *San* Paolo (1489), by Lorenzo the Magnificent; another was the *Santa* Teodora, by Luigi Pulci (d. c. 1484); San *Giovanni Gualberto* (of Florence) treats the religious experience of a latter-day saint; Rosana e Ulimento is a love-story with a Christian moral. Passion plays were performed at Rome in the Coliseum by the *Compagnia* del *Gonfalone;* but there is no evidence on this head before the end of the 15th century. In general, the spectacular magnificence of Italian theatrical displays accorded with the growing pomp of the processions both ecclesiastical and lay—called *trionfi* already in the days of Dante; while the religious drama gradually acquired an artificial character and elaboration of form assimilating it to the classical attempts, to be noted below, which gave rise to the regular Italian drama.

Remnants of the ancient popular drama survived in the improvised farces performed at the courts, in the churches (farse *spirituali*), and among the people; the Roman carnival had preserved its wagon-plays, and various links remained to connect the modern comic drama of the Italians with the Atellanes and *mimes* of their ancestors. But the later comic developments will be noticed below.

In Spain hardly a monument of the mediaeval religious drama has been preserved. There is manuscript evidence of the 11th century attesting the early addition of dramatic elements to the Easter office; and a Spanish fragment of the Three Kings Epiphany play, dating from the 12th century, is one of the very earliest examples of the mediaeval drama in the vernacular. But that religious plays were performed in Spain is clear from the permission granted by Alphonso X. of Castile (d. 1284) to the clergy to represent them, while prohibiting juegos de escarnio (mocking plays). The earliest Spanish plays which we possess belong to the end of the 15th or beginning of the 16th century, and already show humanistic influence. In 1472 the couplets of Mingo *Revulgo* (*i.e.,* Domingo Vulgus, the common people), and about the same time another dialogue by the same author, offer examples of a sort resembling the Italian *contrasti* (see below).

The German religious plays in the vernacular, the earliest of which date from the 14th and 15th centuries and were produced at Trier, Wolfenbuttel. Innsbruck, Vienna, Berlin, etc., were of a simple kind; but in some of them, though they were written by clerks, there are traces of the minstrels' hands. The play of *The Wise and* the Foolish Virgins, in a Thuringian ms. thought to be as early as 1328, a piece of remarkable dignity, was evidently based on a Latin play. In the same century miracle-plays began to be performed, in honour of St. Catherine, St. Dorothea and other saints. The Corpus Christi plays, or *Frohnleichnamsspiele,* are notable, since that of Innsbruck (1391) is probably the earliest extant example of its class. The number of non-scriptural religious plays in Germany was much smaller than that in France; but the theme of the last judgment was common in Germany in the later middle ages. Of this theme Antichrist may be regarded as an episode, though in 1469 an Antichrist appears to have occupied at Frankfort four days in its performance. The earlier (12th century) Antichrist is unique of its kind; this political protest breathes the Ghibelline spirit of the reign (Frederick Barbarossa's) in which it was composed. While the Shrove-Tuesday plays (*Fastnachtsspiele*) of the professional strollers (jahrende Leute) reproduced the practical fun of common life, they occasionally, as in the Liibeck *Fastnachtsspiel* of the Five Virtues, contained an element of the morality, but the main productivity of the writers of moralities and cognate productions falls into the periods of Renaissance and Reformation; and the religious drama proper survived far beyond either in Catholic Germany, and, in fact, was not suppressed in Bavaria and Tirol till the end of the 18th century.

The performance of miracle-plays is traceable in Sweden in the late 14th century; and the Germans who immigrated into the Carpathian lands, and into Galicia in particular, in the later middle ages, brought with them their religious plays. This fact is the more striking, as, though Czech Easter plays were performed about the end of the 14th century, we hear of none among the Magyars, or among their neighbours of the Eastern empire.

Religious Drama in England.—Coming now to the English religious drama, we find that from its extant literature a fair general idea may be derived of the character of these mediaeval productions. The nziracle-plays, miracles or plays (these being the terms used in England) of which we hear in London in the 12th century were probably written in Latin and acted by

ecclesiastics; but in the following century mention is made—in the way of prohibition—of plays acted by professional players. In England as elsewhere, the clergy either sought to control the religious plays, which were occasionally acted in churches even after the Reformation, or else reprobated them, with or without qualifications. In Cornwall miracles in the native Cymric dialect were performed at an early date in extensive amphitheatres constructed for the purpose—one of which, at St. Just near Penzance, has been restored; but those which have been preserved are apparently copies of English or French originals.

The flourishing period of English miracle-plays begins with the practice of their performance by trading-companies in the towns. Of this practice Chester is said to have set the example (1268–76), which was followed by many other towns. These towns with their neighbourhoods include, starting from East Anglia, where the religious drama was particularly at home, Wymondham, Norwich, Sleaford, Lincoln, Leeds, Wakefield, Beverley, York, Newcastle-on-Tyne, with a deviation across the border to Edinburgh and Aberdeen. In the north-west they are found at Kendal, Lancaster, Preston, Chester; whence they may be supposed to have migrated to Dublin. In the west they are noticeable at Shrewsbury, Worcester and Tewkesbury; in the Midlands at Coventry and Leicester; in the east at Cambridge and Bassingbourne, Heybridge and Manningtree; to which places have to be added Reading, Winchester, Canterbury and London, in which last the performers were the parish-clerks. Four collections, in addition to some single examples of such plays, have come down to us: the *York* plays, the so-called *Towneley* plays, which were probably acted at the fairs of Widkirk, near Wakefield, and those bearing the names of *Chester* and of *Coventry*. Their dates are more or less uncertain; that of the *York* seems to be earlier than that of the *Towneley*, which were probably put together about the middle of the 14th century; the *Chester* may be ascribed to the 14th or early 15th; the body of the *Coventry* to the 15th or 16th. Many of the individual plays in these collections were doubtless founded on French originals; others are taken direct from Scripture, from the apocryphal gospels, or from the legends of the saints. Their characteristic feature is the combination of a whole series of plays into one *collective* whole, exhibiting the entire course of Bible history from the creation to the day of judgment. The oldest of the series—the *York* plays—exhibits a fairly close parallel to the scheme of the *Cursor mundi* (*q.v.*). Among the isolated plays may be mentioned *The Harrowing of Hell* and several belonging to a series known as the *Digby Mysteries*, including *Parfre's Candlemas Day* (the massacre of the Innocents), and the miracle of *Mary Magdalene*. Of the so-called "Paternoster" and "Creed" plays (which exhibit the miraculous powers of portions of the church service) no example remains, though of some we have an account; the Croxton *Play of the Sacrament*, the late 15th century ms. of which is preserved at Dublin, exhibits the triumph of the holy wafer over wicked Jewish wiles.

Each play was performed by the representatives of a particular trade or company, after whom it was called the fishers', glovers', etc., *pageant;* while a general prologue was spoken by a herald. As a rule the movable stage sufficed for the action. though we find horsemen riding up to the scaffold, and Herod instructed to "rage in the pagond and in the strete also." There is no evidence that the stage was, as in France, divided into three platforms with a dark cavern at the side of the lowest, appropriated respectively to the Heavenly Father and his angels, to saints, to mere men, and to souls in hell. But hell was frequently displayed in the English miracles, with or without fire in its mouth. The costumes were in part conventional—divine and saintly personages being distinguished by gilt hair and beards, Herod being clad as a Saracen, the demons wearing hideous heads, the souls black and white coats according to their kind, and the angels gold skins and wings. The plays contained an element of humour, often broadly farcical; but much that seems ludicrous or coarse to modern standards of taste would not have so struck contemporaries. The *York* Corpus Christi plays (48) are comparatively free from the tendency to jocularity and vulgarity observable in the *Towneley;* several of the plays concerned with the New Testament and early Christian story are, however, in substance common to both series. The *Towneley Plays* or *Wakefield Mysteries* (32), composed by the friars of Widkirk or Nostel, are of a popular character; and are superior in vivacity and humour to both the later collections. The *Chester Plays* (25) were indebted to the *Mystère du vieil testament* and to earlier French mysteries; they are less popular in character than the two earlier cycles, and on the whole undistinguished by pathos or humour. While these plays were performed at Whitsuntide, the *Coventry Plays* (42) were Corpus Christi performances. They are far more effectively written than the *Chester Plays*, and occasionally rise to real dramatic force. In the *Coventry* series there is already to be observed an element of abstract figures, which connects them with the moralities.

English Moralities.—The *moralities* corresponded to the love for allegory which, while dominating the whole field of mediaeval literature, was nowhere more evident than in England. Moreover, a specially popular element was supplied to these plays in a character borrowed from the miracles and usually provided with a companion whose task it was to lighten the weight of such abstractions as Sapience and Justice. These were the *Devil* and his attendant, the *Vice;* of whom the latter seems to have been of native origin, and, as he was usually dressed in a fool's habit, was probably suggested by the custom of keeping an attendant fool at court or in great houses. The Vice had many *aliases (Shift, Ambidexter, Sin, Fraud, Iniquity*, etc.), but his usual duty is to tease the Devil his master for the edification and diversion of the audience. He was gradually blended with the domestic fool, who survived in the regular drama.

The earlier English moralities—from the reign of Henry VI. to that of Henry VII.—usually allegorize the conflict between good and evil in the mind and life of man, without any side-intention of theological controversy. Such also is still essentially the purpose of the extant morality, *Maguyfycence*, by Henry VIII.'s poet, the witty Skelton. *Everyman* (pr. *c.* 1529), perhaps the most perfect example of its class, contains passages certainly designed to enforce the specific teaching of Rome. But its Dutch original was written at least a generation earlier, and could have no controversial intention. On the other hand, R. Wever's *Lusty Juventus* breathes the spirit of the dogmatic reformation of the reign of Edward VI. Theological controversy largely occupies the moralities of the earlier part of Elizabeth's reign, and connects itself with political feeling in Sir David Lyndsay's *Satire of the Three Estaitis*, written and acted (at Cupar, in 1539) on the other side of the border, where the religious drama proper had been extinguished by the Reformation. Only a single English political morality proper remains to us, which belongs to the beginning of the reign of Elizabeth (*Albyon Knight*). Another series connects itself with the ideas of the Renaissance rather than the Reformation, treating of intellectual progress rather than of moral conduct; this extends from the reign of Henry VIII. to that of Elizabeth. Besides these, there remain some Elizabethan moralities which have no special theological or scientific purpose, and are none the less lively in consequence.

The transition from the morality to the regular drama in England was effected, on the one hand, by the intermixture of historical personages with abstractions—as in Bishop Bale's *Kyng Johan* (c. 1548)—which easily led over to the *chronicle history;* on the other, by the introduction of types of real life by the side of abstract figures. This latter tendency is observable in several of the 16th-century moralities; but before most of these were written, a further step had been taken by a man of genius, John Heywood (b. *c.* 1500, d. between 1577 and 1587), whose "interludes" were short farces in the French manner. Heywood's interludes dealt entirely with real—very real—men and women. Other writers, such as T. Ingeland, took the same direction; and the allegory of abstractions was thus undermined on the stage. Thus the interludes facilitated the advent of comedy, without having superseded the earlier form. Both moralities and miracle-plays survived into the Elizabethan age after the regular drama had already begun its course.

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THE MODERN NATIONAL DRAMA

The literary influence, which finally transformed the growths noticed above into the national dramas of Europe, was that of the Renaissance. Among the remains of classical antiquity which were studied, translated and imitated, those of the drama necessarily held a prominent place. They now became subjects of devoted research and models for more or less exact imitation, first in Greek or Latin, then in modern tongues. This process it will be most convenient to pursue *seriatim,* in connection with the rise and progress of the several dramatic literatures of the West. For no sooner had the stream of the modern drama, whose source and contributories have been described, been brought back into the ancient bed, than its flow diverged into a number of national currents.

ITALY

The priority in this as in most of the other aspects of the Renaissance belongs to Italy. In ultimate achievement the Italian drama fell short of the fulness of the results obtained elsewhere. The cause is doubtless to be sought in the social and political conditions of the period. Literature and the arts were by many considered a refuge from the harassing necessities of daily life, not an incentive to virtue and virtuous action. Violent strife between neighbouring States was followed by a brief period of peace (after 1452) and then by foreign domination. Disgust was as deep as despair. Classical imitation was no help to original creation and to the representations of a society that had no real connection with the society of Rome, and the realistic Italian genius seemed averse to the idealism of tragic characterization.

It is, of course, necessary to take Latin models into account in dealing with the Italian literature of the middle ages and the Renaissance; but learned imitations need not be overrated or mistaken as the only source of the Italian drama. No less than in other countries the religious ritual, particularly of the Holy Week, gave rise, locally to dramatic representations performed inside and outside the churches, and on these liturgical plays, which were originally in Latin, depended the earliest mystery plays in the vernacular. They are sometimes difficult to distinguish from the dramatic dialogues which sprang out of religious song in the vernacular *(laudi)* in the 13th and 14th centuries. The 14th century mystery plays of Cividale, Florence and Rome are traces of such early and rudimentary dramatic shows, and it is interesting to note that they made their appearance independently in different parts of the country. Favourable conditions for the development of a national drama were, however, lacking. On the one hand the establishment of tyrannies in the place of feudal States and free cities, on the other the intentional imitation of the classics hindered spontaneous development and overshadowed such timid attempts as had been made. Intellectual life became centred in the courts, and courtiers and princes were fond of gorgeous shows and rare spectacles. There are records of complex allegorical shows during the 15th century which mere partly based on the forms of the mystery plays. The daring innovation of the 17-year-old Politian who composed a pastoral mystery play on a mythological instead of a Christian subject *(Orfeo,* 1471) should be connected with these allegorical shows. In the *Orfeo,* no less than in the allegorical shows, a considerable part is made over to musical interludes, thus pointing the way to the later transformation of pastoral drama into the modern opera. At the same time the refined and not a little sophisticated audiences at the courts showed some interest at first in the production of Latin plays of Terence and Plautus, in translations, mostly bad and verbose, of the same plays, and later in imitations. The revival of learning had before then stimulated university students and learned scholars to write, and occasionally to perform, shapeless plays in which the technique of the classical comedy and of mystery plays was combined. Petrarch is said to have written a comedy *(Philologia),* Leonardo Bruni wrote the *Poliscena,* Piccolomini the *Chrisis* before he became Pope Pius II; and many others could be cited, but none that achieved real success and was capable of influencing later works; and all were comedies. Tragedy had been in Italy a purely literary exercise from the beginning.

To the later middle ages classical tragedy meant Seneca and the first mediaeval follower of Seneca, Albertino Mussato (1261–1330), may in a sense be called the father of modern dramatic literature. Born at Padua, to which city all his services were given, he in 1315 brought out his *Ecerinis,* a Latin tragedy very near to the confines of epic poetry, intended to warn the Paduans against the designs of Cangrande della Scala. Other tragedies of much the same type followed during the ensuing century; such as L. da Fabiano's *De casu Caesenae* (1377) a sort of chronicle history in Latin prose on Cardinal Albornoz' capture of Caesena. Of G. Manzini della Motta's Latin tragedy on the fall of Antonio della Scala only a chorus remains. He died after 1389. Later plays in Latin of the historic type are the extant Laudivio de' Nobili's *De captivitate Ducis Jacobi* (the *condottiere* Jacopo Piccinino, d. 1464); C. Verardi's *Historia Baetica* (1492), and the same author's *Ferdinandus* (of Aragon) *Servatus.* Purely classical themes were treated in the *Achilleis* of A de' Loschi of Vicenza (d. 1441), in the sketchy *Progne* of the Venetian Gregorio Coraro (c. 1430), and in later Latin productions.

This dramatic revival was confined to the learned class, and it hindered rather than helped the spontaneous growth of Italian drama from mystery plays.

Italian Tragedy. — Early in the 16th century, tragedy began to be written in the native tongue; but it retained from the first, and never wholly lost, the impress of its origin. The chorus, stationary on the stage as in old Roman tragedy, was not reduced to a merely occasional appearance between the acts till the beginning of the 17th century, or ousted altogether from the tragic drama till the earlier half of the 18th. The honour of having been the earliest tragedy in Italian belongs to A. da Pistoia's Pamfila (1499); Carretto's Sofonisba followed in 1502 and M Guazzo's *Discordia d'amore* (c. 1540). But the play usually associated with the beginning of Italian tragedy was another Sofonisba, acted before Leo X. in 1515, and written in blank hendecasyllables instead of the ottava and *terza rima* of the earlier tragedians (retaining, however, the lyric measures of the chorus), by G. G. Trissino. Other tragedies of the former half of the 16th century, largely inspired by Trissino's example, were the Rosmunda and the *Oreste* of Rucellai, a nephew of Lorenzo the Magnificent (1j16); Martelli's *Tullia;* A. de' Pazzi's Dido (1524); Alamanni's *Antigone* (1531); the *Canace* of Sperone Speroni, closely based on Speroni's interpretation of Aristotle's Poetics; Orazia, the earliest dramatic treatment of this famous subject by the notorious Aretino (1549); and the nine tragedies of G. B. Giraldi (Cinthio) of Ferrara, among which *L'Orbecche* (1541) is accounted the best and bloodiest. In the latter half of the 16th century may be mentioned the *Didone* and the *Marianna* of L. Dolce, the translator of Euripides and Seneca (1565); A. Leonico's *Il* Soldato (1550); the *Adriana* (acted before 1561 or 1586) of L. Groto, which treats the story of Romeo and Juliet; Tasso's *Torrismondo* (1587); the *Tancredi* of Asinari (1588); and the *Merope* of Torelli (1593), the last to employ the stationary chorus (*coro* fisso) on the Italian stage.

It was realized at the end of the 16th century that Italian tragedians could claim no outstanding success, and this feeling, becoming ever stronger during the following century, was partly responsible for an activity as feverish as it was unsuccessful. Lacking genius and inspiration, tragedians tried to win fame by technical innovations and changes in the subject matter. Next to tragedies composed in the strictest adherence to classical models, there were plays of romantic adventure and love. Besides ancient subjects religious subjects were favoured, particularly by the Jesuits, among whom Ferrante Pallavicino and Scammacca may be mentioned; also historical subjects were treated, if with little respect for historical truth, and with them could be classed many tragedies dealing with contemporary events. The scene was seldom placed in Italy; it was mostly in Asia as being conveniently remote and unknown, occasionally it was in Spain and in England (*e.g.,* Graziani's *Cromuele,* Savaro's Anna Bolena, Maria *Stuarda*). In romantic and sacred tragedies the influence of the Spanish drama is clearly traceable, but in the course of time French influence triumphed. As if all hopes of an Italian masterpiece were abandoned, at the end of the 17th century only poor imitations and bad translations of French neo-classical plays were produced.

At the beginning of the 18th century a strong reaction set in against such an influence; it took the form of searching criticism and advocated a return to the spirit of the classics combined with a more liberal interpretation of classical rules. Before long the marquis S. Maffei with his *Merope* (first printed in 1713) achieved one of the most brilliant successes recorded in the history of dramatic literature. This play, which is devoid of any love-story, long continued to be considered the masterpiece of Italian tragedy. A. Conti (1677–1749) comes next to Maffei in importance; he much admired the French and was familiar with the Shakespearian drama. Among the lesser tragedians P. J. Martelli (1665–1727), V. Gravina (1664–1718) and V. Bettinelli (1718–1808) may be mentioned. The influence of Voltaire had now come to predominate over the Italian drama; and, in accordance with the spirit of the times, greater freedom prevailed in the choice of tragic themes. Thus the greatest of Italian tragic poets, Count V. Alfieri (1749–1803), found his path prepared for him. Alfieri, an adventurous and romantic man, accepted the most rigid interpretation of the "rules" as expounded by Voltaire, but he aimed at freeing the Italian drama from French influence, at creating a rugged style suited to the expression of patriotic sentiments, and above all at inspiring love of freedom and hatred of political tyranny. Despite formal defects he certainly achieved his end, for his influence was lasting on modern Italian literature in general and particularly strong on Foscolo and Carducci. Among his numerous plays (21), *Merope* and *Saul,* and perhaps Mirra, are accounted his masterpieces.

The political colouring given by Alfieri to Italian tragedy reappears in the plays of U. Foscolo and A. Manzoni, both of whom are under the influence of the romantic school of modern literature; and to these names must be added those of S. Pellico and G. B. Niccolini (1785–1861), Paolo Giacometti (b. 1816) and others, whose dramas treat largely national themes familiar to all students of modern history and literature.

Italian Comedy. — In comedy, the efforts of the scholars of the Italian Renaissance for a time went side by side with the progress of the popular entertainments noticed above. The farsa was still under mediaeval influences, and in this popular form Alione of Asti and P. A. Caracciolo of Naples (soon after 1500) were specially productive. Such diversions became popular and were at first performed by guildsmen (such as the Rozzi of Siena) who soon were succeeded by professional actors; the improvised comedy (*commedia* a soggetto) required special histrionic gifts and training, and was thence called the cornmedia dell' arte. Its scenes, still unwritten except in skeleton (scenario), were connected together by the ligatures or links (*lazzi*) of the arlecclzino. Parallel to this growth was that of the masked comedy, the action of which was chiefly carried on by certain typical figures in masks, speaking in local dialects. Its earliest exponents were A. Beolco of Padua (1502–42), who called himself Ruzzante (joker), and is memorable under that name as the first actor-playwright and A. Calmo (1510–TI), the inventor of the mask of Pantalone.

Meanwhile, the Latin imitations of ancient comedies early led to the production of Italian translations, several of which were performed at Ferrara in the last quarter of the 15th century, whence they spread to Milan, Pavia and other towns of the north. Contemporaneously, imitations of Latin comedy made their appearance. The earliest plays still gave a large part to the mythological and pastoral elements (*e.g.,* Boiardo's Timone and G. del Carretto's *Tempio d'Amore*), but soon a regular comedy was produced by P. F. Mantovano (*Formicone,* 1506) who was almost immediately followed by Ariosto (Cassaria, 1508). Ariosto mostly kept close to his Latin models. His plots are cleverly arranged, but he seldom shows real gifts of dramatic characterization and *vis comica;* among his six completed comedies the *Negromante* (1520) and the *Lena* (1528) are considered the best. Comedies on plots from the classics or the novelists were written by J. Nardi, B. Dovizi (Calandria, 1j13) and others. Machiavelli's *Mandragola* (1513) stands out as by far the best of all and gives a wonderful picture of the corruption of his day. While many discussed the nature of drama, it was P. Aretino who excelled as a playwright, two among his comedies (*Cortigiana,* 1525, and *Marescalco,* 1527) being good fun and true to life. Among the countless comedians of the age may be mentioned L. Alamanni (1495–1556), L. Groto (1541–85), Lorenzino de' Medici (1514–48), G. F. Grazzini, called I1 Lasca (1503–84), whose Strega and *Spiritata* were known in England and whose *Assiuolo* is rightly celebrated, the prolific G. B. della Porta (1535–1615), imitated by Tomkins and Ruggle, and finally G. Bruno, the philosopher, whose pessimistic views of life found a masterly expression in Candelaio (1582).

Pastoral Drama. — During the same century the "pastoral drama," a purely literary development of the bucolic idyll, flourished in Italy; its earliest example is Polilian's Orfeo (1472), which begins like an idyll and ends like a tragedy. N. da Correggio's (1450–1508) Ccfalo and others followed, before in 1554

A. Beccari produced his Arcadian pastoral drama *Il Sagrifizio,* in which the comic element predominates. But an epoch in the history of the species is marked by the Aminta of Tasso (1573); its charm lies not in the interest of its action, but in the passion and sweetness of its sentiment. This work was the model of many others, and the pastoral drama reached its height of popularity in the famous Pastor *fido* (written before 1590) of G. B. Guarini. The artificiality of the pastoral drama impressed itself in an intensified form upon the opera. The foremost Italian masters of the last-named species, so far as it can claim to be included in the poetic drama, were A. Zeno (1668–1750) and P. Metastasio (1698–1782), the master of melodious verse, who succeeded in writing librettos of so rare a literary merit as to call forth Voltaire's unstinted praise.

The comic dramatists of the 17th century are grouped as followers of the classical and of the romantic school, G. B. della Porta (q v.) and G. **A.** Cicognini being regarded as the leading representatives of the former. But neither of these largely intermixed groups of writers could prevail against the competition of the musical drama, of the popular farcical entertainments and of those introduced in imitation of Spanish examples. Italian comedy had fallen into decay, when its reform was undertaken by the wonderful theatrical genius of C. Goldoni. One of the most fertile and rapid of playwrights (of his 150 comedies 16 were written and acted in a single year), he at the same time pursued definite aims as a dramatist. Disgusted with the conventional buffoonery, and ashamed of the rampant immorality of the Italian comic stage. he drew his characters from real life and succeeded best when he employed the Venetian dialect instead of the literary language. Goldoni met with a severe critic and a temporarily successful rival in Count C. Gozzi (1722–1806), who sought to rescue the comic drama from its association with the actual life of the middle classes, and to infuse a new spirit into the figures of the old masked comedy by the invention of a new species which has found favour with recent writers.

Italian Drama of the 19th Century. — During the latter part of the 18th century French influence was strong in all departments of literature and acted as a dissolvent of traditional distinctions. There were tragedians who imitated Alfieri's models with considerable freedom, as Monti and Foscolo; comedians who kept more or less close to Goldoni; but lesser playwrights sought easier success by falling in with the predominant taste for sentimental and lachrymose drama. Romanticism was at the gates. Manzoni's *Carmagnola* (1820) and *Adelchi* (1822) were historical tragedies wholly free from the observance of the unities; they were praised by Goethe but met with scant success Pellico's tragedies lacked fire and characterization; G. B. Niccolini (1782–1861) attempted the classical as well as the romantic drama and owed his fame to the patriotic sentiments that his characters embodied (G. da Procida, 1830; Arnaldo da *Brescia,* 1843). Also P. Cossa at first imitated Alfieri, but he later won fame with historical tragedies (*Nerone,* 1870).

For a time comedians continued in Goldoni's tracks, as G. G. de' Rossi (1754–1827), G. Giraud (1776–1834) and A. Nota (1775–1847); later from France there was imported a new form of drama which partook of tragedy and comedy, and aimed at a realistic representation of life. In a land in which dialects were regularly spoken even by the educated classes. realism necessarily led to the purely dialectal drama such as Goldoni had long since written; thus P. Ferrari (1822–89) began by writing comedies in Modenese dialect, later he won success with historical comedies (Goldoni, *Parini*), and later still, prompted by the example of contemporary French writers. he brought social problems on to the stage (*Il duello*). With him contemporary drama may be said to begin. Stress was laid on social conditions and psychological problems by G. Verga (1840–1928), G. Giacosa (1847–1906), E. A. Butti (1865–1911) and with less force by G. Rovetta. The same subjects on a more realistically described background were treated in dialectal plays by the Venetian G. Gallina (1852–97), by Milanese, Piedmontese, Florentine, Neapolitan and Sicilian playwrights. During the last years of the 19th century the dialectal drama appeared to be losing ground, but it was later revived, particularly in some regions, as in Naples nherc it was helped by so gifted a writer as S. di Giacomo (1862–1934). The fortunes of dialectal drama depend as much on the actors as on playwrights, a circumstance of some relevance for Italian drama in general; at different periods during the 19th century great actors such as G. Modena. C. Rossi, T. Salvini, A. Ristori, E. Duse, E. Novelli and E. Zacconi exercised a notable influence on the taste of the public and of the playwrights themselves. Among dialectal actors E. Ferravilla, F. Benini, G. Grasso should be remernbered. D'Annunzio (1863–1938) tried without success to force the fashion of lyrical tragedy (*e.g., Città morta,* 1898, *Francesca* da *Rimini,* 1901) by sheer beauty of staging and literary skill; and he found followers in Butti (Castello del sogno, 1910), S. Benelli (Cena delle *beffe,* 1909), E. A. Morselli (*Orione,* 1910). Much interest was aroused by R. Bracco's plays, in which psychological problems are studied from an intellectual angle not unlike Ibsen's (*Piccola* fonte, 1905, Piccolo santo, 1912), and by the work of the prolific L. Pirandello (1867–1936) who succeeded by great technical skill in making his challenge to reality a source of interest to his audiences. This "cerebral" drama has had imitators in L. Chiarelli (La maschera e *il volto,* 1917), L. Antonelli, F. M. Martini and others.

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GREECE

Dramas began to be composed from the beginning of the 19th century, but those early works were literary rather than dramatic, and their obvious imitation of the ancient tragedies makes them rather lifeless. The only tragic poet of this early period worthy of the name is **I.** Zamkelios. About the middle of the century there were signs of theatrical life in Athens. Alexandros Rhizos Rhankavēs cultivated all its branches, writing comedies and historical dramas not devoid of interest. But the best and only surviving work of the Othonian age is the Babylonia of Byzantios, a graceful representation of the dialects and customs of the different Greek provinces. The dramatic movement was somewhat systematized during the last decades of the 19th century; two species were specially cultivated — the metrical Byzantine drama (inspired by the German and French romanticists with mediaeval plots), and the comedy of manners. The leading representative of the former was Demetrios Bernardakes; of the latter, Demetrios Koromelâs. About the beginning of the 20th century there was a great movement, suggesting the "busy '90s" of the English theatre. Ring George founded the Royal (now National) theatre, and K. Chrestomanos the "New Stage"— both short-lived foundations, but nevertheless training-schools for actors and authors. During the 1st decade of the 20th century were played remarkable metrical works of Bernardakes, Kleon Rhangabês and I. Polemes, historical comedies describing the political history of 1830–80 (of which the best was the Occupation, *i.e.*, the Anglo-French occupation during the Crimean War, by Bokos), and many social comedies. This last class has alone survived World War I, its three chief representatives being Spyros Melâs, Gregorios Xenopoulos and Penteles Horn.

There are several good dramatists and many good actors; Greece possesses in Kotopoule and Kybele two great actresses. But the general belief is that the Greek theatre requires the foundation of a State playhouse or, at least, of one unconnected with the earning of profits.

See G Bocerdon, *Le théâtre* grec *contemporain* (1892); **A.** M. Andreades. Le *Théâtre* grec *contemporain* (Genève, 1927) (W. M.)

SPAIN

Spain is the only country of modern Europe which shares with England the honour of having achieved, at a relatively early date, the creation of a genuinely national form of the regular drama. The tragi-comedy of *Calisto and Melibea* by *F.* de Rojas, which was completed (in 21 acts) by 1499, became famous under the name of *Celestina*. But the father of the Spanish drama was J. de la Enzina, whose *representaciones* under the name of "eclogues" were dramatic dialogues of a religious or pastoral character. His attempts were imitated by the Portuguese Gil Vicente. who wrote for the stage in the period 1502–36, and used both Spanish and his native tongue. A further impulse came, as was natural, from Spaniards, resident in Italy, and especially from B. de Torres Naharro, who in 1517 published, as the chief among the "firstlings of his genius" *(Propaladia)*, a series of eight *comedias*—*a* term generally applied in Spanish literature to any kind of drama. He claimed some knowledge of the theory of the ancient drama, divided his plays into *jornadas* (to correspond to acts), and opened them with an *introyto* (prologue). Bible plays continued to be acted in church and square, sometimes with elaborate stage scenery. Though the universities produced both translations from the classical drama and modern Latin plays, these exercised very little general effect; but in 1528 H. Perez de Oliva published *La Vengança de Agamenon*, a Spanish adaptation of the *Electra* of Sophocles. Juan Perez's (Petreius') posthumous Latin comedies were mainly versions of Ariosto.

Thus the foundation of the Spanish national theatre was reserved for a man of the people. Cervantes has vividly sketched the humble resources which were at the command of Lope de Rueda, a gold-beater of Seville, who with his friend the bookseller Timoneda, and two brother authors and actors in his strolling company, succeeded in bringing dramatic entertainments out of the churches and palaces into the public places of the towns, where they were produced on temporary scaffolds. The manager carried about his properties in a corn-sack; and the "comedies" were still only "dialogues, and a species of eclogue between two or three shepherds and a shepherdess," enlivened at times by intermezzos of favourite comic figures, such as the negress or the Biscayan. Rueda is now remembered for the lively brief scenes of his *pasos*.

Lope **de Vega.**—The Sevillian J. de la Cueva gave the Spanish drama an ampler and more national expression and thus paved the way for Lope de Vega, one of the most astonishing geniuses the world has known. His fertility, which was such that he wrote about 1,800 plays, besides 400 dramatic works classed as *autos sacramentales* and *entremeses*, and a vast series of other literary compositions, has indisputably prejudiced his reputation with those to whom he is but a name and a number. Yet as a dramatist Lope more fully exemplifies the capabilities of the Spanish theatre than any of his successors, though as a poet Calderon may deserve the palm. With all its inventiveness and vigour, the genius of Lope primarily set itself the task of pleasing his public, —the very spirit of whose inner as well as outer life is accordingly mirrored in his dramatic works.

The plays of Lope, and those of the national Spanish drama in general, are divided into classes which it is naturally not always easy, and which there is no reason to suppose him always to have intended, to keep distinct from one another. After composing, in his early youth, eclogues, pastoral plays, and allegorical moralities in the old style, he began his theatrical activity at Madrid about 1590, and the plays which he thenceforth produced have been distributed under the following heads. The *comedias*, all of which are in verse, include (1) the so-called c. *de capa y espada*—not comedies proper, but dramas in which the principal personages are taken from the class of society that wears cloak and sword. Gallantry is their main theme, an interesting and complicated, but well-constructed and perspicuous intrigue their chief feature; and this is usually accompanied by an underplot in which the *gracioso* (the comic servant domesticated in the Spanish drama by Lope) plays his part. Their titles are frequently taken from the old proverbs or proverbial phrases of the people, upon the theme suggested by which the plays often constitute a kind of gloss *(glosa)* in action. This is the favourite species of the national Spanish theatre; and to the plots of the plays belonging to it the drama of other nations owes a debt almost incalculable in extent. (2) The *c. heróicas* are distinguished by some of their personages being of royal or very high rank, and by their themes being often historical and largely (though not invariably) taken from the national annals, or founded on contemporary or recent events. Hence they exhibit a greater gravity of tone; but in other respects there is no difference between them and the cloak-and-sword comedies with which they share the element of comic underplots. Occasionally Lope condescended in the opposite direction, to (3) plays of which the scene is laid in common life, but for which no special name appears to have existed. After a few dramas on scriptural subjects he turned to the legends of the saints; and the *comedias de santos*, of which he wrote a great number, became an accepted later Spanish variety of the miracle-play. True, however, to the popular instincts of his genius, he threw himself with special zeal and success into the composition of another kind of religious plays—a development of the Corpus Christi pageants, in honour of which all the theatres had to close their doors for a month. These were the famous *autos sacramentales* (*i.e.*, solemn "acts" or proceedings in honour of the Sacrament), which were performed in the open air by actors who had filled the cars of the sacred procession. Of these Lope wrote about 400.

He wrote for a popular audience at Madrid, where the first permanent theatre, the Teatro de la Cruz, was established in 1579. In his *Arte Nuevo de hacer comedias* (1609) he showed that theoretically he favoured the unities but deliberately locked up these rules in obedience to popular demand. Against this overwhelming popularity the protests of Cervantes and L. L. de Argensola, who advocated a more serious, less fantastic drama, were unavailing.

The genius of Cervantes was not technically more dramatic than that of Argensola, although his *Numancia* still holds the reader by its vigorous national spirit, and his short *entremeses* display his wonderfully graphic delineation of types. The real rivals and peers of Lope were J. Ruiz de Alarcón and the Mercenarian friar Gabriel Tellez, who adopted the pseudonym Tirso de Molina. The latter, author of the famous *El Burlador de Sevilla y Convidndo de Piedra*, composed over 400 plays in 20 years; in terse versification, natural presentment of scenes and characters, comic force and in studies of women he can equal and excel Lope himself. The Mexican Ruiz de Alarcón disdained to woo the crowd; he wrote few but masterly plays, marked by careful finish and a serious moral purpose. By the side of these giants, other playwrights who would otherwise have taken first rank almost fade into insignificance. Lope's most devoted disciple, J. P. de Montalban died mad at the age of 36 in 1638, seven years after Guillén de Castro, whose *Las Mocedades del Cid* was the basis of Corneille's play. A. Mira de Amescua's plays were constantly laid under contribution by contemporary dramatists; and a greater playwright, F. de Rojas Zorrilla, was largely plundered by the French dramatists of the latter half of the century. His play *Del rey abajo ninguno* is as celebrated as the historical play *La Estrella de Sevilla*, which is now definitively known not to be by Lope and is tentatively ascribed to P. de Cardenas.

Calderon.—The glories of Spanish dramatic literature reached their height in P. Calderon de la Barca, though in the history of the Spanish theatre he holds only the second place. He elaborated some of the forms of the national drama, but brought about no changes of moment in any of them. Even the brilliancy of his style, glittering with a constant reproduction of the same family of tropes, and the variety of his melodious versification, are mere intensifications of the poetic qualities of Lope. In fertility Calderon was inferior to Lope (for he wrote not many more than 100 plays); but he surpasses the elder poet in richness of style, and more especially in fire of imagination. In his *autos* (of which he is said to have left not less than 73), Calderon probably attained to his most distinctive excellence; some of these appear to take a wide range of allegorical invention, while they uniformly possess great beauty of poetical detail. Other of his most famous or interesting pieces are *comedias de santos*. In his secular plays

he treats as wide a variety of subjects as Lope, but it is not a dissimilar variety; nor would it be easy to decide whether a poet so uniformly admirable within his limits has achieved greater success in romantic historical tragedy *(El Principe constante)*, in the comedy of amorous intrigue *(La Dama duende)*, or in a dramatic work combining fancy and artificiality in such a degree that it has been diversely described as a romantic caprice and as a philosophical poem *(La Vida es sueño)*.

The *autos* continued to flourish till in 1765 (shortly before the expulsion of the Jesuits from Spain) their public representation was prohibited by royal decree. In the world of fashion, the opera had reached Spain already during Calderon's lifetime, together with other French influences, and the great dramatist had himself written one or two of his plays for performance with music. But the regular national drama continued to command popular favour, and A. Moreto (1618–69), although imitative, achieved notable success with his *comedias de figurón* and with his masterpiece, *El desddn con el desdén*.

Later **Dramatists.**—After the end of the 17th century the Spanish drama suffered half a century of eclipse. The earliest Spanish comedy in the French form (a translation only, though written in the national metre) Luzán's *La Razón contra la moda* (1751), and the first original Spanish comedy on the same model, Nicolás Moratin's *Petimetra*, printed in 1726 with a critical dissertation, failed to effect any change in the popular theatre, which was raised from its deepest degradation by R. de la Cruz, a fertile author of light pieces of genuine humour, especially *sainetes*, depicting the manners of the middle and lower classes. The comedies of the younger Moratin, e.g., *El Si de las niñas* (in prose), raised him to the foremost position among the dramatists of his age.

In the hands of the Romantics the Spanish drama produced a series of brilliantly effective first nights rather than a permanent literature. The *Don Alvaro* (1835) of the duke of Rivas, the *El Trovador* (1836) of A. Garcia Gutierrez, the *Los Amantes de Teruel* (1837) of J. E. Hartzenbusch, can scarcely be said to have worn well, although they are still famous; but the *Don Juan Tenorio* (1844) by the later Romantic poet J. Zorrilla retains its popularity. The tradition of Moratin the younger was continued in the genuine comic vein and brilliant versification of M. Bretón de los Herreros and in the vigorous irony of Ventura de la Vega; while M. Tamayo y Baus lives chiefly in his remarkable *Un Drama Nuevo* (1867) in which Shakespeare is represented on the stage. He was the author of many other plays which held the stage until the advent in 1874 of J. Echegaray (1832–1916), mathematician, political economist and playwright, the powerful effects of whose *El Gran Galeoto* (1882) and *El Loco Dios* (1900) are now almost forgotten but who dominated the Spanish stage during the last quarter of the 19th century.

The vogue of the *gdnero chico* began at the Teatro del Recreo in 1868 and continued for 40 years, during which several thousands of these light, one-hour pieces, brief as the *entremés* or satirical *sainete*, were composed by scores of popular authors, including T. Luceño, R. de la Vega, J. de Burgos and C. Arniches. The best of them contained sharply etched popular types recalling those of R. de la Cruz. A revolution was effected by the introduction of the philosophical theatre of ideas by J. Benavente, whose first play was *El Nido Ajeno* (1894) and who, with the more lyrical G. Martinez Sierra, during the first quarter of the 20th century replaced the melodramatic art of Echegaray by a subtle "drama of double planes." They had a rival in the witty M. Linares Rivas, but both his society plays and other contemporary work, the poetical plays of E. Marquina, the political drama of Pérez Galdós, were eclipsed in popularity by the charming dramatic sketches, nearly 200 in number, of the brothers S. and J. Alvarez Quintero. A noticeable feature of all this 20th century dramatic work is that, despite the excellence of the actress Maria Guerrero (d. 1928), who rivalled the popularity of the great actor Maiquez of a century earlier, it loses comparatively little by being read instead of seen on the stage.

PORTUGAL

The Portuguese drama in its earlier phases, especially before the nation completely achieved its independence in the latter part of the 14th century, seems to have followed much the same course as the Spanish; and the religious drama in all its prevailing forms and direct outgrowths retained its popularity even by the side of the products of the Renaissance. In the later period of that movement translations of classical dramas into the vernacular were stimulated by the cosmopolitan example of George Buchanan, who for a time held a post in the University of Coimbra. The rather vague title of "the Plautus of Portugal" is accorded to an earlier comic writer, the celebrated Gil Vicente, who died about 1536, after producing 42 plays of great variety and charm. In order to counteract the popularity of Vicente's farces F. de Sáde Miranda wrote comedies on the classic model (*Os Estrangeiros, Os Vilhalpandos*) and a classical tragedy, *Cleopatra* (*c.* 1550) of which only a few lines survive. A few years later A. Ferreira produced the most celebrated tragedy in Portuguese literature, *Inés de Castro* (*c.* 1557). Among Vicente's most gifted successors are A. Ribeiro, called *Chiado*, who died in 1590; his brother Jeronymo, B. Dias, A. Prestes and J. Pinto. The dramatic efforts of the illustrious poet Luis de Camões (Comoens) are relatively of slight importance; they consist of one of the many modern versions of the *Amphitruo*, and of two other comedies, of which the earlier *(Filodemo)* was acted at Goa in 1553, the subjects having a romantic colour. The prose plays of Jorge Ferreira de Vasconcellos, which bear some resemblance to the Spanish *Celestina*, are valuable as pictures of contemporary manners in city and court.

In the 18th century Alcino Mycenio (1728–70), known as Domingos dos Reis Quita in everyday life, was remarkably successful with a series of plays, including an *Inés de Castro*, which in a subsequent adaptation by J. B. Gomes long held the national stage. Another dramatist, of both merit and higher aspirations, was Lycidas Cynthio *(alias* Manoel de Figueiredo, 1725–1801). But the romantic movement was very late in coming to Portugal. Its chief representative, the viscount da Almeida Garrett, after writing the plays *Merope* and *Catão* (1821) in his student days, turned to national themes in *Um Auto de Gil Vicente* (1835) and *O Alfageme de Santarem* (1842), and in 1844 produced a romantic tragedy of real power, *Frei Luiz de Sousa*. His plays are remarkable for the excellence of their prose. The best known of the dramatists of the latter half of the century were D. João da Camara, who wrote with insight and charm, M. Mesquita, and H. Lopes de Mendonça, who achieved success in both historical and contemporary themes. E. Biester and G. Lobato wrote sparkling comedies of contemporary manners, their successors in the 20th century being Augusto de Castro and E. Schwalbach. But the most prominent dramatist of the 20th century was J. Dantas, who excelled in literary charm, technical skill and variety of subject. Numerous younger dramatists cropped up, but despite these constant efforts Portuguese literature retained its essentially undramatic character.

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(X.)

FRANCE

France was the only country, besides Italy, in which classical tragedy was naturalized. In 1531 the Benedictine Barthélemy of Loches printed a *Christus Xylonicus;* and a very notable impulse was given both to the translation and to the imitation of ancient models by a series of efforts made in the University of Paris and other French places of learning. The most successful of these attempts was the *Johannes Baptistes* of George Buchanan, who taught in Paris for five years and at a rather later date resided at Bordeaux, where in 1540 he composed his celebrated tragedy (afterwards translated into four or five modern languages), in which it is now ascertained that he had in view the trial and condemnation of Sir Thomas More. He also wrote *Jephthah,* and

translated into Latin the Medea and *Alcestis* of Euripides. At a rather later date the great scholar M. A. Muret (Muretus) produced his *Julius* Caesar, a work perhaps superior in correctness to Buchanan's tragic masterpiece, but inferior to it in likeness to life. About the same time the enthusiasm of the Paris classicists showed itself in several translations of Sophoilean and Euripidean tragedies into French verse, and in 1540 Ronsard translated the *Plutus* of Aristophanes. Thus the beginnings of the regular drama in France came to connect themselves directly with the great literary movement of the Renaissance.

Jodelle.—Among the disciples who gathered round Ronsard, and with him formed the "Pleiad" of French literature, Etienne Jodelle, the reformer of the French theatre, soon held a distinguished place. The stage of this period left ample room for the enterprise of this youthful writer. The popularity of the old entertainments had reached its height when Louis XII., in his conflict with Pope Julius II., had not scrupled to call in the aid of Pierre Gringoire (Gringon), and when the *Mère* sotte had mockingly masqueraded in the petticoats of Holy Church. In the reign of Francis I. the Inquisition, and on occasion the king himself, had to some extent succeeded in repressing the audacity of the actors, whose follies were at the same time an utter abomination in the eyes of the Huguenots. For a time the very mysteries of the Brethren of the Passion had been prohibited; while the moralities and farces had sunk to an almost contemptible level. Isolated translations of Italian as well as classical dramas had in literature begun the movement which Jodelle now transferred to the stage itself. His tragedy *Cléopâtre* captive was produced on the same day as his comedy *L'Eugène,* in 1552, his *Didon se sacrifiant* following in 1558.

The history of French tragedy begins with *Cléopâtre* captive, in the representation of which the author, together with other members of the "Pleiad," took part. It is a tragedy in the manner of Seneca, devoid of action and provided with a ghost and a chorus. Though mainly written in the five-foot iambic couplet, it already contains passages in the Alexandrine metre, which soon afterwards J. de La Péruse by his *Médée* (pr. 1556) established in French tragedy, and which Jodelle employed in his *Didon.* Numerous tragedies followed in the same style by various authors, among whom Gabriel Bounyn produced the first French regular tragedy on a subject neither Greek nor Roman (La *Soltane,* 1561) and the brothers de la Taille, and J. Grévin, distinguished themselves by their style. Montchrétien exhibited unusual vigour of rhetoric and in R. Garnier French tragedy reached the greatest height in nobility and dignity of style, as well as in the exhibition of dramatic passion, to which it attained before Corneille. In his tragedies choruses are still interspersed among the long Alexandrine tirades of the dialogue.

Comedy Under Italian Influence.—During this period comedy had likewise been influenced by classical models; but the distance was less between the national farces and Terence, than between the mysteries and moralities and Seneca and the Greeks. *L'Eugène* differs little in style from the more elaborate of the old farces; and while it satirizes the foibles of the clergy without any appreciable abatement of the old licence, its theme is the favourite burden of the French comic theatre in all times—le *cocuage.* The foremost French comic poet of the century, P. de Larivey, likewise an Italian born (of the name of Pietro Giunto), openly professed to imitate the poets of his native country. His plays are more or less literal translations of L. Dolce, Secchi and other Italian dramatists; and this lively and witty author, to whom Molibre owes much, thus connects two of the most important and successful growths of the modern comic drama.

Much of the French drama of the next age is of the same kind as its romance-literature, like which it fell under the polite castigation of Boileau's satire. Heroic love (quite a technical passion), "fertile in tender sentiments," seized hold of the theatre as well as of the romances; and La Calprenbde, G. de Scudéry (*L'Amour tyrannique*) and his sister and others were equally fashionable in both species. J. Mairet was noted for superior vigour. P. Du Ryer's style is described as, while otherwise superior to that of his contemporaries, Italian in its defects. A mixture of the forms of classical comedy with elements of Spanish and of the Italian pastoral was attempted with great temporary success by A. Hardy, a playwright who thanked Heaven that he knew the precepts of his art while preferring to follow the demands of his trade. The mixture of styles begun by him was carried on by the marquis de Racan, J. de Rotrou and others; and among these comedies of intrigue in the Spanish manner the earlier efforts of Corneille hiniself are to be classed. Rotrou's noteworthier productions are later in date than the event which marks an epoch in the history of the French drama, the appearance of Corneille's Cid (1636).

Corneille.—P. Corneille is justly revered as the first, and in some respects the unequalled, great master of French tragedy. The attempts of his predecessors had been without life, because they lacked really tragic characters and the play of really tragic passions; while their style had been either pedantically imitative or a medley of plagiarisms. He conquered tragedy at once for the national literature by a few masterpieces, which may be held to be comprehended within the ten years 1636 to 1646; for in his many later tragedies he never again proved fully equal to himself. The French tragedy, of which the great age begins with the Cid, Horace, Cinna, Polyeucte and *Rodogune,* was not, whatever it professed to be, a copy of the classical tragedy of Greeks or Romans, or an imitation of the Italian imitations of these; nor, though in his later tragedies Corneille depended less and less upon characters and more and mare, after the fashion of the Spaniards, upon situations, and even more upon spectacles, were the forms of the Spanish drama able to assert their dominion over the French tragic stage. The mould of French tragedy was cast by Corneille; but the creative power of his genius was unable to fill it with more than a few examples. His range of passions and characters was limited; he preferred, he said, the reproach of having made his women too heroic to that of having made his men effeminate.

In comedy also Corneille begins the first great original epoch of French dramatic literature; but Le Menteur (the parent, with its sequel, of a numerous dramatic progeny) was itself derived from a Spanish original, which it did not (as was the case with the Cid) transform into something new. French tragi-comedy Corneille can hardly be said to have invented; and of the mongrel growths of sentimental comedy and of domestic drama or drame, he rather suggested than exemplified the conditions.

Racine.—The tragic art of Racine supplements rather than surpasses that of his older contemporary. His works reflect the serene and settled formality of the age. That Racine should permanently hold the position which belongs to him in French dramatic literature is due to the fact that to him it was given to present the forms approved by his age in what may reasonably be called perfection; and, from the point of view of workmanship, Sophocles could not have achieved more. T. Corneille, Campistron, Joseph Duché (1668–1704), Antoine de Lafosse (c. 1653–1708) and Quinault were mere followers of one or both of the great masters of tragedy, though the last-named achieved a reputation of his own in the bastard species of the opera.

The type of French tragedy thus established, like everything else which formed part of the "age of Louis XIV.," proclaimed itself as the definitively settled model of its kind, and was accepted as such by a submissive world. Proud of its self-imposed fetters, French tragedy dictatorially denied the liberty of which it had deprived itself to the art of which it claimed to furnish the highest examples. The unities of time and place, with the Greeks mere rules of convenience, French tragedy imposes upon itself as a permanent yoke. The Euripidean prologue is judiciously exchanged for the exposition of the first act, and the lyrical element essential to Creek tragedy is easily suppressed in its would-be copy; lyrical passages still occur in some of Corneille's early masterpieces, but the chorus is consistently banished, to reappear only in Racine's latest works as a scholastic experiment appropriate to a conventual atmosphere. Its uses for explanation and comment are served by the expedient, which in its turn becomes conventional, of the conversations with confidants and confidantes, which more than sufficiently supply the foil of general sentiments. The epical element is allowed full play in narrative passages, more especially in those

which relate parts of the catastrophe, and, while preserving the stage intact from realisms, suit themselves to the generally rhetorical character of this species of the tragic drama.

18th Century Tragedy.—The universal genius of Voltaire found it necessary to shine in ali branches of literature, and in tragedy to surpass predecessors whom his own authority declared to have surpassed the efiorts of the Attic muse. He succeeded in impressing the world with the belief that his innovations had imparted a fresh vitality to French tragedy; in truth, however, they represent no essential advance in art, but augmented the rhetorical tendency which paralysed true dramatic life. Such life as his plays possess lies in their political and social sentiments, their invective against tyranny, and their exposure of fanaticism. In other respects his versatility was barren of enduring results. Voltaire's would-be rival, the "terrible" Crébillon the elder, professed to vindicate to French tragedy, already mistress of the heavens through Corneille, and of the earth through Racine, Pluto's supplementary realm, but, though thus essaying to carry tragedy lower, failed to carry it farther. Shakespeare, as manipulated by Ducis—an author whose tastes were better than his times—failed to bring about a change. "It is a Moor, not a Frenchman, who has written this play," cried a spectator of Ducis' *Othello* (1791); but Talma's conviction was almost as strong as his capacity was great for convincing his public; and he certainly did much to prepare the influence which Shakespeare was gradually to assert over the French drama, and which was aided by translations, more especially that of Pierre Letourneur (1736–88), which had attracted the sympathy of Diderot and the execrations of the aged Voltaire. No great artist has ever more generously estimated the labours of a predecessor than Talma judged those of Le Kain; but it was Talma himself whose genius was pre-eminently fitted to reproduce the great figures of antiquity in the mimic world, which, like the world outside, both required and possessed its Caesar. He, like Rachel after him, reconciled French classical tragedy with nature; and it is upon the art of great original actors such as these that the theatrical success of this form of the drama in France depends.

Molière.—The rival influences, under which classical tragedy has after a long struggle virtually become a thing of the past in French literature, are also to be traced in the history of French comedy, which under the co-operation of other influences produced a wide variety of growths. The germs of most of these—though not of all—are to be found in the works of the most versatile, the most sure-footed, and, in some respects, the most consummate master of the comic drama whom the world has known—Molikre. What Molikre found in existence was a comedy of intrigue, derived from Spanish or Italian examples, and the elements of a comedy of character, in French and more especially in Italian farce and ballet-pantomime. Corneille's Menteur had pointed the way to a fuller combination of character with intrigue, and in this direction Molière's genius exercised the height of its creative powers. After beginning with farces, he produced in the earliest of his plays (from 1652), of which more than fragments remain, comedies of intrigue which are at the same time marvellously lively pictures of manners, and then proceeded, with the Ecole des *maris* (1661), to begin a long series of masterpieces of comedy of character. Yet even these, the chief of which are altogether unrivalled in dramatic literature, do not exhaust the variety of his productions.

Molière is both a satirist and a humorist; he displays at times the sentiments of a loyal courtier, at others that gay spirit of opposition which is all but indispensable to a popular French wit. His comedies offer elaborate and subtle—even tender—pictures of human character in its eternal types, lively sketches of social follies and literary extravagances, and broad appeals to the ordinary sources of vulgar merriment. Light and perspicuous in construction, he is master of the delicate play of irony, the penetrating force of wit, and the expansive gaiety of frolicsome fun. Faithful to the canons of artistic taste and under the sure guidance of true natural humour, his style suits itself to every species attempted by him. His morality is the reverse of rigid, but its aberrations are not those of prurience, nor its laws those of pretence; and, wholly free as he was from the didactic aim which is foreign to all true dramatic representation, the services rendered by him to his art are not the less services rendered to society, concerning which the laughter of genuine comedy tells the truth. He raised the comedy of character out of the lower sphere of caricature, and in his greatest creations subordinated to the highest ends of all dramatic composition the plots he so skilfully built, and the pictures of the manners he so faithfully reproduced.

Molière's Successors.—But if the mantle of Molikre can be said to have fallen upon any of his contemporaries or successors, this honour must be ascribed to J. F. Regnard, who imitated the great master in both themes and characters, while the skilfulness of his plots, and the gaiety of his treatment even of subjects tempting into the bypath of sentimental comedy, entitle him to be regarded as a comic poet of original genius.

In the next generation (that of Voltaire) comedy gradually—but only gradually—surrendered for a time the very essence of its vitality to the seductions of a hybrid species, which disguised its identity under more than a single name. A. R. Lesage, who as a comic dramatist at first followed successfully in the footsteps of Molikre, proved himself on the stage as well as in picturesque fiction a keen observer and inimitable satirist of human life. The light texture of the playful and elegant art of J. B. L. Gresset was shown on the stage in a character comedy of merit (Le *Méchant*); and in a comedy which reveals something of his pointed wit (La *Métromanie*) A. Piron produced something like a new type of enduring ridiculousness.

P. C. de Marivaux is usually supposed to have formed the connecting link between the "old" French comedy and the "new" and bastard variety. Yet, though his minute analysis of the tender passion excited the scorn of Voltaire, it should not be overlooked that in *marivaudage* proper the wit holds the balance to the sentiment, and that in some of this writer's earlier and most delightful plays the elegance and gaiety of diction are as irresistible as the pathetic sentiment, which is in fact rather an ingredient in his comedy than the pervading characteristic of it. Some of the comedies of P. H. Destouches no doubt have a serious basis, and in his later plays he comes near to a kind of drama in which the comic purpose has been virtually submerged. The writer who is actually to be credited with the transition to sentimental comedy, and who was fully conscious of the change which he was helping to effect, was Nivelle de La Chaussée, in whose hands French comedy became a champion of the sanctity of marriage, and reproduced the sentiments—in one instance even the characters—of Richardson To his play La *Fausse Antipathie* the author supplied a critique, amounting to an apology for the new species of which it was designed as an example.

The new species known as *comédie larmoyante* was now fairly in the ascendant; and it would be easy to show how even Voltaire, who had deprecated the innovation, had to yield to a power greater than his own, and introduced the sentimental element into some of his comedies. The further step, by which *comédie larmoyante* was transformed into tragkdie bourgeoise, from which the comic element was to all intents and purposes extruded, was taken by a great French writer, D. Diderot, to whose influence it was largely due that the species which had attained to this consummation for more than a generation ruled supreme in the dramatic literature of Europe. Diderot announced his plays as examples of a third dramatic form—the genre skrieux—which he declared to be the consummation of the dramatic art. Making war upon the frigid artificiality of classical tragedy, he banished verse from the new species. The effect of these plays was intended to spring from their truth to nature—a truth such as no spectator could mistake, and which should bring home its moral teachings to the business as well as the bosoms of all. The theatre was to become a real and realistic school of the principles of society and of the conduct of life.

Comedy of the Revolution and First Empire.—Among the successful dramatists following on Diderot may be mentioned the critical and versatile J. F. Marmontel, and more especially M. J. Sedaine, who though chiefly working for the opera produced two comedies of acknowledged merit (Le Philosophe *sans le savoir*

and La Gageure *imprévue*). P. A. C. de Beaumarchais (1732–99), who for his early sentimental plays, in which he imitated Diderot, invented the appellation drame—so convenient in its vagueness that it became the accepted name of the hybrid species to which they belonged—in two works of a very different kind, the famous *Barbier* de *Séville* and the still more famous *Mariage* de Figaro, boldly carried comedy back into its old Spanish atmosphere of intrigue; but, while surpassing all his predecessors in the skill with which he constructed his frivolous plots, he drew his characters with a lightness and sureness of touch peculiar to himself, animated his dialogue with an unparalleled brilliancy of wit, and seasoned action as well as dialogue with a political and social meaning which caused his epigrams to become proverbs, and which marks his Figaro as a herald of the Revolution.

The comedy of the empire is, in the hands of Collin d'Harleville, Louis Picard (1769–1828), A. Duval, Etienne and others, mainly a harmless comedy of manners. Sedaine was the father of the *opéra-comique* proper; Marmontel, as well as Rousseau, likewise composed *opérettes*—a smaller sort of opera, at first of the pastoral variety; and these flexible species easily entered into combination. The melodrama proper, of which the invention is also attributed to Rousseau, in its latter development became merely a drama accentuated by music, though usually in little need of any accentuation.

The chief home of the regular drama, however, demanded efforts of another kind. At the Théâtre Français, or Comédie Française, whose history as that of a single company of actors had begun in 1680, the party-strife of the times made itself audible; and the most prominent tragic poet of the Revolution, M. J. de Chénier, a disciple of Voltaire in dramatic poetry as well as in political philosophy, wrote for the national stage the historical drama—with a political moral—in which in the memorable year 1789 the actor Talma achieved his first complete triumph But the victorious Revolution proclaimed among other liberties that of the theatres in Paris, of which soon not less than 50 were open. In 1807 the Empire restricted the number to 9, and reinstated the Théâtre Français in sole possession (or nearly such) of the right of performing the classic drama. The tragedies of C. Delavigne represent the transition from the expiring efforts of the classical to the ambitious beginnings of the romantic school of the French drama.

The Romantic School.—Of modern romantic drama in France it must suffice to say that it derives some of its characteristics from the general movement of romanticism which in various ways and at various points of time transformed nearly every modern European literature, others from the rhetorical tendency which is a French national feature. Victor Hugo was the founder whom it followed in a spirit of high emprise to success upon success, his own being the most conspicuous of all; A. Dumas the elder its unshrinking middleman. Together with them, may, with more or less precision, be classed in the romantic school of dramatists A. de Vigny and George Sand, neither of whom, however, attained to the highest rank in the drama; Jules Sandeau; and A. de Musset, whose originality pervades all his plays, and whose later works, more especially his prose "proverbs" and pieces of a similar kind, have a flavour of delicacy altogether indescribable.

The romantic school was not destined to exercise a permanent control over French public tastr; but it can hardly be said to have been overthrown by the brief classical revival begun by F. Ponsard, and continued, though in closer contact with modern ideas, both by him and by E. Augier, a dramatist who gradually attained to an extraordinary effectiveness in the self-restained treatment of social as well as of historical themes. The theatrical fecundity and the remarkable constructive ability of E. Scribe supplied a long series of productions attesting the rapid growth of the playwright's mastery over the secrets of his craft. After a fashion which would have startled even Diderot, while recalling his efforts in the earnestness of its endeavour to arouse moral interests to which the theatre had long been a stranger, A. Dumas the younger set himself to reform society by means of the stage.

The extraordinary versatility of V. Sardou and his unfailing constructive skill was applied by him to almost every kind of serious or serio-comic, drama—even the most solid of all. In the same period, while E. Pailleron revived some of the most characteristic tendencies of the best French satirical comedy in ridiculing the pompous pretentiousness of learning for its own sake, the lighthearted gaiety of E. Labiche changed into something not altogether similar in the production of the comic muse of L. Halévy and H. Meilhac, ranging from the licence of the musical burlesque which was the congenial delight of the later days of the Second empire to a species of comedy in which the ingredients of bitterness and even of sadness found a place.

Modern Schools.—The long disputed success of the Naturalistic school carried everything before it during the years 1875-85, and its triumphant leaders were tempted to make the best of their advantage by annexing a new province and establishing a footing on the stage. In this they failed signally, both when they were assisted by professional dramatists and when left to their own resources. It became evident that Naturalism, to be acceptable on the stage, would have to undergo a special process of transformation and be handled in a peculiar way. Henry Becque succeeded in embodying the new theories in two plays, which at first met with very indifferent success, but were revived at a later period, and finally obtained permanent recognition in the French theatre even with the acquiescence of the most learned critics, when they discovered, or fancied they discovered, that Becque's comedies agreed, in the main, with Molière's conception of dramatic art. In Les Corbeaux (1882) and La *Parisienne* (1885) the plot is very simple; the episodes are incidents taken from ordinary life. No extraneous character is introduced to discuss moral and social theories, or to acquaint us with the psychology of the real *dramatis* personae, or to suggest humorous observations about the progress of the dramatic action. The characters are left to tell their own tale in their own words, which are sometimes very comical, sometimes very repulsive, but purport to be always true to nature.

Jean Richepin is half *naturaliste* and half *romantique* and he also represents the Villon and Rabelais tradition mixed with the Hugo influence; he wrote Le *Flibustier* (1888), Par *le* glaive (1897), *Miarka* (1905). Wholly romantic is Edmond Rostand. who created a great sensation with Cyrano de Bergerac (1897) and *L'Aiglon* (1900); but the favourable impression did not last. *Chantecler* (1910) was only half a success, and the reputation of Rostand has steadily declined. The naturalistic tendency took a social direction with Paul Hervieu: Les *Tenailles* (189j), La *Loi* de *l'homme* (1897), La *Course du Flambeau* (1901); his view of humanity is harsh and pessimistic. E. Brieux tackled even bigger social problems, which he perhaps over-simplified in La Robe rouge (1900), Les *Avariés* (1901), Les *Remplaçantes* (1901), *Maternité* (1904). F. de Curel, in Les *Fossiles* (1892), studies the decadence and death of the old aristocracy. Lavedan wrote also a satire of the nobility in Le *Prince d'Aurec* (1894). His best known play is Le *Duel* (1905). Georges de Porto Riche, whose best work is Le *vieil* homme (1911), has been somewhat sarcastically called le *Racine juif;* he tried to bring the stage back to a more genuine kind of psychological drama, mixing the realistic and the classical tradition. Maurice Donnay, Robert de Flers and Armand de Caillavet, Tristan Bernard, Courteline, Alfred Jarry have all achieved success in the lighter and sometimes the lightest or the grossest kind of comedy.

Paul Claudel (b. 1868) brought his own conception of symbolism to the stage with *L'Annonce faite à Marie* (1912) but his historical play *L'Otage* (1911) is generally considered a masterpiece of much greater value than anything given on the French stage since perhaps *Ruy Blas.*

After the War, an attempt to re-install verse drama was made by François Porché (1877–) (*Les Butors* et la *Finette,* 1916). There seemed to be symptoms of a revival of the French stage, the naturalistic play having sunk to a very low level. A vigorous, almost violent effort was made by Romain Rolland, in Le Jeu *de l'Amour* et de la *Mort* (1924), coming after many attempts at dramas on the French Revolution A merrier and better comedy than had been seen for many years was produced by Jules

Romains with *Le Docteur Knock* (1924) and his *Le Dictateur* (1926) is a fine psychological study of a benevolent modern tyrant's soul. A somewhat similar subject is dealt with in a different manner by Jean Richard Bloch, whose *Le dernier Empereur* (1926) was a great success. His best dramatic work so far is *Sous le genou des Amazones* (1928), a forecast of the future of the race which is a satire on the present. Pierre Hamp (1876–), celebrated as a novelist, has turned to the stage with vigour in *La Compagnie* (1927) which deals with the conflict between railwaymen and the big railway companies. A remarkable symptom in these last mentioned authors is the practical suppression of the love interest, which is a welcome change on the French stage. At present French drama is not on a level with the great contemporary achievements in the essay or the novel, but the plays just mentioned give us hope of a brighter future at hand.

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ENGLAND

Early Tudor Drama. — Recent investigation has shown that English secular drama takes its beginning from the earliest Tudor period, and in all probability from the end of the 15th century. *Fulgens and Lucres (a* copy of which came to light in 1919), an interlude by Henry Medwall, chaplain to Cardinal Morton, may be dated about 1496. Its theme, the contest between a pleasure-loving patrician and a high-principled commoner for the hand of Lucres is based upon a humanist tale; but it anticipates Shakespearian technique by adding a comic underplot which is a variation of the main subject. Medwall's other extant play *Nature*, though in form a Morality, shows much of the technical skill and realistic observation of *Fulgens and Lucres.* John Rastell, brother-in-law of Sir Thomas More, who printed *Fulgens and Lucres,* was himself the author of *The Interlude of the Four Elements* and of *Gentleness and Nobility,* two didactic plays, without action, but reflecting his interest in scientific and social problems. He also probably adapted from its Spanish source the fragmentary romantic *drama — Calisto and Melibea.* John Rastell's daughter, Joan, married John Heywood, with whose name six interludes are traditionally associated. His authorship of four of these, the ms. *Witty and Witless,* the *Play of Love* and the *Play of the Wether* (both printed by his brother-in-law, William Rastell) and *The Fowe PP.* (printed by *W.* Middleton) is beyond reasonable doubt. *Wether* and *The Foure PP.* have a raciness of dialogue and characterization that are almost Chaucerian. Two other, more acidly farcical plays, *Johan Johan* and *The Pardoner* and *The Frere,* have points of affinity with *The Foure PP.,* but there is no external evidence for Heywood's authorship of these. It has been suggested that they may have been among the *Comoediae juveniles* attributed by Bale to Sir T. More. In any case all the plays mentioned above form an early Tudor group, predominatingly English in spirit and treatment, unaffected in their construction by classical influences.

It was chiefly through the schools and universities that these influences gradually spread and, blending with native and traditional elements, produced the distinctively Elizabethan "Romantic" types of comedy and tragedy. The boys of St. Paul's school acted plays of Plautus and Terence before Wolsey in 1527 and 1528, and among the performances, which were part of the regular curriculum at Eton, Westminster, Merchant Taylors' and other schools, the two masters of Roman comedy had an important place. Scarcely less influential were a group of Continental neo-Latin playwrights such as Ravisius Textor, Macropedius, and Gnaphaeus, whose dramas on the theme of the prodigal son gained great popularity. The most famous of these, the *Acolastus* of Gnaphaeus, was issued in England with a translation by John Palsgrave in 1540.

Classical. neo-classical and native elements are blended in the work of Nicholas Udall, successively headmaster of Eton and Westminster. His *Ralph Roister Doister* (probably 1553), a clever adaptation to English conditions of types from the *Miles Gloriosus* of Plautus, was probably written for his Westminster boys and is the first English play divided into acts on the classical model. Udall was also (as has been recently shown) probably the author about 1537 of the clever adaptation of Textor's dialogue, *Thersites,* and there is reason to suppose that his biblical play, *Ezechias* (revived at Cambridge before Elizabeth in 1564), was another early work. Another attractive biblical play *Jacob and Esau* has features in common with *Roister Doister,* and may well be from Udall's pen. *Jacob and Esau* belongs to the prodigal son class, and other variations on this type are T. Ingelend's *The Disobedient Child,* adapted from a Textor dialogue; the powerful anonymous *Misogonus;* and George Gascoigne's *The Glasse of Government* (1575), heavily didactic, but notable as the first prodigal son play written in prose.

It was however not from the neo-classical but from the Italian drama that the English amateur stage had taken the crucial step of borrowing prose as the instrument of comedy. In 1j66 Gascoigne had translated for performance before the lawyers of Gray's inn Ariosto's *Gli Suppositi,* of which there were both prose and verse forms, but which he turned entirely into English prose. For a time his innovation found no imitators. *The Bugbears,* another (anonymous) adaptation of an Italian comedy, J. Phillip's recently recovered *Pacient Grissell,* and the numerous lost plays on Italian themes mentioned in the Revels' accounts were (so far as we know) in the traditional rhyming metres. So also were the few plays still surviving from the early years of Elizabeth's reign on purely English themes, such as *Tom Tyler and his Wife,* and the admirably constructed Cambridge farcical comedy, whose authorship is still a problem, *Gammer Gurton's Needle.* In another group, represented by *Common Conditions, The Rare Triumphs of Love and Fortune* and *Sir Clyomon and Sir Clamydes,* romantic subjects, sometimes combined with allegorical features, were boldly but unskilfully handled.

Influence of Seneca. — If English comedy intermingled traditional native elements with those borrowed from ancient and Renaissance Italy, English tragedy in its beginnings was predominantly indebted to one classical source, the rhetorical drama of imperial Rome. In the year of Elizabeth's accession a group of English university scholars began to put forth a series of translations of the ten tragedies of Seneca, which one of them, T. Newton, in 1581 collected into a single volume. To the direct influence of Seneca is to be ascribed the composition of the first English tragedy which we possess. *Gorboduc* or *Ferrex and Porrex,* by T. Norton and T. Sackville was first acted on Jan. 18, 1562, by the members of the Inner Temple before Queen Elizabeth. Though its subject is a British legend, and though the action is neither copied nor adapted from any treated by Seneca, yet the resemblance between this tragedy and the *Thebais* is too strong to be fortuitous. In all formal matters — chorus, messengers, etc. — *Gorboduc* adheres to the usage of classical tragedy; but the authors show no respect for the unities of time or place and they introduce before each act the non-classical device of a dumb-show. What gives the play its chief importance is the use for the first time in English drama of blank verse. The model of *Gorboduc* was followed at Gray's inn in 1566 when Gascoigne produced with the aid of two associates (F. Kinwelmersh and Sir C. Yelverton) *Jocasta,* a virtual translation of L. Dolce's *Giocasta,* which was an adaptation of a Latin translation of the *Pkoenissae* of Euripides. *R.* Edwards' *Damon and Pithias (c.* 1564–65) shades off from tragedy into what soon came to be called tragi-comedy. Other more rudely constructed plays of the same class, also on classical themes are J. Pickering's *Horestes* (pr. 1567), R. B.'s *Apius and Virginia* (pr. 1575) and T. Preston's *Cambises (c.* 1569). Two more notable examples have Italian sources. *Gismonde of Salerne,* a play drawn from Boccaccio, was acted before Queen Elizabeth at the Inner Temple in 1568, nearly a generation before it was published, rewritten in blank verse by R. Wilmot, one of the performers. G. Whetstone's *Promos and Cassandra,* founded on a tale by G. Cinthio (from which came the plot of *Measure for Measure*) followed in 1578.

In addition the universities provided a field for neo-Senecan tragedy and tragi-comedy, both in Latin and English. N. Grimald's *Christus Redivivus* and *Archipropheta* (on John the Baptist) were followed from 1581 onwards by W. Gager's series of Latin plays at Christ Church. Oxford, of which *Ulysses Redux* is the most notable. At Cambridge T. Watson's *Absolom,* J. Christopherson's *Jephtha* (both in Greek and Latin) and T. Legge's *Richardus III.* (1579) cast biblical or national history into classical moulds.

Chronicle Histories.—From the double danger which threatened English tragedy in the days of its infancy—that it would congeal on the wintry heights of classical themes, or dissolve its vigour in the glowing heat of a passion fiercer than that of the Italians—it was in part preserved by its association with the traditions of the national history. An exceptional position might seem to be in this respect occupied by T. Hughes's tragedy *The Misfortunes of Arthur* (1587). But the author of this play—in certain portions of whose framework there were associated with him seven other members of Gray's inn, including Francis Bacon, and which was presented before Queen Elizabeth like *Gorboduc*—followed the example of the authors of that work both in choice of theme, in details of form, and in a general though far from servile imitation of the manner of Seneca.

Fortunately at this time a new sphere of activity suggested itself, in which English dramatists speedily came to feel at home. In their dramatization of portions of English history classical models would be of scant service, while Italian examples of the treatment of national historical subjects, having to deal with material so wholly different, could not be followed with advantage. Nor did Bishop Bale's experiment in *King Johan* (*c.* 1547) of combining historical matter with personifications like Sedition, find imitators. The typical English *chronicle history*, which designedly assumed this name in order to make clear its origin and purpose, essayed nothing more or less than a dramatic version of an existing chronicle. Obviously, while the transition from half historical, half epical narrative often implied carrying over into the new form some of the features of the old, it was only when the subject matter had been remoulded and recast that a true dramatic action could result. But the *histories* to be found among the plays of Shakespeare and one or two other Elizabethans are true dramas, and it would be inconvenient to include these in the transitional species, of those known as *chronicle histories.* Among these is *The Famous Victories of Henry the Fifth,* known to have been acted before 1588; in which both the verse and the prose are frequently of a very rude sort, but which has considerable vigour and freshness. Another is *The Troublesome Raigne of King John,* in two parts (pr. 1591), neither a didactic effort like Bale's, nor a living drama like Shakespeare's, but in its own way an effective treatment of its historical theme. The *True Chronicle History of King Leir* (acted in 1593) seems, with all its defects, only to await the touch of the master's hand to become a tragedy of supreme effectiveness.

Elizabethan Theatres and Companies.—Out of such promises as these the glories of English drama were ripened by the warmth and light of the great Elizabethan age—of which the beginnings may fairly be reckoned from the third decennium of the reign to which it owes its name. Against the attacks which a nascent Puritanism was already directing against the stage by the hands of J. Northbrooke, the repentant playwright S. Gosson, P. Stubbes and others, were to be set the steady though frugal favour of royalty and the more liberal patronage of great nobles. This patronage was made a necessity by the Act of 1572 by which all common players were declared rogues and vagabonds unless they were in the service of some lord. Hence the rapid development of companies bearing the name of a prominent nobleman, of which the two chief in the later years of Elizabeth were known as the lord chamberlain's (including R. Burbage, Kemp and Shakespeare) and the lord admiral's (of which Edward Alleyn was the leading figure). These organized companies needed permanent playhouses, of which the first, "the Theater," was built by J. Burbage in Shoreditch in 1576, and was soon followed by the Curtain in Finsbury. These were the predecessors of the Rose and the Swan, the Globe and the Fortune, the first and the second Blackfriars theatres. How intimately the construction of Elizabethan plays is bound up with the "platform stage" of these theatres, and with the absence of a drop-curtain has been made increasingly clear by recent research. And the employment of boys in women's parts accounts for the numerous plots in which the heroine dons doublet and hose. Nor did the "little eyases" perform only in the professional companies. The children of the chapel and the children of Paul's (the choristers of the chapel royal and the cathedral) stood midway between the young professionals and the purely amateur schoolboys.

Shakespeare's Predecessors.—It was for the children of the chapel and thechildren of Paul's that John Lyly wrote his plays. The euphuism, to which his famous romance gave its name, likewise distinguishes his mythological, quasi-historical, allegorical and satirical comedies. But his real service to the progress of English drama is to be sought neither in his choice of subjects nor in his imagery—though to his fondness for fairy lore and for the whole phantasmagoria of legend, classical as well as romantic, his contemporaries, and Shakespeare in particular, were indebted. It does not even lie in the songs interspersed in his plays, which did not appear till the publication of the edition of 1632 and are of doubtful authorship. It consists in his adoption of Gascoigne's innovation of writing plays in prose; and in his having, though under the fetters of an affected style, given the first example of brisk and vivacious dialogue—an example to which even such successors as Shakespeare and Jonson were indebted. Thomas Ryd, the author of the *Spanish Tragedy,* had the born playwright's instinct for effective situations, often but not always of a lurid kind, and may have preceded Christopher Marlowe in the use of blank verse on the popular stage. He almost certainly wrote a lost play on *Hamlet,* while *Soliman and Perseda* and *Arden of Feversham* belong to his school if not to his pen. Marlowe's earliest play, *Tamburlaine the Great,* captured the theatrical public by its "high astounding terms" in which the hero's passion for infinite power found superb though at times too grandiloquent utterance. In *Doctor Faustus* the passion for infinite knowledge, and in *The Jew of Malta* the passion for infinite wealth (both as sources of power) are the leading motives. In *Edward II.* the colours are quieter but there is an advance in dramatic technique, and the closing scenes are marked by truly tragic pity and terror. Compared with *Edward II.* Peele's *Chronicle of Edward I.* still stands on the level of the species to which its title and character alike assign it. His finest play is *David and Bethsabe,* which resembles *Edward I.* in construction, but surpasses it in beauty of language and versification, besides treating its subject with superior dignity. We seem to come into something like a Shakespearian atmosphere in more than one passage of the plays of Robert Greene. His art, most conspicuous in plays treating English life and scenes, could at times free itself from the pedantry apt to beset the flight of Peele's and at times even of Marlowe's muse; and his most delightful work, *Friar Bacon and Friar Bungay,* seems to breathe something of the air which blows over an English countryside. Thomas Lodge, Thomas Nashe, Henry Chettle and Anthony Munday, who wrote the original text of the composite play *Sir Thomas More* (of which Shakespeare has been credited with three leaves in the ms.) and other works, are among the other more important writers of the early Elizabethan drama.

Although the chief of these poets are marked off from one another by the individual genius which impressed itself upon both the form and the matter of their works, yet the stamp of the age is upon them all. Writing for the stage only, of which some of them possessed a personal experience, they acquired an instinctive insight into the laws of dramatic cause and effect, and infused a warm vitality into the dramatic literature which they produced, so to speak, for immediate consumption. On the other hand, the same cause made rapidity of workmanship indispensable to a successful playwright. *How* a play was produced, how many hands had been at work upon it, what loans and what spoliations had been made in the process, were considerations of less moment than the question *whether* it was produced, and whether it succeeded.

This period of the English drama could not therefore yet be one of full consummation. In tragedy the advance which had been made in the choice of great themes, in knitting closer the connection between the theatre and the national history, in vindicating to passion its right to adequate expression, was already enormous. In comedy the advance had been less decisive and less independent; much had been gained in reaching greater freedom of form and something in enlarging the range of subjects; but artificiality had proved a snare in one direction, and the licence of the comic stage in another.

Shakespeare.—These were the circumstances under which the greatest of dramatists began to devote his genius to the theatre. Shakespeare's (*q.v.*) career as a writer of plays can have differed little in its beginnings from those of his contemporaries and rivals. Before or while he was proceeding from the re-touching and re-writing of the plays of others to original dramatic composition, the most gifted of his predecessors had passed away. Shakespeare was no doubt happy in his times, which intensified the strength of the national character, expanded the activities of the national mind, and were able to add their stimulus even to such a creative power as his. He was happy in the antecedents of the form of literature which commended itself to his choice, and in the opportunities which it offered in so many directions for an advance to heights yet undiscovered and unknown.

The great and irresistible demand on the part of Shakespeare's public was for *incident—a* demand which of itself necessitated a method of construction different from that of the Greek drama, or of those modelled more or less closely upon it. Hence in part arises the circumstance that Shakespeare so constantly combined two actions in the course of a single play, not merely supplementing the one by means of the other as a bye- or under-plot. And where he thus led many have followed. Should it, however, be sought to express in one word the greatest debt of the drama to Shakespeare, this word must be the same as that which expresses his supreme gift as a dramatist. It is in *characterization—in* the drawing of characters ranging through almost every type of humanity which furnishes a fit subject for the tragic or the comic art—that he remains absolutely unapproached; and it was in this direction that he pointed the way which the English drama could not henceforth desert without becoming untrue to itself.

Pastoral and Mask.—By the numerous body of poets who, contemporary with Shakespeare or in the next generation, cultivated the wide field of the national drama, every form commending itself to the tastes and sympathies of the national genius was essayed. None was neglected except those from which the spirit of English literature had been estranged by the Reformation, and those which had from the first been artificial importations of the Renaissance. The mystery could not in England, as in Spain, produce such an aftergrowth as the *auto,* and the confines of the religious drama were only now and then tentatively touched. The direct imitations of classical examples were few and feeble. S. Daniel (1562–1619) may be regarded as a belated disciple of Seneca, while experiments like Sir W. Alexander's *Monarchicke Tragedies* (1603–05) are the isolated efforts of a student. At the opposite end of the scale, the light gaiety of the Italian and French farce could not establish itself on the English popular stage without more substantial adjuncts; the Englishman's festive digestion long continued robust, and he liked his amusements solid. In the pastoral drama and the mask, however, many English dramatists found opportunities for the exercise of their lyrical gifts and of their inventive powers. The former could never become other than an exotic, so long as it retained the artificial character of its origin. Shakespeare had accordingly only blended elements derived from it into the action of his romantic comedies. In more or less isolated works Jonson, Fletcher, Daniel, Randolph, and others sought to rival Tasso and Guarini—Jonson in *The Sad Shepherd* coming nearest to nationalizing an essentially foreign growth by the fresh simplicity of his treatment, Fletcher in *The Faithful Shepherdess* by beauty of poetic execution; Daniel in *The Queen's Arcadia* by simpler beauties of style in both verse and prose.

The mask was a more elastic kind of composition, mixing in varying proportions its elements of declamation and dialogue, music and dancing, decoration and scenery. It was introduced, after the manner of Italy, at the court of Henry VIII. in 1512. A frequent ornament of Queen Elizabeth's court festivities and progresses, it was cultivated with increased assiduity in the reign of James I., and in that of his successor outshone, by the favour it enjoyed, the attractions of the regular drama itself. Most of the later Elizabethan dramatists contributed to this species; but by far the most successful writer of masks was Ben Jonson, of whose numerous compositions of this kind many hold a permanent place in English literature, and "next" to whom, in his own judgment, "only Fletcher and Chapman could write a mask." From a poetic point of view, however, they were at least rivalled by Dekker and Ford; in productivity and favour T. Campion seems for a time to have excelled. It was for the performance of a mask in a great nobleman's castle that Milton in 1634 wrote one of the loftiest and loveliest of English poems (*Comus*). In later times the mask merged into the opera, or continued a humble life of its own apart from contact with higher literary effort.

Later Elizabethan Drama.—The annals of English drama proper in the period reaching from the closing years of Elizabeth to the outbreak of the great Revolution include, together with names relatively insignificant, many illustrious in the history of our poetic literature. Among Shakespeare's contemporaries and successors Ben Jonson alone by the energy of his genius, not less than by the circumstances of his literary career, reached undisputed primacy among his fellows. Yet his pre-eminence did not extend to both branches of the regular drama. In tragedy he fell short of the highest success; the weight of his learning lay too heavily upon his efforts to draw from deeper sources than those which had sufficed for Shakespeare. Such as they are, his tragic works stand almost, though not quite, alone in this period as examples of sustained effort in historic tragedy proper. G. Chapman treated stirring themes, especially from modern French history, with genuine effectiveness; but, though rich in beauties of detail, he failed in this branch of the drama to follow Shakespeare in the art of fully developing a character by means of the action. With the great body of the English dramatists of this and of the next period, tragedy had passed into a phase where its interest depended mainly upon plot and incident. The romantic tragedies and tragi-comedies which crowd English literature at this time constitute together a growth of astonishing exuberance, and in mere externals of theme—ranging as these plays do from Byzantium to ancient Britain, and from the Caesars of ancient Rome to the tyrants of the Renaissance—of equally astonishing variety. The sources from which these subjects were derived had been perennially augmenting. Besides Italian, Spanish and French fiction, original or translated, besides British legend in its Romance dress, and English fiction in its humbler or in its more ambitious and artificial forms, the contemporary foreign drama, especially the Spanish, offered opportunities for resort. To the English, as to the French and Italian drama, of both this and the following century, the prolific dramatists clustering round Lope de Vega and Calderon, and the native or naturalized fictions from which they drew their materials supplied a whole arsenal of plots—among others to Middleton, to Webster, and most signally to Beaumont and Fletcher. And, in addition to these resources, a new field of supply was at hand since English dramatists had begun to regard events and episodes of domestic life as fit subjects for tragic treatment. Domestic tragedy of this description was indeed no novelty on a stage which had produced *Arden of Faversham* and *A Yorkshire Tragedy,* but T. Heywood was the first playwright who can be identified as having achieved any work of considerable value in this class (*A Woman Killed with Kindness; The English Traveller*), to which some of the plays of T. Dekker, T. Middleton, and others likewise more or less belong. Yet the number of *motives* employed—at least as a rule—in the tragic drama of this period was comparatively small and limited. Scheming ambition, conjugal jealousy, absolute female devotion, unbridled masculine passion—such are the motives which continually recur. But though the common features of the romantic tragedy are sufficiently marked they leave unobscured the distinctive features in its indi-

vidual writers. In J. Nebster, master as he is of *nzacabre* effects. and in J. Ford, seductive in his sweetness, the monotony of exaggerated passion is broken by those marvellously sudden and subtle touches through which their tragic genius creates its most thrilling effects. Nor will the tendency to excess of passion which F. Beaumont and J. Fletcher exhibit be coniounded with their distinctive power of sustaining tenderly pathetic characters and irresistibly moving situations in a degree unequalled by any of their contemporaries—a power seconded by a beauty of diction and softness of versification which for a time raised them to the highest pinnacle of popular esteem. and which entitles them in their conjunction, and Fletcher as an independent worker, to an enduring pre-eminence among their fellows. Distinctive, too, are the manliness of sentiment and occasionally greater width of outlook which ennoble the rhetorical genius of P. Massinger, and the gift of poetic illustration which entitles J. Shirley to be remembered not merely as the latest and the most fertile of this group of dramatists.

In comedy, on the other hand, the genius and the insight of Jonson pointed the way to a steady and legitimate advance. His theory of "humours" (which found the most palpable expression in two of his earliest plays), if translated into the ordinary language of dramatic art, signifies the paramount importance in the comic drama of the presentation of distinctive human types. In the actual reproduction of humanity in its infinite but never, in his hands, alien variety, it was impossible that Shakespeare should be excelled by Jonson; but in the consciousness with which he recognized and indicated the highest sphere of a comic dramatist's labours, he rendered to the drama a direct service which the greater master had left unperformed. By the rest of his contemporaries and his successors, some of whom, such as R. Brome, were content avowedly to follow in his footsteps, Jonson mas only occasionally rivalled in individual instances of comic creations; in the entirety of its achievements his genius as a comic dramatist remained unapproached in its own sphere. The favourite types of Jonsonian comedy, to which Dekker, J. Marston and Chapman had added others of their own, were elaborated with incessant zeal by their contemporaries and successors. The inexhaustible *verve* of T. Middleton, the buoyant productivity of Fletcher, the observant humour of N. Field, and the artistic versatility of Shirley mirrored in innumerable pictures of contemporary life the follies and foibles of mankind.

Later Academic Drama.—The academic drama of the later Elizabethan period and of the first two Stuart reigns did not fall off either in activity or in variety from that of the preceding generations. At Oxford a long succession of English and Latin plays were performed, from the early years of the 17th century onwards. The production of these plays as distributed among several colleges, among which the most conspicuously active were Christ Church and St. John's, where a series of performances took place in 1607–08 under the collective title of *The Christmas Prince.* Other notable Oxford plays are S. Daniel's pastoral drama, *The Queen's Arcadia* (1605), Barten Holiday's *Technogamia* (1618), W. Strode's *Floating Island* and W. Cartwright's *The Royal Slave* (1636), all of which formed part of royal entertainments. At Cambridge the list of plays performed in the latter half of Elizabeth's reign at Trinity, St. John's, Queens' and a few other colleges, contains several of special interest. Among Latin comedies E. Forsett's *Pedantius,* probably acted at Trinity in 1581, ridicules Gabriel Harvey; *Laelia,* acted at Queens' in 1590 and again in 1598, resembles *Twelfth Night* in part of its plot; while in *Silvanus,* performed in 1597 at St. John's, there are similarities to *As You Like It.* The most interesting of the English plays of the later Cambridge series are the *Parnassus Plays,* successively produced at St. John's in 1598–1602, which illustrated the unfortunate relations between university life and the outside world, including the world of letters and of the stage as represented by Shakespeare's fellows Burbage and Kemp. Upon a different aspect of English university life—the relations between town and gown—a partisan light is thrown by *Club-Law,* acted at Clare in 1599—and by G. Ruggle's Latin comedy of *Ignoramus,* twice acted by members of Clare at Trinity in 1615 before King James I. Other Cambridge English plays of note are T. Tomkis's allegorical *Lingua* (1607) and Phineas Fletcher's *Sicelides* (1615), a "piscatory" (*i.e.,* a pastoral drama in which the place of the shepherds is taken by fishermen). Latin and English plays continued to be brought out in Cambridge till the year of the outbreak of the Civil War, T. Randolph and A. Cowley being among the authors of some of the latest so produced.

The Drama and Puritanism.—Up to the outbreak of the Civil War the drama in all its forms continued to enjoy the favour of the court, although a close supervision was exercised over attempts to make the stage the vehicle of political references. The official agent of this supervision was the Master of the Revels; but under James I. a special ordinance, in harmony with the king's ideas concerning the dignity of the throne, was passed "against representing any modern Christian king in plays on the stage." But the sympathies of the dramatists were so entirely on the side of the court that the real difficulties against which the theatre had to contend came from an opposite quarter. With the growth of Puritanism the feeling of hostility to the stage increased in a large part of the population, well represented by the civic authorities of the capital. Puritans of the more pronounced type openly aimed at the permanent closing of the theatres. The war between them and the dramatists was accordingly of a life-and-death kind. On the one hand, the drama heaped its bitterest and often coarsest attacks upon whatever savoured of the Puritan spirit; gibes, taunts, caricatures in ridicule of Puritans make up a great part of the comic literature of the later Elizabethan and Stuart drama. On the other hand, the looseness of tone, the mockery of ties sanctioned by law and consecrated by religion, the tendency to treat middle-class life as the hunting-ground for the diversions of the upper classes, which infected so much of the dramatic literature of the age, intensified the Puritan opposition to all and any stage plays. This was most loudly voiced in Prynne's *Histrio-Mastix* (1632), which involved its author in persecution, but did not remain wholly without effect upon the tone of the dramatic literature of the subsequent period. The quarrel between Puritanism and the theatre was, however, too old and too deep to end in any but one way, so soon as the latter was deprived of its protectors. The Civil War began in Aug. 1642, and early in the following month was published the ordinance of the Lords and Commons, which, after a brief and solemn preamble, commanded "that while these sad causes and set-times of humiliation do continue, public stage plays shall cease and be forborne." Though there is evidence that dramatic entertainments of one kind or another continued to be occasionally presented, stringent ordinances gave summary powers to magistrates against any players found engaged in such proceedings (1647), and bade them treat all stage-players as rogues, and pull down all stage galleries, seats and boxes (1648). **A** few dramatic works were published in this period; while at fairs about the country were acted farces called "drolls," consisting of the most vulgar scenes to be found in popular plays. Thus the life of the drama was not absolutely extinguished.

Revival **of the** Drama.—Already "in Oliver's time" private performances took place from time to time at noblemen's houses and (though not undisturbed) in the old haunt of the drama, the Red Bull. In 1656 the ingenuity of Sir William Davenant, whose name is memorable as connecting two distinct periods, ventured on a bolder step in the production of a quasi-dramatic entertainment "of declamation and music"; and in the following year he brought out with scenery and music a piece which was afterwards acted in an enlarged form and printed as the first part of his opera The *Siege* of *Rhodes.* This entertainment he afterwards removed from the private house where it had been produced to the Cockpit, where he soon ventured upon the performance of regular plays written by himself. Thus, under the cover of two sister arts, whose aid was in the sequel to prove by no means altogether beneficial to its progress, the English drama had boldly anticipated the Restoration, and was no longer hiding its head when that event took place. Soon after Charles II.'s entry into London, two theatrical companies are known to have been acting in the capital. For these companies patents were soon granted, under the names of "the Duke (of York)'s" and "the King's

Servants," to Davenant and Thomas Killigrew respectively—the former from 1662 acting at Lincoln's Inn Fields, then at Dorset Garden in Salisbury court, the latter from 1663 at the Theatre Royal near Drury lane. These companies were united from 1682, a royal licence being granted in 1695 to a rival company which performed in Lincoln's Inn Fields, and which migrated to Covent Garden in 1733. Meanwhile, Vanbrugh had in 1705 built the theatre in the Haymarket; and a theatre in Goodman's Fields—afterwards rendered famous by the first appearance of Garrick—led a fitful existence from 1729 to 1733. The Act of 1737 deprived the Crown of the power of licensing any more theatres; so that the history of the English stage for a long period was confined to a restricted area. The rule which prevailed after the Restoration, that neither of the rival companies should ever attempt a play produced by the other, operated beneficially both upon the activity of dramatic authorship and upon the progress of the art of acting. This art has rarely flourished more in England than in the days of T. Betterton and his contemporaries, including Hart, Mohun, Kynaston, Nokes, Mrs. Barry, Mrs. Betterton, Mrs. Bracegirdle and Mrs. Eleanor Gwyn. It is to be noted also that during the greater part of the 18th century the Dublin stage rivalled the English in the brilliancy of its stars. Betterton's rival, R. Wilks, Garrick's predecessor in the homage he paid to Shakespeare, Macklin, and his competitor for favour, the "silver-tongued" Barry, were alike products of the Irish stage, as were Peg Woffington and other well-known actresses.

Restoration Drama: Heroic Tragedy.--Owing in part to the influence of the French theatre, which by this time had taken the place of the Spanish as the ruling drama of Europe, the separation between tragedy and comedy is clearly marked in post-Restoration plays. Lord Orrery, in deference, as he declares, to the expressed tastes of his sovereign King Charles II. himself, was the first to set up the standard of *heroic plays.* This new species of tragedy (for such it professed to be) commended itself by its novel choice of themes, to a large extent supplied by recent French romance—the *ronzans de longue haleine* of the Scudérys and their contemporaries—and by French plays treating similar themes. It likewise borrowed from France that garb of rhyme which the English drama had so long abandoned, and which now reappeared in the heroic couplet. In conjunction with his brother-in-law, Sir R. Howard, and afterwards more confidently by himself, Dryden threw the vigour and brilliancy of his genius into the scale. At first, in his *Essay* of *Dramatic Poesy,* he claimed for English tragedy the right to combine her native inheritance of freedom with these valuable foreign acquisitions. Nor was he dismayed by the ridicule which the burlesque (by the duke of Buckingham and others) of *The Rehearsal* (1671) cast upon heroic plays, but returned, in his *Essay of Heroic Plays,* to the defence of a species which he himself was to abandon in the end. Among the other tragic poets of this period, N. Lee, in the outward form of his dramas, accommodated his practice to that of Dryden, like whom he allowed political partisanship to intrude upon the stage. His rhetorical genius was not devoid of genuine energy, nor is he to be regarded as a mere imitator. T. Otway, the most gifted tragic poet of the younger generation contemporary with Dryden, inherited something of the spirit of the Elizabethan drama; he had at his command tragic pathos and melting tenderness. Among dramatists who contributed to the vogue of the "heroic" play may be mentioned J. Bankes, J. Weston, C. Hopkins, E. Cooke, R. Gould, S. Pordage, T. Rymer and Elkanah Settle. The productivity of J. Crowne (d. *c.* 1703) covers part of the earlier period as well as of the later, to which belong T. Southerne, a writer gifted with much pathetic power, but probably chiefly indebted for his long-lived popularity to his skill in the discovery of "sensational" plots; and Lord Lansdowne ("Granville the polite") (*c.* 1667–1735). Congreve, by virtue of a single tragedy *(The Mourning Bride),* and *N.* Rowe, may be further singled out from the list of the tragic dramatists of this period, many of whom were, like their comic contemporaries, mere translators or adapters from the French. The tragedies of Rowe indicate the transition from the fuller declamatory style of Dryden to the calmer and thinner manner of Addison. The excesses of the past period had produced an inevitable reaction; decorum was asserting its claims on the stage as in society; and French tragedy had set the example of sacrificing what passion—and what vigour—it retained in favour of qualities more acceptable to the "reformed" court of Louis XIV. Addison, in allowing his *Cato* to take its chance upon the stage, when a moment of political excitement (April 1713) ensured to it an extraordinary success, unconsciously sealed the doom of English national tragedy. The "first reasonable English tragedy," as Voltaire called it, had been produced, and the oscillations of the tragic drama of the Restoration were at an end.

Restoration Comedy.—English comedy in this period displayed no similar desire to cut itself off from the native soil and it exhibits the influence of Jonson and Fletcher though it freely borrowed the materials for its plots and many of its figures from Spanish, and afterwards more generally from French, originals. The higher efforts of French comedy of character, as well as the refinement of expression in the list of their models, notably in Molière, were alike seasoned to suit the grosser palates of English patrons. This is especially true of the comedies of Dryden from *The Wild Gallant* (1663) to *The Spanish Friar* (1680). In no field did Dryden's versatile genius appear, on the whole, to less advantage, but in his presentation of pairs of witty lovers he anticipates one of the main features of the comedy of manners, which is the most typical product of the Restoration stage. As the latest historian of that stage (A. Nicoll) observes, "the invariable elements of the comedy of manners are the presence of at least one pair of witty lovers, the woman as emancipated as the man, their dialogue free and graceful, an air of refined cynicism over the whole production, the plot of less consequence than the wit, an absence of crude realism, a total lack of any emotion whatever." There is a further approach to the type in Sir C. Sedley's *The Mulberry Garden* (1668) and it is definitely established in plays of Sir George Etherege. Other comic types are exemplified in T. Shadwell's Jonsonian plays, from the *Sullen Lovers* (1668) to *The Squire of Alsatia* (1688); in Sir S. Tuke's and Mrs. Aphra Behn's comedies of intrigue (1672–79); and in T. D'Urfey's partly farcical, partly sentimental plays (1676–96). But it was in the comedy of manners that the most powerful, and the most polished, dramatist of the age found each his medium. W. Wycherley drew his characters with vigour and distinctness, and constructed his plots and chose his language with natural ease. He lacks gaiety of spirit, and his wit is of a cynical turn. But, while he ruthlessly uncloaks the vices of his age, his own moral tone is affected by their influence in as marked a degree as that of the most light-hearted of his contemporaries. W. Congreve is not only one of the wittiest of English writers, but excels in the graceful ease of his dialogue, and draws his characters with the same masterly skill. His *Way of the World* has been truly called "the master-creation of the school of manners." Mirabell and Millamant look back to Benedick and Beatrice and forward to Tanner and Ann Whitfield in Shaw's *Man and Superman.* Sir J. Vanbrugh lacked Congreve's brilliance, but his lively wit and theatrical sense give salt to his two best plays, *The Relapse* and *The Provok'd Wife.* G. Farquhar, whose morality is on a par with that of the other members of this group, is inferior to them in brilliancy; but the pictures of manners, in a wider sphere of life than that which contemporary comedy usually chose to illustrate, give distinction to two of his plays (*The Recruiting Officer* and *The Beaux' Stratagem),* in which we seem to be entering the atmosphere of the 18th century novel.

Sentimental Comedy.—The improvement which now begins to manifest itself in the moral tone and spirit of English comedy is partly due to the reaction against the reaction of the Restoration, partly to the punishment which the excesses of the comic stage had brought upon it in the invective of Jeremy Collier (1698), best-founded of all the assaults on the theatre in England and most productive of perceptible results. Writers like Mrs. Centlivre became anxious to reclaim their offenders with much emphasis in the fifth act; and Colley Cibber may be

credited with having first deliberately made the pathetic treatment of a moral sentiment the basis of the action of a comic drama. But he cannot be said to have consistently pursued the vein which in his Careless Husband (1704) he had essayed. His *Non-Juror* is a political adaptation of *Tartuffe;* and his Provoked *Husband* only supplied a happy ending to Vanbrugh's unfinished play. Sir R. Steele, in accordance with his general tendencies as a writer, pursued a still more definite moral purpose in his comedies; but his genius lacked the sustained vigour necessary for a dramatist, and his humour naturally sought the aid of pathos. From partial he passed to more complete experiment; and thus these two writers, who transplanted to the comic stage a tendency towards the treatment of domestic themes noticeable in such writers of Restoration tragedy as Southerne and Rowe, set the fashion of sentimental *comedy,* a species which exercised a debilitating influence upon the progress of English drama. With Cato English tragedy committed suicide, though its pale ghost survived; with The Conscious Lovers English comedy sank for long into the tearful embraces of artificiality and weakness.

There is every reason to conclude that the art of acting progressed in the same direction of artificiality, and became stereotyped in forms corresponding to the "chant" which represented tragic declamation in a series of actors ending with Quin and Macklin. It was reserved to the genius of Garrick, whose theatrical career extended from 1741 to 1776, to open a new era in his art. His unparalleled success was due in the first instance to his natural gifts; yet these were enhanced by a careful literary training, and confirmed by a purpose which prompted him to essay the noblest, as he was capable of performing the most various, range of English theatrical characters. By devoting himself as actor and manager with special zeal to the production of Shakespeare, Garrick permanently popularized on the national stage the greatest creations of English drama.

Eighteenth Century Tragedy.—The contrast between the tragedy of the 18th century and those plays of Shakespeare and other Elizabethans which in the period before Garrick were known to the English stage, was weakened by the mutilated form in which the old masterpieces generally, if not always, made their appearance there. Even so, however, there are perhaps few instances in theatrical history of so unequal a competition being so long sustained. In the hands of the tragic poets of the age of Pope, as well as that of Johnson. tragedy had hopelessly stiffened into the forms of its accepted French models. Direct reproductions of these continued, as in Ambrose Philips's and Charles Johnson's (1679–1748) translations from Racine, and Aaron Hill's from Voltaire. Among other tragic dramatists of the earlier part of the century may be mentioned J. Hughes, who, after assisting Addison in his Cato, produced at least one praiseworthy tragedy of his own (The Siege of Damascus); E. Fenton, a joint translator of "Pope's Homer" and the author of one extremely successful drama on a theme of enduring interest (*Mariamne*), and L. Theobald the first hero of the Dunciad. A more distinguished name is that of J. Thomson, whose unlucky *Sophonisba* and subsequent tragedies are, however, barely remembered by the side of his poems. The literary genius of E. Young, on the other hand, possessed vigour and variety enough to distinguish his tragedies from the ordinary level of Augustan plays; in one of them (*The* Revenge) he seems to challenge comparison in the treatment of his theme with *Othello,* but by his main characteristics as a dramatist he belongs to the school of his contemporaries. The endeavours of G. Lillo, in his *London Merchant,* or George *Barnwell* (1731), to bring the tragic lessons of terror and pity directly home to his fellow-citizens exercised an astonishingly widespread as well as enduring effect on the history of the 18th century drama. At home, they gave birth to the new. or, more properly speaking, the revived, species of domestic tragedy. Abroad, this play supplied the text to the teachings of Diderot, as well as an example to his own dramatic attempts; and through Diderot the impulse communicated itself to Lessing, and long exercised a great effect upon the literature of the German stage. "Ciassical" tragedy in the generation of Dr Johnson pursued the even tenor of its way, the dictator himself treading with solemn footfall in the accustomed path, and W. Mason making the futile attempt to produce a close imitation of Greek models. The best-remembered tragedy of the century, Home's *Douglas* (1757), was the production of an author whose famous kinsman, David Hume (though no friend of the contemporary English stage), had advised him "to read Shakespeare, but to get Racine and Voltaire by heart."

English Opera.—While thus no high creative talent arose to revive the poetic genius of English tragedy, comedy, which had to contend against the same rivals, naturally met the demands of the conflict with greater buoyancy. In one form the English opera was preserved as a pleasing species of the popular drama. The pastoral drama had (in 1725) produced an isolated aftergrowth in Allan Ramsay's Gentle Shepherd, which, with genuine freshness and humour, but without a trace of burlesque, transferred to the scenery of the Pentland hills the tale of Florizel and Perdita. The dramatic form of this poem is only an accident, but it doubtless suggested an experiment of a different kind to the most playful of London wits. Gay's "Newgate pastoral" of The Beggar's Opera (1728), in which the text of a burlesque farce was interspersed with songs set to popular airs, caught the fancy of the town and became the ancestor of a series of productions, none of which, however, not even its own continuation, Polly, have ever rivalled it in success or celebrity. Among these may be mentioned the pieces of I. Bickerstaffe (Love *in a* Village, etc.) and C. Dibdin (The *Waterman,* etc.). The opera in England thus absorbed what vitality remained to the pastoral drama, while to the ballet and the pantomime (whose glories in England began at Covent Garden in 1733, and to whose popularity even Garrick was obliged to defer) was left the inheritance of the external attractions of the mask and the pageant.

Later **18th** Century Comedy.—In the face of such various rivalries it is not strange that comedy, instead of adhering to the narrow path which Steele and others had marked out for her, should have permitted herself some vagaries of her own. Gay's example pointed the way to a fatally facile form of the comic art; and burlesque began to contribute its influence to the decline of comedy. In an age when party-government was severely straining the capabilities of its system, dramatic satire had not far to look for a source of effective seasonings. The audacity of H. Fielding, whose regular comedies have secured no enduring place on the stage, accordingly ventured in two extravaganzas (*Pasquin* and *The* Historical Register *for 1736)* upon a larger admixture of political with literary and other satire. A third attempt (The Golden Rump), which never reached the stage, furnished the offended minister, Sir Robert Walpole, with the desired occasion for placing a curb upon the licence of the theatre, such as had already been advocated by a representative of its old civic adversaries. The Act of 1737 asserted no new principle, but converted into legal power the customary authority hitherto exercised by the lord chamberlain (to whom it had descended from the Master of the Revels).

Farce had now become a genuine English species, and has as such retained its vitality through all the subsequent fortunes of the stage; it was actively cultivated by Garrick as both actor and author; and he undoubtedly had more than a hand in the best farce of this age, which is ascribed to clerical authorship (High Life Below Stairs, 1759). S. Foote, whose comedies and farces are distinguished both by wit and by variety of characters, introduced into comic acting the abuse of personal mimicry. Meanwhile, the domestic drama of the sentimental kind achieved, though not immediately, a success only inferior to that of Tlze London Merchant, in Tlze Gamester of E. Moore, to which Garrick seems to have contributed; and sentimental comedy gained sympathetic applause in the works of R. Cumberland, F. Reynolds and H. Kelly. It cannot be said that this species was extinguished, as it is sometimes assumed to have been, by Goldsmith; but he certainly published a direct protest against it between the production of his admirable character-comedy of The *Good-Natured* Man, and his delightfully brisk and fresh *She Stoops* to *Conquer.* The most successful efforts of the elder G. Colman had in them something of the spirit of genuine comedy,

besides a finish which is one of the qualities which ensure a long life to a play. And in the masterpieces of R. B. Sheridan some of the happiest features of the comedy of Congreve were revived, together with its too uniform brilliancy of dialogue, but without its indecency of tone. The varnish of the age is indeed upon the style, and the hollowness of its morality in much of the sentiment (even where that sentiment is meant for the audience) of *The Rivals* and *The School for Scandal;* but in tact of construction, in finish of character drawing, and in pungency of social satire, they are to be ranked among the glories of English comedy. Their continued popularity has in fact unduly overshadowed the merits of other later 18th century plays. T. Morton's *Speed the Plough* (where we first hear of "Mrs. Grundy"); A. Murphy's *The Way to Keep Him* and *The School for Guardians;* and the humanitarian drama of T. Holcroft *(The Road to Ruin* and *The Deserted Daughter)* and Mrs. Inchbald *(Every One Has His Faults* and *Wives As They Were And Maids As They Are)* all have distinctive qualities. Notable too are Mrs. Cowley ("Anna Matilda") and G. Colman the younger, both writers of popular comedies, as well as the prolific J. O'Keefe (1746–1833), who contributed to nearly every species of the comic drama.

19th Century Drama.—With the beginning of the 19th century came a decline of dramatic composition of the higher class. Joanna Baillie's well-meant but anaemic attempts to rejuvenate in her plays on the passions poetic tragedy and comedy were based on a misleading theory. In any case the times were out of joint for such an endeavour. The poems, with which Scott and Byron, and the novels, with which Scott both satisfied and stimulated the imaginative demands of the public, diverted the attention of the cultivated classes from dramatic literature, which was unable to escape, with the light foot of verse or prose fiction, into "the new, the romantic land." Scott, who in his earlier days had translated Goethe's *Götz von Berlichingen,* gained no reputation by his own dramatic compositions. W. S. Landor, apart from those *Imaginary Conversations* upon which he best loved to expend his powers of observation and characterization, cast in a formally dramatic mould studies of character of which the value is far from being confined to their wealth in beauties of detail. Of these the magnificent, but in construction altogether undramatic, *Count Julian,* is the most noteworthy. Shelley's *The Cenci,* on the other hand, is not only a poem of great beauty, but a drama of true power, abnormal in theme, but singularly pure and delicate in treatment. A humbler niche in the temple of dramatic literature belongs to some of the plays of C. R. Maturin, Sir T. N. Talfourd and Dean Milman.

Never was the divorce between the theatre and literature so complete and prolonged as during the major part of the 19th century. Fertilizing ideas, distinction of style, whether in poetry or prose, and originality in technique were all wanting. Among the professional playwrights only a few have a claim to remembrance. Sheridan Knowles composed his conventional semblance of genuine tragedy and comedy (*Virginius* and *The Hunchback*) with a thorough knowledge of stage effect. The first Lord Lytton, though his plays were for the most part of a lighter texture, showed even more artificiality of sentiment in their conception and execution; but the romantic touch which he imparted to the *Lady of Lyons* accounts for its long-lived popularity. T. W. Robertson in *School* and *Caste* brought back a refreshing breath of naturalness into the acted comic drama; Tom Taylor made little pretence to original invention, but adapted with an instinct that rarely failed him.

But in the last decades of the Victorian age, the revival of public interest in the theatre co-operated with a gradual change in poetic taste to awaken the hope of a future living reunion. Among English poets who lived in this period, Sir Henry Taylor and R. H. Horne caught something of the Elizabethan accent and spirit. Of the chief poets of the age, Tennyson in his later years attempted, with only partial success, a form of composition not well suited to his genius (though his *Becket,* as interpreted by Irving, was a memorable stage ecclesiastic). Memorable also are the plays of Robert Browning, some of whose distinctive gifts are displayed in his dramatic work; and the sustained endeavours of A. C. Swinburne, after adding a flower of exquisite beauty to the wreath which the lovers of the Attic muse have laid at her feet, to enrich the national historic drama by a trilogy instinct with the ardent eloquence of passion.

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The Theatre of Charles Kean and **Phelps.**—During the greater part of the 19th century the English drama was more fitly to be considered as a part of the general industry of entertainment than as a serious contribution to the world's art of the theatre. When Matthew Arnold protested in 1879 that there was

no English theatre he did not, of course, mean that there were no stages, no actors, and no audiences, but that England was not taking a considerable or a worthy part in the development of a dramatic form of expression which had other ambitions than mere showmanship and the establishment of box-office standards of success. The English drama did, in fact, conform to its position in the industry of catering for the popular leisure by expanding with expanding commerce. It even followed the economic trend so closely that it acquired Free Trade at the time when Free Trade was becoming a dominant social issue. The lingering and rather futile efforts to protect the economic interests of the two historic patent theatres of London, Drury Lane and Covent Garden, by giving them a monopoly of the legitimate drama were abandoned in 1843, when an Act of parliament granted a comprehensive freedom to the stage. Drama was thus liberated like any article of commerce and, as the population was growing rapidly in numbers and in wealth, there was a swift expansion of dramatic output. But what was offered to the new public must, unfortunately, be considered in terms of quantity rather than of quality. Commercial standards became more frankly accepted and the ideal of the "long run" supplanted the old conceptions of a classical repertory in which it was the function of the leading players to appear continually and to display their various powers and graces in a great variety of traditional and testing parts. The old policy, however, of a classical routine was maintained by Charles Kean who became lessee of the Princess's in 18jo and by Samuel Phelps at Sadler's Wells. Kean, on the one hand, was endeavouring to sustain the best kind of dramatic appeal by throwing in costly embellishments which a later taste would have considered unnecessary or even absurd. Phelps, on the other, did splendid work, not only for the public that still wanted Shakespeare. but for the Shakespearian text itself by going back to the Folio for his matter instead of using the adaptations and "versions" which had been started during the Restoration with the authority of Dryden and had continued to grow in numbers and stupidity throughout the 18th century. Even John Philip Kemble, who had been considered something of a purist in these matters, played a musical version of *The Tempest* which contains lyrics in the style of an 18th century ballad opera. Against such barbarism, long taken for granted even by cultured people, Phelps made a strong and splendid stand at Sadler's Wells and during his management there, which lasted from 1844 till 1862, he maintained a dignified level of dramatic art while the national theatre as a whole was only concerned with rhetoric and sensation and with reaping the financial benefits of its new freedom. The drama was still governed by a State censor, for whose office the lord chamberlain was responsible, and by local licensing authorities who could restrict productions either on account of unsuitable premises or unsuitable matter such as might give moral offence or be a likely cause of riots and unrest. But in mid-Victorian times there was little interference with the industry and the players lived and worked in that conipanionable anarchy which is so picturesquely described in the Crummles episodes of *Nicholas Nickleby*.

After the Act of 1843 there was a rapid growth of theatres proper or lord chamberlain's houses; they could multiply according to popular demand, while the old saloon theatres, which had been outside the patent and had dealt mainly in imported romantic dramas and light operas, found that the new rivalry necessitated new measures The saloon theatres accordingly relied more and more upon song and dance and became the parents of the music-hall, while the orthodox houses were occupied by all that early Victorian England could offer in the shape of drama. It was not very much. Right on up to the '80s the Victorian theatre was dominated by the French tradition in farce and melodrama with the result that many English writers who might have been the "abstracts and brief chronicles" of their time, or who might at least have given to the actors opportunities for fulfilling the high function ascribed by Hamlet to the players, remained mere hacks engaged in adapting imported material.

T. W. Robertson's Comedies.—A distinct change was made by T. W. Robertson (1829–71), whose comedies seem to a generation used to Ibsen and Shaw to be painfully stilted and artificial. Robertson, none the less, was the supposed rebel and realist of his times; he believed that he was bringing the drama back to life from the pretty Alsatias and the riotous nonsense-worlds to which it had been driven. He became dramatist to the Bancroft management at the Prince of Wales's theatre where a new school of realistic staging and acting was begun in self-conscious revolt against the tawdry romanticism, the pomposities of rhetoric and spectacle, and the wild fustian of the general drama of the time. Robertson's most important contribution to the theatre of that period was his refusal to accept the battered types which passed for figures of fun. To playgoers 50 years later *Society* (1865) and *Caste* (1867) seemed almost laughably artificial, but they were considered by conteniporary critics to be daring essays in naturalism and actuality. Before Robertson's time the writing and the acting of character parts were limited by certain acknowledged formulae. There was a routine of the ridiculous in the theatre, as there was afterwards in the music-halls where noses had to be red by regulation and umbrellas broken as it were by schedule. The Bancrofts, working on Robertson's pieces, abolished these traditional restrictions upon truth and tried to substitute fresh individual characters for the stale humours of the type, The whole policy was to let in the breeze of actuality into the hot, stale atmosphere of the playhouse, and in this invigorating change they had important allies in two actors of consequence, Sothern and Hare. The latter wrote of Robertson that "As nature was the basis of his work, so he sought to make actors understand that it should be of theirs. He thus founded a school of natural acting which completely revolutionized the then existing method and, by so doing, did incalculable good to the stage." Unfortunately Robertson lacked successors. James Albery was credited with imagination and wit but he found the way of the adapter easier than that of the creator and H. J. Byron altogether fell away from the standards which Robertson had endeavoured to institute. Adaptations went briskly on and it was significant that when Beerbohni Tree went into management at the Haymarket in 1887 he relied niainly upon plays of foreign origin. Until the '80s were well advanced the practice of adaptation from the French (and sometimes, as in the case'of the ever-popular farce *The Private Secretary*, from the German) was held to be the legitimate as well as the customary occupation of a British playwright. To create episode or character was a rarity. Among those who occasionally created and more often adapted were Albery, Gilbert, Godfrey and Tom Taylor.

The **New** Theatre.—But, while the mid-Victorian years were largely sterile in authorship, important changes were being made in the organization and social status of the English theatre. In early Victorian times the actor was usually expected to be a Bohemian and might even be an outcast. The playhouse itself might be rough and ready and the society to be met there little better. The Bancrofts were responsible, not only for freshening the quality of stage writing and production, but for reintroducing the theatre to the attention of the prosperous middle-class and of those who might previously have hesitated before being seen in such a place. Whether it was that they raised the tone by raising prices or were able to raise the prices because they had raised the tone, the fact remains that they gave to their theatre a *cachet* and a *clientèle* which confirmed the place of drama among the arts of a civilized London community. Their theatre was as attractively upholstered as their stage was attractively set. Playgoing was made safe for the well-to-do levels of the democracy and respectability replaced the old notions of a rakish entertainment for rackety people. The half-guinea stall, which became a familiar London institution, was introduced and, what was more. it was sold and filled. It is interesting to notice that complaints made 60 years later about the high prices of seats in London theatres were not based on any historical sense of comparative values. The half guinea of 1868 was at least equivalent in general purchasing power to the pound of 1928. The return of the wealthy people to the play-going class did not work altogether for good; their taste might be more limited than their purse, and they certainly did not demand a form of theatrical art which should be intellectually ambitious. But it was, on the whole, an excellent

tiling that the English theatre should be rescued from its association with the histrionic booth at the fair and the blood-tub of the street-corner melodramas. The Bancrofts may not have found that polite and cultivated society of playgoers which Meredith postulated as essential to the production of comedy, but they rendered admirable service to the drama by restoring it to its place among the exercises and adornments of a civilized community.

The Provincial Tour.—Another of their achievements was the reorganization of theatrical life throughout the country. Provincial production had hitherto been left to stock companies or to travelling troupes working on local circuits. Lovers of Mr. Vincent Crummles will know that the strolling players added more to the strange pleasures of life than to the attractions of the theatre as a recreation for educated and adult people. The great mid-i'ictorian alteration was to bring to the provinces touring companies in recent successful plays with casts efficiently chosen in London and trained under expert supervision. The national development of communications made travel far easier than it had been and it was possible to carry proper scenery from place to place instead of relying upon the accident of local provision. In 1867 Bancroft organized for tour an exact reproduction of the London presentation of *Caste* and the quality of the performance appears to have been greatly appreciated in the towns which were visited. Buckstone's company from the Haymarket followed suit and it soon became common for actor-managers to go on tour and so bring to the various towns a smoothness and a virtuosity of performance to which the local audiences were quite unused. By the end of the 19th century all the great London actors and important foreign visitors, like Sarah Bernhardt, habitually took their companies on tour and the centralization of theatrical activity in the capital was considerably diminished. There were obvious advantages in this, but the old stock companies, which were displaced by the new touring combinations, had been extremely valuable as training-schools. A player brought up in them had to learn to play all kinds of parts at very short notice; he had therefore to be elastic in his technique and to be versatile in his range. He might be king one day and beggar the next. But with the touring companies from London the player went on repeating one part and then was expected to continue in another *rôle* of the same kind. He became a specialist and was cast only for parts in which he was known to specialize. The result was the elaboration of smoothness in certain types of work, but not the creation of actors with plastic masks and personalities who were ready to go anywhere and to do anything. Even those who least approve the type of drama produced by the old conditions of the pre-Bancroft stage would admit that those conditions were likely to evoke a rich and resourceful type of acting in which full command of movement and of diction were absolutely essential.

The Stage Divorced from National Culture.—It is plain from what has been said of the early and mid-Victorian stage-that the play was not the thing. The playgoer's motive was rarely literary nor did he regard it as the function of the dramatic art to hold the mirror up either to human nature, to current manners, or to problems of the hour or of eternity. The period was one of intensely dramatic changes in the national life. The whole economic structure of society was altering; science was coming forward to challenge dogma; the strife of classes and of generations was taking shape in conflicts whose natural artistic expression should surely have been dramatic. But to the student who wishes to map out the social landscape of the time the stage offers extremely little evidence. In no sense were the actors the abstracts of their time. Both the pride in the new progress and the protests against it were made vocal in the novel and in poetry. Unfortunately the English stage was so far divorced from the national culture that it totally failed to interpret in terms of drama the immensely important and immensely exciting developments in the knowledge, wealth and power of mankind. If ever history was throwing material to the playwright it was then; but the playwright was too busy with importing French trivialities or concocting the farces of the routine to pay any attention to his superb opportunities of doing for the theatre what Dickens and Thackeray were doing for the novel. It was only after Ibsen had revolutionized the European theatre by making his drama into a vivid criticism of actual social values that English writers who had a similar artistic purpose came to use the dramatic medium.

An Actor's Theatre.—But in the absence of a great school of playwrights there was both demand and supply of great acting. There are always three parties to the art of the theatre. There is the man who writes, the man who acts, and the man who makes the spectacle. That is a simple analysis which is capable of much refinement in one way or expansion in another. The history of the theatre shows that those three parties are continually engaged in rivalry as well as in co-operation. A struggle for the balance of power is ever in progress. Accordingly, whereas one epoch or generation is particularly distinguished for the quality of its plays and of the authors whom it attracts to theatrical service, another is the golden age of the great actor who is admired for himself alone and not in relation to the splendour or the subtlctjj of that in which he acts, while at another time the emphasis centres on display of scene or on the mass-effects controlled by the producer and the pageant-master. The theatre of England in the 19th century (or at least until the renaissance of English dramatic composition in the '80s) was predominantly an actor's theatre. Pageantry there might be; personality there had to be. The playgoer thought in terms of the actor and his individual magnetism and, whereas the man of culture in 1920 would have said to his friend "Shall we go and see the new Galsworthy or the new Shaw?" his predecessors in polite playgoing would have said in the various earlier periods "Shall we go and see Kemble or Kean or Macready, or Phelps, or Irving?" The primary interest was not in the thing written, but in the thing done. The great actors did not wish to be brief chronicles appearing in the works of the moment but liked to take part in the histrionic tournament provided by rival appearances in the great historic *rôles*. They appealed to connoisseurs who would match their Hamlet or Macbeth against another's. What mattered was neither the mind of the original Shakespeare, nor the absence of a new one, but the arrival of a new virtuoso who would berattle the town with his rhetoric or conquer it with his grace in some grand Shakespearian *rôle*.

The Reign of Henry Irving.—The sovereignty of Henry Irving in the theatre of the time can best be understood if we remember to what extent that theatre was under the actor's domination. Irving carried on the social service of the Bancrofts in bringing honour to his art and rescuing his profession from squalor and from disrepute. Yet of this most eminent Victorian, whose name is almost synonymous with the national theatre of his time, an otherwise sympathetic critic could remark "His managerial career had scarcely any significance for the living English drama. He seldom experimented with a new play, and, of the few which he did produce, only *The* Cup and *Becket* by Lord Tennyson have the remotest chance of being remembered." And even these were soon forgotten. But the man was not. To see *The Bells*, an adaptation from the French of Erckmann-Chatrian, without Irving was to see an ordinary melodrama which might in later years have formed part of a Grand Guignol programme. But Irving's emotional powers enabled him to turn "tushery" into tragedy; he could strike terror, though he sometimes failed to raise compassion, with the result that his melodramatic villains were more successful than his tragic heroes. His reign at the Lyceum (1878–99), in which for so long he had Ellen Terry as his colleague in command, was a sustained and, on the whole, successful demonstration of the benefits that may lie in an actor's dominion over the dramatic art. His Richard III., Iago, and Shylock were commonly accepted as brilliant and he could raise a melodrama like *The* Lyons *Mail* from its natural level of efficient artifice to the higher category of the tragedian's art. There will always be different delights of the theatre and it is a fair distinction which separates the drab talents from the flamboyant. By drab one seeks, without slight, to denote the quiet pleasures of logic, the whisper of realism, and the puissance of that art which is, on the surface, no more than a hint. The

Victorian theatre was the home of the rhetoricians and the flamboyants, and Irving, who went into battle nightly with all his drums beating, was at once the sovereign and the symbol of his time.

Melodrama.— This cult of flamboyance had naturally its various levels. One aspect was the popularity of translations of Sardou, a French playwright who exploited situation with exceptional cunning. His play *Dora*, first produced in English as *Diplomacy* at the Prince of Wales's in 1878 and since frequently revived in London and elsewhere, is a perfect example of the well-made play built to frame highly coloured acting. Lower down the scale there was a steady flow of melodrama, and Henry Arthur Jones, afterwards to be a considerable master of the comedy of manners, won an early success with *The Silver King*, which was produced at the Princess's in 1882 and showed a technical adroitness later to be expended on less crude material. In this *genre* Wilson Barrett was a great performer, George R. Sims a competent and fluent librettist, and the Adelphi theatre a constant home of flamboyant spectacle and unabashed sensationalism. At Drury Lane the famous Christmas pantomimes with their vast display and costly transformation scenes were followed by equally resplendent dramas and the management of Sir Augustus Harris (1879–96) provided many popular triumphs in this type of work. Arthur Collins, who later carried on and developed the tradition of Drury Lane, was no less successful. Melodrama in its crudest form had great difficulty in surviving the competition of the films, but it stayed on obstinately at the Elephant and Castle theatre in south London and during 1927 and 1928 there was a large middle-class audience which made pilgrimages to see and to titter at such flamboyant folk-plays as *Maria Marten* and *Sweeney Todd*.

The mid-Victorian musical stage was in subjection to the Offenbach tradition. That might have meant delightful entertainments, but the adaptations were badly made and now seem pitifully inane. Another form of entertainment was the burlesque which was initiated by J. R. Planché and well developed by the founder's hand; but it was grossly abused by less competent people and the fact that the lamp might shine brightly at the Gaiety did not guarantee a parallel radiance elsewhere. The great mid-Victorian contribution to light opera and the musical theatre in general was the partnership of W. S. Gilbert with Arthur Sullivan. The brief extravaganza *Trial by Jury* (1875) was followed by a long series of operettas, gently satirical and exquisitely melodious, of which *Patience*, a brilliant lampoon of the aesthetic movement, was perhaps the cleverest, while *The Mikado* and *The Yeomen of the Guard* have remained the most popular. Though the two great co-operators were frequently at odds with one another they did their best work in association and the D'Oyly-Carte management at the Savoy theatre from 1881 onwards enjoyed a constant, a wide, and a discriminating support. Meanwhile burlesques fell out of favour and were displaced by a type known as "musical comedy," of which the first example was *In Town*, produced in 1892. The musical comedy adds light airs and "lyrics" to a plot of no consequence; it is less ambitious musically than light opera and it can absorb, on the other hand, the more obvious humours associated with the music-hall stage. It, in turn. found a new rival in "revue," a form of song-and-dance show interspersed with skits and sketches. It may be intimate and satirical or imposing and spectacular. Revues were popular at the Empire music-hall before the World War when ballet was an important element in their composition. Afterwards their elastic form made them a useful medium for any form of light entertainment. In the hands of Ronald Jeans and Noel Coward they were often the containing vessels of really brilliant satire on the fashions of the day and the follies of the town.

H. A. Jones and A. W. Pinero.—The orientation of theatrical effort towards great feats of acting and displays of personal magnetism continued until the end of the century. The visits to England of Duse and Bernhardt and the emergence of an English actress of great power and individuality in Mrs. Patrick Campbell created an intense and stimulating rivalry and a triangular tournament of talent. In June 1895, Bernard Shaw, then critic of The *Saturday Review* wrote "We critics can at last outdo Hazlitt and Leigh Hunt if we have a mind to; for we have just had two Mrs. Ebbsmiths to compare, beside a fourth Fédora, and Duse and Bernhardt playing *La Dame aux Camellias* and Sudermann's *Heimat* against one another at Daly's theatre and at Drury Lane." At the same time, however, the author was recovering his position in the English theatre and a distinct renaissance of the playwright's art began to be noticeable in the '80s. Henry Arthur Jones graduated from emotional drama to write urbane comedy like *The Liars* (1897), or deft plays of situation like *Mrs. Dane's Defence* (1900), while A. W. Pinero, beginning (1885–87) as a *farceur* with three very promising pieces *The Magistrate*, *The Schoolmistress* and *Dandy Dick*, passed on by way of sentimental comedy *(Sweet Lavender)* to become a master of drawing-room drama and England's most important manipulator of the fashionable problem-piece. After composing some pieces of improving quality he wrote *The Second Mrs. Tanqueray* which was produced at the St. James's theatre in 1893 and caused an immediate sensation. Undoubtedly the power and the expertness of this drama presented Pinero with a reputation which was European as well as English. Mrs. Tanqueray's story was followed up by a rapid succession of pieces which kept the dramatist in perpetual discussion and made attendance at his work an essential pleasure for the educated members of London society. *Trelawny of the Wells* was one of his most popular comedies, while *The Gay Lord Quex*, *Iris*, *Letty* and *His House in Order* revealed the many facets of his industry and his technical competence. Meanwhile the successes of Pinero and Jones were calling the notice of managers and actor-managers to the possibilities of using the fresh work of English authors instead of relying, as of old, upon a flow of adaptations. Hence it was that Sydney Grundy, R. C. Carton, Haddon Chambers and others found their opportunities and took them. The partnership of Jones's writing with Wyndham's acting was a notable feature of the '90s. Carton turned out a very capable sequence of light comedies in which his wife, who acted as Miss Compton. was a constant and all-conquering performer. *Lady Huntworth's Experiment* and *Mr. Hopkinson* were typical of his light invention. A new generation of playwrights began to appear. The theatre had recovered its esteem and men of letters need no longer hesitate to contribute to it lest their work should be botched by vulgarity of performance or despised owing to the house in which it was lodged. Oscar Wilde, for instance, turned to the theatre in 1892 and brought to the art of comedy his extraordinary brilliance in artificial dialogue. His mastery of epigram and paradox may seem a brittle talent, but it carried distinction of style into a region from which style had long been absent. Between 1892 and 1895 Wilde wrote *Lady Windermere's Fan*, *A Woman of No Importance*, *An Ideal Husband*, and, most durable of all, *The Importance of Being Earnest*. Between 1902 and 1908 J. M. Barrie, a journalist turned novelist and then dramatist, gave to the stage *Quality Street*, *The Admirable Crichton*, *Little Mary*, *Peter Pan*, *Alice Sit by the Fire* and *What Every Woman Knows*. Among other names that must be mentioned as valuable servants of the stage at that period are those of H. V. Esmond, Albert Sutro and Hubert Henry Davies.

Ibsen's Influence.— At this point it is necessary to turn back and to trace as briefly as possible the external forces which were helping to re-create the English drama after the long inertia of the 19th century. Ibsen's influence had begun to penetrate Europe in 1875 and for the next 20 years his steady output of plays, in which the driving actuality of a realistic method was applied to a social criticism and a radical philosophy of personal independence, made him a pre-eminent figure in any centre where the stage was considered as something more than a pastime and a plaything. When the rebellious wife, Nora, banged the door of *A Doll's House* (1880), the echo of that violence was heard across the continent, and the bitter criticisms of respectability which followed in *Ghosts* started a battle of the critics and a storm of discussion wherever that play was produced. As Ibsenism gathered force there were sporadic but simultaneous movements in the great capitals with the common goal of a new theatrical art freed from the old bondage of routine entertainment, from the rhetoric and the rant of the old acting, and from the fripperies of

the old method of presentation. The new drama was to be expressive of the social needs and purposes of the time. Antoine, a gasworks clerk who began his theatrical experiments in a garret to which he pushed his properties in a hand-cart, founded the Théâtre Libre in Paris in *1887* and transferred to the stage the naturalism which had replaced rdmanticism in the French fiction of his time. He strove to develop a drama which should mirror the pains, pleasures and problems of the day and a style of acting which should be quietly harmonized with the new method of writing. The revolt spread rapidly and "free theatres" were founded in the various capitals and, in turn, gave rise to other small, independent play-houses with such titles as the Modern theatre or the Art theatre. The famous Moscow Art theatre was founded in *1895* as a practical protest against the fustian of alien origin and the eternal traffic in stale French trifles which obstructed all progress on the Russian stage. The idea of the founders, Danchenko and Stanislavsky, was to elicit in terms of what they called "spiritual realism" a native Russian drama which should be representative of the younger generation, of its criticism of life, and of its aspirations and its resolves. "In our destructive and revolutionary aims," wrote Stanislavsky, '(in order to rejuvenate the art we declared war on all the conventionalities of the theatre wherever they might occur—in the acting, the properties, the scenery, or the interpretation of the play." As a result the author Chekhov, who had been on the verge of a suicidal despair, was able to do his work in sympathetic company and comparative cheerfulness and so to achieve his loveliest self-expression before he died. The new theatres, in short, were fostering new dramatists who, in turn, were fostering a new modesty and veracity in the players for whom they provided truthful and subtle dialogue and situations sincerely contrived instead of the familiar *clichés* of theatrical word and melodramatic deed.

The Arrival of Bernard Shaw.—The English parallel of the various free theatres was called the Independent by its founder J. T. Grein and was opened in *1891* with a performance of *Ghosts.* To begin with its directors were naturally attracted by translations of the new and important foreign work. The Independent gave Ibsen and Zola. But in the winter of *1892* it found its man. *Widowers' Houses* by Eernard Shaw was produced and met with no particular enthusiasm. But a new master had broken into the theatrical world and one who was claimed by many to be the greatest English dramatist since Shakespeare began to compose regularly for the stage. The theatre, viewed as a section of the industry of entertainment, may have begun by resenting his invasion as it had resented the arrival of Ibsen and the Ibsenites. But the art of the drama was not to be kept for ever in complete subjection to the commercial machine. The new drama had to live from hand to mouth, by subscription performances on Sunday nights, by special matinées, and by the efforts of amateurs. But it lived audaciously and obstinately and so established its independence. The Stage Society was founded in 1900 to produce on Sunday evenings the plays of merit and of experiment which could not find a home inside the ordinary playhouse, and there have been many subsequent organizations of a similar type and a similar object. The Stage Society discovered Granville Barker as author and producer and it was the Vedrenne-Barker partnership at the Court theatre (1904–07) which won for the first time a considerable English public and a wide recognition for Bernard Shaw. The Court became a practical academy for young actors in search of experience and an outlet for the new authors who were using the method of Ibsen to record their affirmations about every aspect of life. The chief Shaw successes at the Court were *You Never Can Tell, Man and Superman,* in which Granville Barker gave a particularly brilliant performance of the chief part, *John Bull's Other Island, Major Barbara* and *The Doctor's Dilemma.* Another outstanding production was that of *The Silver Box,* which introduced John Galsworthy to the playgoing public, and Prof. Gilbert Murray's translations of Euripides were also among the novel features of the Court programme. St. John Hankin (1869–1909) was a new dramatist to whom the commercial theatre was not usually hospitable. The Court season gave him new opportunities, while Granville Barker's own play *The Voysey Inheritance* was staged under the inspiring direction of the author.

The "Literary" Drama.—From this it may be seen that a remarkable and valuable change had come to the English theatre. The sovereignty of the actor and the actor-manager did not pass away because a few challenging trumpets had been blown outside the walls of the commercial theatre. Sir Herbert Beerbohm Tree continued at His Majesty's theatre to blend poetry with pageantry and both with personality. Stephen Phillips, a poet whose reputation stood astonishingly high in his time but was doomed to an almost complete eclipse after his death, composed *Ulysses* (1902) and *Nero* (1906) for Tree, who also employed Comyns Carr and Louis N. Parker as dramatists or perhaps it would be fair to say as librettists for his grand essays in stage-craft and mass-production. Tree's Shakespearian ventures were launched upon a full spread of scenic canvas and he himself was an actor of resource with a rich technique for the elaboration of character parts. But outside and beyond the splendours of His Majesty's with its tonnage and poundage of panoramic effects, its occasional droves of livestock, and its constant largesse of the incidentals and accessories of drama, the new English voice was making itself heard. It was often quiet and argumentative in distinction to the rhetoric and the colour of conventional work, but it became attractive to the young men and women who found in the theatre a mode of expression which would never have been contemplated by their fathers. There had, of course, been a Victorian "literary" drama. All Tennyson's verse-plays have been acted *(Harold,* long neglected, was given in London in, *1928)* while Swinburne's large output of tragedy has been strangely underrated: despite his lack of concentration he had some sense of the theatre as well as a superb fluency, and his trilogy on Mary Queen of Scots might yet survive if carefully prepared for the stage. Most poets of the period composed occasionally in dramatic form. Robert Bridges wrote *Prometheus (1883)* and *Nero* (1885) while John Davidson poured his wild fancy, anger and despair into a series of published plays. Thomas Hardy also presented his gigantic study of the Napoleonic wars in three volumes of acts and scenes. *The Dynasts,* with its cosmic sweep and philosophic chants as well as its routs and triumphs of embattled hosts, might seem to be beyond the compass of any stage, but Granville Earker produced an epitome which was in fact its essence at the little Kingsway theatre in 1914 and a similar version was played at Oxford in *1921.* But the drama of the poets never exercised a strong hold upon the playgoer: the English had lost their tradition of poetic drama and the manager who sought to revive it was taking serious risks. What did come into the English theatre at the turn of the century was a drama that was only "literary" in the sense that it might be composed by authors who were demonstrating their taste and talent in other fields.

Repertory Theatres.—The Vedrenne-Barker season at the Court was the prelude to the revival of the English stock-company system with a heightened ambition. The new movement abandoned the name of "stock" for that of "repertory" and it was to the new repertory theatres that the men of letters and the young dramatists eagerly turned for their opportunities. Shaw had already revealed an example of how inclusive the kingdom of drama might become. The new dramatists were not only to abandon the old theatricalism with its tedious repetition of plots in which farcical misunderstandings or sexual intrigues were almost the only constituents; they were to shrink from nothing in politics or economics, in ethics or metaphysics. They were to resume the Ibsenite tradition and make the English theatre an informed critic and mouthpiece of its age with the actor no longer domineering in all the richness of a star-part and exhibiting a star-personality but co-operating with the dramatist as an abstract and brief chronicle of the time.

At the Court theatre in London the example had been set; it was in the provinces, however, that the distinctive "repertory" movement was established. The absence of any national or municipal endowments for the theatre meant that the necessary funds for the creation of theatres which could hardly be (and

were not intended to be) serious competitors in the industry of entertainment had to be found among private patrons of the arts and enthusiasts for dramatic enterprise. Alfred Wareing, a young touring-manager fired by a great enthusiasm for the new drama, was enabled by some men of civic spirit in Glasgow to take over the Royalty theatre as a citizens' playhouse and there he maintained an ambitious repertory for several years. Meanwhile Miss A. E. F. Horniman, who had been private secretary to W. B. Yeats and had backed the production of Shaw's *Arms and the Man* at the Avenue theatre in 1894, opened the Abbey theatre in Dublin ten years later. In 1907 she used the Midland theatre, Manchester, to produce Charles MacEvoy's play *David Ballard,* and next purchased the Gaiety theatre in the same town and ran it until 1921, when it was sold to a cinema syndicate. The great period of the Gaiety was in the years between 1908 and 1914, during which time it attracted the widespread attention of critics and authors, enlisted the services of young players and producers who were afterwards to become leaders of the English theatre and gave the name of "Manchester school" to a particular kind of play and type of presentation in which quietness and sincerity were familiar characteristics. Among the authors who found fine opportunities at the Gaiety were Charles MacEvoy, Allan Monkhouse, John Masefield, Stanley Houghton, Elizabeth Baker, and St. John Ervine, while the works of now established playwrights of the new school like Shaw and Galsworthy were constantly in the programme. Iden Payne was for a long time Miss Horniman's chief-of-staff, while among those who were graduating in mastering their art in the "Manchester school" were Miss Sybil Thorndike, Lewis Casson and Basil Dean. Dean conducted an experimental repertory season at Kelly's theatre, Liverpool, in 1911 and became director of the Liverpool Playhouse repertory later in the same year. In 1913 Barry Jackson founded and directed the Birmingham repertory company and built for it a special theatre. The Liverpool and Birmingham repertories survived the war and the peace, and the latter was able to send companies to London where important conquests were made. The Birmingham company, for instance, was the first to act Shaw's vast "metabiological pentateuch" *Back to Methuselah,* which was given in 1923 at Birmingham and subsequently at the Court theatre in London. It may reasonably be asked what London was doing for itself. The answer is that the repertory system had been tried in London by Charles Frohman and had failed. This experiment lasted at the Duke of York's theatre for 17 weeks in 1910. The artistic successes of this season were the productions of *Justice* by John Galsworthy and *The Madras House* by Granville Barker. The most popular piece, however, given by the brilliant company which Frohman had enlisted was Pinero's *Trelawny of the Wells.* The Frohman repertory differed from that of the provinces because he kept bringing pieces in and out of the bill on the Continental model, while the provincial repertories used the method of the "short run," changing their Programme usually once in every week. The latter plan involved a serious strain upon the actor who lived laborious days at constant rehearsals while playing in another piece at night. However, if the obligations were oppressive, the experience was invaluable. The repertory movement may have often been responsible for hasty and unripe presentations, but there is no doubt that it evoked new talents in writing and acting and had a freshening and vitalizing effect upon the whole British drama of the period. The theatre was honoured. No man of letters henceforward could be too proud to write for it and it is significant that the most distinguished novelists of the time were anxious to be dramatists. John Galsworthy frequently succeeded, Arnold Bennett had several successes, particularly in association with Edward Knoblock, John Masefield continually directed his poetry and sometimes his taut and vigorous prose towards the theatre, even Joseph Conrad made dramatic efforts, and only H. G. Wells left it to others to adapt his stories. One effect, and that an important one, of the repertory movement was to restore the theatre to its proper place in the national culture. The drama became once more representative and expressive of the living mind and the social purpose. The future historian of the first decades of the 20th century will be rash if he neglects the theatre which had become a valuable source of evidence about the opinions and aspirations of the age.

The **War and** the Theatre. — But it must riot be supposed that the repertory movement was as widely prosperous as it was intellectually significant. From a financial point of view it mas often a failure and the London theatre was still dominated by the actor-manager who chose his plays to suit his particular talent. Yet the sovereignty of such men as Sir Herbert Beerbohm Tree. Sir George Alexander, and Sir Charles Wyndham, all of whom died during the war, was a beneficent form of government compared with that of the financial syndicates which followed them and turned the playhouses into counters in a great game of hazards rather than of skill. The effect of the war on the English drama was inevitably disastrous. When so many towns, particularly the capital, were lodging houses between life and death in which men on leave snatched what relief they could, the industry of entertainment naturally flourished at the expense of the art of the theatre. The new syndicates which trafficked in playhouses and plays found a ready market for anything trivial or specracular which would bring some anodyne to the mind oppressed with care. London was packed with soldiers from all over the world to all of whom a rousing display or a rackety farce was at least intelligible. Hence it was that the typical war-play was *Chu Chin Chow*—an elaborately oriental panorama with music, which ran at His Majesty's theatre for 2,238 performances, or *The Maid of the Mountains,* a highly competent musical comedy, which was played st Daly's 1,352 times, or *A Little Bit of Fluff,* a hilarious and *risqud* farce, whose life extended to 1,241 nights. The war brought enormous runs because money was plentiful and taste was not exacting. It was a period of quantity not quality. Sir Gerald du Maurier, one of the surviving actor-managers, did, however, maintain a standard of dignity and restraint and had a long run with *Dear Brutzu,* One disastrous casualty out of the many suffered by the theatre during the war was the death of Harold Chapin, a clever actor and writer of promising comedies of which *Art and Opportunity* is the best.

After the war there were distinct signs of a theatrical renaissance. Conditions were difficult because the competition to acquire London theatres in order to produce revues and farces had driven up the rents to appalling levels. A short lease of a London theatre was now on the average four times as expensive as it was before the war, while the prices of seats had risen very little. None the less small theatres like the Ambassadors' and the St. Martin's were available for the intelligent manager and playgoer The Reandean management, directed by Alec Rea and Basil Dean, continued for season after season to stage the best available work at the latter, while H. M. Harwood, a dramatist manager, was responsible for some clever productions at the former. His best play was *The Grain of Mustard Seed,* while the chief Reandean successes were Galsworthy's *The Skin Game* and *Loyalties, A Bill of Divorcement* by Clemence Dane, *R. U. R.* by Karel Capek, and *The Likes of 'Er* by Charles MacEvoy.

Theatres in the Suburbs. — The result of the economic pressure in central London was to drive experimental work into the suburbs where old buildings could be purchased and reconstructed without risk of such ruinous losses as might overtake the producer who failed with a piece in the West End. At Hampstead Norman Macdermott opened the Everyman theatre, where work of merit was continually on view on the short run principle a3d where many players obtained precious experience in pieces which could not have faced the financial difficulties of a West End production At Hammersmith Nigel Playfair, who was knighted in 1928, working in association with Arnold Bennett, reopened the old Lyric theatre and made it into a home for the revival of period pieces, particularly of the ballad operas of the 18th century. Playfair had admirable musicians and designers to help him and the name of Claud Lovat Fraser will be always associated with the painted stage of the Hammersmith convention. The most popular of the Hammersmith revivals was *The Beggar's Opera,* which was produced in June 1920, became the rage of the town, and ran for nearly four years. Previously Hammersmith had

yielded a long run to John Drinkwater's chronicle play *Abraham Lincoln*. Another of Playfair's excellent productions was Congreve's *Way of the World* to which Miss Edith Evans, an actress who rose to the front rank by her brilliance in artificial comedy, contributed a fascinating study of Millamant.

Meanwhile at Barnes Philip Ridgeway made a theatre out of a disused cinema and had the sagacity to employ the Russian producer, Komisarjevsky, to direct his revivals of Chekhov's plays. There, on an inadequate stage, were given some of the finest performances of the time. Komisarjevsky had been trained under Stanislavsky of the Moscow Art Theatre and he brought to these revivals both a long experience of the naturalistic Russian method of stage-craft and a sympathy which enabled him to elicit from English actors a temperamental quality not usually to be found. Another of Ridgeway's productions at Barnes was *Tess of the D'Urbervilles* which Thomas Hardy had dramatized himself. Among the "outer circle" theatres to win prestige and popularity was the "Old Vic." The history of this house is an epitome of recent theatrical history. During the great days of acting the Coburg, as it was then called, was visited by such masters of craft as Edmund Kean. In the bad Victorian times it declined in esteem and became a very rough house with a very rough set of patrons who wanted only the crudest kind of fare. It was rescued by Miss Emma Cons, whose niece, Miss Lilian Baylis, carried on the reforming policy. A Shakespearian repertory was maintained during the war and afterwards a first-rate company was built up. With Robert Atkins as producer the "Old Vic" became a London, as well as a south London, institution, and the version of *Peer Gynt*, given in the summer of 1922, was widely approved and supported. The "Old Vic" has since the war performed the whole canon of plays printed in the First Folio in addition to undertaking some modern and classical adventures outside the Shakespearian routine. Moreover, the management alternated opera with Shakespeare and built up a fine social loyalty and corporate spirit among the patrons. Among the players who either made or increased their reputations at the "Old Vic" were Miss Sybil Thorndike and Miss Edith Evans.

Miss Sybil Thorndike. — The progress of Miss Sybil Thorndike and her husband, Lewis Casson, after the war was one of the remarkable features of the time. Passing from the "Old Vic" to melodrama at Drury Lane and thence to experiments in English "Grand Guignol," Miss Thorndike became a representative of the best type of actor-manager, and in this she was greatly helped by her husband's skill as producer. Among her best impersonations were her Hecuba and Medea in Prof. Murray's version of Euripides, and her Jane Clegg in St. John Ervine's play of that name; but her greatest popular success came with Bernard Shaw's *Saint Joan* which was produced at the New theatre in 1924 and had an unexpectedly long run. By means of this play with its religious interest and fierce human tragedy to leaven the author's familiar argumentative zeal Shaw found a new and larger public. *Saint Joan* was immediately translated and produced in every country with a sense of theatrical values. Among other names that emerged during this period was that of Noel Coward, who began to pour out light and cynical comedies that immediately captured the taste of the time. He did not apply himself to the technique of construction and his plays were frankly dashed off in a way that is in complete contrast to the careful and considered work of men like Pinero. But he was master of terse dialogue which perfectly hit off the accent and the affectations of contemporary Society; in *The Vortex*, his first big success, he attempted something more serious and made signs of a promise which he hardly sustained. Other dramatists to win new distinction were Allan Monkhouse with *The Conquering Hero* (1924), generally accepted as the most sensitive English war-play of the time, Ashley Dukes with *The Man with a Load of Mischief (1925)* and Somerset Maugham with *Our Betters* which had 500 performances. On the lighter stage Frederick Lonsdale had some triumphant receptions for his comedies, which seem as inconsequent as charades, and Eden Phillpotts had a tremendous run at the Court theatre with his rustic farce *The Farmer's Wife*, which was given as a holiday piece by the Birmingham repertory company after their gallant appearance in *Back to Methuselah*. This light affair kept them at their pastoral comedy labours for more than three years.

Outside London as well as in it, times were difficult for the theatre. The competition of the cinema, of broadcasting, and of outdoor sports, booms in dancing during the winter and in lawn-tennis during the summer all helped to weaken the appeal of the touring company. Moreover the important London actors seemed more reluctant than ever to leave town and the quality of the travelling teams was lower than it used to be. But the starved playgoer of the provinces determined to provide for himself. Thus, while from external signs such as the closing of historic theatres or their transmutation into cinemas, it might seem that the drama was hard hit, there was also a distinct dramatic revival which found expression in the institution of many small repertory theatres, worked on a professional or semi-professional basis, and a large extension of the amateur movement whose ambitions were now very much higher than of old. No longer did the amateur content himself with repetitions of faded West End farces; the community drama ranged from experiments in mediaeval mystery to the latest philosophy of the intellectual theatre. By 1928 there was no large town which had not some form of stock company engaged upon the kind of play which the touring system habitually missed. The well-established repertories of Liverpool and Birmingham continued to do their work consistently well and occasionally to win encouraging remuneration in money as well as in repute, while at Newcastle, Hull, Sheffield, Leeds, Manchester, Bristol, Oxford and Cambridge and other towns there were little theatres at work. The relations between the touring managers and their new rivals became strained; but there was no real cause for suspicion or jealousy. The amateur player and the new repertory theatres were creating a public interested in drama and eager to attend the professional playhouse whenever it improved the quality of its wares.

The Scottish National Players. — In Scotland one phase of the dramatic revival was the foundation of the Scottish National Players; this organization found its dramatist in John Brandane, whose best known pieces are *The Glen is Mine* and *The Lifting*. In 1928 an appeal was made to consolidate the position won by the Players and to lay the foundations of a Scottish national theatre. The supporters of this scheme included Sir Johnstone Forbes-Robertson, Sir J. M. Barrie and Neil Munro. In Wales there was a big development of community drama and the movement had its dramatist in J. O. Francis; Richard Hughes was another who at one time seemed likely to write well for the theatre and who was especially interested in the Welsh village drama In Ireland the native drama had had far deeper roots and had already matured before the war. The foundation of the Abbey theatre was a natural part of the Irish literary renaissance which came in with the 20th century. Its origins are complicated because it owes its intellectual origins to the earlier experiments and encouragements of George Moore and Edward Martyn (author of *The Heather Field)*, and their efforts to give dramatic expression to peculiarly Irish views and problems, while Miss A. E. F. Horniman had much to do with the financial organization of the new venture.

Synge and the Irish Drama. — The impulse to found an Irish theatre was in itself both natural and national; it was due to the reaction upon Irish intellectuals and poets of the general wave of independent theatres, stage societies, Vedrenne-Barker seasons and the like. The governing influence fell in the end to W. B. Yeats and Lady Gregory, both dramatists, and it was under their direction that the genius of J. M. Synge found its opportunity and its guidance. Synge was an invalid and died in 1909 before he was 40, but he had completed his *Riders to the Sea, The Well of the Saints* and *The Playboy of the Western World;* and left an unfinished and beautiful version of the Deirdre saga. It was courageous of the management to produce *The Playboy* because the Abbey theatre, on the whole, was devoted to Gaelic idealism and Synge's harshly brilliant comedy was a scathing satire on the credulity and cruelty underlying Gaelic romanticism. This production was the cause of some riots and violent recriminations,

but Synge's matchless translation of rural phrase into a rhythmic prose illumined by metaphors and similes of an exquisite fancy was bound to live down a merely local and sectional discontent caused by his notions of satirical comedy. The smallness of the Abbey stage and of the possible rewards to be won did not prevent an eager crowd of dramatists from offering their services: of these Lady Gregory, W. B. Yeats and Lennox Robinson, who were still directing the theatre in 1928, were distinguished by a variety of gifts, Lennox; Robinson, as producer, having a useful sense of the stage and its practical uses. Others who wrote and wrote finely for the Abbey included William Boyle, T. C. Murray, Padraic Colum, Seumas O'Kelly and St. John Ervine.

Sean **O'Casey.**—That the Abbey was not dependent on one or a few names was shown by its ability to find a dramatist who could express the growing pains of the new Ireland which was being born during the struggle with England. Sean O'Casey, a plasterer from the waterside tenements of Dublin, first made his reputation with a short piece, *The Shadow of a Gunman,* and then confirmed it with *Juno and the Paycock,* produced at the Royalty theatre, London, in 1925. His third piece *The Plough and the Stars* was acted in Dublin and London in 1926. The Dublin production caused some troubles because the Republicans held the play to be an insult to their cause and their martyrs. Whether or not it was an insult, it was certainly a criticism of pretentious nationalism and as such a far more bitter medicine to swallow than ever Synge had offered to his fellow-countrymen. O'Casey's acid humour and his merciless unmasking of the slum patriots were accompanied by a sharp sense of theatrical emphasis and his plays 'are likely to endure. English literary opinion was demonstrated by the award to O'Casey of the Hawthornden prize in 1926. The durability of the Abbey theatre itself was made more probable by the grant of £850 a year from the Free State Exchequer. At the same time £600 was given to the Gaelic players. No other English-speaking Government (if one may so term the Irish Free State Ministry) has ever done even this much for dramatic art. One cannot leave the question of the Irish theatre without a tribute to the extraordinary brilliance of the Irish players, a team built up at the Abbey in its early days and persisting in partnership over more than 20 years of touring and chequered history. In their rhythm of speech they found the perfect articulation for Synge's idiom; in their racy and vigorous realism they were the perfect interpreters of O'Casey. The broad humours of Arthur Sinclair, the early beauty and maturing powers of Sara Allgood and Maire O'Neill, may be selected for particular praise, but the team, as a whole, had a common quality that made their visits to England an exceptional pleasure to connoisseurs of acting. In 1920 Lennox Robinson with his play *The Whiteheaded Boy* had a really popular English success to which he was assisted by these admirable comedians.

Gordon Craig and Stage Design.—During the period under review we have seen distinct phases of theatrical history. From 1840–90 it is roughly true to say that the balance of power in the playhouse lay with the actor; from 1890–1920 the author was reinstating himself and making the drama a vehicle for his own opinions and his criticisms of life. The Ibsenite theatre temporarily defeated the Irvingite theatre. The change from a rhetorical and resonant theatre of grandiose passions to a quiet and argumentative theatre of observation and actuality was the mark of the time. On the Continent, however, there was another change in the years following the war and the producer asserted himself. Reinhardt's reputation had been made before the war, but it was not till the third decade of the century that his lieutenants established themselves and constituted a theatrical school of mass-effect and plastic design in which architectural settings and the abolition of the old proscenium-arch were important features. The influence of Edward Gordon Craig as a theorist on stage-design and as an occasional producer under conditions carefully chosen was greater in Europe and America than in England. Craig's active mind at one time saw that the logical result of a producer-controlled drama would be the reduction of the individual actor to the status of a puppet and in a relentless fit of rationalism he proclaimed the necessity of supplanting men by marionettes. That opinion, though not sustained by its originator, was really a severe criticism of the producer's theatre and of the extreme forms of sovereignty assumed by the *régisseur* in Central and Eastern Europe. Where Craig helped the English stage was by his demand for simplicity and dignity in design: he led a meritorious campaign for the use of imagination in the control of lighting and background in the theatre. His lessons were learned and English methods of production during 1918–28 showed a capacity to derive what was sensible from Continental models without accepting the rackety methods of Expressionism (the dramatic equivalent of Post-Impressionism in painting) or the relapse into mere pageantry which was typical of the annual dramatic festivals at Salzburg. The best producers of the time, Basil Dean, Nigel Playfair, A. E. Filmer, H. K. Ayliff and others, showed their power to experiment without treating the author's text as a mere libretto or the actor as a unit in a regiment of automata. In short, they accepted the three-fold partnership between actor, author, and producer and worked loyally to sustain it. **(I.** BR.)

AMERICA

The first specimens of dramatic writing in the United States of America, reflecting the tastes and tendencies of colonial and revolutionary life, showed definite English, with now and then suggestions of Teutonic influences. They were all imitative and have no interest to-day except as curios. Only two plays written by Americans were actually presented on the stage before the Revolution: *The Prince of Parthia, a* blank-verse tragedy by Thomas Godfrey the younger, arid *The Conquest of Canada, or the Siege of Quebec,* an attempt at historical drama by George Cocking. Neither contained a symptom of promise so far as native drama was concerned, nor was any discernible in the plays written by Americans in the period immediately after. Among these we have as outstanding examples the recreant Maj. Robert Rogers's blank-verse tragedy, *Ponteach, or The Savages of America;* a blank-verse lampoon of certain Boston celebrities of the day, under the title *The Group,* written by Mrs. Mercy Warren (wife of Gen. James Warren), who had gained a measure of partisan notoriety previously with a play called *The Blockheads,* an answer to Gen. Burgoyne's satiric farce, *Tlte Blockade of Boston;* a patriotic play in blank-verse. *The Rattle of Bunkers Hill,* by Hugh Henry Brackenridge; another patriotic affair, *The Fall of British Tyranny,* by John Leacock, incidentally the first example of an American chronicle play and the first in which George Washington appeared as a character; and a comedy reflecting the political spirit of the time (*c.* 1798) called *The Politician Out-Witted,* by Samuel Low, in which we have the earliest known instance of the local theatrical use of negro dialect.

The beginning of what, though still somewhat euphemistically, may be termed the real American drama was synchronous with the active appearance on the American scene of William Dunlap, in many respects the father of the American stage, and Royall Tyler. The latter's comedy *The Contrast* (the second play written by an American to be produced in America by a professional company of actors, *The Prince of Parfhia* being the first) was acted in 1787 and was the first dramatic work to introduce the character that has since become known as the stage Yankee. Written under the inspiration of *The School for Scandal,* it was also the first American play to achieve a box-office success. Dunlap wrote or adapted some 60 plays, of which the best known is his blank-verse tragedy, *André,* produced in 1798. These two men seemed to give an impetus to dramatic writing and to theatrical interest in the new Republic. Among the more significant of their successors, at least in an historical sense, were James Nelson Barker, author of *The Indian Princess, or La Belle Sauvage,* the earliest play on the Pocahontas theme, converted into a libretto for a so-called "operatic melo-drame," and produced in 1808; Mordecai M. Noah, whose *She Would Be a Soldier, or The Plains of Chippewa,* an historical drama, was shown in 1819; Joseph Hutton, actor and playwright, author of *Fashionable Follies;* John Howard Payne, fabricator of such compounds as *Brutus, or the Fall of Tarquin* and *Charles the Second;* and Richard Penn Smith, author of the historical play dealing with the war of 1812 and called *The Triumph of Plattsburg.*

In the '30s of last century there was much dramatic activity. Such things as George Washington Parke Custis's *Pocalzontas, or The Settlers of Virginia;* Robert Montgomery Bird's *The Gladiator* and *The Broker of Bogota;* and John Augustus Stone's *Metamora—all* ranting *opera* written under the inspiration of the actor, Edwin Forrest; Nathaniel P. Willis's *Torfesa the Usurer,* written under the eye of James Wallack for his own use; Joseph Stevens Jones's *The People's Lawyer* (with the unforgotten character, "Solon Shingle"); and Robert T. Conrad's *Jack Cade,* another machine-made Edwin Forrest vehicle, cleared the way for what may fairly be called the first American play of social manners—*The Contrast,* though a social satire, may be dismissed as negligible—and the first native comedy of even mild merit, namely, Mrs. Mowatt's *Fashion,* written under the strong influence of Sheridan, and produced in 1845. This *Fashion,* which enjoyed success in England as well, marks what is practically the birth of a native drama, however modest, worth critical consideration. In the years following its presentation there came into being *Uncle Tom's Cabin,* dramatized from Mrs. Harriet Beecher Stowe's novel by George L. Aiken, Mrs. Sidney F. Bateman's *Self,* Clifton W. Tayleure's *Horseshoe Robinson,* the transplanted Dion Boucicault's *The Octoroon,* dealing with the slavery question in 1859, Frank Mayo's *Davy Crockett,* the dramatization of Irving's *Rip Van Winkle,* made a theatrical classic by Joseph Jefferson, and, finally, Steele MacKaye's *Hazel Kirke* and *Paul Kauvar.*

Gradually, now, the American drama began to move on feet of its own, instead of relying almost entirely upon foreign crutches. MacKaye revolutionized the mechanics of the American stage as he had found it and, with them, certain phases of dramaturgy, at least as it had been practised. A new order of playwrights grew up. Among these, the first was Bronson Howard, the dominant dramatist in the American theatre of his day. Howard is best known for his military melodrama, *Shenandoah,* based upon a work written 20 years before, subjected to several revisions and produced in the late '80s. Among his other plays were *Saratoga* (produced as early as 1870), *Tlze Young Mrs. Winthrop, The Henrietta* and *Aristocracy.* Foreign influences were clearly discernible in some of these, as well as in others that he wrote, but above them sounded a distinctly native note that was not lost upon American audiences. The last decade of the century witnessed the abandonment of the European crutches to an even greater degree. William Gillette with his melodramas, *Held by the Enemy* and *Secret Service,* established American drama as a thing of itself. James A. Herne with his pioneer realism in *Shore Acres, Griffith Davenport* and *Sag Harbor—to* say nothing of *Margaret* Fleming—brought the American drama even more positively into its own. Charles H. Hoyt with his farces and comedies brought American types and phases of American life bodily into the theatre. The movement was furthered by Clyde Fitch, with his commentaries on the lighter side of American society, and by Augustus Thomas, with his series of so-called "State plays," beginning with *In Mizzoura.* Langdon Mitchell appeared with *The New York Idea.* George M. Cohan, whose influence was to colour much of American dramatic writing for many years afterwards, began to write musical pieces, and later on farces and comedies that were genuinely American, as also were George Ade's *The College Widow* and *The County Chairman.* William Vaughn Moody with *The Great Divide* and *The Faith Healer* took the drama into higher literary reaches. A half dozen artistically inferior but theatrically skilful playwrights like Charles Klein, Eugene Walter and Edward Sheldon busied themselves with American types and American themes and completed the divorce from European drama. These men, then, were the stems from which the present-day American drama took flower, a drama that has begun in certain of its phases to repay to Europe its long-standing debt. and to repay that debt with a measure of brilliance.

One of the foremost figures in this present-day American drama is Eugene O'Neill, whose more notable works, such as *Strange Interlude, Mourning Becomes Electra, The Emperor Jones, The Great God Brown, Desire under the Elms, Beyond the Horizon* and *The Hairy Ape,* show genuine dramatic force and'literary merit. Among hii contemporaries are men and women nho are raising American dramatic writing to a distinguished level. Maxwell Anderson and Laurence Stallings in *What Price Glory?* contributed to the stage a war drama of sweeping eloquence and devastating irony. George Kelly's *Craig's Wife* and to a lesser degree *The Show-off,* Paul Green's *In Abrahant's Bosom,* Rita Wellman's *The Gentile Wife,* the comedies of Vincent Lawrence, Zoe Akins's *A Texas Nightingale,* S. N. Behrman's *The Second Man,* and *Rain From Heaven,* Maurine Watkins's *Chicago,* Maxwell Anderson's *Saturday's Children,* Ernest Howard Culbertson's *Goat Alley,* Frank Craven's *The First Year,* George Kaufman's and Edna Ferber's *The Royal Family,* Arthur Richman's *Ambush,* Elmer Rice's *Street Scene,* Hecht and MacArthur's *The Front Page,* John Wexley's *The Last Mile,* Patrick Kearney's *A Man's Man* are other examples of modern American playwriting that call for the scrutiny of serious criticism. On a lower level it may be, but rich in illumination of the American scene, we have a procession of comedies, farces and melodramas of striking originality and suggestive humour. Competition from talking pictures and general economic depression combined to reduce patronage of the legitimate theatre for several years after 1929 and consequently. perhaps, the incentive to writers of good plays. There continued, nevertheless, to be produced each year at least a few noteworthy additions to the national dramatic record. Among those certainly deserving of mention were *The Green Pastures,* adapted by Marc Connolly from Roark Bradford's book of sketches, *Tobacco Road,* adapted from Erskine Caldwell's novel by Jack Kirkland, *The Children's Hour* by Lillian Hellman, and finally Maxwell Anderson's drama in verse *Winterset.* A reflection of political and social disillusionment appeared in a new type of satirical musical show, *Of Thee I Sing* by George Kaufman and George Gershwin. Among the other more recent valuable additions were John Steinbeck's *Of Mice and Men,* William Saroyan's *My Heart's-in the -Highlands,* Robert Turney's *Daughters of Atreus,* Robert Sherwood's *Abe Lincoln In Illinois,* Lillian Hellman's *The Little Foxes,* Paul Green's *Johnny Johnson,* Clifford Odet's *Awake and Sing,* Sidney Kingsley's *Dead End,* Arthur Arent's . . . *one-third of a Nation.*

(G. J. N.)

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GERMANY

The dramatic literature of Germany, though in its beginnings, intimately connected with the great national movement of the Reformation, soon fell under the domination of foreign models. It was not until the end of the 18th century that Germany possessed a national drama of comprehensive character.

The first German (and indeed the earliest transalpine) writer to follow in the footsteps of the Italians was the famous Strasbourg humanist Jacob Wimpheling (1450–1528), whose comedy of *Stylpho* (1480) marks *a* kind of epoch in the history of German dramatic effort. It was succeeded by many other Latin plays of various kinds: Johann Reuchlin (1455–1522) wrote two plays, of which one, *Henno,* was exceedingly popular; and Konrad Celtes (1459–1508) a *Ludus Dianae,* in honour of the emperor Maximilian I The *Acolastus* (1525) of W. Gnaphaeus should also be mentioned, as, though a Dutchman by birth, he spent most of his literary life in Germany. Macropedius (Langhveldt) belongs wholly to the Low Countries; but two of the greatest Latin dramatists of the 16th century, Thomas Kirchmayer (Naogeorgus) (1511–1563) and P. N. Frischlin (1547–1590) were Germans. The flourishing period of the Jesuit drama begins with the spread of the order in the west and south-nest of the empire in

the last decade of the 16th century, and continues until well into the 18th. These productions ranged in their subjects from biblical and classical story to themes of contemporary history.

Side by side with this Latin drama there grew up an interesting literature in the vernacular which was almost exclusive of Protestant inspiration. In Switzerland, P. Gengenbach (d. 1524) and Niklas Manuel (*c.* 1484–1530) defended the new faith in plays of a kind; and in the north B. Waldis (c. 1490–1556), Sixt Birck (1501–54) and Paul Rebhun (*c.* 1500–46) wrote dramas not wanting in poetic skill. Towards the close of the middle ages dramatic performances had in Germany, as in England, largely fallen into the hands of the civic gilds, and play-writing was more especially cultivated by the master-singers of Nuremberg and other towns. Hans Sachs (1494–1576), the immortal shoemaker of Nuremberg, seemed destined to become the father of the popular German drama. In his plays, "spiritual," "secular" and *Fastnachtsspiele* alike, the interest indeed lies in the dialogue rather than in the action, nor do they display any attempt at development of character. But his healthy vigour and fresh humour, and his sympathy with the sentiments of the burgher class to which he belonged, were elements of genuine promise.

Among the foreign actors of various nations who flitted through the innumerable courts of the empire, special prominence was acquired, towards the close of the 16th and in the early years of the 17th century, by "English comedians." Through these players a number of early English dramas found their way into Germany, where they called forth imitations by native authors. Duke Heinrich Julius of Brunswick-Liineburg (1564–1613) and Jacob Ayrer (a citizen of Nuremberg, where he died, 1605) represent the endeavours of the early German drama to suit its still uncouth forms to themes suggested by English examples. The popularity of these strollers was owing to the blood and other horrors with which their plays were deluged, partly to the comic scenes with which they seasoned their performances. The English clown was a model for the various types of German buffoon, known as Hans Wurst, Pickelharing, Ian Bouset, etc., who for generations were the real masters of the German stage. The grossness and ribaldry into which the popular theatre degenerated estranged it from the tastes and sympathies of the educated classes; then came the Thirty Years' War which put its development and improvement in the 17th century out of the question.

When German poets once more began to essay the dramatic form, the national drama was left outside their range of vision. M. Opitz (1597–1639) contented himself with translations of classical dramas and of Italian pastorals. A. Gryphius (1616–64), though as a comic dramatist lacking neither vigour nor variety, chiefly devoted himself to the imitation of Dutch tragedy, the rhetorical dialogue of which he effectively reproduced in the Alexandrine metre. Neither the turgid dramas of D. C. von Lohenstein (1635–83), nor the more natural comedies of Chr. Weise (1642–1708) were brought upon the public stage. The frigid allegories commemorative of contemporary events, and the pastoral dramas of the Nuremberg "shepherds of the Pegnitz" had little value, except in so far as they kept alive the love of dramatic composition and representation.

The history of the German stage remains to about the second decennium of the 18th century one of the most melancholy chapters of theatrical history. Improvisation reigned supreme, not only in farce, where *Hans Wurst* never ceased to charm his public, but in the serious drama likewise (in which, however, he also played his part) the so-called *Haupt- und Staatsactionen* (high-matter-of-State dramas). The hero of this period is "Magister" J. Velthen (or Veltheim) (1640–92), who at the head of a company of players for a time entered the service of the Saxon court, and, by reproducing comedies of Molière and other writers, sought to restrain the general licence. After his death (c. 1693) chaos ensued. But the strolling companies continued to foster the popular love of the stage, more especially at Vienna, where from about 1712 the first permanent German theatre was maintained. But for the actors in general there was little permanence, and amidst miseries of all sorts, and under the growing ban of clerical intolerance, the popular stage seemed destined to hopeless decay.

The first endeavours for reform were neither wholly nor generally successful; but this does not diminish the honour due to two names which deserve all respect. Karoliiie Neuber's (1697–1760) biography is the story of a long-continued effort which may almost be described as heroic. As directress of a company of actors which from 1727 had its headquarters at Leipzig, she resolved to put an end to the formlessness of the existing stage, to separate tragedy and comedy, and to abolish the Harlequin. In this endeavour she was supported by the Leipzig professor, J. Chr. Gottsched (1700–66), who induced her to establish French tragedy and comedy as models of the regular drama, and himself supplied a tragedy, *Der sterbende Cato* (1731), based on English and French models. Literature and the stage thus for the first time joined hands. Men of letters now began to subject their dramatic compositions to the test of performance; the tragedies and comedies of J. E. Schlegel (1719–49), the sentimental comedies of Chr. F. Gellert (1715–69) and others, together with the vigorous popular comedies of the Danish dramatist Holberg, were brought into competition with translations from the French. On the other hand, the Leipzig school exercised a continuous effect upon the progress of the art of acting, and before long produced in K. Ekhof (1720–78) an actor of distinction.

Lessing.—Among the authors contributing to Mme. Neuber's Leipzig enterprise was G. E. Lessing (1729–81), whose services both to the German drama and to dramatic criticism cannot be overestimated. His *Hamburgiscke Dramaturgie,* a series of criticisms of plays and (in its earlier numbers) of actors, was undertaken in furtherance of the attempt, unfortunately unsuccessful, to establish at Hamburg the first national German theatre (1767–69). But the most important effect of the *Dramaturgie* was to overthrow the dominion of the arbitrary French rules and the French models established by Gottsched. Lessing vindicated its real laws to the drama, and established the claims of Shakespeare as the modern master of tragedy. His own *Miss Sara Sampson* (1755) introduced the realism of the English domestic drama to Germany. Then, in his *Minna von Barnhelm* (1767), which owed something to Farquhar, he essayed a national comedy drawn from real life, and appealing to patriotic sentiments as well as to broad human sympathies. It was written in prose, like *Miss Sara Sampson,* but in form held a judicious mean between French and English examples.

The note sounded by the criticisms of Lessing met with a ready response. On the stage, Harlequin and his surroundings proved by no means easy to suppress, more especially at Vienna; but even here a reform was gradually effected, and, under the intelligent rule of the emperor Joseph II., a national stage grew into being. The mantle of Ekhof fell upon the shoulders of his eager younger rival, F. L. Schroder (1744–1816), who was the first to domesticate Shakespeare upon the German stage. In dramatic literature few of Lessing's earlier contemporaries produced any works of value; his friend Chr. F. Weisse (1726–1804) wrote many popular plays; S. Gessner, J. W. L. Gleim and G. K. Pfeffel (1736–1809) composed pastorals; while F. G. Klopstock's (1724–1803) patriotic and religious dramas hardly concern the actual stage. But a far more potent stimulus prompted the efforts of the younger generation. The translation of Shakespeare, begun in 1762 by C. M. Wieland (1733–1813), and completed in 1775 by J. J. Eschenburg, helps to mark an epoch in German literature. Under the influence of Shakespeare arose a youthful group of writers who worshipped their idol as the representative of nature in the theatre. Lessing in his third important drama, the prose tragedy *Emilia Galotti* (1772), set the example of a work of incomparable nicety in its adaptation of means to end. But successful as it proved, it could not stay the excesses of the *Sturm und Drang* period which now set in. Lessing's last drama, *Nathan der Weise* (1779), was not measured to the standard of the contemporary stage; but it caused a reaction in tragedy from prose to blank verse (first essayed in J. W. von Brawe's *Brutus,* 1770), ennobling by its moral dignity the branch of literature to which in form it belongs.

Goethe.—Meanwhile the young geniuses of the *Sturm und Drang* had gone forth, as worshippers rather than followers of Shakespeare, to conquer new worlds. The name of this group of

writers was derived from a drama by one of the most prolific of their number, M. F. von Klinger (1752–1831); other members of the fraternity were J. A. Leisewitz (1752–1806), J. M. R. Lenz (1751–92), H. L. Wagner (1747–79), and F. Mdller the "painter" (1749–1825). The youthful genius of the greatest of German poets contributed to the movement the first of its masterpieces. Goethe's (1749–1832) *Götz von Berlichingen* (1773), both by the choice and treatment of its national theme, and by its freshness and originality, holds a position of its own in German dramatic literature. Though its irregularity of form prevented its complete success upon the stage, yet its influence is far from being represented by the series of mostly feeble imitations, the so-called *Ritterdramen* (plays of chivalry), to which it gave rise; it destroyed the last remnants of theatrical conventionality, and extinguished with them the lingering respect for rules and traditions of dramatic composition which even Lessing had treated with consideration.

Thus, in the classical period of that literature, of which Goethe and Schiller were the ruling stars, the drama had a full share. The dramatic works of Goethe vary widely in form and character, and his way of composition was so peculiar to himself that the history of his dramas cannot be severed from his biography. His *Clavigo* and *Stella,* which succeeded *Götz,* are domestic dramas in prose; but they could not influence the progress of the national drama. In the first conception of his *Faust,* he had indeed sought the suggestion of his theme partly in popular legend, partly in a domestic motive, the story of Gretchen; but the later additions to the First Part (1808), and the Second Part (1832) generally, are the results of meditations belonging to wholly different spheres of thought and experience. The dramatic unity of the whole is thus external only; and the standard of judgment to be applied to this wondrous poem is not one of dramatic criticism. *Egmont* (1788), originally designed as a companion to *Gotz,* was not completed till many years later; in *Iphigenia* (1787) and *Tasso* (1790), Goethe exhibited the perfection of form of which his classical period had enabled him to acquire the mastery.

Schiller.—Schiller's (1759–1805) genius, unlike Goethe's, was naturally and consistently suited to the claims of the theatre. His juvenile works, *Die Rauber, Fiesco, Kabale und Liebe* (1781–84), vibrating under the influence of an age of social revolution, combined in their prose form the truthful expression of passion with considerable extravagance. But Schiller gradually emancipated himself from his earlier style; and with his earliest tragedy in verse, *Don Carlos,* the first period of his dramatic authorship ends. The works of his maturity (1798–1805)—from the *Wallenstein* trilogy to *Wilhelm* Tell—are the acknowledged masterpieces of the German poetic drama, treating historic themes reconstructed by conscious dramatic workmanship, and clothing their dialogue in a noble vestment of rhetorical verse.

Schiller gradually conquered the stage, on which his *Don Carlos* had met with a cold welcome. For a long time, however, its favourites were authors of a very different order, who suited themselves to the demands of a public indifferent to the literary progress of the drama. Popular tastes oscillated between the imitators of *Gotz* and those of *Emilia Galotti,* and as the establishment of standing theatres at the courts and in the large towns increased, demanded above, all good "acting" plays. Famous actors, such as Schroder and A. W. Iffland (1759–1814), sought by translations or compositions of their own—sentimental domestic dramas—to meet the popular likings. But the most successful purveyor of such wares was an author who understood the theatre with a professional instinct—August von Kotzebue (1761–1819). His productivity ranged from the domestic drama and comedy to attempts to rival Schiller and Shakespeare in verse; and though his popularity brought upon him bitter attacks, his self-conceit is not astonishing, and the time has come for saying that there is some exaggeration in the contempt which has been lavished upon him by posterity. Nor should it be forgotten that German literature had so far failed to furnish the comic stage with any successors to *Minna von Barnhelm.* The joint efforts of Goethe and Schiller for the Weimar stage, important in many respects for the history of the German drama, at the same time revealed the want of a national dramatic literature sufficient to supply the needs of a theatre endeavouring to satisfy the demands of art.

The Romantic School.—Meanwhile the so-called Romantic School of German literature was likewise beginning to extend its labours to the drama. To its leaders Germany owed its classical translation of Shakespeare, and other great foreign dramatists. But the original drama of the romanticists was strangely ineffectual. Outside the school, the youthful talent of Th. Körner (1791–1813) was full of promise, cut off prematurely by his patriotic death. But of the leaders of the romantic school, A. W. and F. von Schlegel (1767–1845; 1772–1829) contented themselves with frigid classicalities; and L. Tieck's (1773–1853) plays are written with small consideration for the stage. F. de La Motte Fouqué (1777–1843) tried to infuse poetry into the chivalry drama. Klemens Brentano (1778–1842) was a fantastic dramatist unsuited to the stage. Here a feeble outgrowth of the romanticists, the "destiny dramatists" Z. Werner (1768–1823)—the most original of the group—A. Müllner (1774–1829) and C. E. v. Houwald (1778–1845) achieved a temporary success; and it was with a play of this kind, *Die Ahnfrau* (1817), that the Austrian dramatist F. Grillparzer (1791–1872) began his career. He is assuredly the foremost of the later dramatic poets of Germany, unless that tribute be thought due to the genius of H. von Kleist (1777–1811), who in his short life produced, besides other works, a romantic drama and a rustic comedy of genuine merit, and an historical tragedy of singular originality and power. Grillparzer's long series of plays includes poetic dramas on classical themes and historical subjects from Austrian history. The romantic school, which through Tieck had satirized the drama of the *bourgeoisie,* was in its turn satirized by Count A. von Platen-Hallermunde's (1796–1835) admirable imitations of Aristophanic comedy. Among the objects of his banter were the popular playwright E. Raupach (1784–1852) and K. Immermann (1796–1840), a true poet, who is, however, less generally remembered as a dramatist. F. Hebbel (1813–63) is justly ranked high among the foremost later dramatic poets of his country, few of whom equal him in psychological insight. Other names of literary mark are those of C. D. Grabbe (1801–36), J. Mosen (1803–67), O. Ludwig (1813–65) and in Austria, "F. Halm" (E. F. J. von Münch-Bellinghausen) (1806–71), E. von Bauernfeld (1802–90) and in the domain of fairy-play and farce, F. Raimund (1790–1836) and J. Nestroy (1801–62). The popular dramatists about the middle of the century were K. Gutzkow (1811–78), G. Freytag (1816–95) and H. Laube (1806–84); while, a little later, L. Anzengruber (1839–89), a writer of real genius though restricted range, imparted a new significance to the Austrian popular drama.

During the long period of transition which may be said to have ended with the establishment of the new German empire, the German stage made rapid progress. This was due, partly to a succession, from Ludwig Devrient onwards, of brilliant actors, and partly to theatre managers inspired by the best ideals. The ablest of these was perhaps H. Laube, director of the Vienna Burgtheatre and afterwards of the theatre in Leipzig. F. Dingelstedt, again, in Munich, and subsequently at Weimar and Vienna, raised the theatre to a high level of artistic achievement. At a rather later period, of which the height extended from 1874 to 1890, the company of actors in the service, and under the personal direction, of Duke George of Saxe-Meiningen, created a great effect by their performances both in and outside Germany, both by their artistic settings and the extraordinary perfection of their *ensemble.* But no dramaturgic achievement in the century could compare in grandeur either of conception or of execution with Richard Wagner's Bayreuth performances, where, for the first time in the history of the modern stage, the artistic instinct ruled supreme in all the conditions of the work and its presentment. Though the *Ring of the Nibelung* and its successors belong to opera rather than drama proper, the importance of their production (from 1876 on) should be overlooked by no student of dramatic art.

The Coming of the Realists.—The most significant development of the German theatre during the last century took place at

its close, under the influence of French and Scandinavian realism. The younger generation of German dramatists freed themselves from the persistent Schillerian tradition of the iambic drama on the one hand, and, with the assistance of Ibsen's example, from the tyranny of the machine-like intrigue drama, which had dominated the French stage from Scribe to Sardou, on the other. The revolt was inaugurated by Gerhart Hauptmann (b. 1862) with his *Vor Sonnenaufgang,* and by Hermann Sudermann (1857–1928) with his *Die Ehre,* both produced in the autumn of 1889. With them were associated a number of young playwrights, of whom Max Halbe (b. 1865), O. E. Hartleben (1864–1905) and G. Hirschfeld (b. 1873) produced plays that left a mark on their time. Against this new realism the efforts of the ablest of the more conservative dramatists, E. von Wildenbruch (1845–1909), to keep the historical drama alive, had a difficult stand. But realism on the German stage was short-lived. After the production of his *Die Weber* (1892) and the excellent comedy *Der Biberpelz* (1893), Hauptmann turned to more poetic themes *(Die versunkene Glocke,* 1897); the dramatic fairy-tale came into honour again. Hauptmann has shown himself exceedingly sensitive to the changes in literary taste and skilfully adapted himself to them. He has returned repeatedly to realism, but has employed it rather in the presentation of subtle psychological conflicts than in the depiction of *milieu,* while in verse he has written a number of dramas of imaginative beauty — notably *Und Pippa tanzt* (1906) and the two Mexican plays of his last period (1920) — without, however, repeating the popular success of *Die versunkene Glocke.* The democratic sentiments of his *Festspiel für die Jahrhundertfeier,* written in 1913 to celebrate the centenary of the downfall of Napoleon, were unpalatable to the ruling classes, which led to its withdrawal. Sudermann, who attained a world-wide fame with his *Heimat* in 1893, was less successful in keeping himself abreast of the literary movement; the essentially theatrical nature of his talent brought him into undue discredit in an age which was endeavouring to get away from the traditions of the "well-made play." But he cannot be accused of lack of significant ideas, and his powers of dramatic characterization were superior to those of most of his more ambitious contemporaries.

In Austria, where the great Burgtheater still maintained, in spite of the growing rivalry of Berlin, the premier place among German theatres, the realistic drama bears a definitely Austrian stamp. Here the leading dramatists were Arthur Schnitzler (1862–1931) and Hermann Bahr (1863–1934); while in the domain of the poetic drama Hugo von Hofmannsthal (1874–1929) proved a significant force in subsequent developments of the higher drama. Here, too, Karl Schonherr (1869–)has attained wide popularity with his dramas of peasant life, notably *Glaube und Heimat* (1910).

Expressionism. — Frank Wedekind (1864–1918), whose somewhat violent and grotesque plays may not have great abiding value, had nevertheless a decisive influence on the development of German realism, and prepared the way for the last phase of the drama, that of the so-called "expressionism." The expressionistic drama emerged on the very eve of the World War; and its best known exponents were Georg Kaiser (1878–) and Ernst roller (1894–1939). The former an exceedingly prolific writer, gave the new movement such characteristic plays as *Die Burger von Calais* (1914), *Von Morgens bis Mitternachts* (1916) and the trilogy *Gas* (1918–20), while Toller's most characteristic contribution was *Massemensch* (1921). Other expressionist dramatists of distinction were Karl Sternheim (1878–), Walter Hasenclever (1890–), Reinhard Sorge (1891–1916) and Reinhard Goering (1887–1936). Of finer calibre is F. von Unruh (1885–), who, during the World War, became a convert from militarism to pacifism. But expressionism promises to be an even less stable force in German drama than realism had been; and the demand for a return to actuality is already making itself felt. Meanwhile there have been since the beginning of the century a large number of dramatists who have cultivated the poetic drama of mediaeval history and story. Conspicuous among these are H. Eulenberg (b. 1876), Ernst Hardt (b. 1876), K. G. Vollmoller (b. 1878) and Paul Ernst (1866–1933); one of the most successful and poetically significant dramas of this class has been *Spiegelmensch* (1920) by Franz Werfel (1890–).

Particularly interesting has been the technical development of the German theatre in recent years. A new art of stage production was initiated by Max Reinhardt (b. 1873), who, setting out from the careful *ensemble* productions of the Meiningen, substituted for their often excessive historical accuracy in scene and costume a more imaginative interpretation of the background of the dramatic work. In turn Reinhardt has applied his art to the great classical writers of the past, and to the symbolic and expressionist work of the present, finally to experiment with the new "illusionless" theatre in which the barrier of the footlights between actor and spectator is dispensed with.

The war has brought about significant changes in German theatre organization. The old conservative traditions of the German court theatres have necessarily disappeared with their transference to the direct control of the State; while economic difficulties have rendered it necessary to have recourse to large co-operative undertakings. These have, in particular, led to the establishment of "Volksbiihnen," the financial resources of which are supplied by comparatively small annual subscriptions which entitle the subscribers to an extraordinarily varied theatrical fare. But the general level of German acting and stage-production remains as high as ever, a result principally due to systematic organization and training, to the constantly changing repertory of practically all theatres, the enormous range of that repertory, and, not least, to the stability of the actor's profession, which makes his career less dependent than in other lands, on the speculative commercial manager and the success or lack of success of individual plays.

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HOLLAND

The oldest specimens of Dutch mediaeval drama in existence date from the end of the 14th and the beginning of the 15th centuries. Of the religious plays several have been preserved. *Die Eerste Bliscap van Maria* (The First Joy of Mary), typical of the old mystery plays, was produced by the Brussels Chamber of Rhetoric about 1444. There are also a few so-called *abele spelen,* plays of chivalry with a religious tendency. Those *abele spelen* or "serious plays" were usually followed by a farce or a comically realistic picture from daily existence. One of the most amusing of those farces which has been preserved is *Buskenblaser* which tells the story of an old man who went through a pretended rejuvenation-cure.

The 16th century is the century of the morality or *Spel van Sinnen,* which is the typical rhetoricians' play, and where all or practically all the characters are allegorical. One of the earliest and most beautiful of these moralities, *Elckerlyc,* is still performed in the Netherlands at the present time. Its title means "Everyman" and its contents are almost the same as those of the English play of that name. It has not yet been finally settled which of the two plays is the original. Meanwhile, the farce maintained its position throughout the 16th century, but it was usually known under the name of *Esbattement.* At the same period there is a remarkable middle-class drama, the *Spieghel der Minnen* (Mirror of Love), by Colijn van Rijssele. During the 16th century there was also an interesting school-literature consisting of dramas written in Latin.

The so-called "Golden Century" was the summit of the Renaissance and a most important period in the history of Dutch drama. Gerbrand Adriaensz Bredero (1585–1618) began his career with romantic adaptations of Spanish romances of chivalry. Soon he displayed his original talent in comical interludes which he expanded into farces. He also wrote comedies. Pieter Cornelisz Hooft wrote, mainly under the influence of Seneca, such plays as *Achilles* en Polyxena. The greatest Dutch dramatist, however, is Vondel, the author of 32 dramas, of which 24 are original. (See the article on Dutch literature.) Vondel's preference was for the treatment of stories from the Bible. The sublimest of his plays was *Lucifer* (1654), which shows a considerable resemblance to Milton's Paradise Lost.

At the end of the 17th century there were a few poets who wrote *comédies* de moeurs. Thomas Asselijn is the author of a play called Jan Klaasz, of de Gewaende *Dienstmaagt* (Jan *Klaasz,* or *the Supposed* Maidservant), which deserves attention because of its witty irony at the expense of the ultra-pious. Meanwhile the time of the Dichtgenootschappen (Poetic Societies) had arrived. Their entire theory of art consisted in advising the imitation of the French classical drama. One of the most influential of these societies was called Nil volentibus *arduum.* Foremost among the members was Andries Pels, who made propaganda for his ideas in his rhymed Ars *poetica* called Q. Horatius *Flaccus'* Dichtkunst, *op onze tijden en zeden* gepast (The Ars *Poetica* of Horace Applied to Our Times and Customs). Meanwhile the comedies of Pieter Langendijk, a disciple of Molière, represented something of higher value.

After 1760 the French middle-class drama was extensively translated and copied in Holland. In the 19th century romanticism triumwhed on the Dutch stage in the works of Hendrik Jan Schimmel (1823–1906), who wrote among other plays *Twee* Tudors, and some patriotic dramas. His best work for the stage was a drama in verse, *Struensee.* His contemporary, Lodewijk Mulder, produced an amusing burlesque of the Dutch mania for public meetings in De *Kiesvereeniging* van *Stellendijk* (The Electoral Society of Stellendijk). A play by Eduard Douwes Dekker (better known under his pseudonym "Multatuli"), called Vorstenschool (*The* School for Princes), made a sensation when it appeared in 1872.

Representatives of the modern drama in Holland are Nouhuys, J. de Koo (whose pseudonym is "Doctor Juris"), and especially Marcellus Emants and Herman Heyermans. Emants' first play was a historical drama in verse, Adolf *van* Gelder. His later plays belong to the naturalist genre. Herman Heyermans obtained recognition as a dramatist not only in Holland but far beyond its frontiers, and his vogue surpasses that of any of his colleagues. His first plays are not often performed at the present day, but in 1898 he began that series of socialistic plays which show an unusual theatrical sense and to which he owes his world reputation. In a few of his later plays, such as *Allerzielen* (All Souls) and Dageraad (Dawn), the subject is treated in a symbolic manner. Frederik van Eeden wrote a few amusing comedies while he was still at the university. Among his later works we may mention Lioba, a drama in verse, and *Minnestrel.* Among later authors we shall limit ourselves to the mention of Mrs. J. A. Simons-Mees who brought upon the stage the psychological conflicts of modern existence. Alphonse Laudy made a happy attempt at the reintroduction of the monumental play in verse in his De Paradijs Vloek (Paradise-Ban) which is a sequel to the Adam *in Ballingschap* of Vondel.

See F. von Hellwald, *Geschichte* des hollartdischen Theaters (Rotterdam, 1874); J. A. Warp, *Geschiedenis* van Drama en *Tooneel* in *Nederland.* (J. WAL.)

DENMARK

Before the Reformation the Danish drama had an international character. It consisted of rather unimportant mysteries, moralities and farces. The 16th century was the time of the school-comedies, among which the best is H. J. Ranch's Karrig *Nidding* (*c.* 1600) a work that can compare with the best of Hans Sachs. In the 18th century Denmark's first and foremost dramatist, Ludvig Holberg, was influenced by Molière, but both his vivacious and witty dialogue and his brilliant characterization were highly original. His comedies were performed at the time of the opening of the first Danish theatre (1722). Holberg made use of a set of typical figures, which corresponded to those of the *commedia* dell' arte (servants: Henrik, Pernile; masters from the middle-class: Jeronimus, Magdelone; lovers: Leander, Leonore), but at the same time he created, especially in the title-parts, a great many original satirical portraits. The Danish peasantry and the middle-class of his own time provide the social setting for his plays. He describes them in a jocular way. Altogether the feature of middle-class comedy continued to predominate in the Danish drama. About the turn of the century it was represented by P. A. Heiberg and Olufsen. At the beginning of the 19th century it dissolved into the romantic movement, which was heralded by Ewald. Its most representative figure was Oehlenschlager. At first his tragedies and dramas were related to the German romantic movement, and afterwards to the German classics. They are of great lyric beauty and declamatory power, richly imaged in language. At the same time the middle-class comedy was continued, partly by the romantic poets themselves, *e.g.,* Hertz and J. L. Heiberg, who was the author of a kind of vaudeville, charming musical middle-class plays, which were very characteristic of the Danish mind. The comedies of Hostrup, in the middle of the 19th century, are not so elegant, but they have a pleasantly direct appeal. They have a joviality, a kind of popular romanticism in the best sense of the word, which is also found, in an even larger degree, in the work of Holger Drachmann. At the same time Drachmann was also influenced by the realistic movement, which at the end of the century strongly affected the Danish drama. Among these realistic authors may be mentioned Sven Lange, one of the most important pupils of Ibsen.

See G. Brandes, Ludvig Holberg (1884); V. Andersen, Adam Oehlenschlager (1897–1900); J. C. Norman, *Dansk Drama* efter *Halvfjersene* (1907); Comedies by Holberg (trans. and introd. by Campbell, 1914). (E. NEE.)

NORWAY

The Norwegian drama, which reached its zenith in the plays of Ibsen, is the most vigorous revelation of the mind of a nation that has occurred in recent times. It is no sudden growth, but rather a natural development of the Norwegian genius which first manifested itself in the national folklore. The chief characteristics of both are a spirit of individual independence tempered with good humour and considerable self-reliance. For the latter, the natural difficulties of the country, with its secluded community life, must be held responsible. From an artistic point of view, Norwegian drama owes much to the saga literature, which was both rich in characterization and dramatic in vein.

The drama, as a special branch of art, was unknown in Norway practically up to the 19th century, and there existed none of the elements that are required for the growth and prosperity of a national drama. The country possessed no reigning court and no wealthy nobility; nor was there, with the single exception of Bergen, any town in Norway that possessed sufficient vision to lay the foundations of dramatic art of the future. In Bergen was born Ludvig Holberg (*q.v.,* 1684–1754), one of the greatest dramatists of all time, and the founder of modern Norwegian and Danish literature. Owing to Norway being too impoverished to support a considerable intellectual and cultural life, Holberg took up his abode in Denmark, and though his plays, which were all comedies, deal with Danish manners and customs, and are concerned with life in the district of Copenhagen, they are nevertheless unmistakably Norwegian. His most typical characters are, in fact, not only his compatriots but also natives of Bergen, like himself. Holberg's drama contains all the essentials of the national saga literature and folklore, and his plays, among which may be mentioned *The* Tinker *Politician, Jappe* on the Hill and Erasmus Montanus, became the connecting link between ancient and modern literary Norway, and also formed the foundations of the modern stage. After Holberg, Johan Herman Wessel (1742–85) should be mentioned. He also was a Norwegian, and his well-known burlesque *Love Without* Stockings is still popular, despite the fact that the school of tragedy against which it was originally directed has long since ceased to exist.

Notwithstanding the basis of drama laid by Holberg and Wessel it need hardly be said that a national drama in the true sense of the word could exist only after the dissolution of the union with Denmark in 1814. By this event Norway became once more possessed of the sovereign liberty necessary for the evolution of an independent culture, yet more than a generation had to elapse before the first national theatre was founded in Bergen in 1850. This theatre, which was due to the initiative of Ole Bull (1810–1880), an art enthusiast and one of the foremost violinists of Europe, marks the first step in the direction of an exclusively Norwegian stage. At this time the Christiania theatre, which had opened in 1837, had an entirely Danish personnel. Though the Bergen theatre numbered Ibsen and Bjornson among its managers, it was eventually forced to close, overburdened with financial difficulties Despite its defeat. the National Stage of Bergen, still the official name of the Bergen theatre, had proved the possibility of a Norwegian theatre and after a struggle lasting for a number of years a national theatre was established at both Bergen and Christiania. From 1899 the theatre in the capital naturally became known as the national theatre, and was the centre of the dramatic activities of the country.

Ibsen and **Björnson.**—Meanwhile Henrik Ibsen (1828–1906) and Bjornstjerne Björnson (1832–1910) had come to the front in Norwegian literature in the late '50s, and within less than ten years they both produced a number of dramatic works of rare value, of which Ibsen's *The Warriors at Helgeland* and *The Pretenders* and Bjornson's *Between the Battles* and *Sigurd Slembe,* all dealing with characters and episodes of the saga period, are among the most famous. To the generation which first witnessed them they came as a perfect revelation of the spirit of the sagas, and the intensely human passions and the typically Norwegian outlook of the leading characters bridged the gulf that the archaic form and historical subject matter tended to create.

From the beginning of the '70s, a change came over Norwegian literature that was to exercise a considerable influence over Ibsen and Björnson The chief characteristic of this period was its pronounced realistic spirit which produced the modern social drama. As early as 1865 Bjornson in his little two-act drama *The Newly-Married Couple* and Ibsen in *The League of Youth* had taken the first step into the field of social drama, but it was not until the '70s that they succeeded in leaving all their contemporaries far behind. Bjornson's *A Failure* (1874) made a sensation over the whole of Europe five years before Ibsen impressed the world with *A Doll's House* (1879), followed by *Ghosts* (1881), *The Wild Duck* (1884) and *Rosmersholm* (1886), to mention only the most famous of his plays. The dramas of Ibsen and Bjornson were not only stamped with the keen intellect and the intense sensitiveness of their creators, but they represented the supreme attainment of European culture at the moment. They are also revelations of typically Norwegian characters unfolding themselves under conditions which have been justly described as tending more to develop the spirit of individual independence in man than the corporate spirit of organized society. This latter feature should be remembered since it mas also the breath of life in the sagas and folklore. It may be said of Holberg and Wessel in the 18th century, and of Ibsen and Bjornson in the 19th, that they are the true exponents of the various manifestations of the Norwegian mind and temper.

Later **Dramatists.**—Next to Ibsen and Björnson, Gunnar Heiberg (1857–1929) must be mentioned as the greatest Norwegian dramatist of our time. The chief characteristic of his drama is the sharp and trenchant dialogue, but with the exception of *The Balcony* (1894) and *Love's Tragedy* (1904) his plays can scarcely be considered lasting works of art These two plays in which he has shown love as a destructive force of nature, overwhelrning in its consequences, will always bear witness to his talent. Unfortunately Heiberg did riot develop as a dramatic author, and as a whole the Norwegian drama since Ibsen and Björnson has followed more fortuitous lines This applies, by way of example, to *The Happy Election* (1914) by Niels Kjaer (1870–1924), in which this author, who is considered one of the most accomplished writers of modern Norwegian prose, deals with certain contemporary phenomena of Norwegian politics. among them the language question, in a very clever and realistic way. Another example is Oskar Braaten (b. 1881) who has scored great success on the stage with his comedies *The Kid* (1911) and *The Wholesale Christening* (1925), written in the characteristic language of the industrial population in the vicinity of Oslo and dealing with its life and manners. A dramatist of an entirely different type is Hans E. Kinck (1865–1926), whose remarkable drama *The Cattle Dearer* (1908) is, in the opinion of many critics, unrivalled in Norwegian literature since Ibsen's *Peer Gynt*. This drama, which is too unwieldy for the stage notwithstanding its intrinsic merits as a work of fiction, has never been performed, unlike his Italian drama *Agilulf the Wise,* which was acted at the national theatre in the spring of 1910, when it gave rise to a lively discussion engendered primarily by the sovereign way in which the author disregarded the conventional rules of rhythm and stanzas

Finally it should be mentioned that Knut Hamsun (*q.v.*), the famous novelist, has also appeared as a dramatist But his four plays, of which three were produced in the '90s and one in 1910, have not added anything to the already considerable reputation of their author.

See G. Brandes, *Ibsen-Björnson Studies* (Eng trans, *1899*); E Tissot, *Le Drame norvégien* (1893). (S. C. H)

SWEDEN

The Swedish drama begins with the Reformation, the first work being a *Tobiae Komedia* (1550), ascribed to the reformer Olaus Petri (1493–1552). From the following century we have a considerable number of school-dramas, the earliest a *Thisbe* by M. O. Asteropheros (d. 1647). Johannes Messenius (1579–1636) wrote six dramas based on Swedish saga and history; but they are little more than stories in dialogue form; and the *Rosimunda* (1663) of Urban Hiarne (1641–1724), a Renaissance drama with choruses, is little more. Georg Stiernhielm (1598–1672), the greatest literary figure of the 17th century. was the author of masques in the Italian style Meanwhile the first Swedish troupe of actors was established between 1686 and 1691 in the so-called Lejonkula (lion's den) in Stockholm, and stimulated an interest in the theatre. The classical drama persisted all through the 18th century. 0. von Dalin (1708–63) wrote an Alexandrine tragedy, *Brynhilda* (1743) and a comedy, *Den avundsjuke* (*The Envious Man*) (1738), which shows the influence of Steele. King Gustav III. gave great encouragement to both drama and opera, and was himself a dramatist, or at least planned dramas which the poets of his court executed. Amongst these the most eminent were J. H. Kellgren (1751–95), G J Adlerbeth (1751–1818) and K. G. Leopold (1756–1829). The comedies of this age are much more readable to-day than its turgid Voltairian tragedies. In 1737 Karl Gyllenborg (1679–1746) produced his *Svenska Sprätthöken* (*The Swedish Fop),* the first genuine comedy in the literature. Other successful writers mere R G. Modée (1698–1752), K. I. Hallman (1732–1800), O Kexél (1748–96), and especially K. Envallsson (1756–1806).

The Romantic era in Swedish literature differs from that not only in Denmark, but also in every other land, in being almost wholly lacking in dramatic literature. P. D A. Atterbom (1790–1835), it is true, wrote his greatest work, *Lycksalighetens* O *(The Isle of Bliss)* (1824–27) in dramatic form, but it is in no real sense a drama. Nor did the plays of E. J. Stagnelius (1793–1823), the historical dramas, in Schiller's style, of B. von Beskow (1796–1868) or the experiments of K. J. L. Almqvist (1793–66) leave any mark on the stage. About the middle of the century the most successful playwright in Sweden was August Blanche (1811–68), who acclimatized the art of Scribe; while the plays of J Borjesson (1790–1866) show the influence of Shakespeare, admirably translated about this time by K. A. Hagberg (1810–64). F. A. Dahlgren (1816–95) produced in 1846 *Vermländingarna* (*The Vermlanders*), a peasant play with song and dance, probably the most popular of all Swedish plays. Johan Jolin (1818–84) was also successful in the same *genre* Blanche's successor in comedy was Frans Hedberg (1828–1908), whose son, Tor (1862–1931), inherited his father's talent.

The drama of the last period has been cultivated by writers of talent, notably Alfhild Agrell (1849–1923), H. Molan-

der (1858-goo), Ernst Didring (b. 1868); but it is entirely overshadowed by Sweden's one dramatist of European rank, August Strindberg (*q.v.*). To the realistic drama of the end of last century Strindberg contributed powerful works like *Fadren (Tlze Father)*; while in the smaller plays for the *intime* theatre he has created what is virtually a new *genre*. In later life, after his own spiritual crisis, mysticism assumes very large proportions, notably in *Till Damascus;* and unfortunately morbid and unpleasant themes preponderate in his work. Other forms of his drama are fairy-plays, often of great beauty, and the long series of historical dramas which opens with a masterpiece of the first order, *Master Olof*. No dramatist of our time, except Ibsen, has exerted a deeper and more widespread influence than Strindberg; and he is largely responsible for the trend to mysticism and expressionism in the contemporary Continental drama. (X.)

POLAND

Polish drama is of late growth. Through the first centuries of Polish literature it appeared merely in sporadic or exotic forms, Kochanowski's *Dismissal of the Greek Envoys* (1578) being its sole masterpiece until the end of the 18th century. At that date the Polish theatre rose under King Stanislas Augustus' patronage. Founded on French models it rapidly developed on national lines. After the partition of Poland it reached high artistic beauty during the years of the nation's bondage, frequently serving as a patriotic stimulus. Fredro (1783–1876) remains the master of Polish comedy. His *Maidens' Vows, Revenge,* etc., sparkle with wit and national colour. Slowacki (1809–49) gave Poland her finest tragedies in his dramas on Polish history and legend (*Mazeppa, Balladyna, Lilla Weneda*). Two of the greatest masterpieces of Polish literature were written at the same period in dramatic form:—Mickiewicz's national lamentation, *The Ancestors* (1832), and Krasinski's forecast of social revolution, *The Undivine Comedy* (1835). The brilliant symbolical plays, notably *The Wedding*, of the painter poet S. Wyspiánski (1869–1907) created an epoch in Polish drama. Although no subsequent work has equalled those already mentioned the Polish dramatic output has steadily continued. Among contemporary dramatists Rostworowski *(Caligula; Charitas)* merits special mention. (M. GA.)

RUSSIA

Old Russia had no theatre and no drama. Plays taken from the repertory of the German strolling actors and mysteries and moralities after the Jesuit school-model were first introduced in the second half of the 17th century. The continuous output of original drama begins with the production, in 1747, of the first tragedy, in the French classical style, by Alexander Sumarokov. This style dominated tragedy as well as comedy till about 1825. The classical comedy writers, especially Fonvizin (1744–1792) were more original than the tragic poets, and present many features anticipatory of 19th century realism. This classical realism culminated in the great comedy of Alexander Griboyedov (1791–1829) (*q.v.*), *Woe from Wit,* and in the still greater plays of Gogol (*q.v.*), *The Inspector-General* (1836). Character-drawing is the strongest side of all these writers, but Gogol was also a great master of dramatic construction. His tradition was continued by Sukhovo-Kohylin (1817–1902) and Pisemsky (1820–1881), whose masterpiece is a realistic tragedy of great power. The main current of the Russian drama however neglected action and plot. Its principal representative was Alexander Ostrovsky who from 1850 to 1886 gave the Russian stage about a play a year, and created a new type of dramatic realism, based on character drawing and local colour. Owing to Ostrovsky the Russian drama was alone in Europe to be free from the dictatorship of Scribe. The historical drama in verse, after the "Shakespearean" model introduced already by Pushkin (1831) flourished in the sixties and seventies but produced little of outstanding merit, its principal claim to be remembered being its close connection with the Russian opera. In the end of the 19th century Chekhov (*q.v.*) carried the Russian tradition of inactive and plotless drama still further, producing masterpieces of realistic atmosphere (1896–1904). He was imitated without much success by Gorki and Andreyev. After 1906 realism began to be abandoned and various forms of symbolism and modernism invaded the theatre. With the exception of Blok (*q.v.*) and, perhaps, of Evreinov they produced no work of significance, and the Russian theatre has been within recent years emancipated from the playwright and become the unrestricted playground of the producer. Post-revolutionary dramatic literature has produced little of any value, except the brilliant propaganda plays of the Futurists, Mayakovsky and Tretiakov, and the tensely-constructed though immature plays of action of Leo Lunts (1901–1924).

See Leo Wiener, *The Contemporary Drama of Russia* (Boston, 1924). (D. S. M.)

CZECHOSLOVAKIA

The theatre contributed very appreciably towards the progress of the Czech literary revival which began to gain impetus at the beginning of the 19th century. The earliest plays, which were the work of such pioneers as Václav Klicpera (1792–1859) and J. K. Tyl (1808–56), were largely imitations or adaptations of foreign models. After a short period of romanticism, associated with the first Czech translations of Shakespeare by J. J. Kolar (1812–go), the Czech stage was dominated by realism. The French comedy of Scribe found a skilful follower in Emanuel Bozděch (1841–89), while Ladislav Stroupežnický (1850–92) specialized in the realistic presentation of Czech rustic life.

An important landmark in the history of Czech drama was the opening of the Prague national theatre in 1883. Its first manager was F. S. Šubert (1849–1915) and his wide knowledge of the theatre ensured a repertoire of great variety. The influence of Ibsen now made itself felt, especially in the plays of Jaroslav Kvapil (b. 1868) and Jaroslav Hilbert (b. 1871), but it was followed by a reaction, leading to the vogue of historical drama. One of the best works of this category was *Falkenstein* (1910) written by Hilbert himself, and other examples of this tendency were provided by J. Karásek ze Lvovic (b. 1871) with his *Caesar Borgia* (1905) and by Arnošt Dvořák (1881–1932) whose *Václav IV.* (1910) is perhaps the most noteworthy Czech historical play. Among prominent modern Czech dramatists should also be mentioned Otakar Fischer (1883–1938), who translated Shakespeare and wrote several plays, both historical and contemporary, and Fráňa Šrámek (b. 1877), whose plays are distinguished and sometimes, from a dramatic point of view, marred by the subtle lyrical spirit pervading thern.

The post-war Czech drama is remarkable chiefly for the work of Karel Čapek (1890–1938) who was the first Czech author to win world-wide celebrity. His *R U* R. (1921) was played in the greater part of Europe and America. In *The Life of the Insects* (1921) he collaborated with his brother Josef (b. 1887), whose independent dramatic experiment *The Land of Many Names* (1923) is also a stimulating piece of work. Finally, there is František Langer (b. 1882) whose tragedy *Slums* (1925) is a skilful blend of realism and psychological subtlety.

No reference has here been made to the drama of the Slovaks, which is still in the process of formation. The repertory of the recently established Slovak theatre at Bratislava consists mainly of Czech plays and translations of foreign works, but a few native Slovak dramas by such writers as Urbánek, Rbzus, Tajovský and Hurban have already been produced. On the whole, however, the Slovak drama, like Slovak literature generally, is marked more by promise than achievement. (P. SE.)

DRAMA AND THE STAGE, ARTICLES ON. Drama as a whole is divided into 24 sections, as under: (1) General, (2) Indian, (3) Chinese, (4) Japanese, (5) Persian and other Asiatic drama, (6) Dramatic elements in Egyptian culture, (7) Greek, (8) Roman, (9) Downfall of the Classical Drama, (10) Mediaeval and Early English, (11) Italy, (12) Modern Greece, (13) Spain and Portugal, (14) France, (15) England, (16) Germany, (17) Holland, (18) Denmark, (19) Norway, (20) Sweden, (21) Poland, (22) Russia, (23) Czechoslovakia, (24) America. In addition there are articles on subdivisions of the dramatic arts which will be found under their own headings. An article on STAGE DESIGN embodies the latest ideas on the subject, and other special articles worthy of mention are THEATRES. LAW RELATING TO; NŌ DRAMA; THEATRE, THEATRICAL PRODUCTION and COSTUME DESIGN, THLATRICAL.

DRAMATIC CRITICISM extends from dramatic theory on the one hand to theatrical criticism on the other. Its founder was Aristotle, whose *Poetics* (*c.* 325 B.C.) laid down, miraculously for its time, the basis of all dramatic theory. His definition of tragedy as "an imitation of an action that is serious, complete, and of a certain magnitude . . . in the form of action, not of narrative; through pity and fear affecting the proper purgation of these emotions" lies behind all subsequent discussion. For comedy the *Tractatus Coislinianus*, conjecturally related to Aristotle, gives an analysis that can be supported from Aristophanes, Shakespeare and Molière. Roman theory is represented by Horace's *Ars Poetica* (*c.* 10 B.C.), a clever and superficial work suggesting "good sense," entertainment combined with instruction and a five act division, as the road to success. Horace first, and Aristotle when he was accessible, formed the basis of Renaissance criticism, and ultimately of modern theory. Ancient dramatic criticism in action may be seen at its most amusing in Aristophanes' *Frogs*. Mediaeval theory was in the main concerned with the still popular formal distinction between tragedy, with its unhappy, and comedy with its cheerful, ending. Dante calls his epic a Divine *Comedy* because "in its beginning it is horrible and foul, because it is Hell; in its ending, fortunate, desirable, and joyful, because it is Paradise."

With the Renaissance the rediscovery of Aristotle's *Poetics* gave a new and fierce life to dramatic discussion. A Latin translation by Valla appeared in 1498, the *editio princeps* of the Greek text in 1508, Robertelli's critical edition in 1548, and an Italian translation, the first in any modern tongue, in 1549. Aristotle's cryptic lecture notes needed clarifying, and most commentators loyally interpreted, altered and expanded in accordance with contemporary theatrical conditions. Plays were composed on Aristotelian principles. Theorists were intimidated, but practical men revolted. Dryden later put the matter at its clearest. "It is not enough that Aristotle has said so, for Aristotle drew his models of tragedy from Sophocles and Euripides; and if he had seen ours, might have changed his mind." Ludovico Castelvetro was the powerful and individual founder of the Renaissance neo-classical doctrine, which survived until the Romantic movements of the mid-18th century. In his Aristotelian commentary of 1570 he insisted that plays must be acted and not read, that tragedy is concerned with kings and public characters, and comedy with low and private people, that tragedy might have either a happy or miserable end, as well as comedy, and in so doing looked back, unwittingly, to Plato's concluding comment in his *Symposium* "that the genius of comedy was the same with that of tragedy," and forward to the practice of Chekhov, Benavente and Pirandello. His farthest reaching contribution was the formulation of the doctrine of the three unities. Aristotle has only the unity of *action*, and a part of that of *time*. Castelvetro gave definite shape to the unities of *action*, *time* and *place*.

The Age of Shakespeare. — On the threshold of the great national dramas of England and Spain, Renaissance theory was epitomized in Sidney's *Defence of Poesie* (1595) and in Cervantes' *Don Quixote* (1605). But the world of practice became insistent, and Shakespeare's point of view in England was matched by Lope de Vega's New *Art of* ***Writing*** *Plays* (1609) in which, on the experience gained from writing 483 plays, he put forward the first classic of box-office criticism. "Since the crowd pays for the comedies, it is fitting to talk foolishly to it to satisfy its taste," give plenty of variety, let women wear men's costumes, keep up the suspense and mystery to the last scene, and don't bore your audience with pregnant silences. There is surprisingly little criticism in the Elizabethans. Ben Jonson's is largely second-hand, and Shakespeare's advice on acting, bold and vivid as it is, has Italian forerunners.

With the 17th century, the age of criticism, important changes occur. There was a vast body of drama to discuss. Theatre-going became fashionable, and coffee-house and bookshop comment was a matter of course. Pepys's *Diary* illustrates the tone of lay criticism. In France, Chapelain, the Abbé D'Aubignac, Racine, and above all Corneille, contributed to serious theory. Corneille, in his *Discours* and *Examens* of 1660, for which he claimed "50 years of practical experience of the theatre," took up the problems of decorum, verisimilitude, and the three unities, which had already occupied Castelvetro, and gave them new and live interpretation. It was Corneille's alertness of mind and not his dull position, to please according to the rules, that stimulated Dryden to his *Essay of Dramatick Poesie* (1668) and his prefaces modelled after Corneille's *Examens*. Dryden, as befits an individual Englishman, was torn between the formalist or "good sense" view continued by Boileau and Rapin in France, and Milton and Rymer in England, and the saner view based on practice, of which he was perhaps the only representative. His views on tragi-comedy and on character-drawing, by giving chapter and verse, laid the foundation of modern criticism in England, and his definition of action foreshadowed something of Ibsen's attitude. For comedy, Molière in his scanty utterances, and Congreve, in his *Concerning Humour in Comedy* (1696), express urbanely what can be more robustly gathered from their works.

The 18th Century. — With the decline of drama, adjacent criticism, largely of morals and of theatrical art, becomes more insistent. Jeremy Collier's *Immorality and Profaneness of the English Stage* (1698) is an important landmark, and Colley Cibber's *Apology* (1740) contains some of our earliest and finest descriptions of acting. The 17th century was the age of the fashionable, Baroque theatre, the 18th the age of great or much applauded actors. Diderot's *Paradoxe sur le comédien* (not published till 1830), and Lichtenberg's descriptions of Garrick, not only exemplify the interest in acting, but, together with Lessing's *Hamburgische Dramaturgie* (1767–68) give proof of the growing international interest already shown by St. Evremond and Voltaire. The chief contributions of the 18th century are the flood of Shakespearian criticism and the spread of the theatrical periodical. In Germany alone 133 periodicals have been traced between the *Hamburgische Dramaturgie* and the end of the 18th century. Lessing, leaning heavily on English example, did much to overthrow French post-Cartesian standards in favour of Shakespearian grandeur and liberty, and in his *Laokoon* (1766) gave so powerful a thrust and so rigid an integrity to critical procedure as to earn him a position second to none but Aristotle.

The Romantic rejection of neo-classical dogma in favour of a misty and grandiose Nature, and a grotesque mediaevalism, gave a new dignity to the emotions and their representation. Lessing. Diderot and Schlegel on the Continent, Dr. Johnson (in one outburst against the unities), Lamb, Hazlitt, and above all Coleridge, in England, expressed, more or less ripely, the doctrines of the individual, and from their utterances emerged principles which unfortunately were not exemplified in the new drama. The chief materialization of this activity was the new conception of Hamlet as an amalgam of Byron, Prometheus and Werther. In France alone, with the theory and practice of Victor Hugo (Prefaces to *Cromwell*, 1827, and *Hernani*, 1830), was there a satisfactory Romantic drama. Joanna Baillie, with her dramas of the passions, and Kotzebue with his pre-Pirandellian metaphysics, left little impression after their popularity had died down.

The 19th century was dominated by the "well made play" of Scribe and Sardou, and Sarcey was its critical prophet. His *Essai d'une esthétique de théâtre* (1876) discusses the principles by which, for the average audience, reality is replaced by illusion. The newer schools of Naturalism and Realism endeavoured to restore reality to the theatre, and criticism followed in their wake. Zola wrote much on the theatre and wished his characters to *live* rather than *perform*. Brunetihre's La *Loi du théâtre* (1894) introduced a new topic of discussion. "In drama or farce what we ask of the theatre is the spectacle of a *will* striving towards a goal and conscious of the means which it employs." In Germany Hebbel and Freytag contributed to non-European movements. Ibsen's practice rendered theory unnecessary. The best comments for English readers can be found in C. E. Montague's *Dramatic Values* (1911) and the prefaces and writings of Bernard Shaw.

Theories of the 20th century follow dramatic fashions. Most harm, perhaps, has been done by the writings in which Maeterlinck invites us "to draw nearer to the spheres" in which echoes and whispers and silences reign. Theory has, for the most part,

been side-tracked into discussion of scenery, or into the philosophical abstractions of Pirandello and Benavente. Expressionism has not yet found its critic. Its theory must be sought in Nietzsche's *Birth of* Tragedy (1877) and in the writings of Strindberg and Wedekind.

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DRAMBURG, town, province of Pomerania, Prussia, Germany, on the Drage, a tributary of the Oder, 50 m. E. of Stettin, on the railway Ruhnow-Neustettin. Population 7,300. Its industries include brewing and distilling, spinning and brush and cloth manufactures. It trades in live stock.

DRAMMEN, a town in the county of Buskerud, Norway, at the junction of the Drammen river with the Drammen fjord, the western branch of the Oslofjord. Pop. (1936) 25,000. The town is divided into two sections, Bragernes north of the river and Stromso and Tangen to the south. A fishing village existed here in the 13th century. In 1615 Bragernes and Stromso were incorporated and in 1811 they were united into a municipal town under the name of Drammen. The town is an important railway junction and the export centre for one of the richest forest districts of Norway. Along the Drammen watercourse is centred much of the Norwegian wood-pulp, cellulose and paper industry. The town has several engineering works and saw mills. Wood-pulp, cellulose, paper, timber, frames and mouldings are ordinarily exported while coal is the most important import.

DRAPER, JOHN WILLIAM (1811–1882), American scientist, was born in St. Helen's, near Liverpool on May 5, 1811. He studied at Woodhouse Grove, at the University of London, and again, after removing to America in 1832, at the medical school of the University of Pennsylvania (1835–36). In 1837 he was elected to a medical professorship in the New York university, but, as its medical school was not organized at once, he began his work in its college as professor of chemistry (1839), and was a professor in its school of medicine (1840–so), president of that school (1850–73), and professor of chemistry until 1881. He died in Hastings, N.Y., on Jan. 4, 1882. He made important researches in photo-chemistry, and was the first to take the human portrait by light, having made portrait photography possible by his improvements on Daguerre's process. He was also responsible in great measure for the prominence of New York city as a centre of medical education.

He wrote: *Treatise on the Forces which Produce Organization in Plants* (1844); *Treatise on Chemistry* (1846); *Treatise on Human Physiology or The Condition and Course of Life of Man* (1856); *History of the Intellectual Development of Europe* (1863); *Thoughts on the Future Civil Policy of America* (1864); *History of American Civil Wur* (1867–70); *Distribution of Calorific and Chemical Activities in the Solar Spectrum* (1872); *Contributions to Chemistry* (1874); *History of the Conflict between Religion and Science* (1875); and a collection of published works under the title of *Scientific Memoirs* (1878).

See *Transactions of the New York Academy of Sciences,* vol. i., pp. 106–108 and the *American Journal of Science,* vol. xxiii., pp. 163–166.

His son, HENRY DRAPER (1837–1882), graduated from the medical school of the New Pork university in 1858. He was appointed to the medical staff of Bellevue Hospital in 1858, and served there 18 months. He was professor of natural science in New York university in 1860, professor of physiology (in the medical school), and dean of the faculty in 1866–73. He succeeded his father as professor of chemistry, but only for part of a year, as he died in New York on Nov. 20, 1882. Henry Draper's most important contributions to science were made in spectroscopy; he ruled metal gratings in 1869–70, made valuable spectrum photographs after 1871 and proved the presence of oxygen in the sun in a monograph of 1877. Edward C. Pickering carried on his study of stellar spectra with the funds of the Henry Draper Memorial at Harvard, endowed by his widow (*née* Mary Anna Palmer).

He wrote: *Changes of the Blood Cells in the Spleen* (1858); *Petroleum: Its Importance* (1865); *American Contributions to Spectrum Analysis* (1865); *A Text Book on Chemistry* (1866); and *Discovery of Oxygen in the Sun by Photography* (1877).

See *Bzographical Memoirs of the National Acadenzy of Science,* vols. ii. and iii.

DRAPER. One who deals in cloth or textiles generally. The Fr. *drap,* cloth, from which *drapier* and Eng. "draper" are derived, is of obscure origin. It is possible that the Low Lat. *drappus* or *trappus* (the last form giving the Eng. "trappings") may be connected with words such as "drub," Ger. *treffen,* beat; the original sense would be fulled cloth. "Drab," duil, pale, brown, is also connected, its first meaning being a cloth of a natural undyed colour. The Drapers' Company is one of the great livery companies of the City of London. The fraternity is of very early origin. Henry Fitz-Alwyn (d. 1212?), the first mayor of London, is said to have been a draper. The first charter was granted in 1364. The Drapers' Gild was one of the numerous subdivisions of the clothing trade, and appeared to have been confined to the retailing of woollen cloths, the linen-drapers forming in the 15th century a separate fraternity, which disappeared or was merged in the greater company. It is usual for drapers to combine the sale of "drapery," *i.e.,* of textiles generally, with that of millinery, hosiery, etc. In *Wills* v. *Adams* (reported in *The Times,* London, Nov. 20, 1908), the term "drapery" in a restrictive covenant was held not to include all goods that a draper might sell, such as fur-lined goods.

DRAUGHT, the act or action of drawing, extending, pulling, etc. (from the common Teutonic word "to draw"; *cf.* Ger. *Tracht,* load; the pronunciation led to the variant form "draft," *q.v.,* now confined to certain specific meanings). It is thus applied to animals used for drawing vehicles or loads, "draught oxen," etc., to the quantity of fish taken by one "drag" of a net, to a quantity of liquid taken or "drawn in" to the mouth, and to a current of air in a chimney, a room or other confined space. In furnaces the "draught" is "natural" when not increased artificially, or "forced" when increased by mechanical methods (see BOILERS). The water a ship "draws," or her "draught," is the depth to which she sinks in the water as measured from her keel. The word was also formerly used of a "move" in chess or similar games, and is thus, in the plural, the general English name of the game known also as "checkers" (see DRAUGHTS). For the use of the term "draft" or "draught" in masonry and architecture see DRAFTED MASONRY.

DRAUGHTS. Draughts is a game of skill usually played by two persons on a chequered board of 64 squares. Each player to commence has 12 men of a distinctive colour. In the United States the game is known as checkers.

Fig. 1 shows the board and men set out ready to commence a game. The Black squares are not used throughout the game, and in order to record moves and give a coherent description of play the actual field of operations (*i.e.,* the White system of squares) is numbered as shown in fig. 2. At the outset it should be noted that the board is placed with a "double corner" on the right hand of each player, Black's double corner being the squares 1 and 5 and White's corresponding double corner 32 and 28. Each player has a "single corner" on his left, Black at 4 and White at 29.

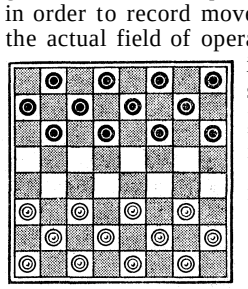


FIG. 1.— DRAUGHT BOARD, OR CHECKER BOARD SET FOR PLAY

The convention is adopted of assuming that at the commencement of a game the Black men always occupy the first 12 squares (1–12), and White the last 12 (21–32). This is merely to get uniformity in recording.

A man moves forward diagonally one step at a time into the next playing square to the right or left provided such square be unoccupied. Thus at the beginning of a game Black has choice of seven different moves—he may play the man on 9 to 13, or the same man to 14, or he may choose 10–14, 10–15, 11–15, 11–16 or 12–16. Suppose he plays 11–15, then White has choice of seven replies, viz., 21–17, 22–17, 22–18, 23–18, 23–19, 24–19 and 24–20 A capturing move (shortly "capture" or "take") occurs when a hostile piece is situated in a square contiguous to one belonging to the player whose turn it is to play, with an empty square imme-

diately behind it. The capture is effected by passing the playing man into the empty square mentioned, removing the man passed over from the board. A cardinal rule is that *it is compulsory to take whenever it is possible to do so.* When two ways of taking present themselves, the player is free to choose between them. Capturing play is continuous as far as there are opposing pieces *en prise*, and it is often possible to take two or more in one move, the only condition being that they shall be strung out, each with a vacant square behind it.

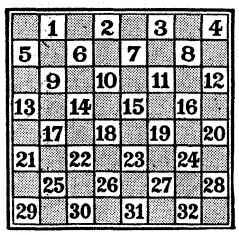


FIG. 2.— DRAUGHTBOARD NOTATION: BLACK OCCUPIES SQUARES 1 TO 12, AND WHITE 21 TO 32

When a man reaches the extreme end of the board he is promoted to a "King." Black men crown on reaching any of the squares 29 to 32, and White men similarly on 1 to 4. A King has the privilege of moving and taking backwards as well as forwards, and thus doubles the functions of a man. It is only in rare or exceptional positions that a King equals two men in value.

The object of each player is to leave his adversary without a move, and in more than 99% of cases this has to be effected by capturing all his pieces. Briefly, you play to clear him off. The only other way of winning is by so confining what pieces he may have left that he cannot move any of them; this sometimes happens, and is technically known as a "block," of which more a little later.

If you cannot win you must if possible avoid loss and try to draw. A draw is when neither player can force a win, such as when the opposing forces are reduced to two or three pieces each with no positional advantage to either side. A draw is usually a matter of easy agreement, drawn positions being readily recognized.

As an elementary exercise, to gather up some of the points already explained, play over the following game, No. 1:—Black moves first, 11–15, White replies 22–18, offering an exchange which forms the "Single Corner" opening; 15–22 (must take), 25–18 (he has the option of 26–17, but that is a bad move as it would seriously divide the White forces); 8–11, 29–25 (bringing up the single corner man in this way as a support is usually good play); 4–8 (the same remark here applies), 25–22 (note that 24–19? instead would allow Black a simple three-for-one by 1—15, 19–10, 6–29); 12–16, 24–20; 10–15 (by this move Black sets a trap) 27–24? (now this move on the surface looks good, because it threatens 24–19 winning a "two-for-one," but the first thing a Draughts player should learn is to distrust the obvious); 15–19! (Black could dispose of the two-for-one threat by playing 8–12, but that course is unnecessary, as he can make a three-for-three exchange which gains a King and leads to a won game), 24–15; 16–19! 23–16; 9–14, 18–9; 11–25 (the man on 9 is safely pocketed to be taken next move), 32–27 (to the uninitiated White's game does not look entirely hopeless, but trial will show that he is in a very bad way however he may play); 5–14 (stronger than taking 6–13), 27–23; 6–10, 16–12; 8–11, 28–24; 25–29 (crowns; Black has not been in a great hurry to do this, but has first massed the body of his men into a solid position), 24–19 (the exchange by 30–25; 29–22, 26–17 affords a little more fight, but with the White forces fatally squandered); 14–18 (the first move of a useful four-for-four stroke, the mechanism of which should be remembered), 23–14; 10–17, 21–14; 29–25! 30–21; 11–16, 20–11; 7–30 Black wins with great ease, as White can only run his men down the board with an almost unbroken "crown-head" facing them and a free King behind them.

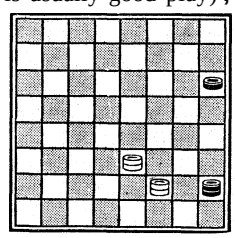


FIG. 3.— "FIRST POSITION," WHITE TO PLAY AND WIN

The trap which White falls into in the above game when playing 27–24 at the 12th move is of very common occurrence, and is known by the quaint designation of the "Goose Walk." It is easily avoided by moving 21–17, and so drawing the game.

There are a few points in connection with Draughts which are subject to much misapprehension among those who have little acquaintance with the game or rules. One knotty point is in connection with the "huff," *i.e.*, a penalty which *may* be enforced against a player who neglects to capture a piece when he should do so. The "huff" simply consists of the removal by the adversary (before he moves) of the piece which should have effected the capture. Now the offending party has *no say whatever* as to whether the penalty shall be exacted or not in any particular case. His adversary may require him to put back the illegal move he has just played, and make the proper capture. In such case there is no huff. It would obviously be absurd if a player could evade a well-planned coup by blandly standing the huff.

It is neither good form nor bad form to "man off." The player who objects to exchanges being forced upon him when he himself is in a minority (on the ground that it is "not sport") is simply displaying ignorance. A player is entitled to make, and should make, the *best move he can see* in any position. Frequently, the only way to press home numerical advantage is to exchange, and so increase the ratio of such advantage.

If a player touch a piece when it is his turn to move, he must play that piece, and if the piece be pushed so as to show over the angle of the square, the move must be completed in that direction.

A man, on reaching the square on the opposing back rank, rests there to be crowned. If he lands there in the course of a capture, he cannot continue capturing as a King.

The ending of two Kings to one is simple. It is a win in all cases for the two Kings, with just one exception which can occur in either single corner.

The ending of three Kings to two, when the weaker party holds one or both the double corners, is apt to be a little puzzling at first. The win is obtained by forcing an exchange, reducing the ending to 2 x 1.

In general esteem, Draughts is placed at a disadvantage by the simplicity of its initial presentation. One can play a game with so very little instruction. Critics sometimes point to the large preponderance of drawn games (between experts) over those that are won, and infer from this that as a subject Draughts is approaching exhaustion. It is not appreciated (but such is the fact) that every well-balanced and easy-looking draw between two good players is the product of long and concentrated preparatory study and analysis on strict lines of scientific method. It is necessary for a player to keep himself informed of all contemporary analytical discoveries, or he will find his play out of date. Notwithstanding all preparation, every player becomes involved in strange positions in actual games; he then must find the best move, knowing well that nothing less will suffice. It is an intellectual feat to draw a game at Draughts against a really fine player.

Combination.— Some of the beauties of the games are exhibited in the following examples, each of which has been selected on account of some striking combination, brilliant idea or other artistic merit displayed.

Game No. 1 AYRSHIRE LASSIE OPENING

*a*11–15	25–18	10–15	22–17	*b*15–18	24–6
*a*24–20	3–8	23–19	13–22	24–20	2–9
8–11	26–22	6–10	26–17	18–27	17–10
28–24	5–9	*c*} *d*} 27–23		11–16	31–24	8–11
9–13	30–26	9–14		20–11	16–23	Drawn
22–18	1–5	18–9		7–16	20–16	**R.** Jordan
15–22	32–28	5–14		29–25	12–19	

a. 11–15, 24–20 forms the "Ayrshire Lassie" opening, so named by Wyllie. It is generally held to admit of unusual scope for the display of critical and brilliant combinations.

b. 16–20, 25–22, 20–27, 31–24, 8–11, 17–13, 2–6, 21–17, 14–21, 22–17 21–25, 17–14, 10–17, 19–1. Drawn.

Game No. 2 PAISLEY OPENING

Played between E. R. Jacques and D. Campbell

11–16	17–14	16–23	25–22	20–27	23–18
24–19	10–17	26–19	7–11	14–9	14–23
8–11	21–14	4–8	19–15	7–14	21–7
28–24	1 6	29–25	12–16	9–6	3–10
16–20	25–21	13–17	15–10	1–10	26–3
22–17	6–9	31–26	2–7-a	18–9	27–31
9–13	23–18	9–13	27–23	5–14	3–7

White wins.

(a) Black's "side game" has not paid him very well, and his forces are now badly divided.

No. 3 LAIRD AND LADY

A classic, by J. Steel, Kilbirnie, Scotland

11–15	17–14	4–8	26–23	12–16	12–3
23–19	1 1	24–19	16–20	19–12	2–7
8–11	21–14	13–17	31–26-a	7–10	3–10
22–17	15–18	28–24	18–22-b	14–7	6–31
9–13	19–15	11–16	25–18	3–28	

Black wins.

(a) Plausible but loses. (b) "The Steel Shot."

No. 4 BRISTOL CROSS

Played at Halifax, Yorlrshire, between C. Horsfall (Black) and S. Greenslade (White)

11–16	12–16	16–23-a	11–16	7–11	6–31
23–18	17–14	17–13	31–26	26–19	13–6
16–19	8–12	4–8	16–20	3–8	1–26
24–15	22–17	28–24	25–22	12–3	30–23
10–19	19–23	8–11	12–16-b	2–7	11–16
21–17	26–19	24–19	19–12	3–10	

Black wins.

(a) Enterprising play. A man so thrust forward is a menace if it can be maintained. (b) Notice how the man on 23 is completely surrounded. Now begins a lovely combination.

No. 5 OLD FOURTEENTH

Played at Buffalo, U.S.A., between Mugridge (Black) and Hodges (White)

11–15	18–9	11–15	26–23	28–32	7–14-d
23–19	1	19–16	24–28	19–15	6–10-e
8–11	26–23	12–19	20–16	32–28	14–7
22–17	1–6	23–16	15–24	15–11	32–28
4–8	30-26-a	15–19	23–19	28–32	21–14
25–22	6–9	27–23	14–18	11–7-b	22–25
9–13	32–27	8–11	22–15	3–10	29–22
27–23	2–6	16–12	13–22	2–7	24–27
6–9	24–20	19–24	15–11	9–13	31–24
23–18	15–24	23–19	10–14	12–8	28–26
9–14	28–19	11–15	11–2	14–17-c	

Black wins.

(a) Evidently this is inferior, but the subsequent play is masterly. (b) A bid for freedom. (c) Very fine. (d) Taking the other way, he would be a man down permanently. (e) This stroke removes all the White pieces from the board.

No. 6 CROSS

The following is an example of a "Block":

11–15	30–26	15–19	27–24	6–10	29–25
23–18	9–13	18–14	8–12	27–23	
7–11	24–20	10–15	25–21	2-6	
26–23	12–16	23–18	1–6	31–27	
3–7	21–17	6–9	32–27	4–8	

and White wins, having the last move. It is now Black's turn to play, and having no move available, he has lost. A counterpart "block" with no piece taken on either side is sure to end in a White win. The game, however, is only a freak.

General Principles.— The foregoing games are entertaining enough, but such spectacular play is rare between accomplished players, although great skill, as well as vigilance, is required to avoid falling occasionally into some subtly prepared stroke. Novices often lose games by stroke play—sometimes indeed they are allowed to make an inviting stroke on their own account, only to find that the resulting position runs badly against them. Strokes and combinations are used by experts as *threats*, and are useful adjuncts to position play, their avoidance by the opponent probably entailing some precautionary move on his part which if not entirely inferior will not improve the strength of his game. Setting traps, however, which if avoided will allow the adversary an improved position, is strictly eschewed by good players.

Of general theory which can be expressed in anything like precise terms there is none. The game is not amenable to treatment by any of the methods of pure mathematics, which seems strange at first, because above everything it demands, constantly, the most exact calculation. The circumstance is fortunate. Investigation of the possibilities and potentialities of the game depends entirely on practical analysis—actual trial and selection of moves in given positions. Such research is being carried on without ceasing by hundreds of busy brains throughout the world, merely multiplying the available data, without getting an inch nearer any conclusion, except the probability that one does not exist.

The authors of textbooks, therefore, are chary of giving general advice, and such as they offer is obscure and sometimes contradictory. Beyond recommending the student to play towards the centre of the board in preference to the sides they say little, preferring instead to recommend a plunge into the columns of figures (representing moves) which bulk so largely in every book on Draughts.

There are several coherent general schemes for bearing the men well understood by experienced players. (Note, however, that such schemes do *not* constitute anything like a complete theory of play.) The more important are: 1. Play a centre-of-the-board game, *i.e.*, move to the middle, bringing up the side men as supports, and try to divide the adversary's men by driving a wedge into his formation. 2. Play to the sides. encouraging the opponent to take up a central position, but with the view of surrounding his front and undermining his supports. 3. Play to occupy the squares 14 and 19 with supported men, as such formation will attack the opposing double corner and secure one's own. 4. Play to attack the single corner by establishing a supported piece (if Black) on 18, or (if White) on 15. 5. Play to keep the game open, especially in the centre, by making judicious exchanges, and refrain from any pronounced attack or defence (especially attack).

There are other general plans, some of which cannot be quite so simply described as the above, but as the experienced player very well knows they are all subject to the qualification of if *permitted* or *as far* as *may be possible and prudent.* Nos. 1 and 2, for instance, are reciprocal to some extent, and the one may be met by the other in many cases without advantage to either. They are opposed very prettily for instance, in certain lines of the "Old Fourteenth" (11–15, 23–19; 8–11, 22–17; **4–8** forms the opening, usually continued 17–13, 15–18, 24–20; 11–15, 28–24; 8–11, 26–23, etc.). No. 3 was the subject of a serious attempt by the American champion, N. W. Banks, to develop a system of play as described, and he shows many applications of it in his book ***Scientific*** *Checkers* (1923). The idea was not original with Banks, but he carried it further than any previous writer, without much practical success, however, as his advocacy tended to make him overrate the scheme, which he recommended in some games where stronger play was demonstrable. The number 3 plan is well exemplified from Black's point of view in the "Dyke" opening (11–15, 22–17; 15–19, 23–16; 12–19, 24–15; 10–19, etc.). No. 4 is not as feasible as some of the others, but is developed by Black fairly strongly in the "Maid of the Mill" opening (11–15, 22–17; 8–11, 17–13; 15–18, 23–14; 9–18—seldom permitted by White, who can easily evade it). No. 5 is often the style of thing which occurs' as a result of compromise or desire to keep the draw in sight: it leads to the adoption of such openings as the "Defiance" (11–15, 23–19; 9–14, 27–23 avoiding many complications consequent on 22–17 and usually continued 8–11, 22–18, the exchange of two-for-two leading to an open game).

Before leaving this discussion of system the following example of the success of the second scheme when opposed to the first may be cited as worthy of more than casual examination. It is selected to show that such advice as "play to the centre" and "do not play to the sides" is not capable of universal application, but is also a splendid exposition of Draughts.

No. 7 ALBEMARLE

It is uncertain who was the first to show the win in the main play of this game.

11–15	9–14-b	7–11	12–16	8–12	9–18
22–17	25–21	30–26-d	32–28	27–23	21–17
8–11	15–18-c	2–7	16–19-e	3–8	23–26
17–13	29–25	24–20	23–16	23–18-f	17–14
4–8	11–15	5–9	18–23	14–23	
21–17-a	26–22	28–24	26–19	17–14	

White wins.

(a) An uncommon opening, but the position after the next two moves can arise in several ways.

(b) The best move is 15–18—an application of scheme No. 4.

(c) Although this move is suggested by scheme No. 1 it loses outright. A draw is obtainable by 15–19, 24–15; 10–19 (11–18 loses), 17–10; 6–15, 23–16; 12–19, which is according to scheme No. 3.

(d) The win is forced by a logical application of scheme No. 2. This man is the pivot of both wings.

(e) An attempt to break the cordon—the only chance.

(f) This counter sacrifice ensures the win.

To resume our consideration of general principles it is safe to say that the main thing which the experienced player keeps in view (assuming that he is opposed by an adversary of equal skill) is the probable state of his end-game, which indeed he begins tentatively to forecast as soon as a few of the opening moves have been made. Normally Draughts is a shortish game, and one or two crises quickly bring about the ending, which if not presenting some feature of difficulty may as well be declared drawn at once To be sure of a draw, however, a player must not be in any numerical inferiority, and must be able to see his way to crown his remaining men, as any man unable to obtain a clear course is a possible source of weakness. Strength in the end-game consists of being able to occupy the centre of the board with Kings, pinning backward men of the opponent's forces to the side squares, and preventing any Kings he may have from actively ca-operating with each other. With a strong ending of such scope a player will be able to dictate replies, force advantageous exchanges, prevent the release of the tied-up men, and eventually exhaust the moves of the last one or two badly placed pieces belonging to his opponent. The "play to the centre and avoid the sides" advice thus becomes intelligible in the ending, however doubtful of application it may be in many cases earlier in the game. In the mid-game therefore the chief object is to shape an end-game with favourable possibilities. Skill to do this may only be acquired by hard practice and judicious book-work.

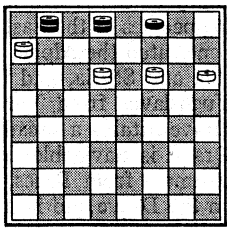


FIG. 4 —"FOURTH POSITION"
(a) White to move and win
(b) Black to move and draw

The End Game. — Perhaps higher qualities are required in playing for the end-game than in actually manipulating the end-game when it has arrived. End-play requires great exactitude and much patience, but its principles are well known, as a number of root endings constantly recur and their handling is purely a matter of technique. Several of these root end-games have special names such as First, Second, Third and Fourth Positions, Payne's Draw, Barker's Triangle, Bowen's Twins, Strickland's Position, the Mackintosh Position, etc., etc End-play largely depends upon calculating the influence of "the move" ("opposition" or "vantage" as it is sometimes called) which consists in ascertaining, after pairing off the forces, piece against piece, which party will have the last move. The virtue of "having the move" is that the opponent's pieces, being obliged to give way, ultimately become confined and held unless "the move" can be altered or a defensive stronghold established

Two root endings, in which the play is not of an elementary nature, are diagramed as examples.

In "First Position" the stronger party has two Kings against King and man. The defending player has his King in the opposing double corner, and his man held up somewhere on his left wing, perhaps farther back than shown. The attacking player (who must have "the move") can drive the King out of the double corner or compel the man to advance, and this course on trial will be found to lead to the win. With the backward man on the other wing the game is drawn.

In Fourth Position the defending player is a man short, but can draw with "the move" in his favour by simple repetition When the attack has "the move" he can construct the following situation: Black man on 21, Kings, 20, 22, 28; White man on 30, Kings 27, 32. Black to play wins by the sacrifice 22–26, 30–23, 28–24, etc. The single White man may be a King without altering the essentials.

History. — The records of the game do not go back farther than the invention of the art of printing. All conjecture as to its origin is purely speculative, and its ancient history (if any) is lost. It is not doubted that board games were played in ancient Egypt, Greece and Rome, but there is no evidence that such games resembled Draughts, even in rudimentary form.

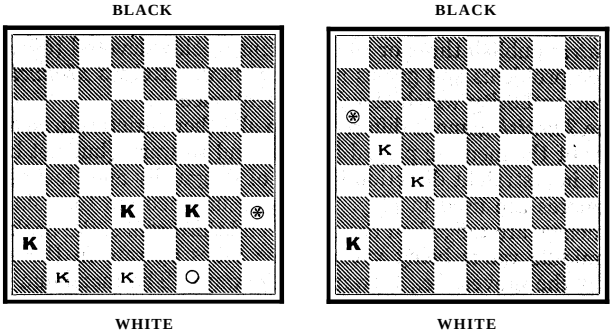
The Spanish authors are the oldest, dating back to the 16th century. The Spanish game to-day is the same as they then described. The early French authors treated of the form which is now generally styled the English game, but the so-called Polish game was evolved and introduced in Paris about the year 1721, superseding the older form. The Polish game spread from France to Holland, Flanders and Switzerland, and its influence is traceable in the German and Russian games. In the meantime the Italians also evolved their own special rules.

The records of English Draughts begin with William Payne (1756) and its form was permanently fixed by Joshua Sturges (1800). Comparatively neglected in the south of England in the beginning, it was developed successfully in Scotland and the north of England. The rise of modem master-play dates from Andrew Anderson, who retired about 1850, after playing five matches (four of which he won) with the celebrated James Wyllie, another Scotsman. Wyllie assumed the title of champion, but the honour was wrested from him by Robert Martins (a Cornishman), only to be regained. A young American named Robert D. Yates defeated both Wyllie and Martins in set matches in 1876–77, but retired, and the title reverted to Wyllie. James Ferrie (of Glasgow) finally defeated Wyllie for the world's championship in 1894. Ferrie lost by the odd game in 40 to Richard Jordan (of Edinburgh) in 1896. The latter died unbeaten in 1909 but it should be mentioned that an American champion, Charles F. Barker, played a drawn match with him in 1900. The present holder and successor to Jordan is Robert Stewart of Blairadam, Fifeshire.

Organization — The game is fairlv well organized in all English-speaking countries: including the' United States, but there is no supreme parliament recognized. There are many bodies such as State and county associations, and city and town clubs, Institutes and recreation clubs generally have draughts circles, and the game has a big following. All the national associations promote periodical tournaments and international team matches have been played. There is an annual British Counties' Championship for teams of 12 players.

Varieties of the Game. — What we have been describing is the English form of the game.

The *Spanish* game is played in a similar manner, but with the following exceptions: (a) The board is placed with the double corner to the left (an English board in the looking-glass, as it were); (b) the King can move over any number of unoccupied squares on the same diagonal; (c) It is compulsory to capture the greatest number of pieces which may be *en prise* at any play, which of course limits or eliminates choice when there are pieces *en prise* in more than one direction. The long moves of the King vastly increase his power in comparison with the ordinary man. The Spanish game, although still practised, is



in a backward state and has never been properly developed. The most recent authority is Dr. M. Carceles Sabater (Madrid, 1904).

The *Italian* game differs from the Spanish game (from which it was probably derived) in the powers of the King. The Italian King moves precisely the same as an English King (subject however to the maximum take being compulsory) but is immune from capture by a man. The Italian game is a very "live" proposition. and analytical discoveries in the English game are readily adapted by the Italian players. The modern authorities are G. Bassani (*La Dama Scientifica*, Milan, 1919) and L. Avigliano (*Il Giuoco della Dama*, 1918, and *La Dama nel Giuoco Moderno*, Milan, 1927).

The *Polish* game is the form most popular on the Continent.

We have already referred to its origin; it appeared in France, but one of its earliest exponents in Paris was a Pole. It is played upon a board of 100 squares, 50 being used; 20 men a side; double corner to the right. The King (*i.e.*, Dame or Queen) has the same powers as the Spanish King, extended to the larger board. The men, whilst moving forward as in the English game, take both backward and forward. The maximum take is compulsory, and in capturing play a man may touch the back rank without crowning if further pieces remain to be taken. The "huff" has been abolished. The characteristic feature of the Polish game is the backward take of the man, which players used to the English, Spanish or Italian rules find both novel and puzzling Polish Draughts is a magnificent game, well suited to the genius and scientific bent of the French and Dutch peoples. One of the declared objects of the French Draughts Association is to convert the draughts players of other countries to the use of the 100 squared board and the Polish rules. The literature of the Polish game is voluminous, although it certainly falls short of the output of books devoted to the English game. Amongst the older French authors Manoury (about 1780) is still in good repute, and his book has been many times reprinted. Le Damier by G. Balédent (Amiens, 1881–87) is a monumental work in four volumes, and later French treatises of value which are readily procurable are those of Barteling, Chiland, Weiss, Felix Jean, etc. The best Dutch writers have produced much progressive work, and after Van Embden (the ancient authority) should be mentioned the modern treatises of Broekkamp, De Haas and Battefeld, Springer and De Jongh. The Polish game is served by no less than four monthly magazines.

The German game is the Polish game on the smaller (8x8) board, and does not call for much special comment. The treatises of J. Dufresne and H. Credner may be referred to, but neither is very modern. This game, by the way, has some minor vogue in the United States.

The Russian game is also minor Polish, with two important differences. The choice which may be exercised in capturing is free, *i.e.*, is identical with the English rule. A man on reaching the back rank in capturing is promoted on touching the crowning square and immediately functions as a King, continuing that play as a King. "Shashki," as it is called, is immensely popular in Russia, and has a fairly good body of literature and a monthly magazine published in Moscow.

In Canada the Montreal or Quebec game is the favourite of the French-speaking people, who refer to it as "Le Jeu Canadien." It is a major form of the Polish game, with identical rules, played on a 12x12 board with 72 playing squares and 30 men aside. This game is also practised in the New England States of the U.S.A. by the French community. Two Montreal newspapers, *La* Presse and *La* Patrie publish three or four columns weekly devoted to it, and include problems and games as well as news. Roby's Manuel is a current authority which should be mentioned.

The Turkish game is different from all other varieties in that the moves of the men are played laterally and forward (but not backward) in a straight direction instead of diagonally and thus all the 64 squares are used in play. The opposing men, 16 to a side, to commence, are ranged on the second and third ranks, the back and two middle ranks being vacant. The takes operate in the same way as the moves, *i.e.*, forward or sideways. The maximum take is compulsory and the pieces are removed one by one as captured. The King has a sweep of any number of squares. This game is practised in the North of Africa, Stamboul and the Levant, but its literature is practically negligible, although some highly interesting mss. are in existence.

The ***Losing*** game (in English or foreign forms) is a reversal of the ordinary rules, as the name implies.

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DRAUPADI, in Hindu legend daughter of Drupada, king of Panchāla, and wife of the five Pāndava heroes in the *Mahābhārata*.

DRAVE or DRAVA (Ger. Drau), one of the principal right-bank affluents of the Danube. It rises below the Innichner Eck, in Tirol, at an altitude of over 4,000 ft., runs eastward, and forms the longest longitudinal valley of the Alps, the Drau Thal. The Drave is 450 m. long; near Zakkany it is joined by the Mur. The valley of the Drave was the chief road through which the invading peoples of the East, such as the Huns, the Slavs and the Turks, penetrated the Alpine countries. The Drave flows through Carinthia and Styria, and forms the boundary between Hungary and Yugoslavia from Varaždin to near Osijek. At its mouth the Drave attains a breadth of 1,055 ft. and a depth of 20 ft. The Drave is navigable for rafts only from Villach, and for river steamers from Bárcs, a distance of 95 m. The principal towns on the Drave and its affluents are Klagenfurt, Graz, Maribor and Osijek. (See DANUBE.)

DRAVIDIAN, a name only applied in Indian usage to the "Southern" group of the Brahmans *q.v.* But "Dravidian" is applied, unfortunately, to the indigenous peoples of India south of the Vindhyas and the northern half of Ceylon; it should be confined to the languages of this area. At least four different stocks have contributed elements in their population. The earliest is dark, short, with wavy hair, broad noses and long heads, so that some have detected affinities with Negroids. This stock, represented by Kadirs and Kurumbas, is akin to the Veddas and to Australian peoples and to the Semang and Sakai (see FURTHER ASIA). Other elements are physically distinct and we have in the Nambutiri Brahmans the purest Aryan stock. The range of culture is equally wide. The Dravidians occupy the oldest geological formation in India, the medley of forest-clad ranges, terraced plateaux, and undulating plains, from the Vindhyas to Cape Comorin, and among them we find the construction of dolmens, the use of the boomerang, kinship in the female line, totemism and many primitive usages. But in the same are found a high degree of civilization, with a remarkable literature and evidence of artistic skill.

E. Thurston, *Castes and Tribes of Southern India*, i. (exhaustive introduction), 1909; *Cambridge History of India* vol. i. (1923); R. D. Dixon, *Racial History of Mankind* (1921).

DRAVIDIAN LANGUAGES, the name given to a collection of Indian languages comprising all the principal forms of speech of Southern India (Sanskrit Dravida). Their territory, which includes the northern half of Ceylon, extends northwards up to an irregular line drawn from a point on the Arabian sea about 100m. below Goa along the Western Ghats as far as Kolhapur, thence north-east through Hyderabad, and farther eastwards to the Bay of Bengal. Farther to the north, Dravidian dialects are spoken by small tribes in the Central Provinces and Chota Nagpur, and up to the banks of the Ganges in the Rajmahal hills. A Dravidian dialect is, finally, spoken by the Brāhūīs of Baluchistan in the far north-west.

Classification.—Tamil and Malayālam can be considered as two dialects of one and the same language, which is, in its turn, closely related to Kanarese. Tulu, Kodagu, Toda, and Kōta lie between Tamil-Malayslam and Kanarese, though more nearly related to the latter than to the former. The same is the case with Kurukh and Malto, while Kui and Gondi gradually approach Telugu, which latter language seems to have branched off from the common stock at an early date. Finally, the Brāhūī dialect of Baluchistan has been so much influenced by other languages that it is no longer a pure Dravidian form of speech.

The Dravidian languages are gradually losing ground in the north, where they meet with Aryan forms of speech. This process has been going on from time immemorial, but it is still possible to trace a Dravidian element in the Aryan languages of North India.

The Dravidian languages form an isolated group, and it has not been possible to prove a connection with any other family of languages. Such attempts have been made with reference to the Munda family, the Tibeto-Burman languages, the Ural-Altaic languages, and the dialects spoken by the aborigines of the Australian

continent. The arguments adduced have not, however, proved to be sufficient. The Dravidian family has several characteristic features of its own. The phonetic systems of the smaller dialects deserve close study and analysis. In general the pronunciation is soft and mellifluous.

Main Features. — In Dravidian words a line above a vowel shows that it is long. The dotted consonants *ṭ, ḍ,* and *ṇ* are pronounced by striking the tip of the tongue against the centre of the hard palate. The dotted *ḷ* is distinguished from *l* in a similar way. Its sound, however, differs in the different districts. A Greek *χ* marks the sound of ch in "loch"; *ṣ* is the English *sh;* c the *ch* in "church"; and *ṛi* is an *r* which is used as a vowel. Abruptness and hard combinations of sounds are avoided. There is a distinct tendency to avoid pronouncing a short consonant at the end of a word, a very short vowel being often added after it. Thus the pronoun of the third person singular, which is *avan,* "he," in Tamil, is pronounced *avanu* in Kanarese; the Sanskrit word *vāk,* "speech," is borrowed in the form *viku* in Tamil; the word *gurram,* "horse," is commonly pronounced *gurramu* in Telugu, and so on. Combinations of consonants are further avoided in many cases. This tendency is illustrated by the changes undergone by some borrowed words. Thus the Sanskrit word *brāhmaṇa,* "a Brahman," becomes *barāmaṇa* in Kanarese and *pirāmaṇa* in Tamil; the Sanskrit *Dramida,* "Dravidian," is borrowed by Tamil under the form *Tirāmiḍa. Dramida* which also occurs as *Dravida* is in its turn developed from an older *Damiḷa* which is identical with the word *Tamiṛ,* Tamil.

The forms *pirāmaṇa* and *Tirāmiḍa* in Tamil illustrate another feature of Dravidian enunciation. There is a tendency in all of them, and in Tamil and Malayālam it has become a law, against any word being permitted to begin with a stopped voice consonant (*g,j,ḍ,d,b*), the corresponding voiceless sounds (*k,c,ṭ,t,p,* respectively) being substituted. In the middle of a word or compound on the other hand, every consonant must be voiced. Thus the Sanskrit word *danta,* "tooth," has been borrowed by Tamil in the form *tandam,* and the Telugu *anna,* "elder brother," *tammulu,* "younger brother," become when compounded *annadammulu,* "elder and younger brothers."

There is no strongly marked accent on any one syllable, though there is a slight stress upon the first one. In some dialects this equilibrium between the different parts of a word is accompanied by a tendency to approach to each other the sound of vowels in consecutive syllables. This tendency, which has been called the "law of harmonic sequence," is most apparent in Telugu, where the short *u* of certain suffixes is replaced by *i* when the preceding syllable contains one of the vowels *i* (short and long) and *ei.* Compare the dative suffix *ku, ki,* in *gurramu-ku,* "to a horse"; but *tammuni-ki* "to a younger brother." This tendency does not, however, play a prominent rôle in the Dravidian languages.

Words are formed from roots and bases by means of suffixed formative additions. The root itself generally remains unchanged throughout. Thus from the Tamil base *per,* "great," we can form adjectives such as *per-iya* and *per-urn,* '(great"; verbs such as *per-u-gu,* "to become increased"; *per-u-kku* "to cause to increase," and so on.

Many bases can be used at will as nouns, as adjectives, and as verbs. Thus the Tamil *kadu* can mean "sharpness," "sharp," and "to be sharp." Other bases are, of course, more restricted in their respective spheres.

The inflexion of words is effected by agglutination; *i.e.,* various additions are suffixed to the base in order to form what we would call cases and tenses. Such additions probably once were separate words. Most of them are, however, now only used as suffixes. Thus from the Tamil base *kōn,* "king." we can form an accusative *kōn-ei,* a verb *kōn-en,* "I am king,"–and so on.

Dravidian nouns are divided into two classes, which Tamil grammarians called high-caste and casteless respectively. The former includes those nouns which denote beings endowed with reason, the latter all others. Gender is only distinguished in the former class, while all casteless nouns are neuter. The gender of animals (which are irrational) must accordingly be distinguished by using different words for the male and the female, or else by adding words meaning male, female, respectively, to the name of the animal — processes which do not, strictly speaking, fall under the head of grammar.

There are two numbers, the singular and the plural. The latter is formed by adding suffixes. It, however, often remains unmarked in the case of casteless nouns.

Cases are formed by adding postpositions and suffixes, usually to a modified form of the noun which is commonly called the oblique base. Thus we have the Tamil *maram,* "tree," *maratt-āl,* "from a tree"; *maratt-u-kkzc,* "to a tree," *vīḍu,* "a house"; *vīṭṭ-āl,* "from a house." The case terminations are the same in the singular and in the plural. The genitive, which precedes the governing noun, is often identical with the oblique base, or else it is formed by adding suffixes.

The numeral system is decimal and higher numbers are counted in tens; thus Tamil *pattu,* "ten"; *iru-badu,* "two-tens," "twenty."

The personal pronoun of the first person in most dialects has a double form in the plural, one including and the other excluding the person addressed. Thus, Tamil *nām,* "we," *i.e.,* I and you; *nhngal,* "we," *i.e.,* I and they.

There is no relative pronoun. Relative clauses are effected by using relative participles. Thus in Telugu the sentence "the book which you gave to me" must be translated *miru nāku iccina pustakamu, i.e.,* "you me-to given book." There are several such participles in use. Thus from the Telugu verb *koṭṭa* "to strike," are formed *koṭṭ ut-unna,* "that strikes," *koṭṭi-i-na,* "that struck," *koṭṭe,* "that would strike," "that usually strikes." By adding pronouns, or the terminations of pronouns, to such forms, nouns are derived which denote the person who performs the action. Thus from Telugu *koṭṭe* and *vāḍu,* "he," is formed *koṭṭe vhdu,* "one who usually strikes." Such forms are used as ordinary verbs, and the usual verbal forms of Dravidian languages can broadly be described as such nouns of agency. Thus, the Telugu *koṭṭinăḍu,* "he struck," can be translated literally "a striker in the past."

Verbal tenses distinguish the person and number of the subject by adding abbreviated forms of the personal pronouns. Thus in Kanarese we have *māḍid-enu,* "I did," *māḍid-i,* "thou didst," *māḍid-evu,* "we did"; *māḍid-aru,* "they did."

One of the most characteristic features of the Dravidian verb is the separate negative conjugation. It usually has only one tense and is formed by adding the personal terminations to a negative base. Thus, Kanarese *mid-enu,* "I did not," *mid-evu,* "we did not"; *mhd-aru,* "they did not."

The vocabulary has adopted numerous Aryan loan-words. This was a necessary consequence of the early connection with the superior Aryan civilization.

The oldest Dravidian literature is largely indebted to the Aryans, though it goes back to a very early date. Tamil, Malayslam, Kanarese, and Telugu are the principal literary languages. The language of literature in all of them differs considerably from the colloquial. The oldest known specimen of a Dravidian language occurs in a Greek play which is preserved in a papyrus of the 2nd century A.D. The exact period to which the indigenous literature can be traced back, on the other hand, has not been fixed with certainty.

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DRAWBACK, the repayment of a duty, previously exacted, when excisable goods are exported or foreign goods re-exported. The object of a drawback is to enable commodities which are subject to taxation to be exported and sold in a foreign country on the same terms as goods from countries where they are untaxed. It differs from a bounty in that the latter enables commodities to be sold abroad at less than their cost price; under certain conditions, however, the giving of a drawback has an

effect equivalent to that of a bounty. The tariffs of many countries contained tables of the drawbacks allowed on the exportation or re-exportation of commodities, but so far as the United Kingdom is concerned the system of "bonded warehouses" practically abolished drawbacks, as commodities can be warehoused (placed "in bond") until required for subsequent exportation. (*See* BONDED WAREHOUSE.)

DRAWING, the art of delineation or of portrayal by means of lines, is so primitive that its history is practically that of man. That it was practised 50,000 years ago we know but for how long before that, it is difficult to establish. Its beginnings, however, must have been early, for one of the first things a child will busy its hands with is the making of marks in the dirt, and the walls of many a schoolhouse or home stand as mute witnesses to the inherent tendency of man to draw. It is a deep-rooted instinct whose satisfaction gives great pleasure.

Early Art.—In the beginning the primitive mind with its usual groping for essentials was satisfied with simple structural lines and, at times, outlines of those objects wherein the structure was less evident. The cave-man drew his pictures of men just as the child does—with the inverted Y for the body and legs, a cross-piece for the arms and a circle for the head, part of his drawing showing structure and part outline. The first of these drawings of the child are always without consideration of motion but it does not take long before, with the addition of feet, the figure is walking and soon the arms are brought to the front. Thus we see the early beginnings of the three elements which are essential to all drawing, if it is to please man who has for thousands of generations and from childhood up been trained to expect them: structure, outline and motion. (See fig. 1.)

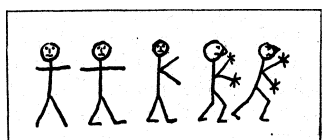


FIG. 1.—CHILD'S DRAWING SHOWING NATURAL DEVELOPMENT OF MOTION

In order to draw the human figure successfully the artist must first learn about its bony structure. He must master the knowledge of the lengths of the various units and of their possibilities for movement (see DRAWING: *Anatomy).* But his work does not cease in this study of structure. Trees spread their branches in certain characteristic ways each of which is slightly different, and in fact each type of leaf has its own anatomy as has every animal, bird and flower. Rocks must be closely examined and their origin understood or they cannot be given the proper structure. The artist cannot slight this work or his drawing will be unconvincing. We must spend much time in finding out how things were put together or how they grew and why.

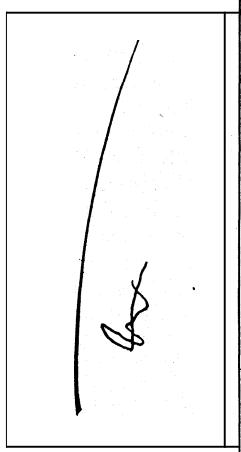


FIG. 2.—LINES WHICH ARE ESSENTIALLY BEAUTIFUL AND UNBEAUTIFUL

In speaking of outline we should think first of line itself. It has been contended that "It cannot be reasonably held that one purely abstract line or curve is more beautiful than another, for the simple reason that people have no common ground upon which to establish the nature of abstract beauty." This is, of course, false, for if there were no common ground in beauty there would be very little incentive to draw other than as a simple record. But to put into words just what this beauty consists of, is a difficult task. Fig. 2 illustrates two lines. It will be agreed that one is more beautiful than the other. One has a sureness and sensitive taper while the other wanders in a hesitant and aimless manner without object, without character. Perhaps that is it. Perhaps a line can have character and therefore can show those beauties and weaknesses which we see in the characters of our fellows. This is undoubtedly possihle, for no two men can draw a line exactly alike and certainly into the lines of each must creep something of the man himself (*see* TECHNIQUE IN ART). Therefore, beauty of line does exist but is difficult to analyze, as it is dependent upon the personality of the artist. It may be as difficult to tell why you like one line better than another as why you like one friend better than another; nevertheless, there is no doubt of your preference in the matter.

Besides this beauty of abstract line we find the age-old necessity for outlining objects, and when asked to describe a thing our minds at once turn to its shape. Its consistency, its structure, its movement are all often secondary unless they assert themselves strongly. The artist has only his eyes to help him in this work but a knowledge of what lies within is also an aid to him. The author on drawing in the eleventh edition makes use of an illustration given herewith, to show how hard it often is to guess the shape of an object by its silhouette alone. (See fig. 3.) As soon as the three lines are added which indicate its structure it is obvious in shape.

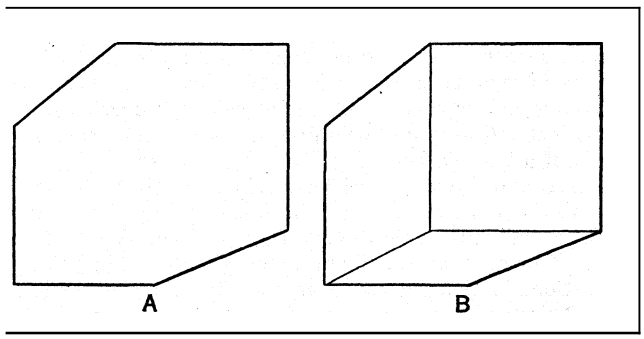


FIG. 3.—DIAGRAM SHOWING (A) DEFICIENCY OF OUTLINE ALONE (B) NECESSITY FOR STRUCTURE IN ORDER TO MAKE FORM UNDERSTANDABLE

It is sometimes possible to erect an imaginary structure which is of assistance and artists frequently resort to this method. For instance, in the drawing of a vase (see fig. 5) the straight lines might be sketched in lightly and would be of some assistance in judging both curves and proportions. In other words a sort of scaffolding is first erected and then the outline drawn upon it. After a little practice the scaffolding need not be drawn for the artist can visualize it without the aid of actual lines. Another help in drawing the silhouette of an object is to reverse the idea and look at the silhouette of the background instead. This process is often employed by sculptors in their work and is undoubtedly of some assistance to them. But all of these are simply suggested aids to seeing, and it takes practice to be able to draw what one sees. (See fig. 4.)

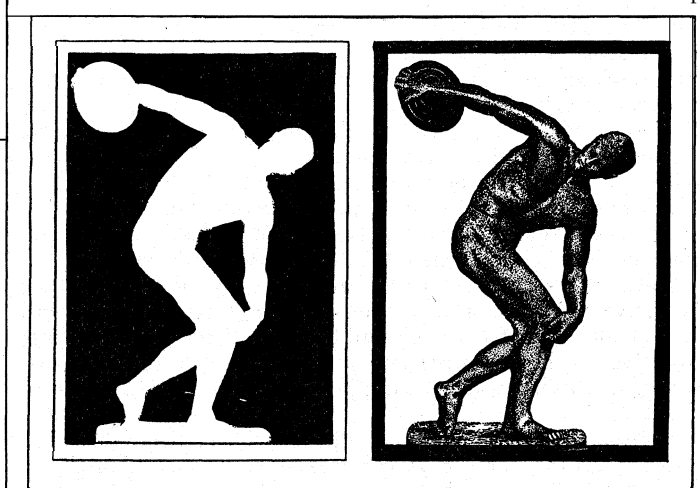
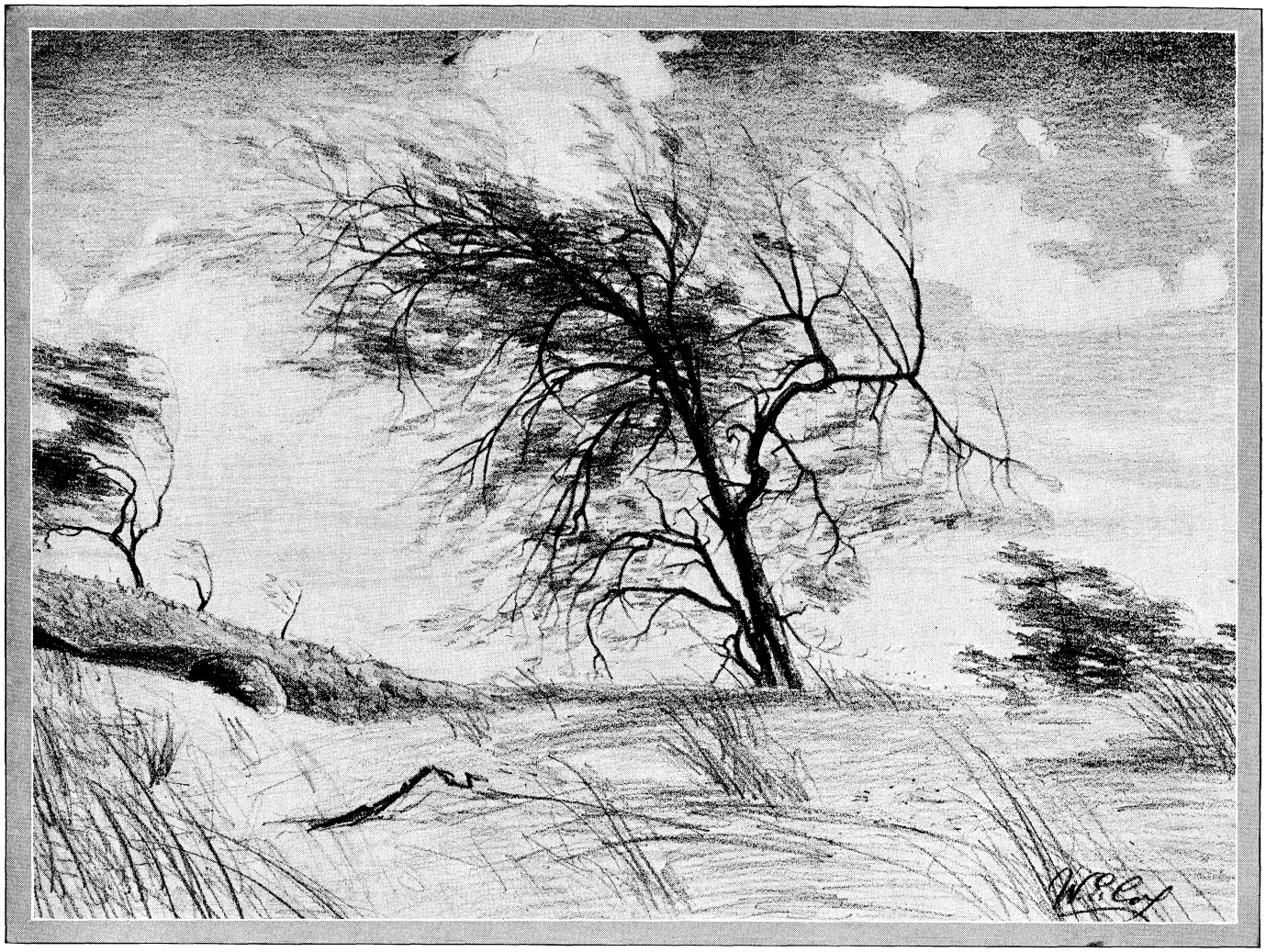


FIG. 4.—TWO REPRESENTATIONS OF THE SAME STATUE ILLUSTRATING THE VALUE OF A SILHOUETTED FIGURE (LEFT) OVER A STRAIGHT RENDERING (RIGHT) IN OBSERVING FORM

THE REQUIREMENTS OF A DRAWING

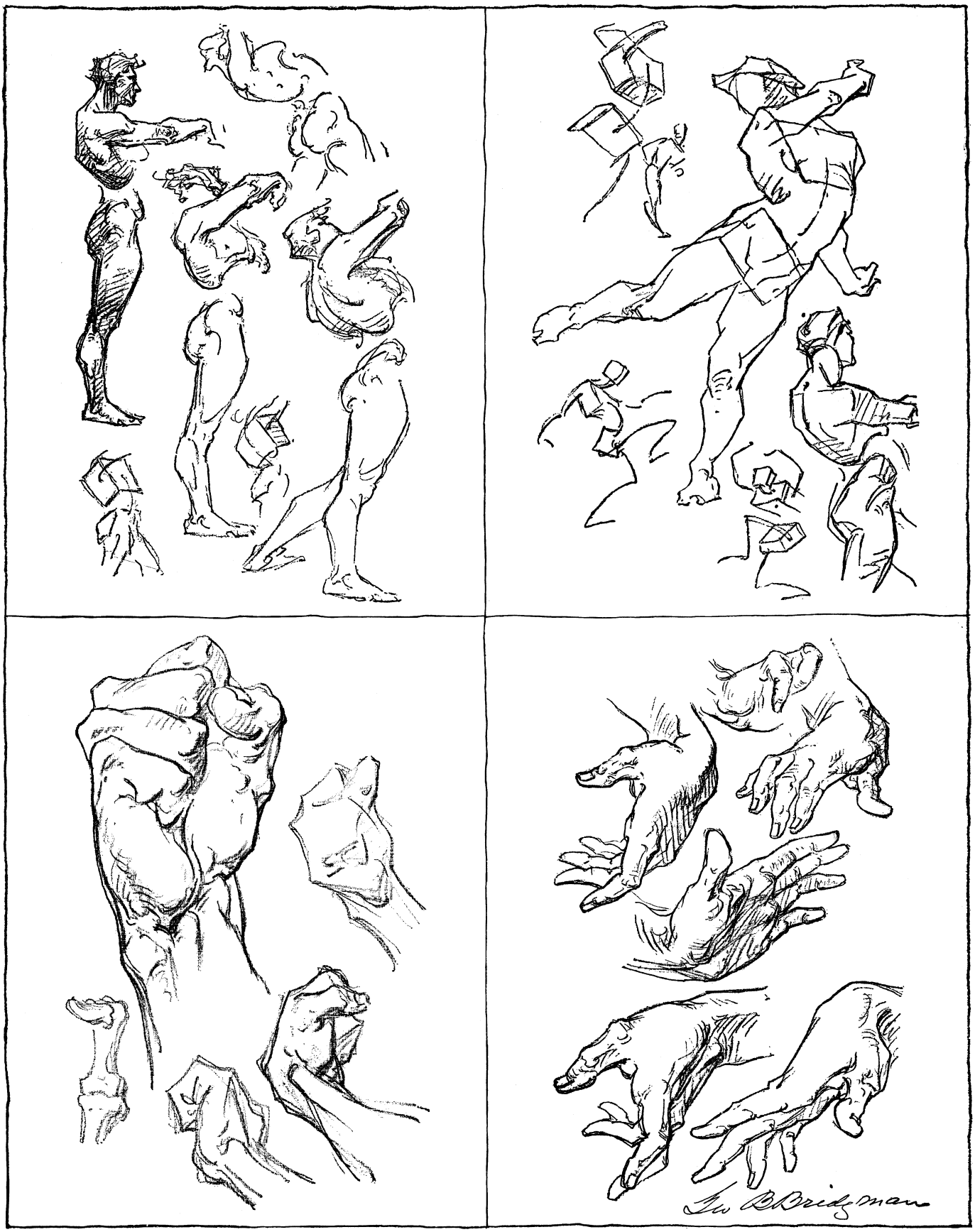
Even more practice and observation are necessary to catch the movement which is also one of the fundamental appeals of good draughtsinanship. First it must be understood that there



LITHOGRAPHIC CRAYON DRAWING BY WARREN E. COX

This drawing was especially prepared by the author of this article to show the appeal which is obtainable through the proper observance of the fundamental laws of structure, movement and composition. The structure of the old tree clearly suggests its struggle against the prevailing winds. The movement of the foliage and grasses is immediate and vital. This movement is aided by the slower movement of the clouds and the even slower movement of the sand dunes and is opposed by that of the tree branch to the right, the dead stick in the sand and the boulder to the left, all of which only help to indicate the strength of the wind. The composition is well balanced but made dynamic by the small tree placed at the extreme lett just disappearing off the picture as does the crow described on the Japanese screen in the text. By the use of these elements the artist has attempted to give the feeling that the sea is just out of sight over the dunes

DRAWING



FROM BRIDGMAN, "CONSTRUCTIVE ANATOMY"

DRAWINGS OF THE FIGURE IN MOVEMENT AND STUDIES OF THE HAND

Upper left. Unchanging masses of the head, torso and pelvis, to be conceived as blocks, and the turning or twisting of these blocks or masses

Upper right. Blocked movements of the figure, showing tilting of the masses

Lower left. Studies of the hand on the wrist indicating power or force

Lower right. Studies of the hand showing rhythm

is movement in everything. Trees, when well drawn, seem to show how through years they have twisted and grown up out of the ground. Rocks show the bending of their hot masses by volcanic eruptions and the splitting and eroding of their surfaces. Just as each thing has characteristic structure and outline so too has it characteristic movement, and this movement must be caught in the drawing and should be emulated to a degree in the very movement of the lines. One does not draw the placid sea of a summer night with the same quality of line and movement as one would use to portray its raging strength in a storm. Without typical movement a drawing lacks life and therefore interest. The savage all over the world typifies a snake by a simple wavy line showing its motion, and he feels that an animal is "not himself" in a drawing, if not shown in typical movement.

Composition. — Closely related to these three fundamental requirements in good drawing is a fourth which came into the consciousness of man undoubtedly at a later date, but thousands of years ago, that is, composition. No doubt the first artists drew without any consideration of a boundary or limitation to their work, but at some time in the dim past, in the decoration of a clay vase or some other object, a discovery was made that the design was related to the space in which it was executed. Slowly through thousands of years drawings were developed which seemed to be a part of the structure of the limitations or borders themselves; outlines were so related that the eye of the observer was held within the limited area and led from one important detail to another, and it was found that movement was somewhat assisted by the proper placing of figures in the surrounding border.

Much has been written about composition. The Far Eastern artist is perhaps its greatest master. After observing carefully the object to be drawn, he sits and looks at the piece of silk or paper upon which he is to work and plans where he is to place the main features. He does not start at once to sketch as do many of our western artists, for he has found that once the pencil or brush is touched to paper one's ideas crystallize and it is difficult to get away from the slightest commitment. It is, therefore, much better to keep the mind at first in a fluid state so that the final arrangement can be unhampered and things can take their proper relationship.

Simple proportions in composition are easy to grasp and have more meaning than have those proportions which the eye does not understand. Rhythmical or parallel movements are interesting methods of accenting what seem to be the most typical lines and are often used. Perfect symmetry is tiring. It is as though one were to sit upright in a chair for a long time. The balance should then be thrown to a greater or lesser degree away from the centre to indicate the movement of the picture and give it ease. The story is told of a famous artist in Japan who was asked to paint a screen for the emperor, showing crows in flight. He at length painted one crow just disappearing off of the fourth panel, leaving the other three untouched. Thus composition helped the movement of the drawing, and the finished work is famous.

If these four simple laws of drawing are observed, it is possible that the finished work will be excellent, but, if any one be omitted, this is impossible. Man has for so long learned to observe structure, outline, movement and composition that the most casual observer feels a lack, if the work does not show them all. Good modelling, perspective and all other considerations can be neglected, and yet a drawing may be a masterpiece aesthetically, though there is no doubt that these do add to its appeal. But these four elements do not in themselves make a great work of art but rather their proper balancing and expression, which may be called taste.

Good Taste. — In considering taste it is first necessary to understand what enters into a good drawing, or any outstanding work of art. The personality of the artist or his style is a great part of it and this may be dashing and strong or delicate and sensitive; it may be keen and light, or ponderous and powerful There are as many styles as there are artists and much of the love that people have for some works of famous artists is due to the fact that these works give some idea of the man himself. There is also the medium used, be it drypoint, graphite, etching, lithographic crayon or brush, and each medium has advantages and disadvantages. The drypoint line is strong and delicate without much flexibility but with a burr which is distinctive. The etched line has a sure clean-cut quality, but neither admit the soft shading possible with the pencil and the crayon or the flexibility of the brush. The appropriateness of the medium and its adaptation to the subject expressed are considerations often neglected, for artists sometimes become used to one medium alone and never find out the possibilities of the others. Finally there are the mood and character of the subject to be expressed. The woodlands which Corot chose to paint seemed to be a part of an enchanted world. The jagged rocks crashing into heaven which Li Lung Mien so deftly rendered with his brush are like flames crackling against the sky. These artists added much of their own imagination to what already existed; but it is nevertheless necessary to have something to start with, and without having seen the elms of France Corot would have found it difficult to paint, as would Li Lung Mien without the rough mountains of China.

Good taste is the perfect fusion of the personality of the artist through long years of practice into a skilful wielding of the tool, which in turn expresses the vital and inner meaning of the object portrayed with all due attention to its structure, its typical silhouette and motion, with appropriate and reasonable composition. When a thing is drawn in good taste one can see what the artist felt while drawing and what his reactions were to the subject shown. Each mark on the paper not only tells how he felt and what his mood was, but what he saw in the mood of the subject. If his subject be a gladiator he may have felt the glory of battle, the vigorous strength, the cruel beauty of the contest; or on the other hand he may have felt the pity and pathos of the inevitable destruction of so beautiful a body. In the one case his strokes would be sharp and vigorous; in the other heavy and dull. Moreover the composition, structure and movement would also reflect both the artist's feelings and those of the subject; both the artist's soul and that of the subject for it is only in this dual expression finely balanced that we ever find the really great works of art.

Some artists fail in good taste because they are so self-centred that they portray everything with too much of themselves and too little of the subject in the work. Others fail because they are so weak that they attempt a totally different treatment for each subject and have nothing to say about any. A drawing may also be in good taste in its expression of line, in its balance of the subjective and objective, but fail because the composition has not been studied to express this condition and is therefore not appropriate. Drawing is like music: it has tempo, key, pitch and many other elements, all of which, when perfectly handled by a master, make for beauty; but which, in the hahds of one untrained or unfeeling, may prove terrible pitfalls.

Three Dimensions. — In this discussion nothing has been said of the attempt to portray three dimensions on a two dimensional surface (see PERSPECTIVE). It is the consensus of opinion that a work of fine drawing can be just as great in two as in three dimensions. Nay, it has often been pointed out that drawing is fundamentally two dimensional art and that the introduction of the third dimension savours of trickeries, and either builds lumps on the two dimensional surface or pushes holes into it. However, since the discovery of perspective, such superb trickery is it that a great vogue for its use has sprung up, and in the development of realistic painting which found its apex in the early 19th century much was done to make man expect the third dimension in drawing. Others, led perhaps by Cézanne, have attempted to give an even greater feeling of solidity to objects by the use of exaggeration and distortion. This is all interesting and may, in thousands of years to come, grow so into the consciousness of man that children drawing in the sand with a stick will spontaneously depict the third dimension, but at present it is a comparatively new development and has not yet penetrated deeply enough to make it one of the fundamental requisites. A

work of art can be a masterpiece if drawn in only two dimensions and does not gain an appreciable aesthetic advantage, if drawn in three.

The Teaching of Drawing.— Owing to a faulty understanding of terms and a general misunderstanding of the underlying principles of art there has been a great etiort in the last generation to teach "originality" and individual expression in all the arts. One might as well try to teach character or soul. These are things which grow through the years and which cannot be taught. The result is a chaotic condition hampered by the belief that artists are born, and that they express their "gift" suddenly and without the work which a careful study of the lives of all great masters proves to be necessary. Some schools do not feel it is necessary to teach the pupils the fundamentals of art, so cautious are they in the foolish etiort to protect their pupils' freedom. Therefore it seems necessary to consider the sane and proper method which should be followed in the instruction of others or of self.

First of all, become friendly with a ruler. A large part of the artist's work consists in measuring with the eye, and it is imperative that the eye be trained to accuracy. Only by judging distances and proportions and then checking one's judgment by measurement can this accuracy be obtained. A good plan for the beginner is to purchase a drawing board, T square, triangles, compasses and pair of medium size calipers. With these instruments an attempt should be made to draw vases of simple form so that the eye may be trained to see curves and proportions. For example (see fig. 5) after the piece of paper is fixed to the board with thumb-tacks (drawing pins) so that its lower edge is in line with the T square when pressed in place at the left side of the board, a line is drawn near the bottom to act as base line and upon this line a portion is measured off with a ruler, equal to the diameter of the base. This line is then divided in half and a perpendicular is erected at its centre, upon which the height of the vase is laid off; at this point another horizontal line is drawn, upon which is laid off the diameter of the lip centred immediately above the base. The ruler is then stood perpendicular to the table upon which the vase stands and moved until it touches the side of the vase at a point where it is widest, and another horizontal line is drawn with the T square, the same distance from the base line as this point is from the table. With the calipers this widest diameter is found and it is laid off on this line. Similar measurements are taken of the narrowest diameters and of their height from the table, and finally the curves are drawn in, touching those points which have been established.

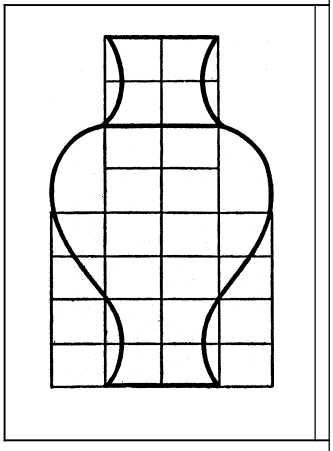


FIG. 5.— DRAWING OF VASE SHOWING METHOD OF TAKING MEASUREMENTS

It will be surprising to the beginner to find how accurate his first drawing is, if done in this manner. It will also be surprising to find how quickly he can grasp the amount of concavity or convexity of a curve no matter in what position it may occur; and to grasp its changes into another curve after he has drawn a number of vases. He will begin to see where one curve becomes more abrupt and another more gentle in its course. Looking back upon his first drawing, he will see all the slight delicacies of line which he missed, and will begin to appreciate the fine innuendoes the potter had put into the vase, which had at first completely escaped his eye.

The modernist may criticize this method and say that it will make the student a slave to the ruler. This is not true, for as time goes on the student needs fewer and fewer actual measurements, until at length he can draw a vase on any scale accurately. It is then time to attempt more complicated forms and these too should be measured at first. The greatest sculptors do not entirely trust their eyes for this work, and it is only by long training and much hard though interesting work that real efficiency can be accomplished, but new beauties will reward the student at every turn as he begins to train his eye to see. There is time enough later to try certain distortions or caricatures of the objects, to gain points which it is wished to stress. These distortions must be based upon correct drawing, or they will not be convincing. During this training the student should constantly observe masterpieces of various kinds, and remember that masterpieces are not only paintings which hang in museums but vases, sculpture, furniture and all of the thousand and one other things which show the touch of real art. The East should be studied as well as the West and every thing which especially appeals should be copied; for it will be found that one sees into a thing much more, if it is actually copied, than one can by any amount of mere looking at it. Through all of this study, the principles which were first pointed out should be kept in mind and an attempt should be made at all times to incorporate them in the actual work as it goes along. (W. E. **Cx.)**

DRAWING, ANATOMICAL. The study of the anatomy of the human body is approached by the artist and the anatomist from different points of view. The former, by a process of artistic selection, seeks the ideal and adopts the proportions which give the most pleasing effect, while the latter desires to know only the mean, or average, of a large series of measurements. *(See* COMPARATIVE ANATOMY.)

ARTISTIC ANATOMY

The representation of the anatomical form of man as applied to the Graphic Arts may be called *Artistic Anatomy*. This form of illustration may be divided into three groups: (1) The schematic, (2) That which represents the subject exactly, (3) The ideal conception or the ideal figure, constructed from the mean proportion of several types.

The schematic drawing is one which represents in outline the main characteristics of the object. It may be drawn with little or no regard as to the exact knowledge of the form. It has been of use in setting forth certain physiologic principles by the general form and location of the organs of the body, and especially used in post-mortem and zootomic comparisons.

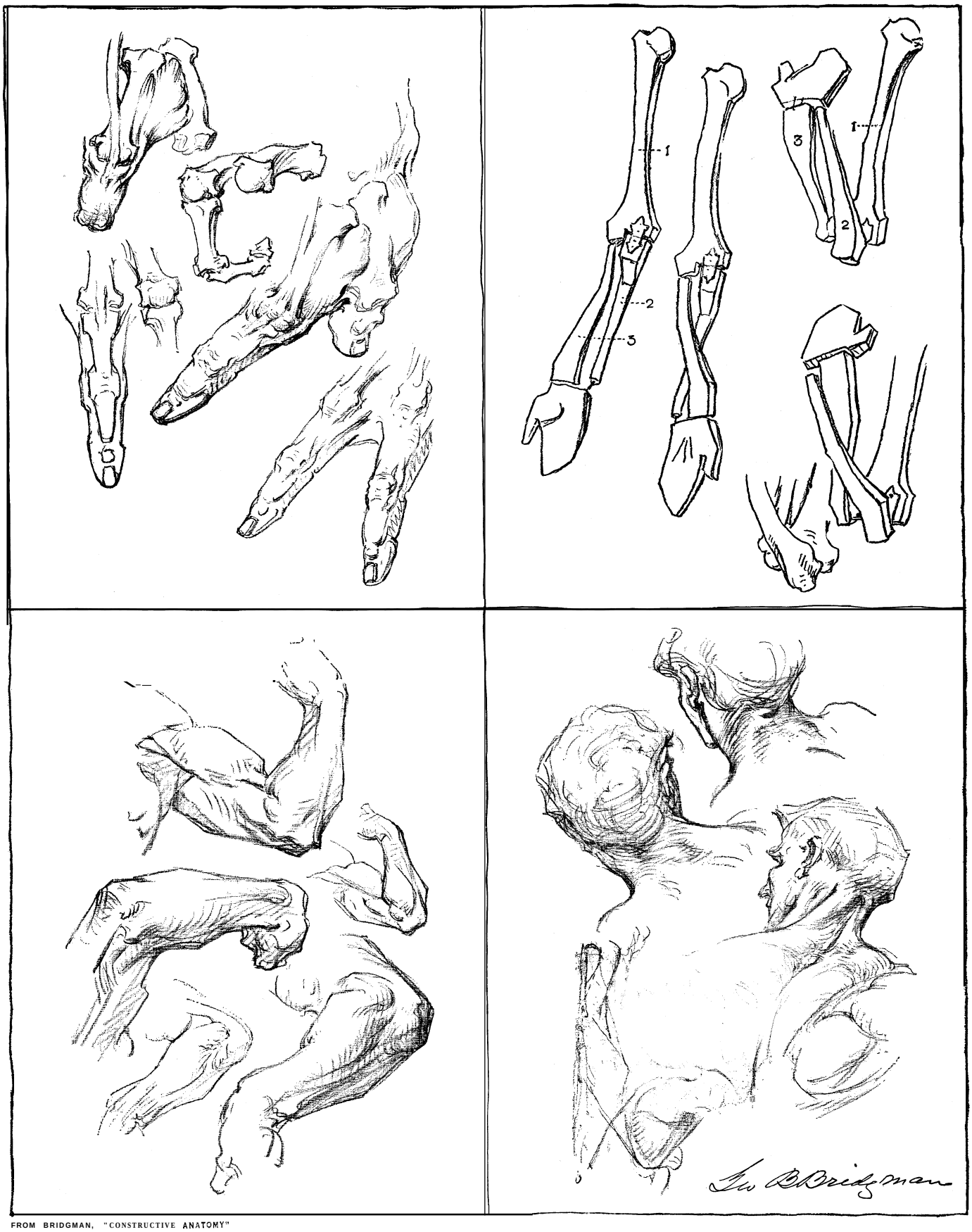
The true drawings occur particularly in pathologic anatomy, where various and unknown forms are sought and where certain organs have to be shown in the individual, as in the case of human embryology and comparative anatomy.

The representation of the ideal is the only form suitable for teaching — and the very development of this figuration corresponds with the growth of the science of anatomy in all its periods. This type of drawing presupposes a vast amount of previous study of the human figure. It cannot come out of a period in which the artistic development overshadows that of the science of anatomy. This vague feeling for beauty, with a corresponding neglect of the real, was evidenced in an early period of anatomical illustration, when conditions favoured an artistic point of view, as was the case in the first half of the 16th century. This, however, changed as the cold scientific and extensive dissection was practised during the 17th and 18th centuries. It is only the combination of these two tendencies which can satisfactorily serve the advanced science of anatomy and the modern art of drawing, bringing to perfection through exactness of detail and ceaseless observation a comprehension of beauty in the entire figure.

In artistic anatomy, nothing else is of value to the artist but the idealized drawing. The more he eliminates unessential, the better; the keener his eye for the unnecessary, the bigger his vision of the true needs of the artist. The unnecessary is harmful, and the artist's presentation of too much anatomy makes of him a professional anatomist. Of immediate necessity is the study of the antique, or the older plaster models of Greek figures, for in drawing the nude the young artist visualizes the actual healthy form in all its fulness of life and movement, thus adding an element which can never be supplied by purely anatomic delineation.

HISTORY

The development of artistic anatomy was not of outstanding consequence before the 16th century. Only a few anatomical en-

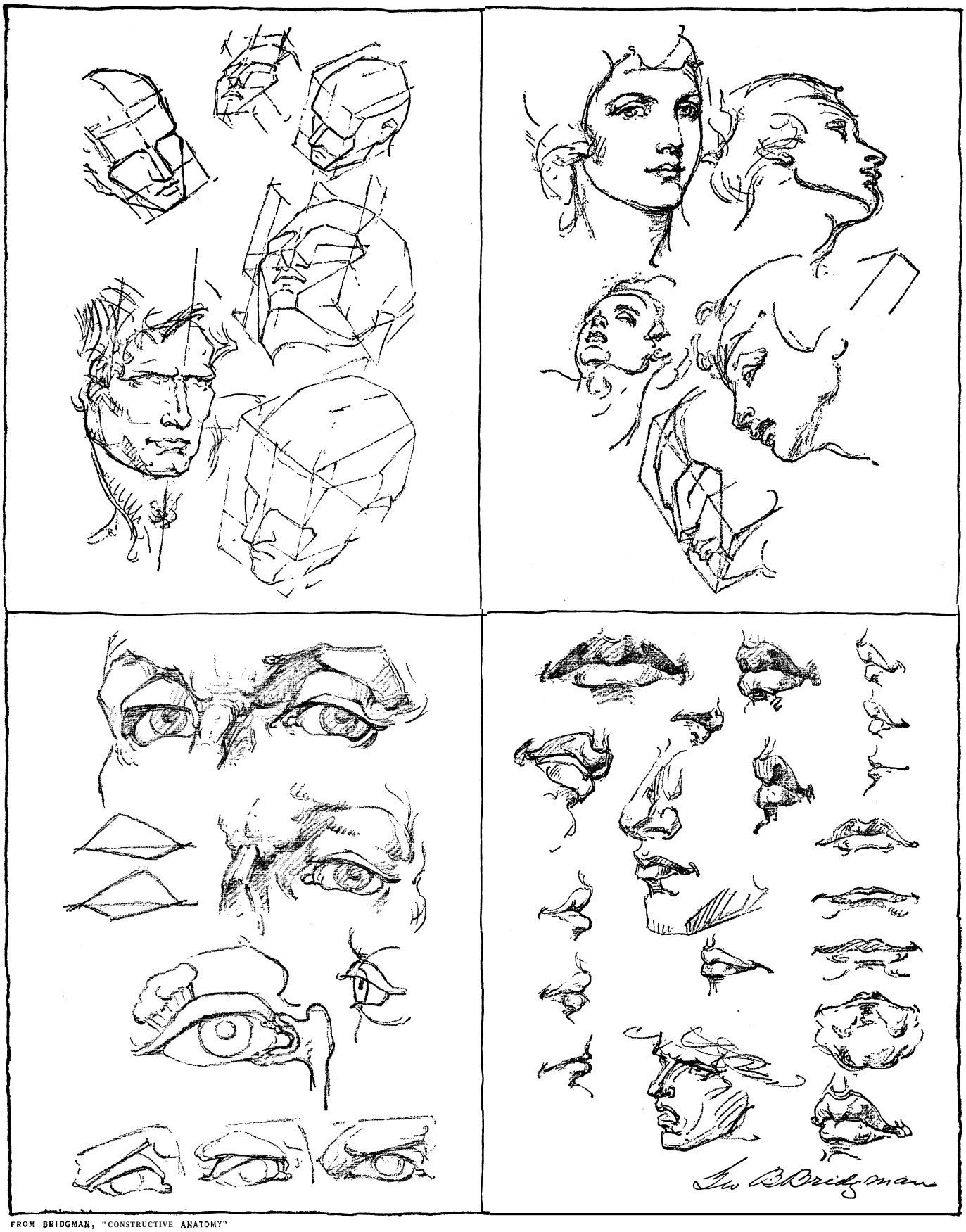


FROM BRIDGMAN, "CONSTRUCTIVE ANATOMY"

MECHANISM OF ARM AND FINGER JOINTS AND DIAGRAM OF THE BACK OF THE NECK

Upper left. Mechanism of finger joints and knuckles. *Upper right.* Wooden device used to illustrate the crossing of radius over ulna. (1) Humerus, armbone. (2) Ulna, forearm, little finger side. (3) Radius, forearm, thumb side). *Lower left.* Flexing of forearm on arm. *Lower right.* Diagram of muscles of back of neck

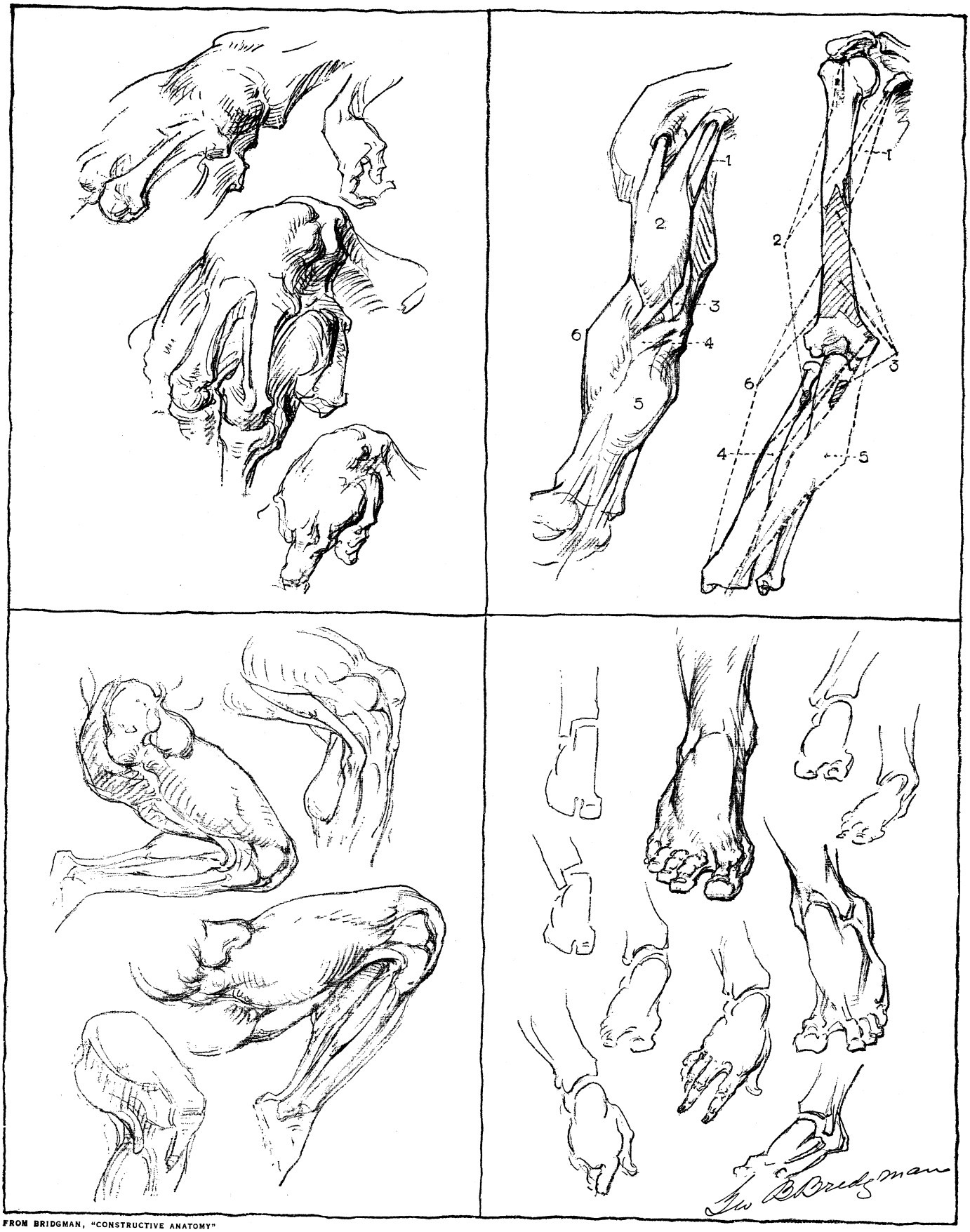
DRAWING



FROM BRIDGMAN, "CONSTRUCTIVE ANATOMY"

STUDIES IN CONSTRUCTION OF THE HEAD, EYE, NOSE AND MOUTH

Upper left. Blocked construction of the head
Upper right. Heads seen in different perspectives
Lower left. Construction of the eye
Lower right. Construction of the mouth

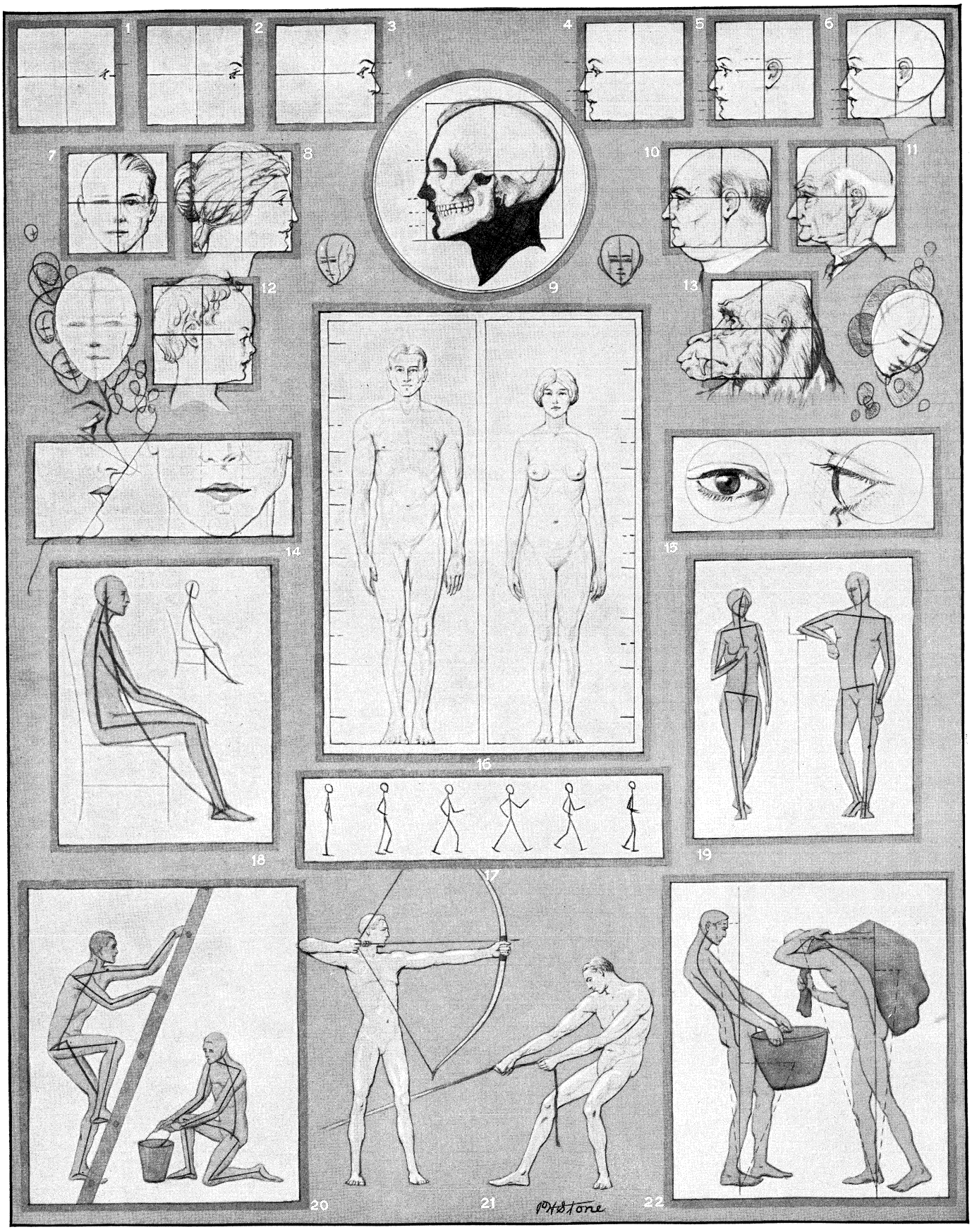


FROM BRIDGMAN, "CONSTRUCTIVE ANATOMY"

DRAWINGS ILLUSTRATING THE MECHANISM OF MOVEMENT

Upper left. Back of hand, showing movement of the hand on the wrist. *Upper right.* The muscles of the arm and forearm: (1) Coraco-brachialis, (2) Biceps, (3) Brachialis anticus, (4) Pronator radii teres, (5) Flexors grouped, (6) Supinator longus. *Lower left.* Flexing of leg on thigh. *Lower right.* Comparative movements of hands and feet

DRAWING



ANATOMICAL STUDIES FOR ELEMENTARY DRAWING

1–6. Illustrate the method of applying the egg-shape to a profile by means of *a* square

7–13. Are variations controlled by the principle of the egg-shape and square

14–15. Show the construction of nose and eye

16. Shows the proportional measurements of male and female forms

17. Shows six stages in a single step illustrating balance in walking

18–22. Illustrate distribution of weight in figure at rest and in action

gravings and woodcuts are found to that date. Even the drawings that Aristotle used in supplementing his works on anatomy have been lost. Figurations of skeletons and representations of bodies on cameos, seals and bronzes were common, but these delineations never served the purpose of anatomic instruction; they were rather of an emblematic nature: symbols of death, magic amulets, references to the fable of Prometheus, etc. In view of this, artistic anatomy may be divided into the following periods:

To the 16th Century. — Anatomical drawings of the Classic Period and the Middle Ages were known, and even mentioned by Aristotle, but so few have come to us for study that the subject cannot be adequately covered. Before the time of Berengario, commonly called Berenger of Carpi, about 1521, most of the attempts were schematic drawings for medical observation, artistic anatomy remaining in the background as a private study and depending largely upon professional anatomists for its development.

The 16th Century. — Although the name Berengario belongs only to the annals of medicine and will be remembered as the most zealous and eminent in cultivating the anatomy of the human body, it was his day, and that of Vesalius (1514–64), that marked the beginning of the attempt to free the anatomical drawing from schematic and arbitrary features and recognized its place in art. This artistic anatomy, was promoted by both artist and anatomist for the sole purpose of instruction. It was during this period that the Italian School of Anatomy reached its height of interest in the woodcut; it was during this period that sculpture and painting adopted proportions of the human body never before developed; it was during this period that Michelangelo lived. Other 16th century artists who contributed to the study of anatomical figures were Leonardo da Vinci, Raphael, Titian and Diirer.

The **17th** Century. — A comparative study of the antique, a clinging to Vesalian patterns, and the advent of independent publications on artistic anatomy mark the development of the study in the 17th century. A closer training in details and an effort toward the artistically perfect reproduction may also be included.

18th–19th **Century.**—Albinus (1697–1770) was one of the most famous teachers of anatomy in Europe, his classroom at the Leyden School of Anatomy being frequented not only by students but by many practising physicians. The Leyden school exerted untold influence in creating a greater exactness in all details. The styles of both Vesalius and Albinus were used as patterns in anatomical drawinq, many independent attempts proving unsuccessful.

About 1778 combinations of utmost anatomic truths with artistically beautiful reproductions were brought out. The adoption of the steel engraving, lithography, the daguerreotype, as well as the revival of the woodcut in an improved form, meant an advance in the art; the exclusive use of the Albinian patterns gave rise to a greater independence. In fact, 1778 may be given as the beginning of the period in which the most valuable material on artistic anatomy was produced. Modern scientific medicine had gained its stride and was already moving swiftly toward the goal of a well-organized body of real knowledge capable of continuous growth. And this development may be shown in the bibliographic list as given below, the chain running from the first half of the 18th century to the present day. This bibliographic account gives the distinctive examples of anatomic illustration, including the modern work in both the technical and the artistic.

TECHNIQUE

For the young student of anatomy as applied to art the simple drawing is the most effective in learning to construct the human figure. The eye must follow a line or a plane or a mass, which in construction becomes a moving line, a moving plane, a moving mass. But the mental construction must precede the physical, and in this the concept of mass must come first, that of the plane second, that of line last.

Certain laws enter into the functioning of the various organs of the body, just as pronounced as they are in controlling any other machinery. To the bones, for example, which make up the pressure system, belong the laws of architecture. as in the dome of the head, the arches of the foot, the pillars of the legs, etc.; also the laws of mechanics, such as the hinges of the elbows, the levers of the limbs, etc. Ligaments constitute the retaining or tension system, and express other laws of mechanics. Muscles produce action by their contraction or shortening and are expressed in the laws of dynamics and power, as well as the laws of leverage.

In giving herewith only an outline of the construction of the main parts of the body, the author presupposes a rudimentary knowledge of drawing, on the part of the student, and offers the following, in connection with the illustrations only as a further guide in studying the elements of anatomy and becoming more adept in the art of drawing.

The Hand. — In drawing the hand the artist must realize that, as in the human figure, there is an action and inaction side. When the thumb side is the action side the little finger is the inaction side. The inaction construction line runs straight down the arm to the base of the little finger. The action construction line runs down the arm to the base of the thumb at the wrist, from there out to the middle of the joint, at the widest part of the hand; thence to the knuckle of the first finger, then to that of the second finger, and then joins the inaction line at the little finger. However, with the hand still prone, when it is drawn *from* the body the thumb side becomes the inaction side and is straight with the arm, while the little finger, corresponding previously to the thumb, is at almost right angles with it. The inaction construction line now runs straight to the middle joint of the thumb, while the action line runs to the wrist on the little finger side, thence to the first joint.

The Fingers. — Each of the four fingers has three bones. The middle finger is the longest and largest, because in the clasped hand it is opposite the thumb and with it bears the chief burden. The little finger is the smallest and shortest and most freely movable for the opposite reason. The middle joint of each finger is the largest, and, like all the bones of the body, the bones of the finger are narrower in the shaft than at the ends. In the clenched fist it is the end of the bone of the hand that is exposed to make the knuckle. Each of the three joints moves about one right angle except the last, which moves slightly less. The movements of the joints are also limited to one plane, except the lower one, which has also a slight lateral movement, as shown when the fingers are spread.

The Thumb. — The centre of all the activities of the fingers. the hand, and the forearm, is the thumb. The fingers, gathered together, form a corona around its tip. Spread out, they radiate from a common centre at its base; and a line connecting their tips forms a curve whose centre is the same point. This is true of the rows of joints also. The thumb has three joints, and its bones are heavier and its joints more rugged than those of the fingers. It is pyramidal at the base, narrow in the middle, pear-shaped at the end. The ball faces to the front more than sideways. The thumb reaches to the middle joint of the first finger. The last segment bends sharply back, its joint having about one right angle of movement, and only in one plane. The middle segment is square with rounded edges, smaller than the other two, with a small pad. Its joint is also limited to one plane. The basal segment is rounded and bulged on all sides. The joint of its base is a saddle joint, with the free and easy movement of one in a saddle.

The Arm. — The forearm has two bones, lying side by side. One, the radius, is large at the wrist and the other, the ulna, is large at the elbow. Diagonally opposite the thumb, on the ulna, is a bump of bone which is the pivot for both the radius and also the thumb. Muscles must lie above the joint they move, so the muscles that bulge the forearm are mainly the flexors and extensors of the wrist and hand. The flexors and pronators form the inner mass at the elbow, the extensors and supinators form the outer mass.

Both the above masses arise from the condyles of the humerus, which is the bone of the upper arm. The part of the humerus near the shoulder is rounded and enlarged, where it joins the shoulder blade. The lower end is flattened out sideways to give

attachment to the ulna and radius, forming the condyles. The shaft itself is straight and nearly round, and is entirely covered with muscles except at the condyles.

The Shoulder.—The deltoid muscle, triangular in shape, gives form to the shoulder. Just below the base is a ripple which marks the head of the arm bone. The masses of the shoulder, arm, forearm and hand do not join directly end to end with each other, but overlap and lie at various angles. They are joined by wedges and wedging movements. Constructing these masses first as blocks, we will have the mass of the shoulder, or deltoid muscle, with its long diameter sloping down and out, leveled off at the end; its broad side facing up and out; its narrow edge straight forward. The mass of the forearm overlaps the end of the arm on the outside by a wedge that rises a third of the way up the arm, reaches a broad apex at the broadest part of the forearm and tapers to the wrist, pointing always to the thumb; and on the inside by a wedge that rises back of the arm and points to the little finger. In the lower half of the forearm, the thin edge of the mass, toward the thumb, is made by a continuation of this wedge from the outside. In the back view of the arm, the mass of the shoulder sits across its top as in the front view.

The Neck.—Curving slightly forward, the neck rises from the sloping platform of the shoulders. The strength of the neck is at the back of the head, this portion being somewhat flat and overhung by the base of the skull. The sternomastoid muscles descend from the bony prominences back of the ears to meet almost at the root of the neck, forming a triangle whose base is the canopy of the chin. In this triangle below is the thyroid gland, larger in women, and above it the angular cartilage of the larynx, or Adam's apple, larger in men.

The Head.—Both the oval and the cube have been used by artists as a basis for drawing the head, but the cube seems preferable in that the oval is too indefinite and offers no points for comparison, no basis for measurement, and the eye does not fix on any point in a curved line. The block not only carries the sense of mass, but provides a ground plan on which any form may be built, as well as its perspective and foreshortening. The element of bilateral symmetry enters the drawing of the head. A vertical line in the centre divides the head or the trunk into parts equal, opposite and complemental. The right eye is the counterpart of the left; the two halves of the nose are symmetrical; the limbs, except for changes of position, are nearly exact though reversed duplicates of each other.

The cranium, the skeleton of the face, and the jaw constitute the masses of the head. Into the rounded mass of the cranium sets the narrower mass of the forehead bounded by the temples at the sides and by the brows below. From the lower outer corners of the forehead the wedge of the cheek bones begins, moves outward and downward until it just passes the curve of the cranium, then down and in, in a long sweep, to the corner of the chin. The two cheek bones together form the central mass of the face, in the middle of which rises the nose.

The planes of the head are those of the forehead, sloping upward and backward to become the cranium. The sides turn sharply to the plane of the temples. The plane of the face, divided by the nose, is broken on each side by a line from the outer corner of the cheek bone to the centre of the upper lip, making two smaller planes. The outer of these tends to become the plane of the jaw, which is again divided, etc. The relations of these masses and planes is to the moulding of a head what architecture is to a house. They vary in proportion with each individual and now must be carefully compared with a mental standard.

The Eye.—Below the eyebrow, on the lid, are three planes, wedging into each other at different angles. The first is from the bridge of the nose to the eye. The second is from the brow to the cheek bone, which is again divided into two smaller planes, one sloping toward the root of the nose, the other directed toward and joining with the cheek bone. The lower lid is stable; it is the upper lid that moves. It may be wrinkled and slightly lifted inward, bulging below the inner end of the lid. The cornea is always curtained by the upper lid, in part. The immovable masses of the forehead. nose and cheek hones form a strong setting for the most variant and expressive of the features.

The Nose.—The bony part of the nose is a very clear wedge, its ridge only half the length of the nose. The cartilaginous portion is quite flexible, the wings being raised in laughter, dilated in heavy breathing, narrowed in distaste, and wings and tips are raised in scorn, wrinkling the skin over the nose.

The ears, the mouth, the lips, and the chin, all offer variations in construction, and it is through comparison with others that the art of drawing them can best be acquired.

The Trunk.—The upper part of the body is built around a bony cage called the thorax, conical in shape, and flattened in front. The walls of this cage are the ribs, twelve on each side, fastening to the spine behind and to the sternum or breast bone in front. The first seven are called true ribs, the next three false, and the last two floating ribs. The masses of the torso are the chest, the abdomen or pelvis, and between them the epigastrum, the first two comparatively stable, the middle one quite movable. The shoulders are also movable, changing the lines of the first mass and bulging the pectoral muscles, but the mass itself changes little except the slight change in respiration. The mass of the abdomen is even more unchanging.

The Torso.—In profile the torso presents three masses: the chest, the waist and the abdomen. The mass of the chest is bounded above by the line of the collar bones; below, by a line following the cartilages of the ribs. This mass is widened by the expansion of the chest in breathing, and the shoulder moves freely over it, carrying the shoulder blade, collar bone and muscles. The back view of the torso presents numerous depressions and prominences, due to its bony structure and the crossing and recrossing of a number of thin layers of muscles. The outside layers mardfest themselves only when in action, and for this reason the spine, the shoulder-blade, and the hip-bone are the landmarks of this region.

The Lower Limbs.—The thigh, the leg, and the foot constitute the lower limb. The thigh bone is the longest and strongest bone of the body, and the mass of the thigh is inclined inward from hip to knee, and is slightly beveled toward the knee from front, back and outside. Below the knee is the shin bone, the ridge of which descends straight down the front of the leg, a sharp edge toward the outside, a flat surface toward the inside, which at the ankle bends in to become the inner ankle bone. The outer bone of the foreleg soon overlaid by a gracefully bulging muscular mass, emerges again to become the outer ankle bone. Two large muscles form the mass on the back of the leg.

The Foot.—In action, the foot comes almost into straight line with the leg, but when settling upon the ground it bends to keep flat with the ground. A series of arches form the symmetry of the foot, the function of these arches being that of weight-bearing. The five arches of the foot converge on the heel, the toes being flying buttresses to them. The balls of the foot form a transverse arch. The inner arches of the foot are successively higher, forming half of a transverse arch whose completion is in the opposite foot. (See COMPARATIVE ANATOMY; ILLUSTRATION; SCULPTURE.)

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(E. C. Br.; G. B. Br.)

Elementary. — The young artist is primarily interested in making drawings of people, faces and particularly, profiles. A series of charts giving the simple and fundamental rules of proportion is shown as a practical means of starting him in this art.

For the profile, a square is drawn and divided into four equal squares, and the eyes, nose, mouth, chin and ear are placed upon this chart as shown in the progressive illustrations. When the head is complete, the student will discern the egg-shape, which is his first and constant principle, and which should be practised constantly until an egg can be drawn perfectly with one sweep of the hand. Proportions can soon be found on an egg-shape without the aid of a square. Next, the full face is attempted, following the same principles of proportion. It will be observed that the eyes divide the width of the egg-shape into approximately five equal spaces. The two-thirds view and all other variations of the human Bead should be drawn by means of the egg. With the profile the beginner will discover that all types of heads, fat, thin and old, may be drawn over the square chart with only minor variations in line. The baby and the gorilla are opposite extremes and present exceptions to the rule for placing the eye on the half-way point.

The "Greek Ideal" divided the human figure into eight divisions, each equal to one head in height; but actually it is seven and one half heads high. The woman's head is smaller, but the divisions of the body are in similar proportion. Note that in the figure of the man the shoulders are wider than the hips, and the woman's hips are wider than her shoulders.

Taking up these two figures in action, the young artist must learn to look at the figure as a whole; he must consider the one line which expresses the motion he desires, and forget that the figure is made of arms and legs and torso. He must also consider balance. The distribution of weight is directly over the feet, no matter how heavy the load. Without carrying a weight, the chin of the figure is directly over the foot which sustains the weight.

(P. H. St.)

DRAWING, ENGINEERING, the general term for the drawing used in the industrial world by engineers and designers, mechanical, architectural, structural, etc., as the formula in which is expressed and recorded the ideas and information necessary for the building of machines and structures. It is distinguished from drawing as a fine art in that it is not pictorial representation but a complete graphical language in which exact and positive information is given regarding every detail of the structure or machine to be built. Since it describes the object as it actually is to be and does not show it in pictorial form as it would appear to the eye it can be read and understood only by one trained in its use. When this language is written exactly and accurately it is done with the aid of mathematical instruments and is called *mechanical drawing*. When done freehand it is known as *technical sketching*. As it cannot be read aloud like a written language it must be interpreted by forming a mental image of the subject represented, and the engineer in reading a drawing that would appear to be only a complicated mass of lines has as clear a picture of the structure standing in space as if it were actually before him. Apart from its practical utility, the value of teaching drawing in the schools is in the training of this constructive imagination, the perceptive ability to think in three dimensions, to visualize quickly and accurately, to build up a clear mental image, a training useful not only to professional designers but to all who may be interested in technical industries.

The basis of engineering drawing is orthographic projection, which may be defined as the method of representing the exact shape of an object by two or more views on planes at right angles to each other, by dropping perpendiculars from the object to the planes. There are two systems in use; the first and older is *first angle projection*, in which the object is assumed to be placed in the first quadrant of the four dihedral angles formed by the intersection of two reference planes called the co-ordinate planes or planes of projection, fig. 1 (*cf.* Descriptive Geometry). and its points projected to these planes, the horizontal plane (*H*) then revolved to coincide with the vertical plane (V), the two being represented by the plane of the drawing paper. A third or profile plane (P) perpendicular to the H and V planes is used for a third view if necessary. Fig. 2 shows an object in the first angle and fig. 3 the resulting arrangement of views when the planes are opened. This is the system in present use in Great Britain and other European countries except the Netherlands. It was used in the United States until about 1890 when the industrial works began to change to the newer system of *third angle projection* which in a few years entirely replaced the former method. It is significant that this movement originated in the shops instead

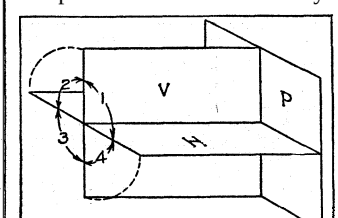


FIG. 1— THETHEORETICAL PLANES OF PROJECTION. SHOWING THE FOUR ANGLES

of in the colleges, after experiments with workmen demonstrated that they could read third angle drawings much more easily than those made in the first angle.

Third angle, or, as it is called in Europe, American projection, assumes the object to be placed in the third quadrant of the co-ordinate planes, and the observer to be looking *through* the planes at the object, as shown in fig. 4. These planes when opened into one plane give an arrangement of views as in fig. 5. Thus the object may be thought of as surrounded by a glass box with its sides hinged to each other (fig. 6), the object projected to these sides and the box opened up into one plane. In both systems the projection on the front plane is known as the *front view, elevation* or *vertical projection,* that on the top plane the *top view, plan* or *horizontal projection,* that on the side plane as the *side'view* or *end view, side* or *end elevation* or *profile projection.* For a simple object two views are often sufficient, others may require three or more. Sometimes the left side view can be used to better advantage than the right side. In some cases the bottom view, and more rarely the back view will be required. Fig. 7 shows the box as it opens and indicates the positions of these different views.

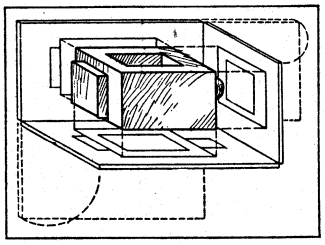


FIG. 2.—AN OBJECT IN THE FIRST ANGLE, PROJECTED TO THE PLANES

It is a growing practice in the United States to teach elementary projection drawing without reference to the planes of projection, by explaining that the problem is to represent a solid, with three dimensions, on a flat sheet of paper having only two dimensions in such a way as to tell its exact shape, and that this is done by drawing a system of "views" of the object as seen from different positions and arranging these views in a definite manner, each view showing two of the three dimensions. Taking, for example, the block shown in pictorial form in fig. 8, if the observer imagine himself as in a position directly in front (theoretically at an infinite distance, practically at a reasonable seeing distance but imagining the rays of light from each point to his eye as parallel) its front view would appear as in fig. ga. This view tells the length and height but not the width of the block nor the depth of the notch. Then let the observer change his position so as to look down from directly above the-block. He will see the top view (fig. gb), giving the length and width, and the shape of the notch. It is necessary to have another view from the side in this case to show the shape of the triangular part. Fig. 9c is the right side view. These three views arranged in their natural position with the top view directly above the front view and the right side view to the right of the front view, completely describe the shape of the block. Note that in the top and side views the front of the block always faces toward the front view.

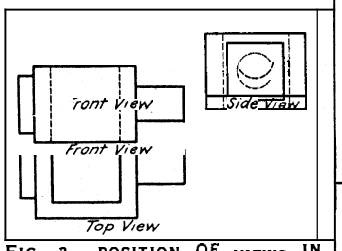


FIG. 3.—POSITION OF VIEWS IN

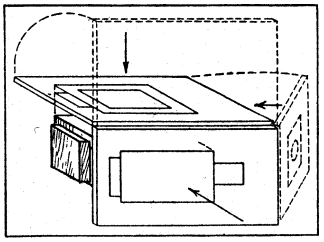


FIG. 4.— AN OBJECT IN THE THIRD ANGLE. PROJECTED TO THE PLANES

The argument for this teaching method is that the student visualizes the object itself without being confused in trying to visualize the projections. Its success is indicated in that some engineering schools are now teaching the whole subject of descriptive geometry without using the reference planes.

Reading a Drawing.—A line on a drawing always indicates either an intersection of two surfaces, as in the projection of a prism, or a contour, as in the projection of a cylinder (fig. 10), a visible edge being represented by a full line and an invisible one by a "dotted" line, *i.e.,* a line made up of short dashes. One cannot read a drawing by looking at one view. Each line on the view (except a contour line) denotes an abrupt change in direction, but the corresponding part of another view must be consulted to tell what the change is. For example, a circle on a front view might mean either a hole or a projecting boss. A glance at the side view or top view will tell immediately which it is. In reading a drawing one should first gain a general idea of the shape of the object by a rapid survey of all the views given, then should select for more careful study the view that best shows the characteristic shape, and by referring back and forth to the adjacent views see what each line represents. In looking at any view one should always imagine that it is the object itself, not a flat projection of it, that is seen, and in glancing from one view to another the reader should imagine himself as moving around the object and looking at it from the direction the view was taken.

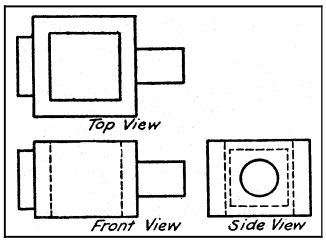


FIG. 5.—POSITION OF VIEWS IN THIRD-ANGLE PROJECTION

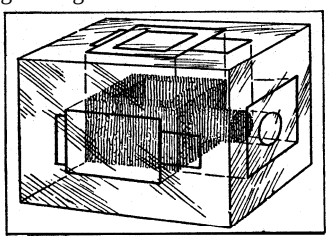


FIG. 6.— TRANSPARENT BOX. ILLUSTRATING THE THEORY OF THIRD-ANGLE PROJECTION

Auxiliary Views.—A surface is shown in its true shape when projected on a plane parallel to it. In the majority of cases an object may be placed with its principal facesparallel to the three reference planes and be fully described by the regular views. Sometimes however the object may have one or more inclined faces whose true shape it is desirable or necessary to show, especially if irregular in outline. This is done by making an auxiliary view looking straight against the surface, that is, imagining a projection on an extra or auxiliary plane parallel to the inclined surface, therefore perpendicular to the same reference plane to which the inclined surface is perpendicular, and revolving it into the plane of the paper There are three kinds of auxiliary views, first *auxiliary elevations* (fig 11), made on planes which are perpendicular to the horizontal plane but at an angle with the vertical plane, or in other words the kind of views that would be seen if one walked around the object starting from the position at which the front view is seen Thus an auxiliary elevation would have the same height as the front view. The second kind, called sometimes *left and right auxiliary views,* are used much more frequently. They are made on planes perpendicular to V but inclined to *H* Fig 12 is an example, showing that the width of the auxiliary view is the same as the width of the top view. Third, *front and rear auxiliary views,* on planes perpendicu-

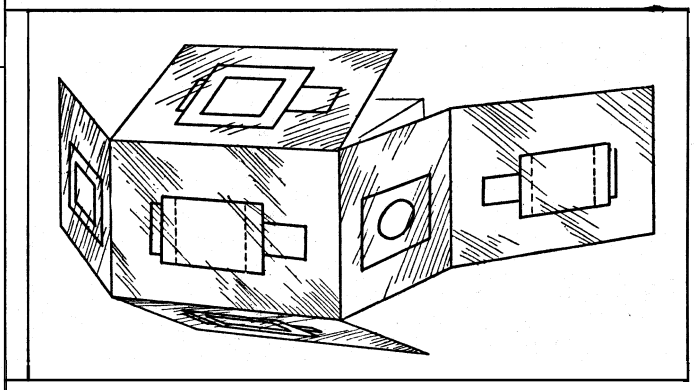


FIG. 7.— THE BOX PARTLY OPENED INTO THE PLANE OF THE PAPER. SHOWING THE RELATIVE POSITIONS OF TOP, FRONT, LEFT, RIGHT. REAR AND BOTTOM VIEWS

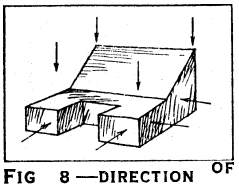


FIG 8 —DIRECTION OF VIEWS

lar to the profile plane but inclined to H and V, in which the width of the auxiliary view is the same as the width of the front view (fig. 13). Often an auxiliary view will save making one or more of the regular views and at the same time show the shape or construction of the object to better advantage. They are used extensively in the drawing of machine parts and usually are only partial views showing the inclined surface alone. In fig. 14 a front view, partial top view and two partial auxiliary views, describe the shape of the piece in the simplest way.

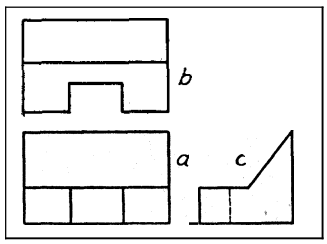


FIG. 9.— FRONT. TOP AND RIGHT SIDE VIEWS OF BLOCK

Sectional Views.—When an object is solid or the interior simple the invisible parts can be represented satisfactorily by dotted lines, but if there is much interior detail, especially if the object is made in more than one piece, the dotted lines become confusing and hard to read. In such cases a view is made "in section," as if for that particular view a part of the object were supposed to be cut away and removed, exposing the interior. This view is known as a sectional view or simply a *section.* If the object is symmetrical the cutting plane is usually passed through one of the main axes and the front half imagined as removed. The exposed cut surface of the material is indicated by "section-lining" or "cross-hatching" with uniformly spaced fine lines. It must be understood clearly that in thus removing the front portion in order to show the sectional view this portion is not removed from the other views. Fig. 15 shows in pictorial form a casting intersected by a cutting plane and its appearance when the front half is removed; fig. 16 shows the two views of the casting, the front view in section. The edge of the cutting plane is indicated by the line symbol of a dash and two dots, with reference letters and arrows showing the direction in which the view is taken. The cutting plane need not be in a single continuous plane but may be offset in any part of its length to go through some detail. Shafts, bolts, nuts, keys, rods, rivets and the like whose axes occur in the plane of the section are left in full and not sectioned. Adjacent pieces are section-lined in opposite directions, and are often brought out more clearly by varying the pitch, using closer spacing for smaller pieces. The same piece in different views or in different parts of the same view should always be section-lined identically in direction and spacing. A common and economical way of showing an object which is symmetrical about a centre line is by making what is called a *half section,* drawing one side in section and the other in full. In such a view dotted lines are unnecessary. *Revolved sections,* made by passing a cutting plane through some detail such as a rib or the arm of a wheel and turning it in place are often used (fig. 17). *Detail sections* are for the same purpose but instead of being drawn on the view they are set off to some adjacent place on the paper. The cutting plane, with reference letters, should always be indicated. *Phantom sections* are exterior views with the interior construction brought out by dotted cross-hatching.

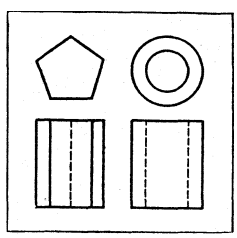


FIG. 10.— INTERSECTION LINES AND CONTOUR LINES

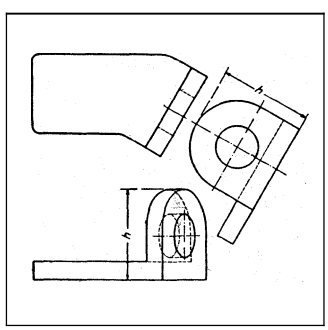


FIG. 11.— AUXILIARY ELEVATION, PROJECTED FROM TOP VIEW

A *working drawing* is a drawing that gives all the information necessary for the complete construction of the object represented. It includes (1) The full representation of the *shape* of every part of the object (orthographic projection). (2) The *size* of every part, in figures (dimensioning). (3) Explanatory notes giving specifications as to materials, finish, etc. (4) A descriptive title. Often as in architectural and structural drawing the notes of materials and workmanship are too extensive to be lettered on the drawings so are made up separately in typewritten or printed form and are called the *specifications,* hence the term "drawings and specifications." Working drawings are divided into two general classes, *assembly* drawings and *detail* drawings. An assembly drawing is, as its name implies, a drawing of the machine or structure put together, showing the relative positions of the different parts (fig 18). Its particular use is in the erection of the structure. It may give the all-over dimensions and distances from centre to centre or part to part of the different pieces, showing their relation to each other, usually indicating the different parts by "piece numbers," often enclosed in circles. It frequently includes a "bill of materials," a tabulated statement of all the used, including stock parts such as bolts, screws, cotters, etc. Classified under the general term of assembly drawings would be other forms, as the *design drawing,* the preliminary layout, full size if possible, on which the scheming, inventing and designing are worked out accurately after freehand sketches and calculations have determined the general idea. From it the detail drawings of each piece are made. Sometimes the finished assembly drawing is traced from the design drawing, more often it is redrawn, perhaps to smaller scale to fit a standard sheet, using the detail drawings to work from, thereby checking their correctness. An *outline assembly* is used to show the appearance of the machine, sometimes for catalogue or other illustrative purposes. Piping, wiring and oiling diagrams are also forms of assembly drawings. An *assembly working drawing* showing fully the dimensions and construction of each piece as well as their relative positions, so that no separate detail drawings are needed, may be made for a simple machine. A *unit assembly drawing* is a drawing of a related group of parts, in a complicated machine or structure.

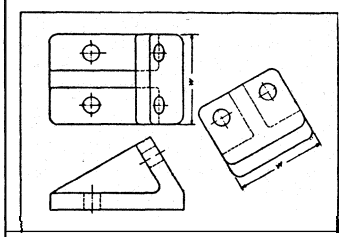


FIG. 12.— RIGHT AUXILIARY VIEW. PROJECTED FROM THE FRONT VIEW

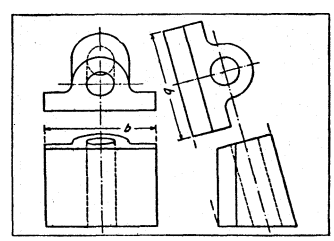


FIG. 13.—FRONT AUXILIARY VIEW, PROJECTED FROM SIDE VIEW

A *detail drawing* is a complete description of each separate piece, giving its shape, size, material and finish, what shop operations are necessary, what limits of accuracy are demanded and how many of each are wanted (fig. 19). Sometimes smaller parts of the same material or character are grouped together, as forgings on one sheet, special bolts and screws on another, etc., but in large production the accepted practice in a set of drawings is to have each piece, no matter how small, on a separate sheet.

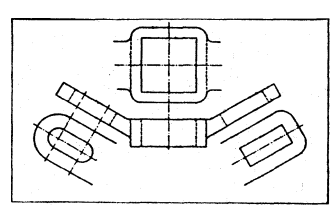


FIG. 14.—FRONT VIEW, WITH PARTIAL TOP VIEW AND PARTIAL AUXILIARY VIEWS

In commercial drafting, accuracy and speed are the two requirements. The drafting room is an expensive department. There are therefore many conventional methods or idioms and abbreviations of the language, with which the draftsman must be familiar. There are also allowable violations of the strict principles of projection when added clearness may be gained. One of the time-saving conventions is in the representation of screw threads. The helical curves are never drawn except on screws of very large diameter, but are conventionalized into straight lines, and on screws less than perhaps an inch in diameter the thread contours are omitted, the threaded portion of a shaft being represented by one of a number of conventional symbols, of which three are shown in fig. 20, A being the commonest. As another example: in making working drawings of gears and toothed wheels the

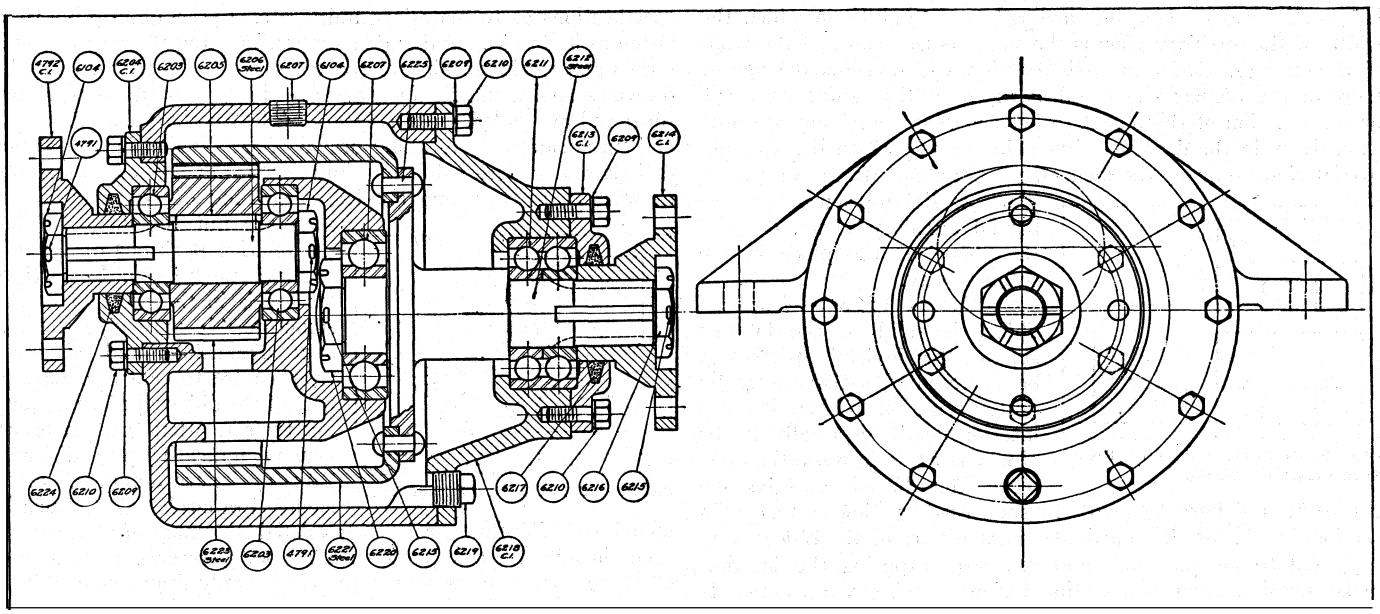
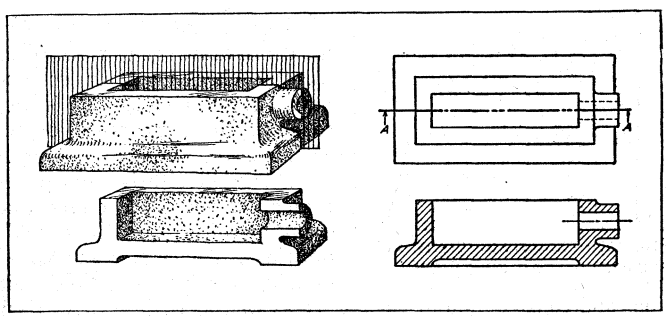


FIG. 18.— ASSEMBLY DRAWING WITH PIECE NUMBERS

teeth are not drawn but are represented by drawing the pitch circle, addendum and root circles. On detail drawings for cast gears the full-size outline of one tooth is added and for cut gears the blank is drawn with notes and dimensions giving full information.



FIGS. 15 & 16 — SHOWING THE CUTTING PLANE AND SECTION ON A-A

On patent drawings, however, all the teeth on a gear must be shown.

Fig. 21 is an illustration of the violation of theory, in which the true projection of the sectional view is not as good an explanation of the piece as the preferred form in the second view. When a cutting plane passes through a rib (fig 22), a true section, *A* is heavy and misleading. The usual method is to omit the section lines from the rib, *B*, as if the cutting plane were just in front of it. Another method sometimes used is to section the rib as at C. There have been a number of different codes of symbols proposed and published for the indication of different metals and materials in section, but there is no established universal standard. At the present time, however, all the countries where drawings are made have either officially adopted each its own standard set of rules and symbols for all the conventions used in drawing, as threads, finish, dimensioning, materials, etc., or are working on such standards through the Government or the engineering societies.

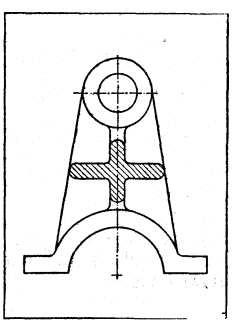


FIG 17.—A REVOLVED SECTION

Scales.—In representing objects which are larger than can be drawn to their natural or "full size" on the paper, it is necessary to reduce the dimensions on the drawing proportionally, and for this purpose the so-called architect's scale of proportional feet and inches is used The first reduction is to what is commonly called "half-size," or correctly speaking "to the scale of $6''=1'$. This scale reduction is used on working drawings even if the object be only slightly larger than could be drawn in full size, and is generally worked with the full size scale by halving the dimensions. If this is too large for the paper the drawing is made to the scale of $3''=1'$, commonly called quarter-size. This is the first scale of the usual commercial set. Others are $1\frac{1}{2}''$; $1''$; $\frac{3}{4}''$; $\frac{1}{2}''$; $\frac{3}{8}''$; $\frac{1}{4}''$; $\frac{3}{16}''$; $\frac{1}{8}''$; and $\frac{3}{32}''$ to the foot. Drawings to odd proportions as

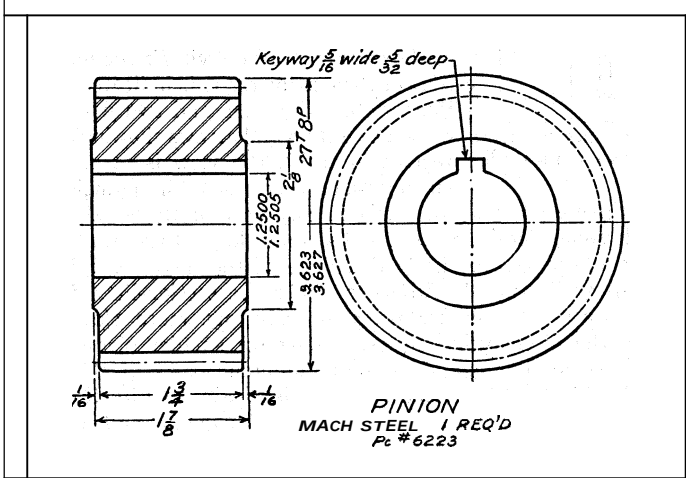


FIG. 19.— DETAILDRAWING

$9''=1'$, $4''=1'$, etc., are not used except in rare cases when it is desired to make it difficult or impossible for a workman to measure them with an ordinary rule. The scale $\frac{1}{4}''=1'$ is a usual one for ordinary house plans and is often called by architects "quarter-inch-scale," meaning not quarter size but that one-quarter inch on the drawing represents one foot on the building. For plotting and map drawing the civil engineer's scale of decimal parts, 10, 20, 30, 40, 50, 60, 80, 100 to the inch, is used but this scale should never be used for machine or structural work. Drawings in the metric system are not made to half-size or quarter-size. The first regular scale smaller than full size is one-fifth size, then one-tenth size, although sometimes the scale of 1 to $2\frac{1}{2}$ is used. The unit of measurement is the millimetre and figures are all understood to be millimetres, without any indicating mark.

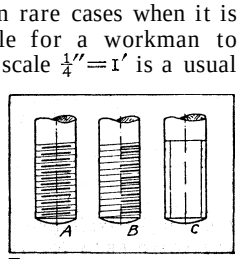


FIG. 20.—THREAD SYMBOLS

Dimensioning.— After the correct representation of the object by its projections, that is, telling the *shape,* the entire value of

the drawing as a working drawing lies in the dimensions, *i.e.*, telling the size. Successful dimensioning requires not only a knowledge of the principles and conventions but an acquaintance with the shop processes which enter into the construction. A dimension line is usually made as a fine full line terminated by carefully made arrow-heads which indicate exactly the points to which the dimension is taken. Some use a dash line and some a red line for dimension lines. On machine drawings a space for the

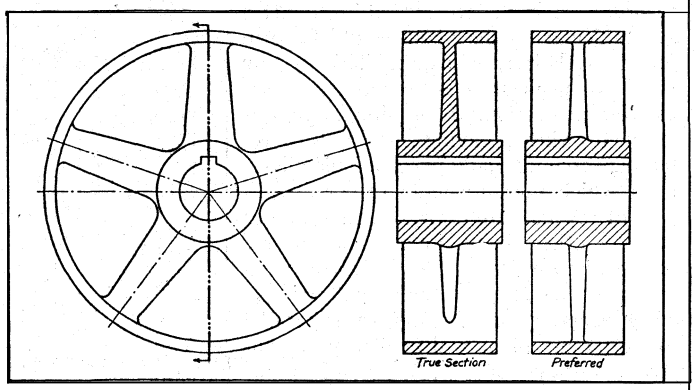


FIG. 21.— TRUE SECTION AND ITS PRACTICAL MODIFICATION

figures is left in the dimension line; in structural and much architectural practice the figure is placed above a continuous dimension line. Extension or witness lines not touching the outline, indicate the distance measured when the dimension is placed outside the figure.

In dimensioning there are some conventional practices which have come to represent good form to such an extent as to have the force of rules:

1. Dimensions on horizontal and inclined dimension lines should read from left to right; those on vertical lines from bottom to top; *i.e.*, so as to be read from the right hand side of the sheet.
2. Preferably keep dimensions outside the view unless added clearness, simplicity and ease of reading will result from placing them inside. They should for appearance's sake be kept off the cut surfaces of sections. When necessary to be placed there the section-lining is omitted around the numbers.
3. Feet and inches are designated thus, 5'-3". When a dimension is in even feet it is indicated thus 5'-0".
4. Fractions are always made with horizontal division lines.
5. Dimensions should generally be placed between views.
6. Do not repeat dimensions unless there is a special reason for it.
7. Do not crowd dimensions.
8. In general give dimensions from or about centre lines. Never locate holes or other machine operations from the edge of unfinished castings.
9. Never give dimensions to the edge of a circular part but always from centre to centre.
10. If it is practicable to locate a point by dimensioning from two centre lines do not give an angular dimension.
11. Never use a centre line as a dimension line.
12. Never use a line of the drawing as a dimension line.
13. Do not allow a dimension line to cross an extension line unless unavoidable.
14. The diameter of the "bolt circle" of holes in circular flanges is given, with the number and size of holes.
15. Give the diameter of a circle, not the radius.
16. Give the radius of an arc. marking it ***R*** or Rad.
17. Never place a dimension so that it is crossed by a line.

Fits and Tolerances — With the demand for interchangeability and quantity production the exact size in decimals is specified for "essential dimensions" with the amount of "tolerance" over and under which will be allowed by the inspector, since it is not possible to work to an absolutely accurate dimension. These limits are set by the engineering department and placed on the drawing, and the shop follows orders explicitly. In fitting one piece with another, as a shaft and hub, the diameters in decimals with allowed tolerances are given for each, superseding the older practice of leaving the amount of allowance for different kinds of fits to the machine shop. Much experience in manufacturing is needed as well as a study of the particular mechanism involved before the draughtsman is able to know just the accuracy necessary and to specify proper tolerance. When unnecessarily small tolerances are set the cost of manufacture is greatly increased. The general tolerance is often stated in a note near the title.

Checking. — Before being sent to the shop a working drawing is carefully checked for errors and omissions. A first check of the pencil drawing is made by the chief designer, who knows the price at which the machine is to be made and checks the design and its mechanism for soundness and economy, sees if existing patterns for any parts can be used, checks for correct representation, *e.g.*, adequate lubrication. He sees that every piece is correctly described, checks all dimensions by scaling and computation, checks for tolerances, checks for finishes, checks for specifications of material, looks for interferences and clearances, sees that small

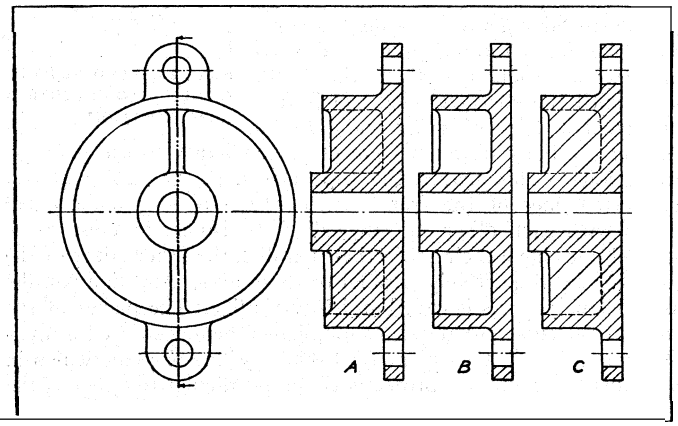


FIG. 22.— A, TRUE SECTION THROUGH A RIB; *B*, THE USUAL METHOD OF DRAWING SUCH SECTION; *C*, AN ALTERNATE METHOD

details are standard and stock sizes where possible, checks the title and bill of material.

Working drawings are always duplicated for shop use by some printing process, and the original is not allowed to be taken out of the office. The great majority are blueprinted. Photostat prints, and reproductions made by various forms of gelatine, stencil and lithographic processes are also used. Drawings are usually made in pencil on cream or buff detail paper and traced, either for economy on tracing paper, or on tracing cloth, a transparentized cotton fabric which gives a better print and is much more durable.

One-plane **Projection.**—Orthographic projection with its two or more views describes an object completely, but requires an effort of the geometrical imagination to visualize its appearance. On the other hand, a picture of the object showing it as it would appear to the eye can be made by perspective drawing, but is not useful as a working drawing as its lines cannot be measured directly. To obtain the pictorial effect of perspective drawing with the possibility of measuring the principal lines several kinds of one plane projection or conventional picture methods have been devised. With the combined advantages are some serious disadvantages which limit their usefulness. They are distorted until the appearance is often unpleasant, only certain lines can be measured, the execution requires more time, and it is difficult to add many figured dimensions, but with all this, a knowledge of these methods and facility in their use is of great value to the draughtsman. Mechanical or structural details not clear in orthographic projection may be drawn pictorially or illustrated by supplementary pictorial views. Technical illustrations, patent office drawings, layouts, piping and wiring diagrams, preliminary free-hand sketches, etc., can all be done advantageously in one-plane projection. Aside from perspective drawing there are two general divisions of pictorial projection, *axonometric* projection with its divisions into isometric, dimetric and trimetric, and *oblique* projection with several variations.

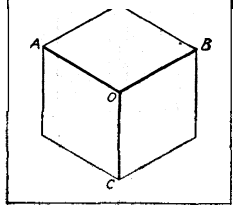


FIG. 23.—ISOMETRIC PROJECTION OF A CUBE

Axonometric projection, theoretically, is simply a form of orthographic projection in which only one plane is used, so placed with relation to the object that a rectangular solid projected on it would show three faces. Usually the object is considered as turned from

its natural position and the vertical plane taken as the plane of projection. Imagine a vertical plane with a cube behind (or in front) of it, having one face parallel to the plane. Its projection will be a square. Rotate the cube about its vertical axis through any angle less than 90°, the projection will now show two faces, foreshortened. From this position tilt the cube forward any amount and three faces will show on the projection. There are thus an infinite number of axonometric positions, only a few of which are ever used as a basis for drawing. The simplest of these is the "isometric" (equal measure) position, where the three faces are foreshortened equally, as would occur if the cube were rotated about the vertical axis through 45° then tilted forward until the edge *OC* (fig. 23) is foreshortened equally with *OA* and *OB* thus making the body diagonal from *O* perpendicular to the plane of projection. (This makes the top face slope 35°–16′ approx.) The three lines of the front corner, *OA, OB, OC,* make equal angles with each other and are called the isometric axes. Since parallel lines have their projections parallel, the other edges of the cube will be respectively parallel to these axes. Any line parallel to an isometric axis is called an isometric line. The planes of the faces of the cube and all planes parallel to them are called isometric planes. It will thus be noticed that any line or plane which in its regular orthographic projection is perpendicular to either of the reference planes, will be an isometric line or plane. In this isometric projection the lines have been foreshortened to approximately $\frac{81}{100}$ of their length and to measure them would require a special scale. In all practical use of the isometric system this foreshortened scale is not used but the full scale lengths are laid off on the axes. This gives a figure slightly larger but of exactly the same shape and is called *isometric drawing.* As the effect of increased size is usually of no consequence and the advantage of measuring the lines with standard scales is of such great convenience, isometric drawing is used almost exclusively instead of isometric projection. In making an isometric drawing the axes are first drawn, 120° apart, drawing one vertical and the other two with the 30° triangle. On these three lines are measured the length, breadth and thickness of the object. Lines not parallel to one of the isometric axes are called non-isometric lines. The one important rule is, measurements can be made only on isometric lines. Since a non-isometric line does not appear in its true length its extremities must be located by isometric co-ordinates. A circle on any isometric plane will appear as an ellipse, and is usually drawn as a four-centred approximation with the construction of fig. 24. It is sometimes desirable to show the lower face of an object, by tilting it back instead of forward, and drawing it on reversed axes. Fig. 25 shows a sketch on reversed axes. Isometric drawings are from their pictorial nature usually outside views but sometimes an isometric section or half-section can be employed to good advantage. The cutting planes are taken as isometric planes. Fig. 26 is a half-section, made by outlining the figure, then cutting out the front quarter.

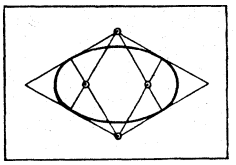


FIG. 24.— ISOMETRIC CIRCLE, FOUR-CENTRED APPROXIMATION

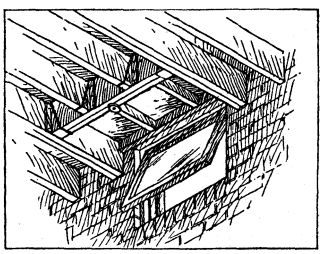


FIG. 25.—ISOMETRIC SKETCH ON REVERSED AXES

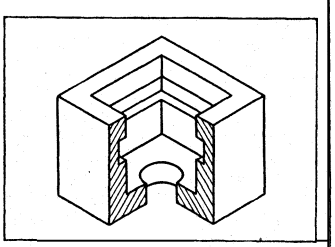


FIG. 26.—ISOMETRIC HALF-SECTION

The reference cube can be turned into any number of positions where two edges would be equally foreshortened and the third to a different length, and any one of these positions might be taken as a basis for a system of *dimetric drawing. A* simple dimetric position is one with the ratios 1:1:). In this position the tangents of the angles of the axes are $\frac{1}{8}$ and $\frac{7}{8}$ making the angles approximately 1 and 41 degrees. Fig. 27 is a drawing in this system. *Trimetric drawing,* with three unequal axes, has little if any practical value.

Oblique Proyection is a one-plane method in which the projecting lines are parallel but make an angle other than go° with the picture plane. Suppose the reference cube to be set with one face parallel to the picture plane and the projectors to make an angle of 45" with the plane, in any direction. The face parallel to the picture plane would be projected in its true size and the edges perpendicular to the plane would be projected in their true length. This system with 45° projectors is sometimes called cavalier projection. It is similar to isometric drawing in having three axes representing three mutually perpendicular lines, upon which measurements can be made. Two of the axes are always at right angles to each other, being in a plane parallel to the picture plane. The third or cross axis may be at any angle, 30° or 45" being generally used. Any face parallel to the picture plane will evidently be projected without distortion, an advantage over isometric of particular value in the representation of objects with circular or irregular outline, thus objects should always be placed with their characteristic contour parallel to the picture plane (fig. 28). Oblique drawing always gives the distorted effect of excessive thickness. *A* variation called *cabinet drawing* devised to overcome this effect is an oblique projection, with the projectors assumed at such an angle that all measurements in the direction of the cross axis are reduced one-half (fig. 29), which makes easy measurement but the effect is often too thin. Other ratios such as $\frac{2}{3}$ or $\frac{3}{4}$ may be used with more pleasing effect. The cross axes may be at any angle, but areusually made either 30° or· 45°. A special system of oblique projection called *clinographic projection,* used in drawing mineral crystals in crystallography, is based on the axes of a cube first revolved about a vertical axis through an angle whose tangent is $\frac{1}{3}$, then projected obliquely to the vertical plane with the eye (at an infinite distance) elevated through an angle whose tangent is $\frac{1}{6}$.

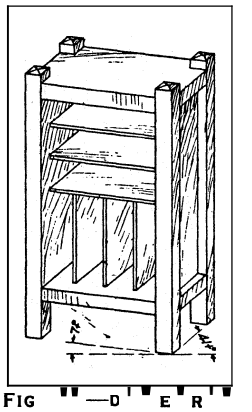


FIG DRAWING

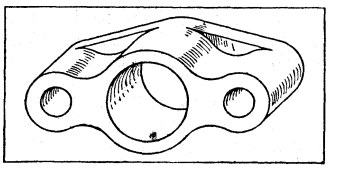


FIG. 28

Execution. — As drawing instruments are used for all accurate work, the first requirement in making a drawing is the ability to use them with facility and in good form. The drawing table, with softwood top or carrying a softwood drawing board, should be set so that the light comes from the left, the paper held in place with thumb tacks, and a hard pencil selected, sharpened to a long sharp point. A T-square, 45" and 30°–60° triangles, compasses, dividers, scale, pencil eraser and sandpaper pad should be at hand. Horizontal lines are drawn with the T-square guided by the left edge of the drawing board, and vertical lines are drawn with the triangle set against the T-square, always with the perpendicular edge nearest the head of the square and toward the light (fig. 30). These lines are always drawn up from the bottom to top, consequently their location points should be made at the bottom. With the triangles against the T-square, lines at 30°, 45° and 60" may be drawn, and the two triangles may be used in combination for angles of 15° and 75°, directly (fig. 31). Thus any multiple of 15° may be drawn and a circle may be divided with the 45° triangle into 4 or 8 parts, with the 60° triangle into 6 or 12 parts and with both into 24 parts. The *dividers,* used for transferring distances, etc , are manipulated with one hand, and opened by pinching at the chamfer with the thumb

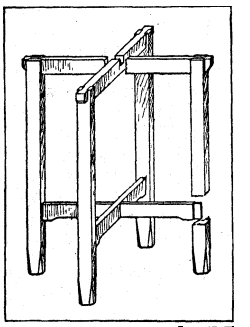


FIG 29—CABINET DRAWING

and second finger. This puts them in correct position with the thumb and forefinger on the outside of the legs and the second and third fingers on the inside (fig. 32). The compasses are manipulated in the same way, adjusting to the radius marked on the paper, then raising the hand to the handle and drawing the circle (clockwise) in one sweep by rolling the handle with the thumb and forefinger, inclining the compasses slightly in the direction of the line (fig. 33). In making a working diagram the order of pencilling should be somewhat as follows: first, make a preliminary freehand layout sketch, estimating the position and space required for each view; second, decide the scale to be used; third, draw the centre lines for each view and block in the views with the principal outlines; fourth, finish the projections, carrying them on together; fifth draw all dimension lines, then put in the dimensions; sixth, lay out the title; seventh, check the drawing as carefully as possible.

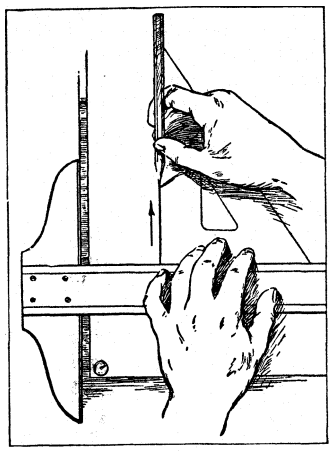


FIG. 30.—DRAWING A VERTICAL LINE

After being made in pencil, drawings, except when inked on the paper, as patent drawings or display drawings, are traced for blueprinting or other method of reproduction. When intended to be used perhaps only once, as tool-room drawings, architectural details, etc., they are very commonly traced in firm pencil lines on tracing paper. Production drawings and works of permanent value are traced in ink on tracing cloth. The ruling pen is always used with drawing ink and guiding edge, either T-square or triangle. To fill it touch the quill filler of the ink bottle between the nibs, being careful not to get any ink on the outside of the blades. The pen is held as in fig. 34 and the width of line adjusted by turning the screw. The pen is held against the straight-edge with the blades parallel to it and in a plane perpendicular to the paper. If the ink refuses to flow it is because it has dried and clogged in the point of the pen. If pinching the blades slightly or touching the pen on the finger does not start it, it should be wiped out and fresh ink supplied. Faulty lines may occur by pressing the pen too hard against the T-square, by sloping the pen away from the T-square, or by having it too close to the blade, when the ink will run under; by having ink on the outside of the blade; by not keeping the blades parallel to the line, or by letting the triangle slip into the wet line. Visible outlines should be strong full lines, invisible lines much lighter lines made with short dashes. Centre lines of long dash and dot, and dimension lines are made either of the same weight as invisible lines or still finer. Inking should be done in a systematic order, first, all visible circles, beginning with the smallest; second, full lines, horizontal, vertical, inclined; third, dotted circles and lines; fourth, centre lines; fifth, extension and dimension lines; sixth, arrow heads and dimensions; seventh, section lines; eighth, notes and title; ninth, border; tenth, check the tracing.

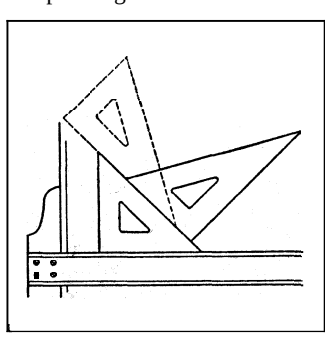


FIG. 31.—COMBINATION FOR 15° AND 75° ANGLES

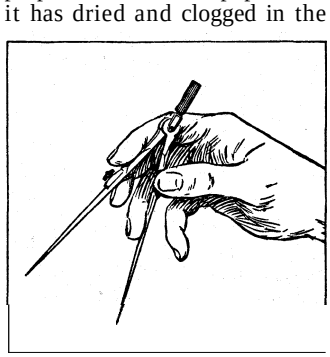


FIG. 32.—HANDLING THE DIVIDERS

In lettering a working drawing the two requirements are legibility and speed. Lettering is not mechanical drawing and the use of "geometrical" letters, "block" letters, etc., made of straight lines and ruled with T-square and triangles is not approved in good practice. The "commercial gothic" or "sans serif" letter made freehand in a single stroke, either vertical or inclined is the style almost universally used.

Technical Sketching.— From its use in connection with art the word sketch suggests a free or incomplete or careless rendering of some idea. This is not its meaning in engineering drawing. A sketch is a working drawing made freehand, a quick expression of graphic language, but complete in its information. In all mechanical thinking in invention, all preliminary designing, all explanation and instruction of the designer to the draftsman, sketching is the mode of expression. It represents the mastery of the language, gained only after proficiency in mechanical execution. Sketches of machine parts would be made in orthographic projection, explanatory of illustrative sketches either in orthographic or in one of the pictorial methods. Design sketches are often made on co-ordinate paper. The memory for form may be strengthened and the capacity for "stored observation" greatly increased by systematic practice in sketching from memory, studying a drawing or casting with close concentration until every detail is stored for future visualization, then making an accurate sketch without further reference to the original and comparing it when finished. See also ENGINEERING; RENDERING, ARCHITECTURAL; DESCRIPTIVE GEOMETRY; SUN COPYING; BLUE-PRINT.

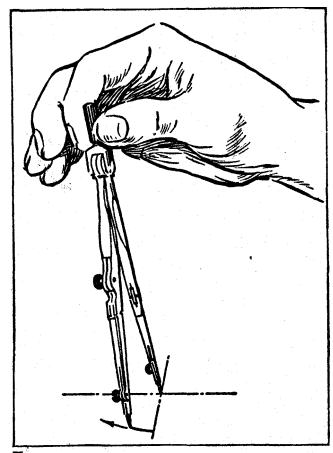


FIG. 33.—DRAWING A CIRCLE WITH THE COMPASSES

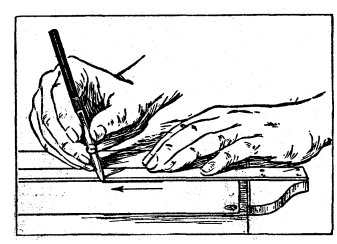


FIG. 34.— POSITIONOF THE RULING PEN

(T. E. F.)

DRAWING AND QUARTERING, part of the penalty anciently ordained in England for treason. Until 1870 the full punishment for the crime was that the culprit be dragged on a hurdle to the place of execution; that he be hanged by the neck but not till he was dead; that he should be disembowelled or drawn and his entrails burned before his eyes; that his head be cut off and his body divided into four parts or quartered. This brutal penalty was first inflicted in 1284 on the Welsh prince David, and a few years later on Sir William Wallace. Edward Marcus Despard and his six accomplices were in 1803 hanged, drawn and quartered for conspiring to assassinate George III. The sentence was last passed (though not carried out) upon the Fenians Burke and O'Brien in 1867.

DRAWING-ROOM, the English name generally employed for a room used in a dwelling-house for the reception of company. It is a shortened form of the 16th and 17th century "withdrawing room," and originated in the setting apart of a room for the ladies of the household, to which they withdrew from the dining-room.

DRAW-PLATE, a plate of hardened steel with a series of holes, with converging sides, graded in size and of similar shape, through which metal is drawn in manufacturing wire (*q.v.*).

DRAYTON, MICHAEL (1563–1631), English poet, was born at Hartshill, Warwickshire, and settled in London about 1590. His first volume of poems, The Harmony of *the* Church, appeared in 1591; the whole edition, with the exception of 40 copies seized by the archbishop of Canterbury, was destroyed by public order. In Idea; the *Shepherd's* Garland (1593), a collection of nine pastorals, and Idea's Mirror (1594), a cycle of 64 sonnets, he celebrated his love for a Warwickshire lady. *The Legend* of

Piers *Gaveston* (1593) is the first of Drayton's historical poems; it was followed by *Mortimeriados* (1596), written in ottava rima and afterwards enlarged as The Barons' Wars (1603); The Legend of Robert, Duke of *Normandy* (1596); and England's Heroical Epistles (1597) modelled on Ovid.

Drayton had been in high favour with Elizabeth, but his overtures to James I. were rejected, and his pique found expression in The Owl (1604), an unsuccessful satire. In 1606 he made a collection of poems entitled Poems Lyric and Pastoral, including among other hitherto unpublished works, his famous "Ballad of Agincourt."

As early as 1598 he had formed the plan of celebrating all the points of topographical or antiquarian interest in the island of Great Britain. In 1613, the first part of this vast work was published under the title of *Poly-Olbion,* 18 books being produced, to which Selden supplied notes. The success of this, his most famous work, was at first small, and the 12 more books of the second part only appeared in 1622. This completed the survey of England, and the poet, who had hoped "to crown Scotland with flowers," and arrive at last at the Orcades, never crossed the Tweed. In 1627 he published another of his miscellaneous volumes, and this contains some of his most characteristic and exquisite writing. It consists of the following pieces: *The* Battle of *Agincourt,* an historical poem in ottava *rima* (not to be cpnfused with his ballad on the same subject), and *The* Miseries of Queen Margaret, written in the same verse and manner; Nimphidia, the Court of *Faery,* a most graceful little epic of fairyland; The Quest of *Cinthia* and *The Shepherd's Sirena,* two lyrical pastorals; and finally *The* Moon Calf, a sort of satire. Of these Nimphidia is perhaps the best thing Drayton ever wrote, except his famous ballad on the battle of Agincourt; it is quite unique of its kind and full of rare fantastic fancy.

The last of Drayton's voluminous publications was The Muses' *Elizium* in 1630. He died in London and was buried in Westminster Abbey. Drayton corresponded familiarly with Drummond; Ben Jonson, William Browne, George Wither and others were among his friends. There is a tradition that he was a friend of Shakespeare, supported by a statement of John Ward, once vicar of Stratford-on-Avon, that "Shakespear, Drayton and Ben Jonson had a merry meeting, and it seems, drank too hard, for Shakespear died of a feavour there contracted." He had a share, with Munday, Chettle and Wilson, in writing Sir John Oldcastle, which was printed in 1600.

The poet with whom it is most natural to compare Drayton is Daniel; he is more rough and vigorous, more varied and more daring than the latter, but Daniel surpasses him in grace, delicacy and judgment. In their elegies and epistles, however, the two writers frequently resemble each other. Drayton, however, approaches the very first poets of the Elizabethan era in his charming Nimphidia, a poem which inspired Herrick with his sweet fairy fancies and stands alone of its kind in English literature; while some of his odes and lyrics are inspired by noble feeling and virile imagination.

In 1748 a folio edition of Drayton's complete works was published under the editorial supervision of William Oldys, and again in 1753 there appeared an issue in four volumes. But these were very unintelligently and inaccurately prepared. A complete edition of Drayton's works with variant readings was projected by Richard Hooper in 1876, but 3 vols. only were completed; a volume of selection, edited by A. H. Bullen, appeared in 1883. See especially Oliver Elton, *Michael* Drayton (1905). (E. G.)

DREADNOUGHT: see BATTLESHIP.

DREAM, the state of consciousness during sleep; it may also be defined as a hallucination or illusion peculiarly associated with the condition of sleep, but not necessarily confined to that state (from a root dreug, connected with Ger. *trügen,* to deceive). In sleep the withdrawal of the mind from the external world is more complete and the objectivity of the dream images is usually unquestioned, whereas in the waking state the hallucination is usually recognized as such; we may, however, be conscious that we are dreaming, and thus in a measure be aware of the hallucinatory character of our percepts. The physiological nature of sleep (*q.v.;* see also MUSCLE and NERVE) and of dreaming is obscure. As a rule the control over the voluntary muscles in dreams is slight; the sleep-walker is the exception and not the rule, and the motor activity represented in the dream is seldom realized in practice, largely, no doubt, because we are ignorant, under these circumstances, of the spatial relations of our bodies. Among the psychological problems raised by dreams are the condition of attention, which is variously regarded as altogether absent or as fixed, the extent of mental control, and the relation of ideas and motor impulses. There is present in all dreams a certain amount of dissociation of consciousness, or of obstructed association, which may manifest itself in the preliminary stage of drowsiness by such phenomena as the apparent transformation or inversion of the words of a book. We may distinguish two types of dreams, (*a*) representative or centrally initiated, (b) presentative or due to the stimulation of the end organs of sense. In both cases, the dream having once been initiated, we are concerned with a combination of ideas suggested by resemblances or other associative elements. The false reasoning of dreams is due in the first place to the absence, to a large extent, of the memory elements on which our ordinary reasoning depends, and, secondly, to the absence of the normal supply of sensory elements.

Apparent Objectivity **of** Dreams. — In waking life we distinguish ideas or mental images from real objects by the fact that we are able under normal circumstances to dismiss the former at will. In sleep, on the other hand, we have, in the first place, no real objects with which to compare the images, which therefore take on a character of reality comparable to the hallucination of waking life; moreover, powers of visualization and other faculties are enhanced in sleep, so that the strength of dream images considerably exceeds those of ordinary mental images; changes in powers of attention, volition and memory help to increase the hallucinatory force of the dream. In the second place, the ideas of our dreams are presented in the form of images, which we are unable to dismiss; we therefore mistake them for realities, exactly as the sufferer from delirium tremens in waking life is apt to regard his phantoms as real.

Representative Dreams. — Centrally initiated dreams may be due to a kind of automatic excitation of the cerebral regions, especially in the case of those clearly arising from the occupations or sensations of the day or the hours immediately preceding the dream. To the same cause we may attribute the recalling of images apparently long since forgotten. Some of these revivals of memory may be due to the fact that links of association which are insufficient to restore an idea to consciousness in the waking state may suffice to do so in sleep. Just as a good visualizer in his waking moments may call up an object never clearly seen and yet distinguish the parts, so in sleep, as L. F. A. Maury (1817–92) and others have shown, an image may be more distinct in a dream than it was originally presented (see also below, Memory).

Presentative Dreams. — The dreams due to seal sensations, more or less metamorphosed, may arise (a) from the states of the internal organs, (b) from muscular states, (c) from sensations due to the circulation, etc., or (d) from the ordinary cause of the action of external stimuli on the organs of sense.

(a) The state of the stomach, heart, etc., has long been recognized as important in the causation of dreams (see below, Classical Views). The common sensation of flying seems to be due in many cases to the disturbance of these organs setting up sensations resembling those felt in rapidly ascending or descending, as in a swing or a lift. Indigestion is a frequent cause of nightmare — the name given to oppressive and horrible dreams — and bodily discomfort is sometimes translated into the moral region, giving rise to the dream that a murder has been committed (b) Dreams of flying, etc., have also been attributed to the condition of the muscles during sleep; W. Wundt remarks that the movements of the body, such as breathing, extensions of the limbs and so on, must give rise to dream fancies; the awkward position of the limbs may also excite images. (c) Especially important, probably, for the dreams of the early part of the night are the retinal conditions to which are due the illusions *hypnagogiques* of the

preliminary drowsy stage; but probably Ladd goes too far in maintaining that entoptic stimuli, either intra- or extra-organic in origin, condition all dreams. Illusions *hypnagogiques*, termed popularly "faces in the dark," of which Maury has given a full account, are the not uncommon sensations experienced, usually visual and seen with both open and closed eyes, in the interval between retiring to rest and actually falling asleep; they are comparable to the crystal-gazing visions of waking moments; though mainly visual they may also affect other senses. Besides the eye the ear may supply material for dreams, when the circulation of the blood suggests rushing waters or similar ideas. (d) It is a matter of common observation that the temperature of the surface of the body determines in many cases the character of the dreams, the real circumstances, as might be expected from the general character of the dream state, being exaggerated. In the same way the pressure of bed-clothes, obstruction of the supply of air, etc, may serve as the starting-point of dreams The common dream of being unclothed may perhaps be due to this cause, the sensations associated with clothing being absent or so far modified as to be unrecognizable. In the same way the absence of foot-gear may account for some dreams of flying. It is possible to test the influence of external stimuli by direct experiment; Maury made a number of trials with the aid of an assistant.

Rapidity of Dreams.—It has often been asserted that we dream with extreme rapidity; but this statement is by no means borne out by experiment. In a trial recorded by J. Clavière the beginning of the dream was accurately fixed by the sounding of an alarm clock, which rang, then was silent for 22sec., and then began to ring continuously; the dream scene was in a theatre. and he found by actual trial that the time required in the dream for the performance of the scenes during the interval of silence was about the same as in ordinary life. Spontaneous dreams seem to show a different state of things; it must be remembered that (1) dreams are commonly a succession of images, the number of which cannot be legitimately compared with the number of extra-organic stimuli which would correspond to them in ordinary life; the real comparison is with mental images; and (2) the rapidity of association varies enormously in ordinary waking life. No proof, therefore, that some dreams are slow can show that this mentation in others is not extremely rapid. The most commonly quoted case is one of Maury's; a bed-pole fell on his neck, and (so it is stated) he dreamt of the French Revolution, the scenes culminating in the fall of the guillotine on his neck; this has been held to show that (1) dreams are extremely rapid; and (2) we construct a dream story leading up to the external stimulus which is assumed to have originated the dream. But Maury's dream was not recorded till many years after it had occurred; there is nothing to show that the dream, in this as in other similar cases, was not in progress when the bed-pole fell, which thus by mere coincidence would have intervened at the psychological moment; Maury's memory on waking may have been to some extent hallucinatory. But there are records of waking states, not necessarily abnormal, in which time-perception is disturbed and brief incidents seem interminably long; on the other hand, it appears from the experiences of persons recovered from drowning that there is great rapidity of ideation before the extinction of consciousness; the same rapidity of thought has been observed in a fall from a bicycle.

Reason in Dreams.—Studies of dreams of normal individuals based on large collections of instances are singularly few in number; such as there are indicate great variations in the source of dream thoughts and images, in the coherence of the dream, and in the powers of memory. In ordinary life attention dominates the images presented; in dreams heterogeneous and disconnected elements are often combined; a resemblance need not even have been consciously recognized for the mind to combine two impressions in a dream; for example, an aching tooth may (according to the dream) be extracted, and found to resemble rocks on the sea-shore, which had not struck the waking mind as in any way like teeth. Incongruence and incoherence are not, however, a necessary characteristic of dreams, and individuals are found whose dream ideas and scenes show a power of reasoning and orderliness equal to that of a scene imagined or experienced in ordinary life. In some cases the reasoning power may attain a higher level than that of the ordinary conscious life. In a well-authenticated case Prof. Hilprecht was able in a dream to solve a difficulty connected with two Babylonian inscriptions, which had not previously been recognized as complementary to each other; a point of peculiar interest is the dramatic form in which the information came to him—an old Babylonian priest appeared in his dream and gave him the clue to the problem (see also below, Personality).

Memory in Dreams.—Although prima facie the dream memory is fragmentary and far less complete than the waking memory, it is by no means uncommon to find a revival in sleep of early, apparently quite forgotten, experiences: more striking is the recollection in dreams of matters never supraliminally (see SUBLIMINAL SELF) apperceived at all.

The relation between the memory in dreams and in the hypnotic trance is curious: suggestions given in the trance may be accepted and then forgotten or never remembered in ordinary life; this does not prevent them from reappearing occasionally in dreams; conversely dreams forgotten in ordinary life may be remembered in the hypnotic trance. These dream memories of other states of consciousness suggest that dreams are sometimes the product of a deeper stratum of the personality than comes into play in ordinary waking life. It must be remembered in this connection that we judge of our dream consciousness by our waking recollections, not directly, and our recollection of our dreams is extraordinarily fragmentary; we do not know how far our dream memory really extends. Connected with memory of other states is the question of memory in dreams of previous dream states; occasionally a separate chain of memory, analogous to a secondary personality, seems to be formed. We may be also conscious that we have been dreaming, and subsequently, without intermediate waking, relate as a dream the dream previously experienced. In spite of the irrationality of dreams in general, it by no means follows that the earlier and later portions of a dream do not cohere; we may interpolate an episode and again take up the first motive, exactly as happens in real life. The strength of the dream memory is shown by the recurrence of images in dreams; a picture, the page of a book, or other image may be reproduced before our eyes several times in the course of a dream without the slightest alteration, although the waking consciousness would be quite incapable of such a feat of visualizing. In this connection may be mentioned the phenomenon of redreaming; the same dream may recur either on the same or on different nights; this seems to be in many cases pathological or due to drugs, but may also occur under normal conditions.

Personality.—As a rule the personality of the dreamer is unchanged; but it also happens that the confusion of identity observed with regard to other objects embraces the dreamer himself; he imagines himself to be some one else; he is alternately actor and observer; he may see himself playing a part or may divest himself of his body and wander incorporeally. Ordinary dreams, however, do not go beyond a splitting of personality; we hold conversations, and are intensely surprised at the utterances of a dream figure, which, however, is merely an alter ego. As in the case of Hilprecht (see above) the information given by another part of the personality may not only appear but actually be novel.

Supernormal Dreams.—In addition to dreams in which there is a revival of memory or a rise into consciousness of facts previously only subliminally cognized, a certain number of dreams are on record in which telepathy (*q.v.*) seems to play a part; much of the evidence is, however, discounted by the possibility of hallucinatory memory. Another class of dreams (prodromic) is that in which the abnormal bodily states of the dreamer are brought to his knowledge in sleep, sometimes in a symbolical form; thus a dream of battle or sanguinary conflict may presage a haemorrhage. The increased power of suggestion which is the normal accompaniment of the hypnotic trance may make its appearance in dreams, and exercise either a curative influence or

act capriciously in producing hysteria and the tropic changes known as "stigmata." We may meet with various forms of hyperaesthesia in dreams; quite apart from the recovery of sight by those who have lost it wholly or in part (see below, Dreams of the Blind), we find that the powers of the senses may undergo an intensification, and, *e.g.*, the power of appreciating music be enormously enhanced in persons usually indifferent to it. Mention must also be made of the experience of R. L. Stevenson, who tells in Across the Plains how by self-suggestion he was able to secure from his dreams the motives of some of his best romances.

Voluntary Action in Dreams.—Connected with dreams voluntarily influenced is the question of how far dreams once initiated are modifiable at the will of the dreamer. Some few observers, like F. W. H. Myers and Dr. F. van Eeden, record that they can at longer or shorter intervals control their actions in their dreams, though usually to a less extent than their imagined actions in waking life. Dr. van Eeden, for example, tells us that he has what he calls a "clear dream" once a month and is able to predetermine what he will do when he becomes aware that he is dreaming.

Dreams of Children.—Opinions differ widely as to the age at which children begin to dream; G. Compayré maintains that dreaming has been observed in the fourth month, but reflex action is always a possible explanation of the observed facts. S. de Sanctis found that in boys of eleven only one out of eight said that he dreamt seldom, as against four out of seven at the age of six; but we cannot exclude the possibility that dreams were frequent but forgotten.

Dreams of the Old.—In normal individuals above the age of 65 de Sanctis found dreams were rare; atmospheric influences seem to be important elements in causing them; memory of them is weak; they are emotionally poor, and deal with long past scenes.

Dreams of Adults.—Any attempt to record or influence our dreams may be complicated by (a) direct suggestion, leading to the production of the phenomena for which we are looking, and (b) indirect suggestion leading to the more lively recollection of dreams in general and of certain dreams in particular. Consequently it cannot be assumed that the facts thus ascertained represent the normal conditions. According to F. Heerwagen's statistics women sleep more lightly and dream more than men; the frequency of dreams is proportional to their vividness; women who dream sleep longer than those who do not; dreams tend to become less frequent with advancing age.

In the matter of complication of dream experiences the sexes are about equal; daily life supplies more material in the dreams of men; nearly twice as many women as men remember their dreams clearly, a fact which hangs together to some extent with the vividness of the dreams, though it by no means follows that a vivid dream is well remembered. There are great variations in the emotional character of dreams; some observers report twice as many unpleasant dreams as the reverse; in other cases the emotions seem to be absent; others again have none but pleasing dreams. Individual experience also varies very largely as to the time when most dreams are experienced; in some cases the great majority are subsequent to 6:30 A.M.; others find that quite half occur before 4 A.M.

Dreams of the **Neuropathic,** Insane, Idiots, **etc.**—Much attention has been given to the dreams of hysterical subjects. It appears that their dreams are specially liable to exercise an influence over their waking life, perhaps because they do not distinguish them, any more than their waking hallucinations, from reality. P. Janet maintains that the cause of hysteria may be sought in a dream. The dreams of the hysterical have a tendency to recur. Epileptic subjects dream less than the hysterical, and their dreams are seldom of a terrifying nature; certain dreams seem to take the place of an epileptic attack. Dreaming seems to be rare in idiots. De Sanctis divides paranoiacs into three classes: (a) those with systematized delusions, (b) those with frequent hallucinations, and (c) degenerates—the dreams of the first class resemble their delusions; the second class is distinguished by the complexity of its dreams; the third by their vividness, by their delusions of megalomania, and by their influence on daily life. Alcoholic subjects have vivid and terrifying dreams, characterized by the frequent appearance of animals in them, and delirium tremens may originate during sleep.

Dreams of the Blind, Deaf, *etc.*—As regards visual dreams the blind fall into three classes—(I) those who are blind from birth or become blind before the age of five; (2) those who become blind at the "critical age" from five to seven; (3) those who become blind after the age of seven. The dreams of the first class are non-visual; but in the dreams of Helen Keller there are traces of a visual content; the second class sometimes has visual dreams; the third class does not differ from normal persons, though visual dreams may fade away after many years of blindness. In the case of the partially blind the clearness of vision in a dream exceeds that of normal life when the partial loss of sight occurred in the sixth or later years. The education of Helen Keller is interesting from another point of view; after losing the senses of sight and hearing in infancy she began her education at seven years and was able to articulate at eleven; it is recorded that she "talked" in her dreams soon after. This accords with the experience of normal individuals who acquire a foreign language. Her extraordinary memory enables her to recall faintly some traces of the sunlit period of her life, but they hardly affect her dreams, so far as can be judged. The dreams of the blind, according to the records of F. Hitschmann, present some peculiarities; animals as well as man speak; toothache and bodily pains are perceived as such; impersonal dreaming, taking the form of a drama or reading aloud, is found; and he had a strong tendency to reproduce or create verse.

Dreams of *Animals.*—We are naturally reduced to inference in dealing with animals as with very young children; but various observations seem to show that dreams are common in older dogs, especially after hunting expeditions; in young dogs sleep seems to be quieter; dogs accustomed to the chase seem to dream more than other kinds.

Dreams Among the Non-European Peoples.—In the lower stages of culture the dream is regarded as no less real and its personages as no less objective than those of the ordinary waking life; this is due in the main to the habit of mind of such peoples (see ANIMISM), but possibly in some measure also to the occurrence of veridical dreams (see TELEPATHY). In either case the savage explanation is animistic, and animism is commonly assumed to have been developed very largely as a result of theorizing dreams. Two explanations of a dream are found among the lower races: (1) that the soul of the dreamer goes out, and visits his friends, living or dead, his old haunts or unfamiliar scenes and so on; (2) that the souls of the dead and others come to visit him, either of their own motion or at divine command. In either of the latter cases or at a higher stage of culture when the dream is regarded as god-sent, though no longer explained in terms of animism, it is often regarded as oracular (see ORACLE), the explanation being sometimes symbolical, sometimes simple.

There are two classes of dreams which have a special importance in the lower cultures: (1) the dream or vision of the initiation fast; and (2) the dream caused by the process known as incubation, which is often analogous to the initiation fast. In many parts of North America the individual Indian acquires a tutelary spirit, known as *manito* or nagual, by his initiation dream or vision; the idea being, perhaps, that the spirit by the act of appearing shows its subjection to the will of the man. Similarly, the magician acquires his familiar in North America, Australia and elsewhere by dreaming of an animal. Incubation consists in retiring to sleep in a temple, sometimes on the top of a mountain or other unusual spot, in order to obtain a revelation through a dream. Fasting, continence and other observances are frequently prescribed as preliminaries. Certain classes of dreams have, especially in the middle ages, been attributed to the influence of evil spirits (see DEMONOLOGY).

Classical and Mediaeval Views of Dreams.—Side by side with the prevalent animistic view of dreams we find in antiquity and among the semi-civilized attempts at philosophical or physiological explanations of dreams. Democritus, from whom the

Epicureans derived their theory, held the cause of them to be the simulacra or phantasms of corporeal objects which are constantly floating about the atmosphere and attack the soul in sleep—a view hardly distinguishable from animism. Aristotle, however, refers them to the impressions left by objects seen with the eyes of the body; he further remarks on the exaggeration of slight stimuli when they are incorporated into a dream; a small sound becomes a noise like thunder. Plato, too, connects dreaming with the normal waking operations of the mind; Pliny, on the other hand, admits this only for dreams which take place after meals, the remainder being supernatural. Cicero, however, takes the view that they are simply natural occurrences no more and no less than the mental operations and sensations of the waking state. The pathological side of dreams attracted the notice of physicians. Hippocrates was disposed to admit that some dreams might be divine, but held that others were premonitory of diseased states of the body. Galen took the same view in some of his speculations.

Symbolical interpretations are combined with pathological no less than animistic interpretations of dreams; they are also extremely common among the lower classes in Europe at the present day, but in this case no consistent explanation of their importance for the divination of future events is usually discoverable. Among the Greeks Plato in the *Timaeus* (ch. xlvi., xlvii.) explains dreams as prophetic visions received by the lower appetitive soul through the liver; their interpretation requires intelligence. The Stoics seem to have held that dreams may be a divine revelation and more than one volume on the interpretation of dreams has come down to us, the most important being perhaps the Ὀνειροκριτικά of Daldianus Artemidorus. We find parallels to this in a Muslim work by Gabdorrachaman, translated by Pierre Vattier under the name of *Onirocrite mussulman*, and in the numerous books on the interpretation of dreams which circulate at the present day. In Siam dream books are found (*Intern. Arckiv fur Anthr.* viii. 150); one of the functions of the Australian medicine man is to decide how a dream is to be interpreted.

Modern Views.—The doctrine of Descartes that existence depended upon thought naturally led his followers to maintain that the mind is always thinking and consequently that dreaming is continuous. Locke replied to this that men are not always conscious of dreaming, and it is hard to be conceived that the soul of the sleeping man should this moment be thinking, while the soul of the waking man cannot recollect in the next moment a jot of all those thoughts. That we always dream was maintained by Leibniz, Kant, Sir. W. Hamilton and others; the latter refutes the argument of Locke by the just observation that the somnambulist has certainly been conscious, but fails to recall the fact when he returns to the normal state.

It has been commonly held by metaphysicians that the nature of dreams is explained by the suspension of volition during sleep; Dugald Stewart asserts that it is not wholly dormant but loses its hold on the faculties, and he thus accounts for the incoherence of dreams and the apparent reality of dream images.

Cudworth, from the orderly sequence of dream combinations and their novelty, argues that the state arises, not from any "fortuitous dancings of the spirits," but from the "phantastical power of the soul." According to K. A. Scherner, dreaming is a decentralization of the movement of life; the ego becomes purely receptive and is merely the point around which the peripheral life plays in perfect freedom. Hobbes held that dreams all proceed from the agitation of the inward parts of a man's body, which, owing to their connection with the brain, serve to keep the latter in motion. For Schopenhauer the cause of dreams is the stimulation of the brain by the internal regions of the organism through the sympathetic nervous system. These impressions the mind afterwards works up into quasi-realities by means of its forms of space, time, causality, etc.

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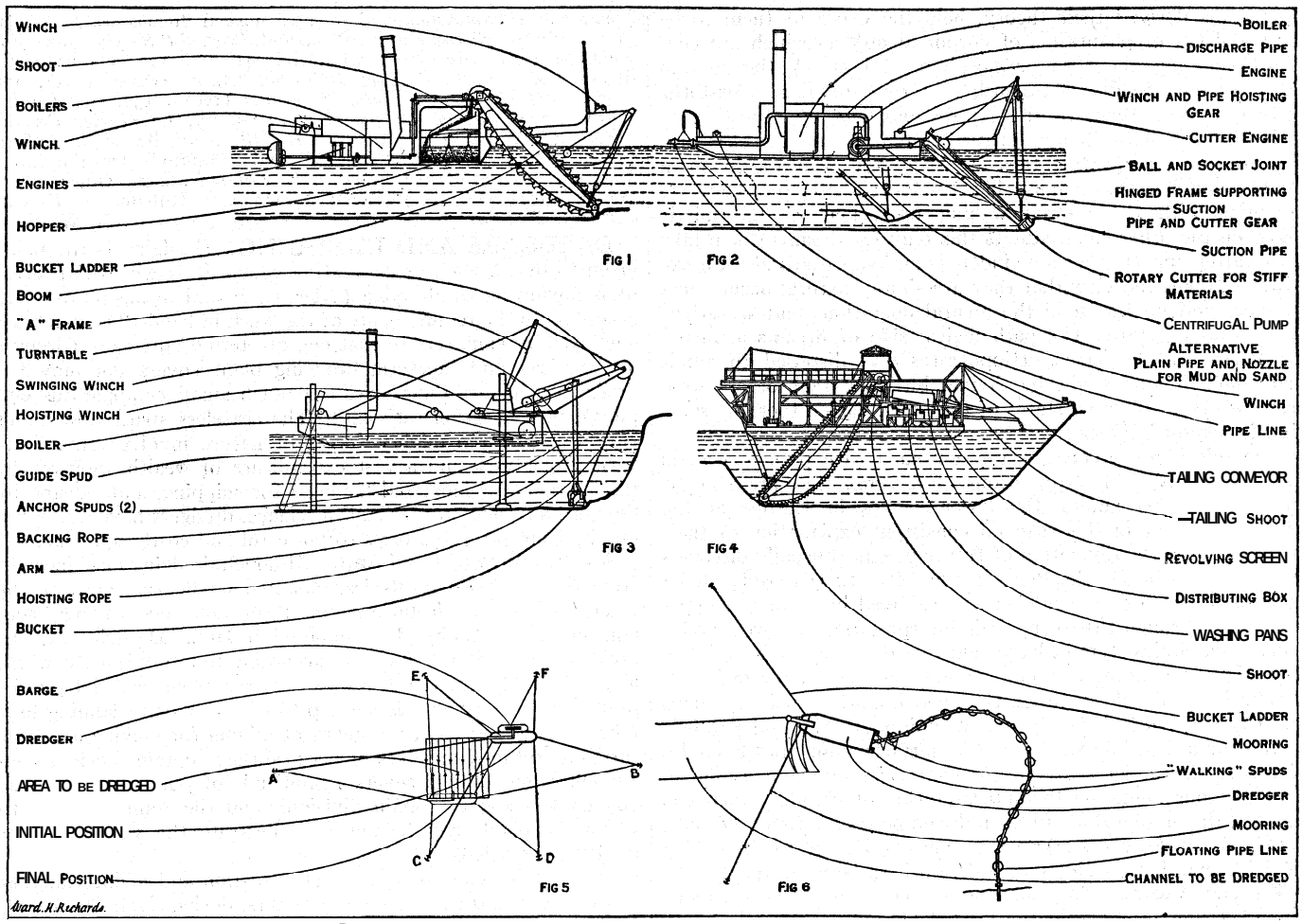
DREDGERS AND DREDGING. Dredging is the name given to that branch of excavation which deals with the process of removing materials lying under water and disposing of them according to the requirements of the work in hand. The machines employed by engineers to that end are termed dredgers (dredges in America) and the term dredging plant covers not only the dredging machines themselves but much auxiliary apparatus employed in connection therewith. The ceaseless struggle of man's efforts against the mighty forces of nature involves an infinite variety of attack and a vast expenditure of wealth. Spurred by the demands for increased facilities for shipping, and assisted by the great advances of mechanical science, dredgers have developed rapidly from primitive tools to powerful and costly appliances.

Applications of Dredging.—Although dredging machinery is, from the nature of its duties, mounted on floating craft in the great majority of instances, the term does not exclude subaqueous excavation by plant mounted on land. Dredging may be divided broadly into two classes according to the object for which it is employed, viz., (a) as a means of removing material for the purpose of increasing existing depths of water or reclaiming low-lying ground, and (b) as a means of mining for making available earths useful in themselves or because they contain precious constituents; but its field covers a multitude of purposes within the bounds of these two main divisions, and the following uses to which the plant may be put will illustrate the wide scope of dredging operations.

Material Shifting Dredgers.—The creation and maintenance of satisfactory depths of water in harbours, docks, rivers and canals for the purposes of navigation; the removal of material for the foundations of marine and river works and for the preparation of sites for floating docks; the deepening, widening and straightening of rivers to increase or conserve their discharging capacity; the cutting of drainage and irrigation canals; the removal of material for the reclamation of low-lying land or the formation of dykes, levees or dams.

Mining Dredgers.—The recovery of gold from rivers or placer deposits, also platinum, tin and other heavy metals; the raising of gravel, sand and clay for building and industrial purposes.

Characteristics of Materials Dealt with.—Dredgers have been constructed to deal, in varying degrees of efficiency, with anything from mud to rock. The materials when removed from the bottom are termed "spoil" and naturally occur in endless variety of kinds and mixture of kinds. In general, however, the natural basins of alluvial deposits forming the rivers and bays in which harbours and other marine works are mostly sited, are the situations peculiar to dredging operations. Sand and mud are the most common materials met with in dredging, forming the bulk of obstruction to navigation and of accumulations in and about harbours and river channels. Materials other than sand and mud are more difficult to dredge. Clay and loam are classed as loose materials but can scarcely be regarded as "free-getting" as they may be somewhat difficult to dislodge from the apparatus when being discharged. Further along the scale of compactness comes a wide and rather indefinite class of mixtures of loam and boulders in various degrees of cementation. They are resistant to penetration and cause difficulty owing to size of the boulders. Gravel is often found in dense layers strongly compacted with sand, and this together with indurated sand, is difficult to disintegrate, but once penetrated removal is comparatively easy. Conglomerates, consisting of pebbles held together by natural forms of cement, and solid rock will require either the application of excessive power in the dredging tool or previous disintegration by percussion or blasting, with subsequent dredging of the débris.



DIAGRAMS SHOWING DREDGERS IN ACTION AND METHODS OF OPERATION

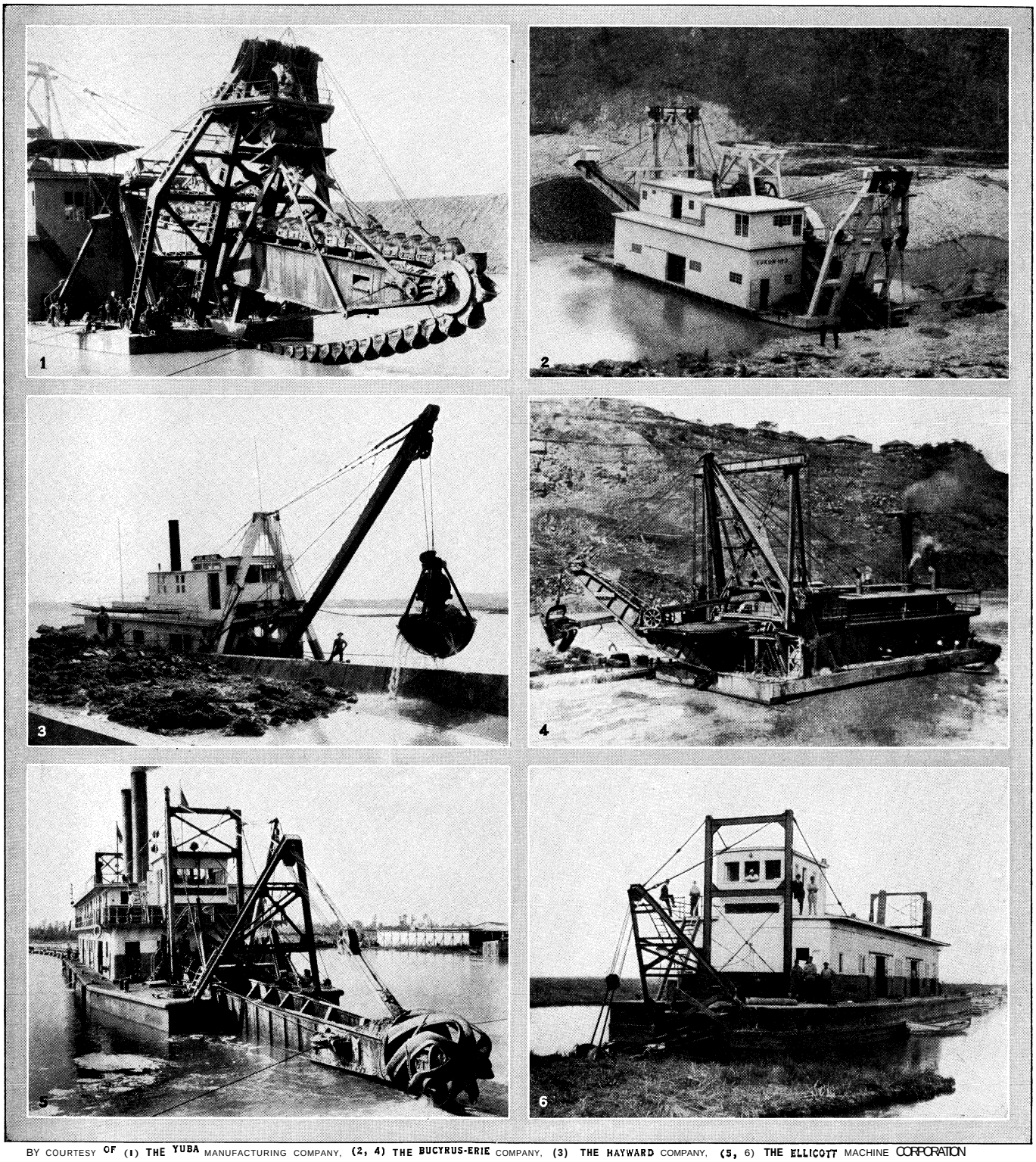
Fig. 1.—Action of Bucket Ladder Hopper Dredger. Fig. 2.—Action of Suction Dredger. Fig. 3.—Action of Dipper Dredger. Fig. 4.—Mining Dredger for the recovery of tin. Fig. 5.—Moorings arranged for dredging a given area at one setting. Fig. 6.—Method of dredging on the "Walking Spud" system

Classification of Dredging Plant.—Dredgers fall into two main classifications according to the conditions under which they operate, viz., sea-going vessels and vessels for inland water service. The former are generally ship-shape vessels constructed as far as possible in the accepted manner for withstanding sea conditions and ocean voyages, and carrying their own propelling machinery. The latter class is of lighter construction partaking more of the box or pontoon form and generally lacking propelling machinery. There are, of course, intermediate types, and in general it may be said that dredging vessels of whatever type require to be more strongly constructed to withstand the working stresses to which they are subject than vessels for commercial purposes. Mining dredgers as a class are of the inland type. A further classification is possible according to the system on which they dispose of the dredged materials. "Stationary" dredgers discharge their spoil into barges brought alongside, or to river banks or shore either directly or through long shoots or pipes. "Hopper" dredgers receive the spoil into a specially formed hold or hopper in the hull of the dredger and, when full, proceed to sea or other convenient site to "dump" their load. The inland dredger class as a whole is of the stationary type, but sea-going dredgers are of either type according to the particular requirements of the work and situation; and not infrequently hopper dredgers include arrangements which make them capable of working on either system.

Basic Types of Plant.—The basic types of dredging machine are the bucket ladder dredger, the suction or hydraulic dredger, the dipper dredger and the grab dredger. In addition, dredging often necessitates the employment of a variety of auxiliary plants, and there are a number of appliances which, although not falling strictly within the definition of a dredger, in that they do no more than loosen without raising the spoil to the surface, yet serve to carry out in some measure with the help of moving water, the work of dredging.

The Ladder Dredger.—The main feature of the ladder dredger is a continuous chain of buckets running round a rigid frame called the ladder extending down from the ship to the bottom of the water, as shown in fig. 1. The buckets run empty down the underside of the ladder, dig into the material as they turn round the end, and return full along the top side of the ladder. On reaching the top each bucket, as it turns over, discharges its contents into a shoot which conveys the spoil to the vessel's own hopper, or to a barge, or in some cases to the shore. The revolving members at each end of the ladder are called tumblers and the top tumbler drives the bucket chain. The ladder of the typical ladder dredger is hinged at the top to a high structure on the vessel, the height of which is regulated by the requirements of the discharging operation, and extends downwards at an angle not exceeding 45° through an open recess or well in the hull, the lower end being supported by rope tackle which serves to adjust it to the dredging depth required or to raise it up entirely when it is desired to steam away.

The Suction Dredger.--On the other hand the suction dredger, shown in fig. 2, depends on quite different agencies for its operation. Whereas the ladder dredger removes and raises the material mechanically, the suction or hydraulic dredger, as its name implies, relies on suction to lift the material to the surface. The device consists essentially of an air-tight suction pipe, one end of which is lowered down to the bed of the sea or river, and the other connected with a centrifugal pump. The



BY COURTESY OF (1) THE YUBA MANUFACTURING COMPANY, (2, 4) THE BUCYRUS-ERIE COMPANY, (3) THE HAYWARD COMPANY, (5, 6) THE ELLICOTT MACHINE CORPORATION

GOLD AND CHANNEL DREDGES AT WORK

1. Digging ladder of a large gold dredge. The steel derrick supports the ladder arm, around which the bucket chain travels. Shell buckets raise the gold-bearing sand of river bed for panning within dredge house. The size of the machine is evident by comparison with the figures at left
2. Gold dredge in Bonanza Creek, Yukon, a forerunner of dredge in fig. 1. Right, bucket chain removing gold-bearing sand from creek bed; centre, power and separating house; left, discharge conveyor dumping gravel
3. Orange-peel dredge dipping up slag from side of pier. In this form of dredge the hoist controls a bucket divided into triangular sections pointed at base. When lowered the bucket is open until it strikes into bed of material, then closed upon the material. The filled bucket is shown being carried over wall of the pier
4. Large dipper dredge at work in the Panama canal. This type of dredge operates like a steam shovel, scooping up material from bed of waterway and depositing it in barge at side. A trap door in the bucket scoop is operated by a chain or rope under the movable arm in the swinging hoist
5. Hydraulic pipe-line dredge, showing arm raised above surface. The spiral dredging head revolves, digging silt which is drawn by suction into pipe located within dredging arm. At left edge of picture may be seen the discharge pipe, leading from dredge to barge or to land
6. Hydraulic dredge driven by Diesel engine used in shallow water. The dredge is shown removing grass-grown bank from river channel. A pipe line may be seen (right) in the rear of the dredge, supported by pontoons reaching the shore

latter comprises a casing within which an impeller or fan is revolved at high speed and by its action expels the contents, whether air or water, outwards from the centre through an outlet on the periphery or rim of the casing, thereby causing a partial vacuum at the centre, to which the suction pipe is attached. The atmospheric pressure on the water outside proceeds to repair this vacuum by forcing water in through the only available route, viz., the suction pipe, and the water in its mad rush into the pipe agitates and carries with it a proportion of solids. In some situations, means are provided at the suction pipe end, or nozzle, of disintegrating or actually cutting the compact materials to enable them to come under the influence of the so-called suction.

The Dipper Dredger.—The dipper and grab dredgers are also of the bucket type, but more intermittent in operation than the ladder dredger. The dipper dredger is illustrated diagrammatically in fig. 3. The principal features of the dipper dredger are the bucket and the arm to which it is attached, the boom which supports and guides the arm and which is mounted on a turntable so that dredging can be undertaken round a wide arc and the load deposited to either side, the hoisting rope which passes over a sheave at the boom head and gives the required excavating movement to the bucket, and the backing rope by means of which the vessel may be turned and moved forward using the bucket resting on the bottom as an anchor. The bucket has a hinged bottom, the catch of which is released by a hand rope to dump the load. To counteract the heavy digging reactions the vessel is made to rest on the bottom partly independent of water support on two anchor spuds, and a guide or poling spud is provided at the stern.

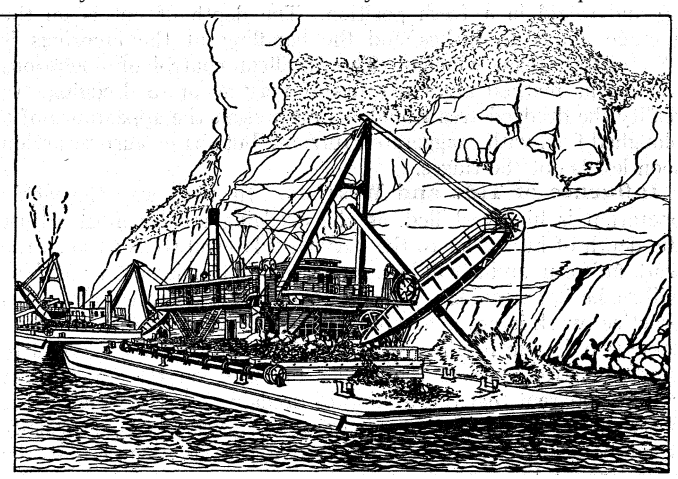
The Grab Dredger.—The grab dredger employs a slewing crane to operate its bucket which latter is in two parts hinged together, and controlled by levers and chains or ropes. The bucket is dropped to the bottom in an open condition by means of one rope, digs in partially by virtue of its own weight, and completes its bite by means of the strong leverage effected by the other rope on the two halves when the crane begins to hoist. By holding on the hoist or "holding" rope and releasing the "closing" rope the bucket opens and discharges its contents. Some grabs are specially arranged to operate with one rope only, discharge being effected by means of a tripping device suspended from the jib head.

Auxiliary Plant and Miscellaneous Appliances.—The auxiliary plant often to be found in connection with dredgers is of two types, one of which is employed before dredging and the other after. Examples of the former are rock-breakers and rock-drillers used to disintegrate rock by hammering or prepare it for blasting so that it may be dredged. The rock-breaker consists of a pointed heavy steel ram which is dropped through a guide repeatedly on the same spot, being raised by means of a rope operated by a special winch. Auxiliary plant used in the disposal of the dredged spoil comprises barges, either self-propelling or with tugs; reclamation vessels for delivering the spoil ashore; pipelines, floating and on shore; and shoots. The miscellaneous appliances comprise snag pullers, grapnels, rakes and harrows, mechanical stirrers, water jets and other devices for placing the material into suspension so that it may be carried away by river flow or by the ebb tide. Being for the most part makeshift devices and not capable of extended applications they do not exhibit any marked degree of development.

The Mining Dredger.—The mining dredger for the recovery of precious metals is generally an adaptation of the Ladder Dredger. It is often to be found at considerable distances from a river, having cut its way through the land and deposited the spoil behind it, in effect carrying with it the pool in which it Aoats. A typical tin dredger is shown in fig. 4. The earth brought up by the buckets is discharged into a perforated cylindrical revolving screen which disintegrates it and allows the heavier tin-laden soil to drop through the perforations into a distributing box, while the large rough materials pass out of the screen and are discharged over the stern by a belt conveyor. The soil from the distributing box, together with an ample supply of water, is led by shoots into pans in which it is agitated by mechanically operated jigs. This operation allows the heavy tin to sink to the bottom of the pans while the lighter soil remains in suspension in the water and passes overboard through a tail shoot. The metal is collected from the pans at intervals.

Prime Movers.—Steam is the universal motive power used on dredging plant, being particularly well adapted to the rough and fluctuating character of the work. Steam plant is comparatively simple and well understood, while its inherent flexibility is an invaluable characteristic for dredging operations, enabling it to accommodate itself conveniently to the constantly varying power requirements and, if need be, to sustain a heavy pressure on the tool when the latter has been brought to a dead stop by the severity of the work. The internal-combustion oil engine is finding some application in situations where economy of space and fuel are vital considerations, but, although suitable for driving centrifugal dredging pumps, is not yet the equal of steam plant for the majority of dredging applications. In general, its lower range of flexibility and inferior capabilities of sustained power at low speeds, together with the high pressures possible, necessitate the introduction of safeguards which operate to reduce the economy and convenience to be expected from its higher thermal efficiency and self-contained character. The diesel-electric drive in which the oil engine operates under favourable conditions as a prime mover for the electric secondary machinery, which drives the various motions, has also been applied and possesses characteristics more suited to many dredging machines than the direct oil engine drive, although with the added cost and complication of electrical equipment. The electric drive pure and simple is in use in the tin-mining areas where many dredgers are suppiied through cables from a central generating station.

Selection of Dredging Plant.—It will be evident that the selection of dredging plant to satisfy the requirements of diiferent localities and different circumstances needs the exercise of sound judgment. The ladder dredger is eminently adapted for dealing up to great depths with all classes of material from mud to the softer varieties of rock, including small boulders, and of preparing a level bottom. Its mechanism tends to make it very heavy and cumbrous, with correspondingly heavy capital cost and upkeep charges. It may, however, be regarded as the universal large dredging tool and is preferred in a great number of cases where accuracy of work in a wide variety of materials is required and



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DIPPER DREDGER AT WORK IN A "SLIDE" IN CULEBRA CUT DURING THE CONSTRUCTION OF THE PANAMA CANAL

it can be kept fully employed, provided its bulk and widespread moorings are not of grave consequence. Seventy feet is the maximum dredging depth in sea works and this the ladder dredger can tackle. Some of the mining dredgers, however, work down to 100 feet and more. In more restricted situations and for less extensive projects the grab dredger will generally prove more economical in first cost and upkeep, and is well suited to maintenance work and work of an intermittent nature or in awkward situations. The dipper dredger is as capable as the ladder dredger of dealing with all classes of materials and as a

tool for really difficult individual tasks at depths up to some 35ft. has no equal, owing to the great force which can be exerted with the cutting edge of its bucket and the large capacity, sometimes up to 15cu.yd., of the latter. The grab dredger is not so powerful but can dredge at great depths exceeding any other type, and is eminently suitable for pioneer inland work. The suction dredger succeeds when large quantities of soft materials have to be dealt with, provided there is no objection to the large admixture of water. Quantity not quality is its leading characteristic, for it effects its object in free-flowing materials by excavating large holes in the bottom. The irregularities are subsequently levelled down by sea or river action, thus effecting an increase in the depth of water. In the more compact sands a series of high-pressure water jets around the nozzle serve to break up the material sufficiently, but in clay and similar substances a rotary cutter is required and serves to increase the accuracy of dredging to as great a degree as any dredger can attain. By reason of the large quantity of water, often 90% of the total volume pumped, the suction dredger is relatively inefficient, but the operation is continuous and has the valuable property of enabling, when required, the spoil to be discharged direct through a pipe system to considerable distances without expensive re-handling. The majority of all types of dredgers have their excavating member so located in advance of the hull that the vessel can cut its own flotation.

Methods of Dredging.— In the case of the bucket dredger practically only one general method of dredging is pursued. The vessel is moored by means of six anchors and chain cables set out as shown diagrammatically in fig. 5. The head and stern moorings are much longer than the side moorings, and the vessel swings to or pivots about the head mooring **A** and is dragged slowly transversely by one pair of side moorings C and D. On reaching the limit of the cut to that side the vessel is advanced about six feet by pulling on the head mooring, the stern line being paid out to correspond, and the vessel is dragged across to the other side of the cut by side moorings E and F, the other side moorings C and D being paid out the while. This operation goes on until the head chain becomes too short and the angles of the side chains tend to become ineffective, when the vessel is pulled back by the stern mooring B to commence a fresh series of cuts at a lower depth or, if the required depth has been reached, dredging is stopped for the time being and the whole of the anchors taken up and relaid in a fresh position. The depth of cut is on the average about 18 inches and the handling of the moorings is effected by steam winches. The excellent control of operations which this method gives permits of very accurate dredging. In reality the dredged area would at first present the appearance of a ploughed field with exaggerated furrows, but sea or current action soon levels out the ridges.

Influence of Tide and Weather.— In a sea-way the whole operation is highly skilled, as the dredging master must adjust the depth of his ladder to the varying tide level so as to keep the work uniform, and it will be appreciated that inclement conditions will make it exceedingly difficult to maintain a level bottom. In practice, work is nat generally permissible when the swell attains some two feet in height, owing to the structure being exposed to immense stresses from the ladder bumping on the bottom. It will be apparent that this system of dredging constitutes a serious obstruction to shipping in a narrow waterway, more especially when barges are employed to remove the spoil, and that the operation of lifting and relaying moorings on a fresh field is a heavy undertaking. **A** hopper dredger will present less of an obstacle but loses, for dredging, the time occupied in transporting the dredgings to the dumping site and returning to its work. When the hopper is full, the three forward chains are coupled together and let go, and similarly with the three stern moorings, the ends being attached to mark buoys. The operation of picking up these moorings again and connecting them to the winches is also one of considerable moment.

Suction Dredging.— The suction dredger operates generally on the same principles as the bucket dredger, but in some cases the six anchor moorings are dispensed with in favour of two "walking" spuds, placed abreast some distance apart at the stern, together with two forward side or "breast" moorings, consisting of wire ropes and anchors. In operation under this system one spud is let down to the bottom to act as an anchor and the forward end with suction pipe is swung by one breast mooring to the limit of the cut. Their relative positioning now brings the other spud in advance of the pivot spud; the former is let down to act as pivot, the latter raised, and the dredger swung on a new advanced arc back to the opposite side of the cut by the other breast mooring. The two spuds thus act as legs and the dredger "walks" forward. Fig. 6 illustrates this method.

Bar Dredging.— A particular case in which a different method is employed is the dredging of a navigable channel through a sand bar blocking a river entrance. Here large quantities require to be removed under arduous open sea conditions, precluding in most cases the employment of such a rigid structure as a bucket ladder, or in some cases even the use of moorings. The suction dredger is eminently adapted to this work as its suction pipe can be made flexibly jointed, thus relieving the ship of any bumping stresses. The dredger simply steams to the dredging position, lowers the suction pipe, maintains position roughly with the propellers, and takes on board into her hopper a load of sand in a comparatively short space of time. The power is arranged so that this operation is generally performed in some 30 to 40 minutes even with the largest hoppers up to 4,000 tons or more capacity. Without further ado the dredger steams out to sea, deposits the load through the doors arranged in the bottom, and returns to carry out the same procedure. In those cases where the sand will not run freely to the suction pipe, the latter requires to be made somewhat more rigid and is fitted with a drag head or cutting edge. The dredger steams slowly ahead, and the drag head slices off the material to a depth of 18 inches or two feet to bring it under the influence of the suction pipe. This is of course a rough operation, as the result is simply the cutting of a series of longitudinal furrows. In such situations the bar is often of sufficient width to permit of a full load being obtained in one cut. The drag method is also employed successfully where the area is large and the depth to be removed small, and it is capable of more accurate work than ordinary suction dredging.

Stationary Dredging.— In the case of the dipper dredger which relies on spuds, no external moorings are necessary. The dredging machinery being arranged on a turntable, cuts are taken round an arc of some go° or more while the vessel remains stationary. The anchor spuds are then lifted and the vessel moved up to suit the next series of cuts by means of the backing rope and the stern spud acting after the manner of a punt pole. The anchor spuds are then re-set and dredging operations continued. **A** development of the suction dredger employs a suction pipe mounted on a turntable after the manner of a dipper dredger, and operates on a similar method, the hull being kept stationary during the progress of each arc of cut either by moorings or by spuds. The grab dredger is another example of this system of operation, but requires some three or four moorings only to retain and adjust its position at its work, the dredging reactions being purely vertical.

Determination of Work Done.—The work done by dredgers is measured either "in the solid" or "in the loose" as the two methods are termed. Measurement in the solid involves the determination by soundings taken before and after dredging of the levels of the excavation. Measurement in the loose is based on a determination of the amount of spoil actually issuing from the dredger, either from the known capacity of the barges or hopper used, or in the case of pipe-line work, by survey of the deposit. Rough and ready methods based on known data are sometimes employed, such as by counting the rate at which the buckets travel on a ladder dredger, the number of dips or grabs per hour, or estimation of the velocity of flow and percentage of solids in a pipeline. Spoil, originally lying closely compacted in its natural state on the bottom, has been dug into, stirred up, and mixed with water by the action of the dredging tool, hence a swelling, generally taken as 30% in the absence of definite data, is observable in "loose" or "barge" measurement, as compared with "solid" or "place" measurernent.

Disposal of Spoil.—The disposal of spoil demands close consideration as it has an important effect on the cost of dredging. Where it is desired simply to get rid of the spoil, as in the improvement and upkeep of navigable channels, it is usually requisite to transport it considerable distances out to sea and deposit it in deep water whence there is little likelihood that it will find its way back under the influence of currents or sea action. For this purpose a fleet of barges, either self-propelled or towed, may be employed or the dredger itself conveys to sea the spoil which it excavates. In each case the hopper bottom is formed of a number of doors which can be opened to allow the spoil to drop out. The conditions determining the method to be adopted vary almost with every project. Obviously it is advisable to keep such an expensive item of plant as a dredger fully employed if at all possible, and the use of hopper dredgers is only resorted to when attendant barge traffic is either impracticable on account of inclement conditions or likely to cause serious additional obstruction to navigation in a busy and restricted waterway. The hopper type is useful also in the smaller sizes for general maintenance work as a self-contained unit. In those cases where the distance to the dumping site does not exceed a mile or two or where the material is required for reclamation purposes, towed barges are used, while for long distances, large speedy self-propelling barges holding up to 1,200 tons are necessary. Large quantities have been dredged from the Suez Canal by high tower ladder dredgers and deposited directly on the banks through long shoots, but this direct method is more generally applicable to the suction dredger for wide waterways and to the dipper or grab dredgers for narrow channels. For the important work of reclaiming land the suction dredger and a long pipe-line are generally employed so long as free-getting materials are to be dealt with. The portion of the pipe-line from the dredger to the shore is made in sections 30 to 50ft. long, flexibly connected together by ball and socket joints so as to permit the dredger its necessary range of movement. Each section of the pipe is carried on a pontoon and the floating pipe-line connects to a shore delivery pipe-line laid directly on the ground or mounted on trestles. If harder materials must necessarily be used or the conditions of exposure or obstruction to navigation preclude the use of a pipe-line, it becomes necessary to employ a fleet consisting of a cutter-suction or ladder dredger and a special reclamation vessel with barges as the connecting links. The reclamation vessel is in most respects equipped like a suction dredger except that its suction pipe is arranged over one side so as to dip into a barge; it is moored to a wharf or staging on the other side and its discharge pipe is flexibly connected direct to the shore pipe-line. By this means low-lying areas situated up to 6,000 feet from the water-front can be reclaimed, and at still further distances by the employment of boosting pumps.

Those desirous of pursuing the subject further will find the following useful:—C. Prelini, *Dredges & Dredging* (1912); T. C. Earl, *Gold Dredging* (1913); Sergeant, *Centrifugal Pumps & Suction Dredgers* (1918); A. B. McDaniel, *Excavation Machinery, Methods & Costs* (1919); F. L. Simon, *Dredging Engineering* (1920); G. B. Massey, *The Engineering of Excavation* (1923); P. M. Dekker, *Dredging & Dredging Appliances* (1927).

The writer is indebted to the many firms in Europe and America who have furnished particulars of plant, of which special mention may be made of the following British constructors: Messrs. Wm. Simons & Co., Ltd., Renfrew; Lobnitz & Co., Ltd., Renfrew; Fleming & Ferguson, Ltd., Paisley; Ferguson Brothers (Port Glasgow), Ltd., Port Glasgow; and Priestman Brothers, Ltd., Hull. A number of the examples have been taken from the writer's own practice. (A. T. C.)

DREISER, THEODORE (1871–), American author, was born at Terre Haute, Ind., on Aug. 27, 1871. He attended the public schools at Warsaw, Ind., and for a brief period Indiana university. He then went into newspaper work in Chicago, St. Louis and Pittsburgh. He began writing for various periodicals, engaged in editorial work, and became in 1907 editor-in-chief of the Butterick publications in New York city. This post he held until 1910. His first novel, *Sister Carrie,* published in 1900, was suppressed, but not before it had aroused the admiration, for its unsparing and poignant realism, of Frank Norris, the noted American realist, and later in England of Arnold Bennett, H. G. Wells and Hugh Walpole. Dreiser's second novel, *Jennie Gerhardt,* did not, however, follow until 1911. It had been written as a relief from editorial work, and its publication found Dreiser now devoting himself entirely to literature. In 1912 he brought out *The Financier,* the first of two books based upon the career of the traction magnate, Charles T. Yerkes. The second, *The Titan,* followed in 1914. In the year between Dreiser published *A Traveller at Forty,* an autobiographical volume, the fruit of a first trip abroad. *The Genius,* in 1915, was a long and detailed study of the ruthless type of artistic temperament. This was followed by Dreiser's first venture into intimate drama, *Plays of the Natural and Supernatural,* and the same year, 1916, brought forth *A Hoosier Holiday,* based upon a revisiting of his native State. Subsequent volumes included *The Hand of the Potter,* a tragedy (1918); *Twelve Men* (1919); *Hey, Rub-a-Dub-Dub* (1920); *A Book about Myself* (1922); *The Color of a Great City* (1923) and *A Gallery of Women* (1929). The publication in 1925 of *An American Tragedy,* based upon an actual American crime, brought Dreiser his first widespread popular recognition. The novel was dramatized by Patrick Kearney, presented by the Theatre Guild, and proved the sensational play of the season.

Theodore Dreiser was in 1929 probably the most important realist writing fiction in the United States, and this, in spite of the fact that he has been called "the most suppressed and insuppressible writer in America," and the more important fact that he can hardly be said to have achieved a style, his writing being often heavy-handed and clumsy. His large attempts, his close attention to detail, the cumulative effect he gains by laborious presentation of the exact truth are qualities that would not in themselves account for the stature he has attained as a novelist. A greater quality than these is to be found in the deep human sympathy underlying his treatment even of the most sordid and sombre human affairs. It goes hand in hand with a sincerity that has never swerved. The manner of Dreiser's writing has been the subject of much criticism from an artistic point of view; but there is general agreement as to the value of his super-reportorial presentation of some of the most significant aspects of modern American civilization. He builds solidly the story, for the most part, of tragic lives, tracing their inevitable course every step of the way and refraining from any comment save that implicit in the lives themselves. He has achieved a remarkable detachment in his writing.

A brother of Theodore Dreiser was the late Paul Dresser, the popular song-writer. A collection of his best songs has recently appeared with an introduction written by Dreiser. Further biographical and bibliographical material upon this novelist may be found in Burton Rascoe's *Theodore Dreiser* (1925), in Bessie Graham's *The Bookman's Manual* (1924) and in H. L. Mencken's *A Book of Prefaces* (1917). (W. R. BE.)

DRELINCOURT, CHARLES (1595–1669), French Protestant divine, born at Sedan on July 10, 1595, became minister of the Reformed Church at Charenton. His *Catechism* (*Catéchisme ou instruction familière*, 1652) and *Christian's Defense against the Fears of Death (Consolations de l'âme fidèle contre les frayeurs de la mort,* 1651) became well known in England by means of translations, which were very frequently reprinted. It has been said that Defoe wrote his fiction of Mrs. Veal (*A True Relation of the Apparition of Mrs. Veal*), who came from the other world to recommend the perusal of *Drelincourt on Death,* for the express purpose of promoting the sale of the English translation of the *Consolations,* to the fourth edition of which (1706) his contribution is added. Drelincourt died on Nov. 3, 1669.

DRENTE (or DRENTHE), a province of Holland, bounded north and northeast by Groningen, southeast by Germany, south and southwest by Overysel, and northwest by Friesland; area, 1,028 sq.mi.; pop. (1938) 245,321. Drente is a sandy plateau forming the nucleus of the surrounding provinces. The sandy soil is covered with bleak moorland, patches of wood, and fen. This is only varied by the strip of fertile clay and grass-land which is found along the river banks, and by the areas of high fen in the southeastern corner and on the western borders near Assen. The surface slopes from southwest to northeast,

where it ends in the ridge the Hondsrug (Dog's Back) along the eastern border. The watershed runs from east to west, along the line of the Orange canal. The southern streams are all collected at two points on the southern borders, namely, at Meppel and Koevorden, whence they communicate with the Zwarte Water and the Vecht respectively by means of the Meppeler Diep and the Koevorden canal. The Steenwyker Aa, however, enters the Zuider Zee independently. The northern rivers all flow into Groningen.

History. — The megalithic sepulchral mounds, the *Hunnebedden,* particularly along the western edge of the Hondsrug suggest the early settlement of the region. In the 5th and 6th centuries the country was overrun by Saxon tribes, and later on was governed by counts under the Frankish and German kings. In 1046 the emperor Henry III. gave the countship to the bishop and chapter of Utrecht, who governed it through the burgrave, or châtelain, of Koevorden, a dignity which became hereditary after 1143 in the family of Ludolf or Roelof, brother of Heribert of Bierum, bishop of Utrecht (1138–1150). After 1232 the countship passed to Henry I. of Borculo (1232–1261). In 1395 Reinald IV. (d. 1410) of Borculo-Koevorden was deposed by Bishop Frederick of Utrecht, and the country was henceforth administered by an episcopal official (amtmann). With its popularly elected assembly of twenty-four Etten (*jurati*) Drente remained practically independent. In 1522 it was conquered by Duke Charles of Gelderland, from whom it was taken by the emperor Charles V. in 1536, and from that time it became part of the Habsburg dominions.

Drente took part in the revolt of the Netherlands, but owing to its poverty and sparse population, it had no separate representation in the assembly of the states general. It was subdued by the Spaniards in 1580, but reconquered by Maurice of Nassau in 1594. Drente retained its local independence and had its own stadtholder. At the general assembly of 1651 Drente unsuccessfully claimed admission as a province. After the deaths of William II. (1650) and of William III. (1702) Drente remained for a time without a stadtholder, but in 1722 William Charles Henry, who had become prince of Orange, was elected. His descendants held the office, which was declared hereditary, until the French conquest in 1795. In 1796 Drente at length obtained representation in the states general. Between 1806 and 1813 Drente, with the rest of the Netherlands, was incorporated in the French empire, and, with part of Groningen, formed the department of Ems Occidental. With the accession of William I. it was restored as a province of the new kingdom. The province was speedily conquered by Germans in invasion of May 1940.

Two industries have for centuries been associated with the barren heaths and sodden fens so usually found together on the sand-grounds, namely, the cultivation of buckwheat and peat-digging. The latter being directed also towards the draining of the land and its subsequent use for cultivation. The soil thus prepared is, however, soon exhausted. Potatoes, rye, oats, beans and peas are cultivated. In connection with the cultivation of potatoes, the by-products (spirits, potato meal, etc.), are important. Furthermore, agriculture is accompanied on the sand-grounds by the rearing of a poor type of sheep and cattle, which assist in fertilizing the soil. The breeding of pigs is also widely practised. Of the fen-colonies in Drente the best known are those of Frederiksoord and Veenhuizen.

Owing to the general condition of poverty which prevailed after the French evacuation early in the 19th century, attention was turned to the unreclaimed heath-lands in the eastern provinces, and the Society of Charity began by establishing the free agricultural colony of Frederiksoord, about 10 m. N. of Meppel. In addition, various industries, such as mat and rope making, and jute, and cotton weaving were introduced. In later times forest culture was added, and the Gerard Adriaan van Swieten schools of forestry, agriculture and horticulture were established. To this colony were added those of Willemsoord and Kolonie VII. in Overysel, and Wilhelminasoord partly in Friesland. The colony of Veenhuizen lies about 7 mi. N.W. of Assen, and was founded by the same society in 1823. In 1859, the Veenhuizen estates were sold to the government.

Owing to its geographical isolation, the development of Drente has remained behind that of the other provinces of the Netherlands, and the character and customs of the people likewise conservative. Assen is the chief town. In the south are Meppel and Koevorden. Hoogeveen, situated between these two, owes its origin to the fen reclamation which was begun here in 1625. Extensive fir woods have been laid out in the neighbourhood. Zuidlaren. at the northern end of the Hondsrug, has an important market. The railway from Amsterdam to Groningen traverses Drente; branch lines connect Meppel with Leeuwarden and Assen with Delfzÿl.

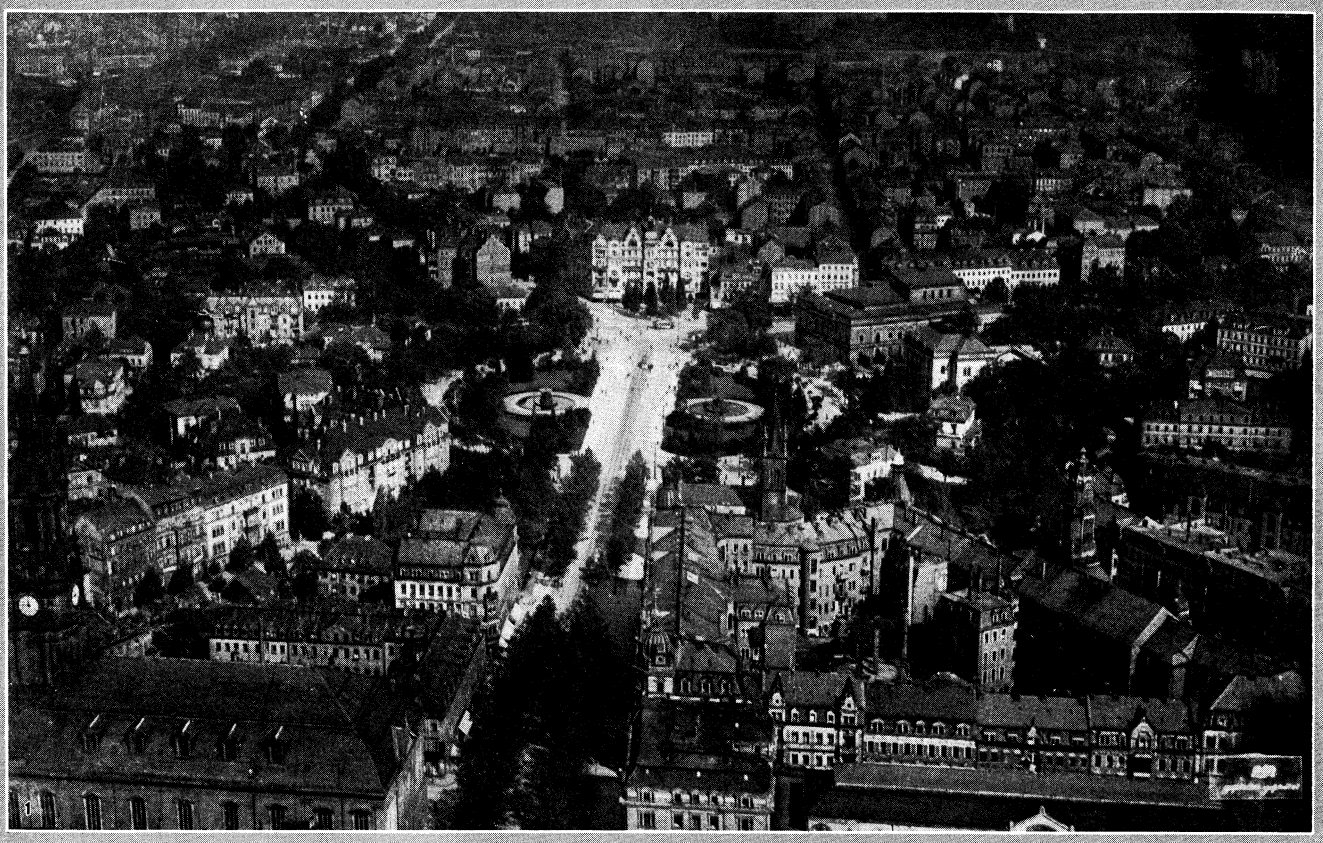
DRESDEN, a city of Germany, capital of the Land of Saxony, 71 mi. E.S.E. from Leipzig and 111 mi. S. from Berlin by railway. Pop. (1939) 625,174, mainly Lutheran. It lies 402 ft. above the Baltic, in a broad valley on both banks of the Elbe. The prospect. of cupolas, towers, spires and copper green roofs is of striking beauty. On the left bank of the river are the Altstadt (old town) with old and new suburbs, and the Friedrichstadt (separated from the Altstadt by a long railway viaduct); on the right, the Neustadt (new town), Antonstadt, and Alberstadt. Five fine bridges connect the Altstadt and Neustadt. The beautiful central bridge — the Alte or Augustusbriicke — with 16 arches, built in 1727–1731, and 1,420 ft. long, has been demolished (1906) and replaced by a wider structure. Up-stream are the two modern Albert and Konigin Carola bridges, and, down-stream, the Marien and the Eisenbahn (railway) bridges.

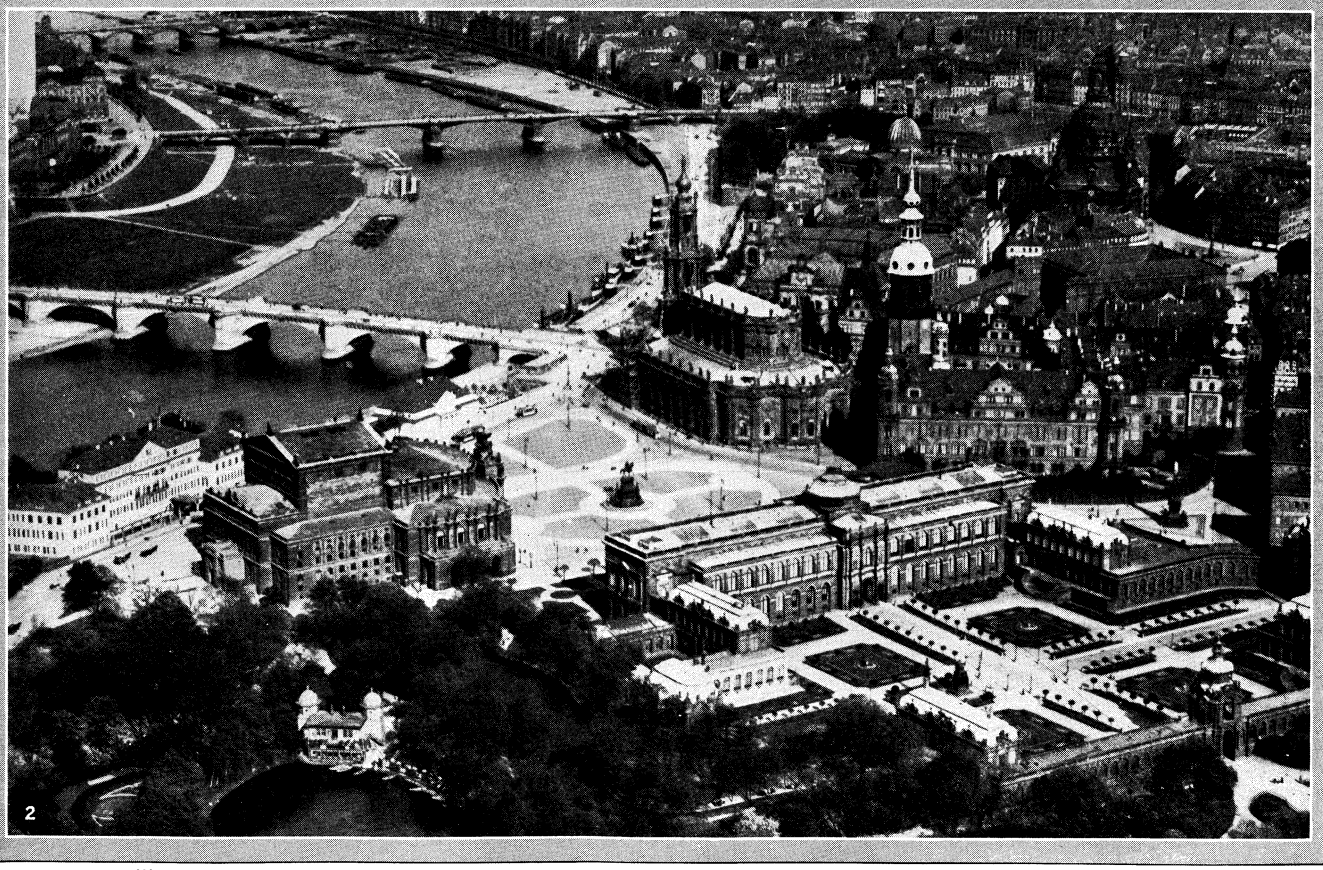
History. — Dresden (Old Slav Drezga, forest, *Drezgajan,* forest-dwellers), which is known to have existed in 1206, is of Slavonic origin, and was originally founded on the right bank of the Elbe, on the site of the present Neustadt, which is thus actually the old town. It became the capital of Henry the Illustrious, margrave of Meissen, in 1270, but belonged for some time after his death, first to Wenceslaus of Bohemia, and next to the margrave of Brandenburg. Early in the 14th century.it was restored to the margrave of Meissen. On the division of Saxony in 1485 it fell to the Albertine line, which has since held it. Having beeh burned almost to the ground in 1491, it was rebuilt; and in the 16th century the fortifications were begun and gradually extended. John George II., in the 17th century, formed the Grosser Garten, and otherwise greatly improved the town; in the first half of the 18th century, Augustus I. and Augustus II., kings of Poland as well as electors of Saxony, modernized Dresden. The Neustadt, which had been burned down in the 17th century, was founded anew by Augustus I.; he also founded Friedrichstadt. The town was bombarded in 1760 during the Seven Years' War. Napoleon made it a centre of operations in 1813, and one buttress and two arches of the old bridge were blown up. The dismantling of the fortifications, begun by the French in 1810, was completed after 1817, and gardens and promenades made. Many buildings were completed or founded by King Anthony, from whom Antonstadt derives its name. Dresden again suffered severely during the revolution of 1849, but all traces of the disturbances which then took place were soon effaced. In 1866 it was occupied by the Prussians, who did not finally evacuate it until the spring of the following year. There was a good deai of fighting in the streets during the year of 1919.

Situation and Buildings. — Dresden is often called "German Florence," because of its situation, its art treasures and the educational advantages it offers. Within two decades (1880–1900) the capital almost at a single bound advanced into the front rank of German commercial and industrial towns; but while gaining in prosperity it lost much of its mediaeval aspect, and old buildings in the heart of the Altstadt were swept away. The Theaterplatz in the Altstadt is especially fine.

The most imposing churches include the Roman Catholic Hofkirche, built (1739–1751) by C. Chiaveri, in rococo style, with a tower 300 ft. high. It contains a fine organ and pictures, the outside being adorned with 59 statues. On the Neumarkt is the Frauenkirche, with stone cupola rising 311 ft.; close to the Altmarkt, the Kreuzkirche, rebuilt after destruction by fire in 1897, also with a lofty tower surmounted by a cupoia; and near the

DRESDEN





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AIR VIEWS OF DRESDEN, SAXONY

1. The city of Dresden, Germany, showing the Albertplatz
2. The centre of Dresden, showing the Elbe River and three of its bridges. The Zwinger, one of the most famous art galleries and museums in the world, with its enclosed court, is in the right foreground. The opera house is to the left. Across the open Theater-Platz is the former court church, and across the narrow street from this the former royal palace

Postplatz the Sophienkirche, with twin spires. In the Neustadt is the Dreikonigskirche (dating from the 18th century) with a high pinnacled tower.

The former royal palace in the Altstadt built in 1530–1535 by Duke George (and thus called Georgenschloss), was thoroughly restored between 1890 and 1902, in German Renaissance style. The Georgentor has been widened, and through it, and beneath the royal apartments, vehicular traffic from the centre of the town is directed to the Augustusbriicke. The whole is surmounted by a lofty tower—387 ft.—the highest in Dresden. The interior is splendidly decorated. In the palace chapel are pictures by Rembrandt, Nicolas Poussin, Guido Reni and Annibale Caracci. The adjoining Prinzen-Palais on the Taschenberg, built in 1715, has a fine chapel, in which are various works of S. Torelli; it has also a library of 20,000 volumes. The Zwinger, begun in 1711 in the rococo style was intended to be the vestibule to a palace, but now contains a number of collections of great value. Until 1846 it was open at the north side; but this space has since been occupied by the museum, a building in Renaissance style, the exterior of which is adorned by statues of Michelangelo, Raphael, Giotto, Dante, Goethe and other artists and poets by Rietschel and Hahnel, and it contains the famous picture gallery. The Briihl palace, built in 1737 by Count Briihl, minister of Augustus II., has been in some measure demolished to make room for the new Standehaus (diet house), with its main façade facing the Hofkirche; before the main entrance there is an equestrian statue (1906) of King Albert. Close by is the Briihl Terrace, approached by a fine flight of steps, on which are groups, by Schilling, representing Morning, Evening, Day and Night. The terrace commands a view of the Elbe and the distant heights of Loschwitz and the Weisser Hirsch, but the prospect has become somewhat marred, owing to the extension of the town up the river and to the two new up-stream bridges. The Japanese palace in the Neustadt, built in 1715 as a summer residence for Augustus II., receives its name from certain oriental figures with which it is decorated; it is sometimes called the Augusteum and contains the library. Among other buildings of note is the Hoftheater, in the Renaissance style, built after the designs of Semper, to replace the theatre burnt in 1869, and completed in 1878. A new town hall of huge dimensions, also in German Renaissance, with an octagon tower 400 ft. in height, stands on the former southern ramparts of the inner town, close to the Kreuzkirche.

In the Altstadt the most striking of the newer edifices is the Kunstakademie. The Albertinum, which was formerly the arsenal, originally built in 1559–1563, was rebuilt 1884–1889, and fitted up as a museum of oriental and classical antiquities, and as the depository of the state archives. On the right bank of the Elbe in Neustadt stand many administrative buildings. In the suburbs which encircle the old town are to be noted the vast central Hauptbahnhof (1893–1898) occupying the site of the old Bohmischer railway station, the municipal hospital and the exhibition buildings.

The chief pleasure-ground of Dresden is the Grosser Garten, in which there are a summer theatre, the Reitschel museum and a château containing a museum of antiquities, chiefly objects removed from the churches in consequence of the Reformation. Near the château is the zoological garden, formed in 1860. A little south of Dresden, on the left bank of the Elbe, is the village Räcknitz, in which is Moreau's monument, erected on the spot where he was mortally wounded in 1813. The mountains of Saxon Switzerland are seen from this neighbourhood, and are much visited in summer.

Art.—Dresden owes part of its fame to its splendid picture gallery, founded by Augustus I, and increased by his successors at great cost. It is in the museum, and contains about 2,500 pictures, being especially rich in specimens of the Italian, Dutch and Flemish schools. The gem of the collection is Raphael's "Madonna di San Sisto," for which a room is set apart. There is also a special room for the "Madonna" of the younger Holbein. Other paintings with which the name of the gallery is generally associated are Correggio's "La Notte" and "Mary Magdalene"; Titian's "Tribute Money" and "Venus"; "The Adoration" by Paul Veronese; Andrea del Sarto's "Abraham's Sacrifice"; Rembrandt's "Portrait of Himself with his Wife sitting on his Knee"; "The Judgment of Paris" and "The Boar Hunt," by Rubens; Van Dyck's "Charles I., his Queen and their Children."

Of modern painters, this magnificent collection contains masterpieces by Tefregger. Vautier, Makart, Munkacsy, Fritz von Uhde, Bocklin, Hans Thoma; portraits by Leon Pohle, Delaroche and Sargent; landscapes by Andreas and Oswald Achenbach and allegorical works by Sascha Schneider. In separate compartments there are a number of crayon portraits, most of them by Rosalba Carriera, and views of Dresden by Canaletto and other artists. Besides the picture gallery the museum includes a magnificent collection of engravings and drawings, arranged so as to mark the great epochs in the history of art. A collection of casts, likewise in the museum, is designed to display the progress of plastic art from the time of the Egyptians and Assyrians to modern ages. This collection was begun by Raphael Mengs, who secured casts of the most valuable antiques in Italy, some of which no longer exist.

The Japanese palace contains a large public library with about 3,000 mss. and 20,000 maps. It is especially rich in the ancient classics, and in works bearing on literary history and the history of Germany, Poland and France. There are also a valuable cabinet of coins and a collection of ancient works of art. A collection of porcelain in the "Museum Johanneum" (which once contained the picture gallery) is made up of specimens of Chinese, Japanese, East Indian, Sbvres and Meissen manufacture, carefully arranged in chronological order. There is in the same building an excellent historical museum. In the Griines Gewolbe (Green Vault) of the Royal Palace, so called from the character of its original decorations, there is an unequalled collection of precious stones, pearls and works of art in gold, silver, amber and ivory. The objects, which are about 3,000 in number, are arranged in eight rooms. They include the regalia of Augustus II. as king of Poland; the electoral sword of Saxony; a group by Dinglinger, in gold and enamel, representing the court of the grand mogul Aurungzebe, and consisting of 132 figures upon a plate of silver 4 ft. 4 in. square; the largest onyx known, $6\frac{2}{3}$ in. by $2\frac{1}{4}$ in.; a pearl representing the dwarf of Charles II. of Spain; and a green brilliant weighing 40 carats. The royal palace also has a gallery of arms consisting of more than 2,000 weapons of artistic or historical value. In the Zwinger are the zoological and mineralogical museums and a collection of instruments used in mathematical and physical science. The Korner museum contains numerous reminiscences of the Goethe-Schiller epoch, and of the wars of liberation (1813–15).

Education.—Dresden is the seat of a number of well-known scientific associations. The educational institutions are numerous. including a technical high school (with about 1,100 students), which enjoys the privilege of conferring the degrees of doctor of engineering, doctor of technical sciences, etc., a veterinary college, a political-economic institution (Gehestiftung), with library, a school of architects, a royal and four municipal gymnasia, numerous lower grade and popular schools, the royal conservatorium for music and drama, and a celebrated academy of painting.

Music.—The orchestra attached to the *Hoftheater,* founded by Augustus II, became famous throughout the world, owing to its masters, Paer, Weber, Reissiger and Wagner. Symphony and popular concerts are held throughout the year in various public halls, and, during the winter, concerts of church music are frequently given in the churches.

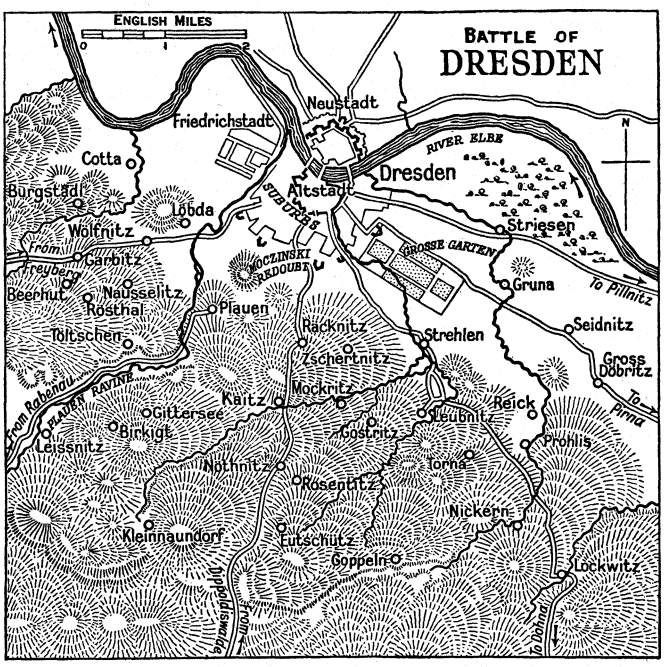
Communications and Industries.—Dresden lies at the centre of an extensive railway system, which places it in communication with the chief cities of northern and central Germany as well as with the southeast. Here cross the grand trunk lines Berlin-Vienna. Chemnitz-Gorlitz-Breslau. It is connected by two lines of railway with Leipzig and by local lines with neighbouring smaller towns. The navigation on the Elbe has largely developed, and, in addition to trade by river with Bohemia and Magdeburg-Hamburg, there is a considerable pleasure-boat traffic during the summer months. Among the more notable industries of Dresden may be mentioned the manufacture of china, of gold and silver ornaments, cigarettes, chocolate, coloured postcards, per-

fumery, leather, lace, soap, straw-plaiting, artificial flowers, agricultural machinery, paper, musical, photographic and other instruments. There are several distilleries and breweries; corn trade is carried on, and an extensive business is done in books and objects of art.

See Lindau, *Geschichte der Haupt- und Residenzstadt Dresden* (2 vols., Dresden, 1884–85); Prolss, *Geschichte des Hoftheaters in Dresden* (Dresden, 1877); Schumann, *Führer durch die Konigl. Sammlungen zu Dresden* (1903); Woerl, *Fuhrer durch Dresden;* Daniel, *Deutschland* (1894); Mary Endell, *Dresden: History, Stage, Gallery* (Dresden, 1908); S. Ruge, *Dresden und die Sachsische Schweiz* (Bielefeld [171 p.], 1913); O. Trautman, Aitendresden, *Neues Archiv für Sächsische Geschichte und Altertumskunde,* Bd. 46, p. 78–94 (Dresden, 1925); O. E. Schmidt, "Die Besiedlung des sachsischen Elbkessels und die Anfänge von Dresden," *Neues Archiv fur sächsische Geschichte und Altertumskunde,* Bd. 48, p. 31–60 (Dresden, 1927).

BATTLE OF DRESDEN

The battle of Dresden, the last of the great victories of Napoleon, was fought on Aug. 26 and 27, 1813. The intervention of Austria in the War of Liberation, and the consequent advance of the Allies under the Austrian field-marshal Prince Schwarzenberg from Prague upon Dresden, recalled Napoleon from Silesia, where he was engaged against the Prussians and Russians under Blucher. Only by a narrow margin of time, indeed, was he able to bring back sufficient troops for the first day's battle. He detached a column under Vandamme to the mountains to interpose between Schwarzenberg and Prague (see NAPOLEONIC CAMPAIGNS); the rest of the army pressed on by forced marches for Dresden, around which a position for the whole army had been chosen and fortified, though at the moment this was held by less than 20,000 men under Gouvion St. Cyr, who retired thither from the mountains, leaving a garrison in Königstein, and had repeatedly sent reports to the emperor as to the allied masses gathering to the southward. The battle of the first day began late in the afternoon, for Schwarzenberg waited as long as possible for the corps of Klenau, which formed his extreme left wing on the Freiberg road. At last, about 6 P.M. he decided to wait no longer, and six heavy columns of attack advanced against the suburbs defended by St. Cyr and now also by the leading troops of the main army. Three hundred guns covered the assault, and Dresden was set on fire in places by the cannonade, while the French columns marched unceasingly over the bridges and through the Altstadt. On the right the Russians under Wittgenstein advanced from Striesen, the Prussians under Kleist through the Grosse Garten, whilst Prussians under Prince Augustus and Austrians under Colloredo moved upon the Moczinski redoubt, which was the scene of the most desperate fighting, and was repeatedly taken and retaken. The attack to the westward was carried out by the other Austrian corps; Klenau, however, was still far distant. In the end, the French defences remained unshaken. Ney led a counter-attack against the Allies' left, the Moczinski redoubt was definitely recaptured from Colloredo, and the Prussians were driven out of the Grosse Garten. The *coup* of the Allies had failed, for every hour saw the arrival of fresh forces on the side of Napoleon, and at length the Austrian leader drew off his men to the heights again. He was prepared to fight another battle on the morrow—indeed he could scarcely have avoided it had he wished to do so, for behind him lay the mountain defiles, towards which Vandamme was marching with all speed.



BATTLE OF DRESDEN, LAST OF NAPOLEON'S GREAT VICTORIES. AUG. 1813
On Aug. 27, Napoleon launched his army of 97,000 men against both flanks of the Allies, composed of 200,000 Austrians, Russians and Prussians. Murat's cavalry and Victor's infantry annihilated the Austrian divisions under General Metzko, at Wölfnitz and Lobda, while Ney's columns, on the left, drove the Russians from Seidnitz, Gross Dobritz and Reick. The Allies retreated, having lost 38,000 killed, wounded and prisoners. French losses were 10,000

Napoleon's plan for the 27th was, as usual, simple in its outline. As at Friedland, a ravine separated a part of the hostile line of battle from the rest. The villages west of the Plauen ravine and even Lobda were occupied in the early morning by Gen. Metzko with the leading division of Klenau's corps from Freiberg, and upon Metzko Napoleon intended first to throw the weight of his attack, giving to Victor's infantry and the cavalry of Murat the task of overwhelming the isolated Austrians. The centre, aided by the defences of the Dresden suburbs, could hold its own, as the events of the 26th had shown; the left, now under Ney, with whom served Kellermann's cavalry and the Young Guard, was to attack Wittgenstein's Russians on the Pirna road. Thus, for once, Napoleon decided to attack both flanks of the enemy. His motives in so doing have been much discussed by the critics; Vandamme's movements, it may be suggested, contributed to the French emperor's plan, which if carried out would open the Pirna road. Still, the left attack may have had a purely tactical object, for in that quarter was the main body of the Prussians and Russians, and Napoleon's method was always to concentrate the fury of the attack on the heaviest masses of the enemy, *i.e.,* the best target for his own artillery. A very heavy rainstorm during the night seriously affected the movements of troops on the following day, but all to Napoleon's advantage, for his more mobile artillery, reinforced by every horse available in and about Dresden, was still able to move where the Allied guns sank in mud. Further, if the cavalry had to walk, or at most trot, through the fields the opposing infantry was almost always unable to fire their muskets. "You cannot fire; surrender," said Murat to an Austrian battalion in the battle. "Never," they replied; "you cannot charge us." On the appearance of Murat's horse artillery, however, they had to surrender at once. Under such conditions, Metzko, unsupported either by Klenau or the main army beyond the ravine, was an easy victim. Victor from Lobda drove in the advanced posts and assaulted the line of villages Wolfnitz-Toltschen; Metzko had to retire to the higher ground south-west of the first line, and Murat, with an overwhelming cavalry force from Cotta and Burgstadl, outflanked his left, broke up whole battalions, and finally, in conjunction with the renewed frontal attack of Victor's infantry, annihilated the division. The Austrian corps of Gyulai arrived too late to save it.

Meanwhile Ney on the other flank, with his left on the Pillnitz road and his right on the Grosse Garten, had opened his attack. The Russians offered a strenuous resistance, defending Seidnitz, Gross Dobritz and Reick with their usual steadiness, and Ney was so far advanced that several generals at the Allied headquarters suggested a counter-attack of the centre by way of Strehlen, so as to cut off the French left from Dresden. This plan was adopted, but, owing to various misunderstandings, failed of execution. Thus the Allied centre remained inactive all day, cannonaded by the Dresden redoubts. One incident only, but that of great importance, took place here. The tsar, the king of Prussia, Schwarzenberg and a very large headquarter staff watched the fighting from a hill near Räcknitz and offered an easy mark to the French guns. In default of formed bodies to fire at, the latter had for a moment

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COSTUMES OF ASIA AND THE MEDITERRANEAN

First Row: Egyptian (18th dynasty); Assyrian (about 1100 to 650 B.C.); Byzantine (about A.D. 600); Greek Athlete (fifth century B.C.); Greek Lady (third century B.C.); Roman (time of Trajan AD. 53–117)

Second Row: Byzantine (about A.D. 1100); Persian Man (about A.D. 1530); Tatar Noble (14th century); Mongolian (19th century); Chinese (Ming dynasty A.D. 1368–1644)

Third Row: Russian Noble (17th century); Javanese Dancer (18th century); Rajput Lady (15th century); Japanese Lady (18th century); Japanese Noble (17th century ceremonial court costume)

ceased fire; Napoleon, riding by, half carelessly told them to reopen, and one of their first shots, directed at 2,000 yards range against the mass of officers on the sky-line, mortally wounded Gen. Moreau, who was standing by the emperor Alexander. A council of war followed. The tsar was for continuing the fight; Schwarzenberg, however, knowing the exhaustion of his troops decided to retreat. As at Bautzen, the French cavalry was unable to make any effective pursuit.

DRESDNER BANK, German Bank was established in Dresden in **1872** by a founders' syndicate headed by Consul Eugen Gutmann taking over the banking house of M. Kaskel in Dresden.

The Office in Berlin, which is now the head office of the bank, was established in **1881.** The bank disposed in **1928** of a capital (including open reserves) of **132** millions of Reichsmarks. It is one of the group of leading German banks, known as the "D-Banks," because their names begin with D.

Besides branches in about 80 places throughout Germany the *Dresdner Bank* maintains branches at Danzig, Bucharest and at three places in Poland. The bank has further an agency at Amsterdam and a special representative in New York. The *Deutsch-Südamerikanische Bank* (*Banco Germanico de la America del Sud)* and the *Deutsche Orientbank* are affiliated institutions of the *Dresdner Bank.* Through its Board of General Managers, the *Dresdner Bank* is represented on the Boards of Administration of most of the important German industrial and commercial concerns with which it maintains very close business relations.

The bank undertakes every kind of banking business both in Germany and foreign countries. It opens current, checking and deposit accounts, executes orders for the purchase and sale of shares and bonds at any Stock Exchange; grants covered and clean credits; receives securities for safe custody; opens commercial credits and issues travellers' letters of credit; provides facilities for every description of oversea-business; advises as to trade openings in all parts of the world; furnishes credit information; forms syndicates and issues or negotiates loans for corporations, municipalities and countries. In fact the bank is concerned with all branches of modern banking organization and is equipped to deal with every banking service.

It is particularly well equipped for transactions in foreign exchange, by reason of the large number of its foreign correspondents. (C. HR.)

DRESS (from the Fr. *dresser,* to set out, arrange, formed from Lat. *directus,* arranged, *dirigere,* to direct, arrange), a substantive of which the most usual meaning is that of clothing or costume in general, or, specifically, the principal outer garment worn by a woman. The verb "to dress" has various applications which can be deduced from its original meaning. It is thus used not only of the putting on of clothing, but of the preparing and finishing of leather, the preparation of food for eating, the application of cleansing and healing substances or of bandages, to a wound, the drawing up in a correct line of a body of troops, and, generally, adorning or decking out, as of a ship with flags. In the language of the theatre the "dresser" is the person who looks after the actor's wardrobe and assists him in the changing of his costumes.

INTRODUCTION

The subject of dress in its currently accepted meaning of clothing is of far wider application than appears at first sight. To the average man there is a distinction between clothing and ornament, the first being regarded as that covering which satisfies the claims of modesty, the second as those appendages which satisfy the aesthetic sense. This distinction, however, does not exist for science, and indeed the first definition involves a fallacy of which it will be as well to dispose forthwith.

Modesty is not innate in man, and its conventional nature is easily seen from a consideration of the different ideas held by different races on this subject. With Mahommedan peoples it is sufficient for a woman to cover her face; the Chinese women would think it extremely indecent to show their artificially compressed feet, and it is even improper to mention them to a woman; in Sumatra and Celebes the wild tribes consider the exposure of the knee immodest; in central Asia the finger-tips, and in Samoa the navel are similarly regarded. In Tahiti and Tonga clothing might be discarded without offence, provided the individual were tattooed; and among the Caribs a woman might leave the hut without her girdle but not unpainted. Similarly, in Alaska, women felt great shame when seen without the plugs they carried in their lips. Europeans are considered indelicate in many ways by other races, and a remark of Peschel is to the point: "Were a pious Mussulman of Ferghana to be present at our balls and see the bare shoulders of our wives and daughters, and the semi-embraces of our round dances, he would silently wonder at the long-suffering of Allah who had not long ago poured fire and brimstone on this sinful and shameless generation." Another point of interest lies in the difference of outlook with which nudity is regarded by the English and Japanese. Among the latter it has been common for the sexes to take baths together without clothing, while in England mixed bathing, even in full costume, is even now by no means universal. Yet in England the representation of the nude in art meets with no reproach, though considered improper by the Japanese. Even more striking is the fact that in civilized countries what is permitted at certain times is forbidden at others; a woman will expose far more of her person at night, in the ballroom or theatre, than would be considered seemly by day in the street; and a bathing costume which would be thought modest on the beach would meet with reprobation in a town.

Modesty therefore is highly conventional, and to discover its origin the most primitive tribes must be observed. Among these, in Africa, South America, Australia and so forth, where clothing is at a minimum, the men are always more elaborately ornamented than the women. At the same time it is noticeable that no cases of spinsterhood are found; celibacy, rare as it is, is confined to the male sex. It is reasonable, therefore, to conclude that ornament is a stimulus to sexual selection, and this conclusion is enforced by the fact that among many comparatively nude peoples clothing is assumed at certain dances which have as their confessed object the excitation of the passions of the opposite sex. Many forms of clothing, moreover, seem to call attention to those parts of the body of which, under the conditions of Western civilization at the present day, it aims at the concealment; certain articles of dress worn by the New Hebrideans, the Zulu-Xosa tribes, certain tribes of Brazil and others, are cases in point. Clothing, moreover—and this is true also of the present day—almost always tends to accentuate rather than to conceal the difference between the sexes. Looking at the question then from the point of view of sexual selection it would seem that a stage in the progress of human society is marked by the discovery that concealment affords a greater stimulus than revelation; that the fact is true is obvious,--even to modern eyes a figure partially clad appears far more indecent than a nude. That the stimulus is real is seen in the fact that among nude races flagrant immorality is far less common than among the more clothed; the contrast between the Polynesians and Melanesians, living as neighbours under similar conditions, is striking evidence on this point. Later, when the novelty of clothing has spent its force, the stimulus is supplied by nudity complete or partial.

One more point must be considered: there is the evidence of competent observers to show that members of a tribe'accustomed to nudity, when made to assume clothing for the first time, exhibit as much confusion as would a European compelled to strip in public. This fact, considered together with what has been said above, compels the conclusion that modesty is a feeling merely of acute self-consciousness due to appearing unusual, and is the result of clothing rather than the cause. In the words of Westermarck: "The facts appear to prove that the feeling of shame, far from being the cause of man's covering his body, is, on the contrary, a result of this custom; and that the covering, if not used as a protection from the climate, owes its origin, at least in a great many cases, to the desire of men and women to make themselves mutually attractive."

PRIMITIVE DRESS

Primitive adornment in its earliest stages may be divided into

three classes; first the moulding of the body itself to certain local standards of beauty. In this category may be placed head-deformation, which reached its extreme development among the Indians of North-West America and the ancient Peruvians; foot-constriction as practised by the Chinese; tooth-chipping among many African tribes; and waist-compression common in Europe at the present day. Many forms of deformation, it may be remarked in passing, emphasize some natural physical characteristic of the people who practise them. Secondly, the application of extraneous matter to the body, as painting and tattooing, and the raising of ornamental scars often by the introduction of foreign matter into flesh-wounds (this practice belongs partly to the first category also). Thirdly, the suspension of foreign bodies from, or their attachment to, convenient portions of the body. This category, by far the largest, includes ear-, nose- and lip-ornaments, head-dresses, necklets, armlets, wristlets, leglets, anklets, finger- and toe-rings and girdles. The last are important, as it is from the waist-ornament chiefly that what is commonly considered clothing at the present day has been developed.

Setting aside for the moment the less important, historically, of these, nearly all of which exist in Western civilization of the present day, it will be as well to consider that form of dress which is marked by the greatest evolution. It is generally supposed that man originated in tropical or subtropical latitudes, and spread gradually towards the poles. Naturally, as the temperature became lower, a new function was gradually acquired by his clothing, that of protecting the body of the wearer. Climate then is one of the forces which play an important part in the evolution of dress; at the same time care must be taken not to attribute too much influence to it. It must be remembered that the Arabs, who inhabit an extremely hot country, are very fully clothed, while the Fuegians at the extremity of Cape Horn, exposed to all the rigours of an antarctic climate, have, as sole protection, a skin attached to the body by cords.

Dr. C. H. Stratz divides clothing climatically into two classes: tropical, which is based on the girdle (or, when the attachment is fastened round the neck, the cloak), and the arctic, based on the trouser. This classification is ingenious and convenient as far as it goes, but it seems probable that the trouser, which also has the waist as its point of attachment, may itself be a further development of the girdle. Certainly, however, in historical times the division holds good, and it is worthy of remark that one of the points about the northern barbarians which struck the ancient Greeks and Romans most forcibly was the fact that they wore trousers. Amongst the most northerly races the latter garb is worn by both sexes alike; farther south by the men, the women retaining the tropical form; farther south still the latter reigns supreme. No distinct latitude can be assigned as a boundary between the two forms, from the simple fact that where migration in comparatively recent times has taken place a natural conservatism has prevented the more familiar garb from being discarded; at the same time the two forms can often be seen within the limits of the same country; as, for instance, in China, where the women of Shanghai commonly wear trousers, those of Hong-Kong skirts. The retention by women in Europe of the tropical garb can be explained by the fact that her sphere has been mainly confined to the house, and her life has been less active than that of man; consequently the adoption of the arctic dress has been in her case less necessary. But it is noticeable that where women engage in occupations of a more than usually strenuous nature, they frequently don male costume while at their work; as, for instance, women who work in mines (Belgium) and who tend cattle (Switzerland, Tirol). The retention of the tropical pattern by the Highlanders is due directly to environment, since the kilt is better suited than trousers for walking over wet heather.

Another factor besides climate which has exerted a powerful influence on dress—more perhaps on what is commonly regarded as "jewellery" as distinct from "clothing"—is superstition. Doubtless many of the smaller objects with which primitive man adorned himself, especially trophies from the animal world, were supposed to exert some beneficial or protective influence on the wearer, or to produce in him the distinguishing characteristics attributed to the object, or to the whole of which the object was a part. Such objects might be imitated in other materials and by successive copying lose their identity, or their first meaning might be otherwise forgotten, and they would ultimately exercise a purely decorative function. Though this factor may be responsible for much, or even the greater part, of primitive "jewellery," yet it does not seem likely that it is the cause of all forms of ornament; much must be attributed to the desire to satisfy an innate aesthetic sense, which is seen in children and of which some glimmerings appear among the lower animals also.

See E. Westermarck, *The History of Human Marriage* (London, 1901); Racinet, *Le Costume historique* (Paris, 1888); C. H. Stratz, *Frauenkleidung* (Stuttgart). (T. A. J.)

BABYLONIAN AND ASSYRIAN COSTUME

c. 3000–2000 **B.C.**—In Sumerian days (3000–2000 B.C.) Babylonian men wore a fringed garment of wool, known to us generally by the name of the kaunakes (a graecized form of the classical period): the wool seems to have been unspun, and probably the garment consisted merely of natural locks without the hide. It has been conjectured that kaunakes of feathers were also worn. One shoulder was generally covered by this garment, the other left bare, but a long and heavy cloak, open in front, was often worn. The feet were bare. Men and women both wore their hair equally long. Men dressed it in a catogan or chignon at the back, often with the addition of two plaited tails crossed at the back beneath the chignon and with their ends fastened over the forehead. Women had rather more elaborate chignons, sometimes three, one at the back and two at the sides. Priests had their heads shaven and performed certain rites stark naked, as also did the kings and great men, who on these occasions wore their hair down their backs. Beards were occasionally worn. Large hats with brims indicated a mark of dignity, and were worn by gods and kings. Gods had them adorned with horns. Later on we find the kings and important personages wearing a turban consisting of a round cap with a thick band around it. A tunic, sometimes sleeved, and long robes also came in. Warriors wore conical copper helmets, like the mediaeval bassinet, and carried shields and spears; a king could wear a gold helmet made in imitation of his own headdress (tomb at Ur) and use golden swords and javelins. Copper breast-plates may also have been used. Feet were generally bare; but in later days in Assyria sandals and elaborate high boots were worn. A cylinder-seal of stone was carried, fastened to a great pin with lapis lazuli and round gold head, and used to fasten the garment. It was also used as a stiletto, if needed. Large-knobbed walking-sticks were always carried. Herodotus correctly describes the seal and stick carried by every Babylonian. Daggers had often gold and lapis hilts, sometimes even gold blades in early times. In later days the well-known Assyrian "Tiara" with its spike was worn by the kings; the bull-horn headdress was given to gods. The heavily ornamented robes of the Assyrian period are well-known; the enormous earrings and necklaces, the elaborately curled hair and beards of the Assyrian have been familiar to us since the days of Layard. The war-gear of the later period shows, of course, the development from copper to bronze and then to iron weapons, the helmet taking the characteristic Assyrian peaked form, and in the 7th century it is crowned with the Graeco-Carian crest, adopted from the West. Great round shields were carried and hauberks worn of metal plates or scales sewn on leather.

We have so few representations of Babylonian or Assyrian women, other than goddesses (who wear long flounced robes) that it is almost impossible to say much of their costume. In the early period one sees them wearing a modification of the men's kaunakes, with hair rather more elaborately dressed than the men's (see above) and ornamented with nodding balls or flowers of gold and lapos on a comb-like ornament that was stuck into the catogan with a sharp-ended shank. Later on they wore a shapeless robe, with the hair usually "down." Assyrian women wore earrings of great length and weight like the men's, and other adornments like theirs. The Ur excavations have shown that the Sumerian women of 2,000 years before already used "vanity-cases" of gold, with tweezers, earpick and head-scratcher complete.

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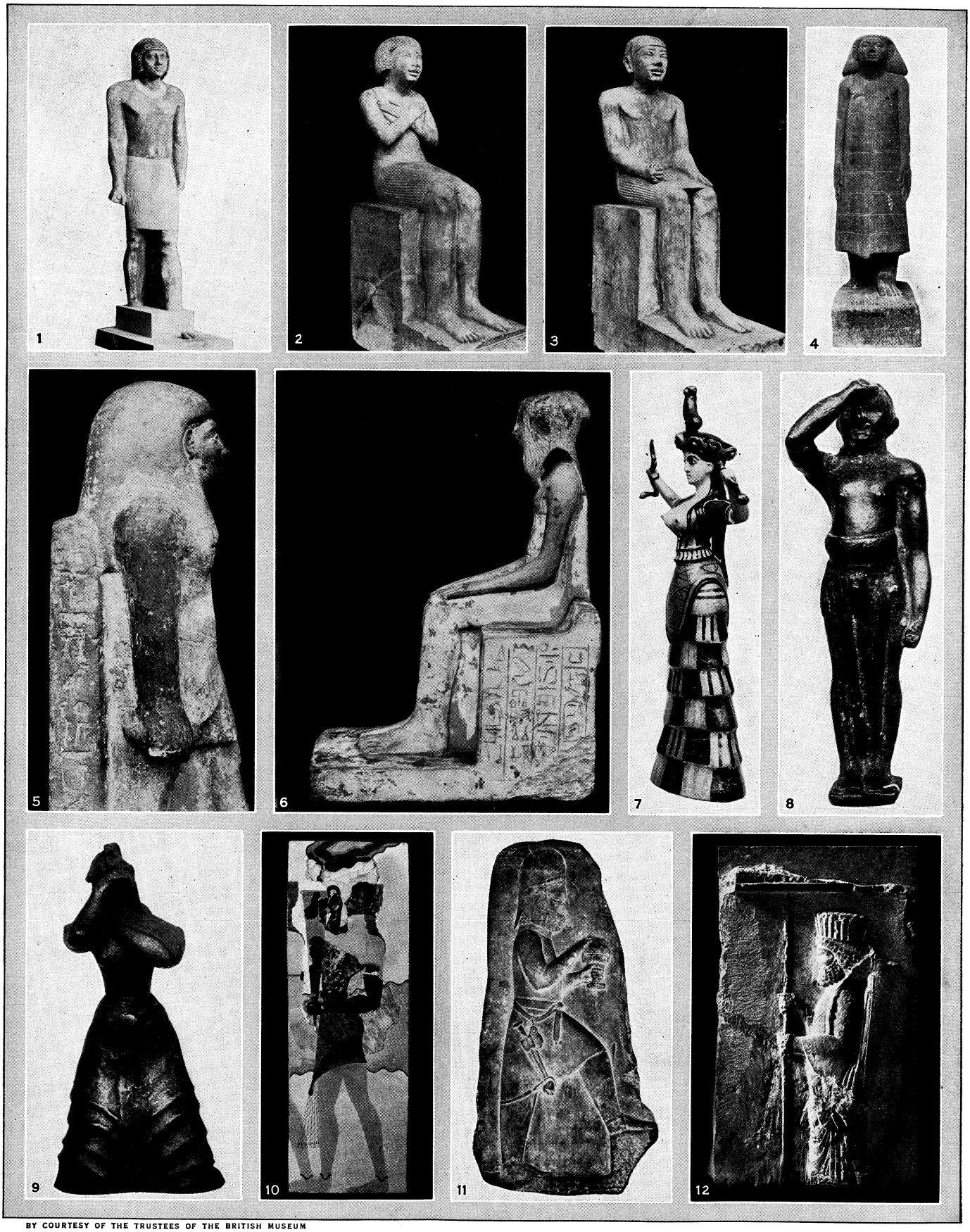
EUROPEAN COSTUMES FROM THE FIFTEENTH TO THE EIGHTEENTH CENTURY

First Row: Italian Renaissance Gentleman and Lady (15th century); Spanish Lady and Gentleman (17th century, late 16th century)

Second Row: German Warrior and Lady (16th century); French Gentleman (Time of Louis XIV) 1638–1715: French Lady (Time of Louis XV) 1710–1774; French Lady (Time of Louis XVI) 1754–1793; French Lady (Time of the Empire of Napoleon I) 1804–1815

Third Row: English Puritan (17th century); English Cavalier (17th century); English Lady (16th century); English Lady (18th century); American Colonial (18th century)

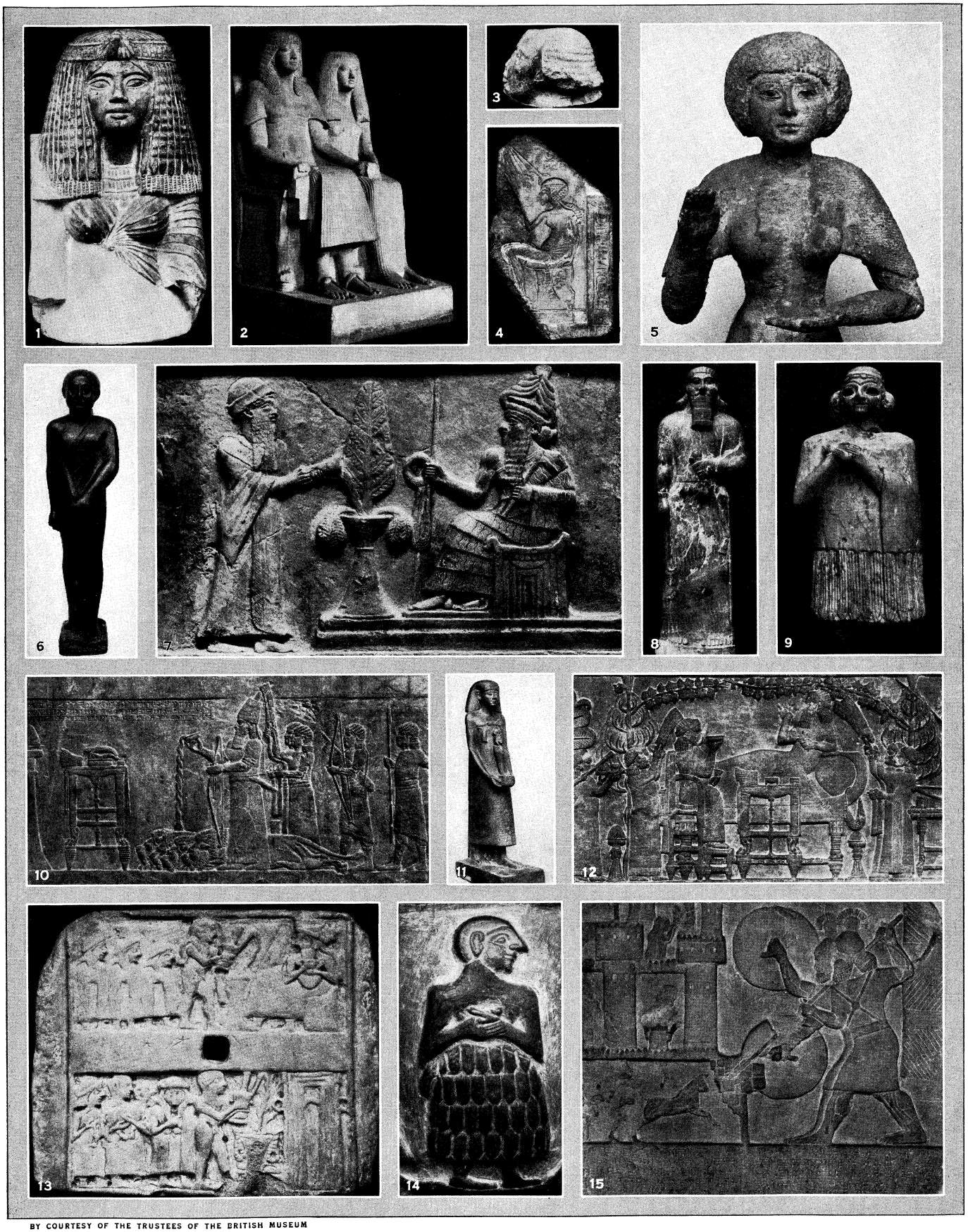


BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

EGYPTIAN, CRETAN, PERSIAN DRESS, 27TH TO 5TH CENTURY B. C.

1. Male dress, Vth dynasty (*c.* 2600 B.C.). 2. and 3. Male dress, XIth dynasty (*c.* 2200 B.C.). 4. Male dress, XIIth dynasty. 5. Male dress, XIIIth dynasty (*c.* 2000–1800 B.C.). 6. Female dress, XVIIth dynasty (*c.* 1650–1600 B.C.). 7. Cretan (Minoan) priestess or serpent goddess, Knossos (*c.* 1800 B.C.). 8. Cretan male costume, 18th–17th centuries. 9. Cretan female costume, 18th–17th centuries. 10. Cretan male costume, 17th–16th centuries, "The Cup-bearer" fresco, Knossos. 11. Persian costume, 6th–5th centuries, Persepolis. 12. Persian archer, one of the "Immortals," 6th century, Persepolis

DRESS



ANCIENT EGYPTIAN, ASSYRIAN, BABYLONIAN DRESS

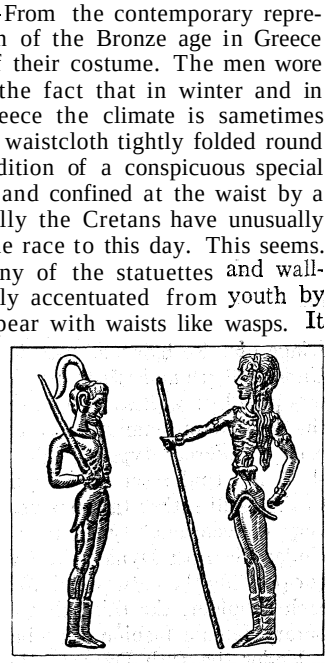
1. Priestess, Egypt (*c.* 1450 B.C.). 2. Male and female dress, Egypt (*c.* 1425 B.C.). 3. Egyptian head, natural hair (*c.* 1400 B.C.). 4. Male dress, Egypt (c. 1376-1360 B.C.). 5. Egyptian queen or princess (*c.* 900 B.C.). 6. Egyptian male dress, 2d century A.D. 7. Costume of king and god (right). Ur (c. 2300 B.C.). 8. King Assur-nasir-pal, Assyria (883-859 B.C.). 9. Sumerian female dress (c. 2300 B.C.). 10. King Assur-bani-pal, Assyria (668–626 B.C.). 11. Egyptian male dress (*c.* 500–400 B.C.). 12. King Assur-bani-pal with queen. 13. Sumerian dress, gods, priests and nobles, Ur (*c.* 3300 B.C.). 14. Sumerian male dress (*c.* 2900 B.C.). 15. Assyrian military uniform (745-727 B.C.)

The Persians wore as court-dress a modification of the Assyrian gear, including the tiara and curled hair and beard. Their native headdress was a "Phrygian" hood, sometimes worn with a veil or scarf across the mouth to keep the dust out, like the *litham* of the Tuareg. Small felt hats, square-topped or round, were worn as their descendants are to this day; a waisted tunic and gaily coloured pyjama-trousers, confined at the ankle, were characteristic of the Persian male costume, so far as it was not influenced by that of Mesopotamia.

In later times in Persia we find the Sassanian kings wearing a development of the old Persian dress, with high tiaras and many chaplets and necklaces of beads, earrings, etc. The hair was worn very bushy, over the shoulders; this was characteristic of the men. We know little of what the Persian women wore.

MINOAN COSTUME

The Bronze Age in Greece.—From the contemporary representations of the men and women of the Bronze age in Greece we can gather a very good idea of their costume. The men wore a very scanty dress, considering the fact that in winter and in the mountains everywhere in Greece the climate is sametimes cold. It consisted principally of a waistcloth tightly folded round the loins, sometimes with the addition of a conspicuous special sheath or codpiece for the penis, and confined at the waist by a large and very tight belt. Naturally the Cretans have unusually small waists, a characteristic of the race to this day. This seems, judging by the universal testimony of the statuettes and wall-paintings, to have been artificially accentuated from youth by tight belting, so that the men appear with waists like wasps. It even seems probable that in the case of the young men the belt was of metal, riveted on in boyhood, and retained till manhood, so that the young men had waists artificially constricted to the size of those of small boys. In middle age it would seem that this ring was removed, and the body eventually assumed a normal form. Statuettes of older men show them as somewhat obese. The women often wore the same constricting belt when young. In form it was generally bevelled. Over the tight waistclout was worn a kilt, in court dress apparently ornamented by a hanging fringe of network (Knossos frescoes, etc.). This kilt, sometimes with the sheath showing, is carefully represented in the Egyptian wall-paintings of the Keftian ambassadors to Egypt in the time of the XVIIIth Dynasty (see EGYPT). It was gaily ornamented with zigzag and other patterns, thus contrasting vividly with the white kilt of the Egyptians. Sometimes this kilt is of considerable length, reaching to the calf of the leg; at other times it, or a development of the waistclout resembling our bathing-drawers or shorts, is lengthened and so full as to resemble the voluminous *βράκαις* of the modern Cretan and Greek islander, which may indeed be derived from it in direct descent. In cold weather and doubtless by older men a cloak was worn, resembling the modern Cretan capote somewhat, but with a heavy fringed lower border. This has been regarded as a sacral garment, but without much reason. In Greece proper the addition was made (due perhaps to a colder climate in winter) of a shirt or chiton with short sleeves: this is never seen in Crete. On the feet either sandals were worn, often with bands round the calf of the leg exactly resembling puttees, or high boots like those still universally worn in thorny and stony Crete, of soft white leather. The arms and neck were decorated with bracelets and necklaces of gold or silver, or stone and kyanos (glass heads). Then, next to the narrow waist, the most characteristic note of Minoan male costume. the hair, was evidently worn at its full natural length. Occasionally it is seen cut short, but this would seem to be so only in the case of mourning men and priests; the latter seem to have worn long robes, confined at the waist, like those worn by the priestesses, and usually white. Normally the men wore the hair unshorn, and falling loose to the waist or below it: on the top of the head it was done up into fantastic knots or curls (horns) which were carefully represented by the Egyptian artists as characteristic. Fashion evidently dictated various modifications of this hair-dressing, more or less elaborate. Sometimes part of the hair was piled up in coils on the top of the head, while the rest hung loose about the body (Tylissos figure: Knossos frescoes, etc). Sometimes, in the case of warriors, it was all knotted up in a "bun" or chignon at the top or back of the head like that of a Sikh. At other times it was twisted (plaited?) in a pigtail (Knossos relief vase) or simply tied behind at the neck in 18th century fashion (Vaphio cup) or confined by bands or slides at the top or sides or back (Chieftain vase).



FROM HALL, "CIVILIZATION OF GREECE IN THE BRONZE AGE

FIG. 1.—PRINCE AND THE WARRIOR; TRIADA WARRIOR VASE, HAGIA

FROM SCHUCHHARDT "SCHLIEMANN'S EXCAVATIONS" (MACMILLAN)

FIG. 2.—DRESS OF A GREEK WARRIOR IN PROCESSION ON WARRIOR VASE. MYCENAE

A fresco (unpublished) in the Ashmolean Museum shows it tied up in three separate bunches, one at the back of the neck, one at the top of the head, and the third over the forehead. Headgear was not common; but we have representations of a broad-brimmed hat, the later Greek *petasos* (Leiden Museum; fig. 4), and of small round caps evidently concealing a topknot. A god (?) can wear a tiara, or is shown wearing a high headdress of peacock (?) feathers (Knossos fresco). Metal helmets of Roman rather than of Greek form, with a domed crown, ear-pieces and with a knob at the top were worn, sometimes with the addition of nodding crests, the forerunners of the λόφοι of later days The hair is sometimes invisible, being evidently knotted beneath the helmet, or is shown falling down the back, when it is worn (gladiators vase). We have representations of cuirasses on the clay tablets, but usually armour does not appear, or was perhaps of a laminated type like that worn by the Philistines, Shardana and other "Peoples of the Sea" in the Mediterranean area at the end of the Bronze age. The shield was of a peculiar double shape like the figure 8, and reached from ankle to neck, replaced by a smaller round shield at the end of the period, which was of non-Minoan (probably central-European—Hellenic) origin. The usual weapons were a rapier-like sword with decorated hilt; though rarely (Mallia) a great broadsword appears (typical of the Philistines and Shardana later, like the round shield and laminated body-armour); daggers; and spear-heads of a peculiar rounded form somewhat resembling the mediaeval Japanese; bows and arrows with barbed metal heads, and slings were also used. The Cretan slingers were always renowned. The "Peoples of the Sea" who overran the Minoan lands at the end of the Bronze age, coming perhaps from Europe, perhaps (or partly) from the Caucasus by sea, wore characteristic headgear of their own, the Philistines a high feathered cap, the Shardana a round helmet with crescent and ball as insignia. They may have shaved their heads or worn short hair, as it is never shown long in the Minoan and the (shorter) early classical Greek (Iron age) fashion. The kilt was common to them as also to the Hittites of Anatolia.

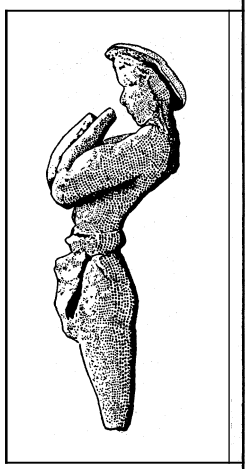
FROM DAVIES, IN "BULLETIN" MET MUS. ART, N Y.

FIG. 3 — MINOANSIN THE TOMB OF USER-AMON, WITH MINOAN BULL-RHYTON AND STANDING BULL

During the early classical period, Greek men wore their hair long, but not so long as the Minoans. Generally reaching the small of the back, it was worn either hanging in loose ringlets (sometimes with a band at the neck), or else braided in two plaits that were wound round the head (we have no instance of this fashion in Minoan times), rolled round a headband, or knotted in a *κρωβύλος* at the back of the head. Short hair did not come into fashion until the second quarter of the fifth century, after the

Persian wars, and then was retained (except, as now, in the case of priests) for 1,000 years, throughout the classical Greek and Roman periods until the fall of the Roman Empire, when the "barbarian" fashion of long hair came in again. A difference between Minoan and classical Greek costume is seen in the fact that the early Greek men often went more or less naked; they habitually exposed their persons in a way that the Minoans never did. We have only one certain representation of a naked Minoan, and he is swimming, arid one doubtful, the "Blue Boy" or saffron-gatherer on a fresco from Knossos. There is none of women (see below). Women's hair in the early Iron age was always worn hanging, in tresses, over the shoulders, sometimes confined at the neck by a band. (For classical Greek dress see section "Greek and Roman.")

Minoan women wore a heavy petticoat-like skirted and flounced garment reaching the ankles and a sort of short-sleeved "zouave" jacket, sometimes with a tight belt like the men. This dress was gaily ornamented with patterned designs. The flounces of the skirt make it resemble curiously the fashionable European skirts of the '70s and '80s.



BY COURTESY OF THE LEIDEN MUSEUM

FIG. 4.—BRONZE FIGURE OF A YOUTH WEARING A PETASOS (HAT)

Breasts were exposed or protected by sheaths. But no representation of a nude woman exists. A cloak with a high "Medici" collar behind is represented. On the head are various forms of headgear, sometimes a horned headdress (Petsofà), sometimes a high blunted conical *polos* (Knossos), sometimes a sort of flat turban. Generally the hair flowed loose, but is always represented as clipped considerably shorter than that of the men, which must have been unshorn from childhood, judging by its length; the hair of the women rarely reaches the waist. It is not often knotted up or entirely concealed beneath the headdress. Bare heads were perhaps rare in the case of the women until the Late Minoan period (c. 1500 B.C.) when we see a court fashion of bare heads with the hair partly knotted behind, partly falling at the sides in comparatively short curls, the fashion much resembling that of the ladies of the courts of Louis XIV. and Charles II., with perhaps a touch of the French Second Empire coiffure associated with the Empress Eugénie (Knossos frescoes). With this golden diadems were often worn, of a type resembling those of classical times (*ibid.*, Mycenae; Tiryns frescoes). Necklaces of gold, lapis and glass of the peculiar Minoan blue (kyanos), were of course worn, and possibly ear-rings by the women. We have only one representation of a man wearing ear-rings, and that is doubtful (cupbearer fresco, Knossos). Egyptian and Asiatic men and women both wore ear-rings and ear-studs, the Egyptians from about 1500 B.C., and not before. Elaborate gold hairpins were used by the Minoan women; golden hairpins of simpler form also by the men, as we see from their discovery with weapons in tombs of men at Mycenae. They would of course be as necessary for the heavy male coiffure as for the women's hair. The women's shoes are rather a doubtful point; probably their feet were usually unshod. Priestesses wore long waisted robes which were also worn by priests, apparently, or temple-musicians of the male sex, as in Lydia. When they participated in the games, as in the religious sport of the bull-leaping (ταυρο-καθάψια) the girls wore the young men's dress of tight belt and waistclout (Knossos fresco, etc.).

Generally we know more of the male costume than the female, owing to the greater number of representations of men, and the fact of their double costume, for war as well as peace. At present it is difficult, except in the case of the women, to confine certain costumes to certain periods; as our knowledge increases it will be possible to do this as accurately as we now can do it in the case of the Egyptians, with our much greater Egyptian material.

The female costume is even more unlike that of classical times than the male, though in the Enrly Iron Greek age women still wore a full skirt tightly confined at the waist, just as the men often wore a tight belt round the waist in the Minoan fashion, but without any clout or sheath.

We have practically no representations of children, so cannot say whether their costume differed in any notable way from that of their elders. An ivory figure of a boy-god is shown with hair long, flowing from beneath his tiara, but much shorter than that of the men. He wears the tight waist-belt. A head of a boy on a sealing has short hair.

BIBLIOGRAPHY.—J. L. Myres, ***Ann. Brit. Sch. Ath.*** ix., p. *361* ff. A. J. B. Wace, ***A Cretarc Statuette in the Fitzwilliam Museum (Cam***bridge, 1927); H. R. Hall, ***Civilization of Greece in the Bronze Age*** (London, *1928*).

EGYPTIAN COSTUME

Until the 18th Dynasty men in the way of costume wore a simple white kilt, which under the 12th Dynasty was often made very high, so that it began almost immediately under the armpits. It was often starched and stiff in the case of persons of some rank. Kings wore more particoioured garments, of the same general type; in archaic days unconventional clothes were apparently worn by them, which later fell out of use. In early days the natural hair was worn long, and the kings kept it in a linen bag of characteristic shape, to exclude the dust, with a pigtail behind, which in later times was retained as a specifically royal headdress, pigtail and all, although the head was really shaved and a short wig worn. Wigs were probably introduced very early, and it may well be imagined that the discomfort of thick and long hair in the Egyptian climate conduced to their invention. We certainly find them in use as early as the Old Kingdom, and a fringe of false hair was found in a 1st Dynasty tomb at Abydos. Under the 4th and 5th Dynasties a short wig of curls cut step-wise was popular; wigless heads are rare. Under the 11th, we have at the British museum two companion figures of a noble wearing each a different type of kilt, and one a short wig, the other a skullcap. Under the 12th Dynasty the hair was kept shorn close to the skull rather than shaved, and the wig was of a longer and very conventional type; men are often represented without it. Under the 13th Dynasty the wig grows longer still, and either it (or possibly the natural hair?) is dressed in three masses, one over each shoulder, the third down the back, something like contemporary female fashion (see below), but not plaited.

Under the 18th Dynasty the long natural hair was commonly worn again, sometimes simply parted in the middle and combed down over the shoulders, but far more usually surmounted by a short wig, so that we see the natural hair falling in front of the ears to the level of the chin or shoulder, while the short artificial wig above it is cut off diagonally across the ears, and forms a square fringe of curls in front. Many men however undoubtedly shaved the head, as of old, and wore nothing but a wig, usually imitating the combed wig and long hair fashion, the shoulder-locks being stiff curls as artificial as the rest. In the Ramesside period all men of position appear to have shaved the head and to have worn wigs of this type; priests now usually wear no wig. This fashion now became universal. Under the Bubastites the "step" form, which had continued sporadically since the time of the Old Kingdom, came in again generally. Under the Saites at first a modification of the Ramesside wig, later a full rounded form was usual besides the archaistic "step" form. Under the Ptolemies and Romans Egyptian men seem to have generally dispensed with wigs, appearing always with carefully shaven crowns. Boys at all times preserved the ancient juvenile fashion of shaving only part of the head, generally the left side, and wearing a single thick plait of their own hair over the right ear, hanging below the shoulder; wigs were an attribute of manhood. Royal princes of mature age wore an imitation of this lock to indicate their filial relationship to the king; and a particular rank of priest wore it combined with a short wig over the rest of the scalp,

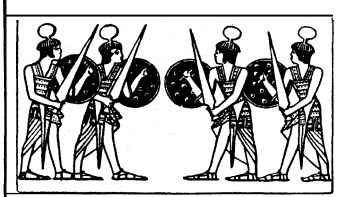
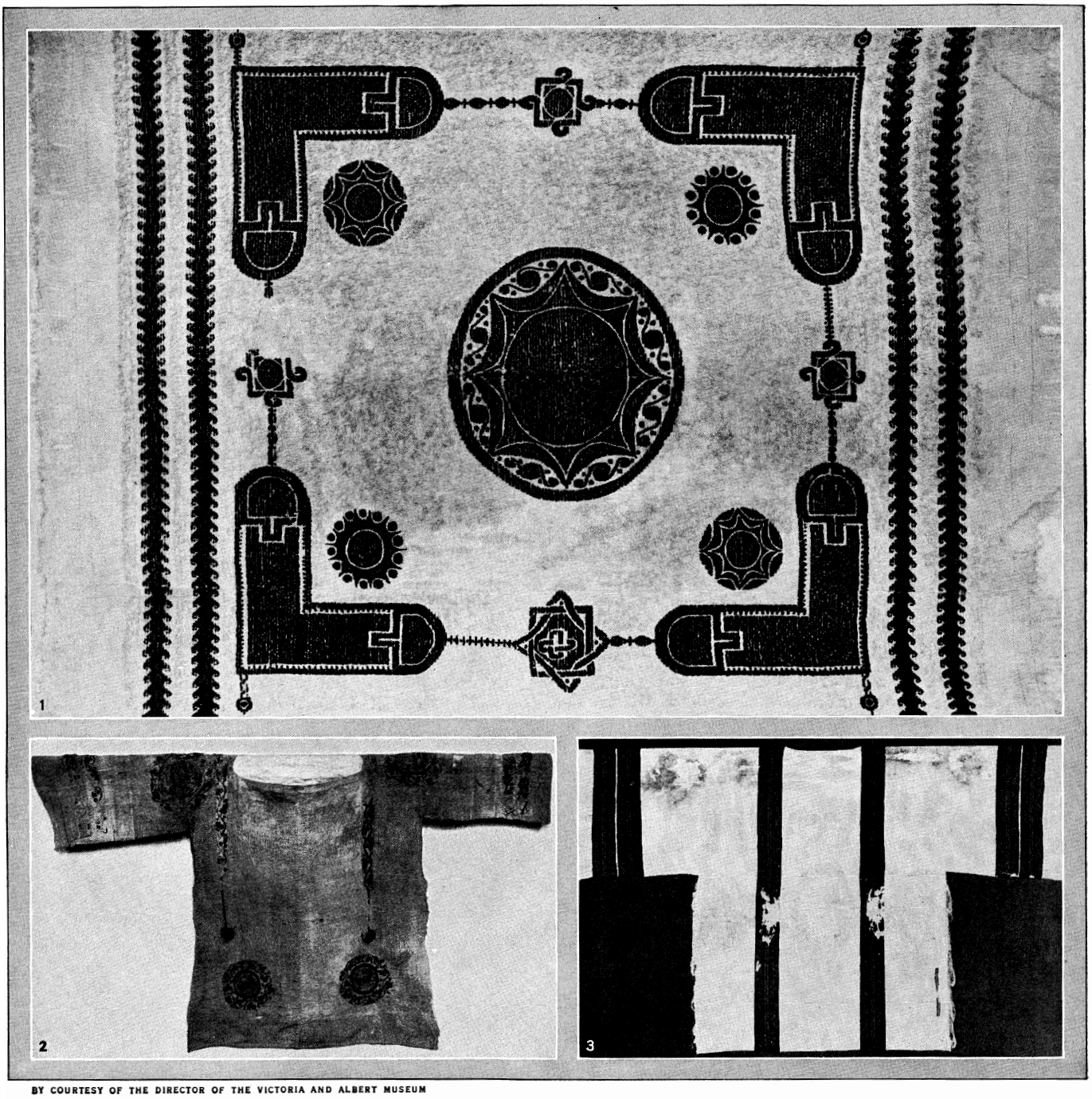


FIG. 5.—SHARDANA GUARDS WITH BROADSWORDS

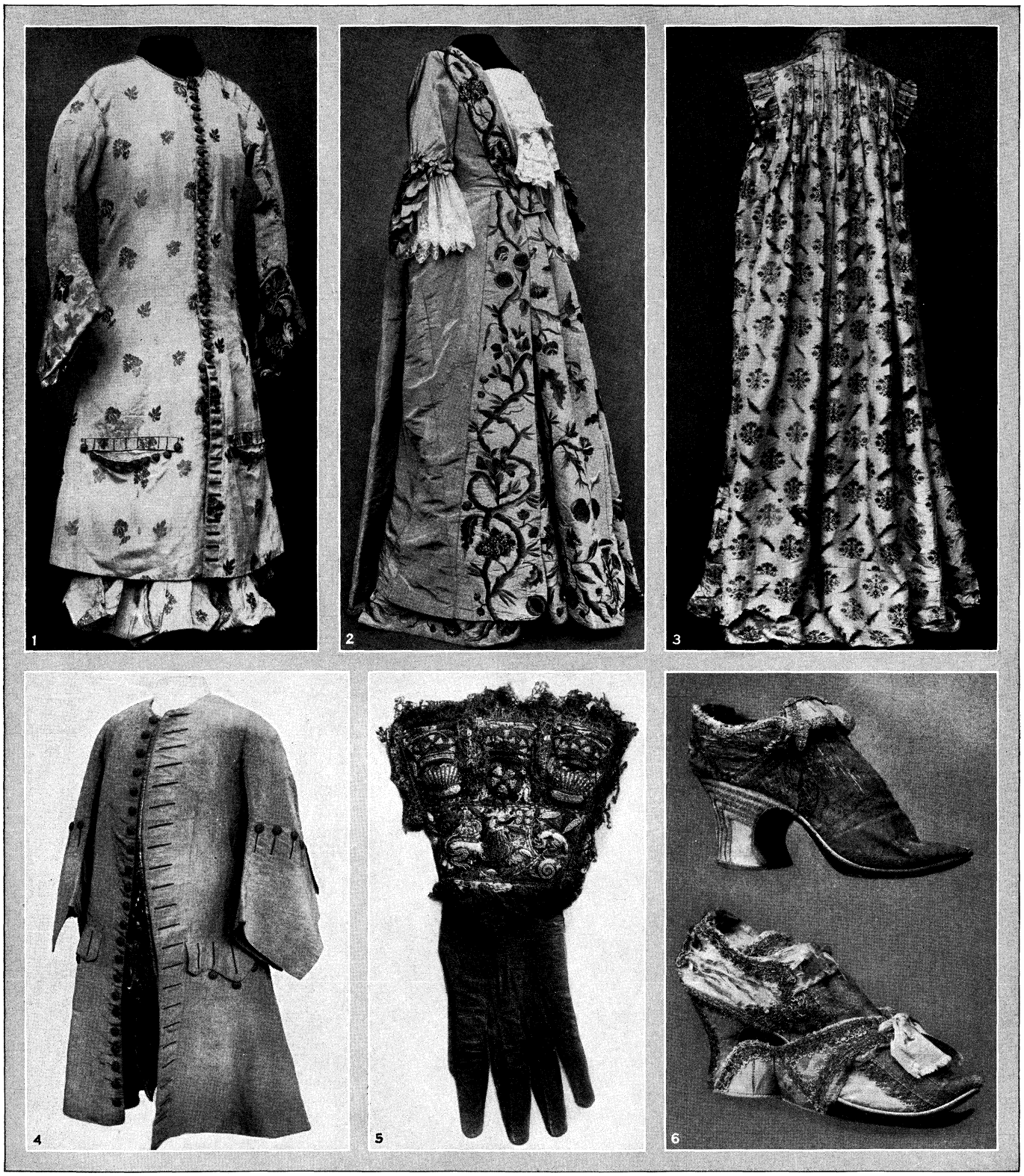


BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

TUNICS AND CLOAK, LATE EGYPTIAN

1. Cloak from Egypt, Graeco-Roman period, 3rd or 4th century B.C. It is of linen cloth, faced with inter. woven loops in linen and purple wool, and oblong in shape. It served also as a shroud for the dead
2. Child's linen tunic from Akhmim, Egypt, 4th or 5th century B.C. The tapestry-woven ornaments are in purple wool and linen thread
3. Man's linen tunic from Akhmim, Egypt, 3rd or 4th century B.C. The two purple stripes, indicating the rank of Roman senator, and the double sleeve-bands are tapestry woven in purple wool and undyed linen

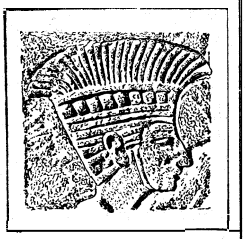
DRESS



ENGLISH DRESS, 16TH TO 18TH CENTURY

1. Coat and trunks (1681) made for Sir Thomas Isham's wedding, but never worn. The drab-coloured silk brocade is woven in silver-gilt thread and cream-coloured silk
2. Lady's dress and petticoat (early 18th century), of coffee-coloured silk, embroidered with coloured silks
3. Back of lady's dress, Elizabethan (1558–1603). The silk brocade is woven in colours on a cream-coloured ground and slashed
4. Man's coat, early 18th century
5. Glove, said to be of Henry VIII.'s era, but possibly of James I.'s, as suggested by the style of decoration and the alternating thistle of Scotland and rose of England. The satin cuff, embroidered with coloured silks, silver-gilt thread and seed pearls, is fringed with gold and silver lace
6. Shoe and clog (early 18th century), silk damask and brocaded front

through a hole in which the plait emerged, as a religious vestment. Caps, or hats, except occasionally a light skull-cap, were not worn till Roman days. Peasants habitually wore their natural hair more or less long, and usually worked naked or with but a close-fitting waist clout, as they do to-day. Under the 18th Dynasty men's dress became more elaborate *(see* ART); over the waist clout or kilt a long linen robe was worn, carefully fluted or gauffred, depending from iust below the navel, while-a cape-or semi-sleeved jacket of similar material covered the shoulders. Necklaces were worn more commonly than before, and such things as bangles, while ear-rings or ear-studs were now introduced from Asia and were worn after the middle of the dynasty as ordinarily by men as by women. The studs (of rosette shape) were large and made a great hole in the lobe, which is always indicated in the statuary of this time, and found on the mummies. Later on, after the 20th Dynasty, these great ear-studs were no longer worn by men, and after the 22nd women also seem to have given them up. But small ear-rings were certainly worn by men as well as by women under the Saites, though the piercing of the lobe necessary ior them was not noticeable enough to be represented in the statues. Shoes, or sandals of reed or palm-fibre were now usual for the better classes; earlier the feet had always been bare.



BY COURTESY OF SIR F. PETRIE AND OF THE TRUSTEES OF THE BRITISH MUSEUM

FIG. 6.— THEHEADDRESS OF A PHILISTINE

The elaborate dress of the 18th Dynasty persisted with little alteration till Ptolemaic times, although under the Saites men are often represented archaistically as wearing only the kilt, as under the Old Kingdom. In Roman times a new fashioned garment with *dagged* borders leaving one shoulder bare, was introduced. The royal crown proper , which remained the same from the 1st Dynasty till Roman times, was composed of two parts, the upper, white, for Upper Egypt, and , red, for Lower Egypt. A peculiar blue royal helm, was introduced under the 18th Dynasty.

Women.—The early dress of women was a close-fitting garment, often blue, with a yoke over the shoulders and a "hobble" skirt. Wigs were early worn over the natural hair which is shown parted in the middle beneath it in a 4th Dynasty statue in the British Museum. Except under the 13th Dynasty, when the men's coiffure was as long as that of the women, the women's wigs were always longer than the men's. Under the 12th the hair, real or false, was worn in a peculiar style, in two masses, bound with gold. and turned up and outwards at the ends on-the breasts. These masses were mostly of small plaits. This coiffure continued till the 18th Dynasty, when it was succeeded by a more flowing coiffure of plaits and curls. Certainly women sometimes had shaven heads beneath their wigs like the men, but the natural hair was no doubt commonly worn long by them, whereas it never was by the men after the pre-dynastic period except possibly under the 13th and certainly under the 18th Dynasty. Towards the end of the 18th Dynasty fashionable women took to exposing their shaven polls, which they never had done before, dropping the use of the wig altogether. Queen Nefertiti wore a high cap or *polos* on her shaven crown, with *infulae* or ribbons hanging from it behind, but her daughters are represented with shaven, and what is more, deformed skulls; it is evident that the practice of rlongating the female skull in childhood rather on the style of the Botocudos Indian of Brazil, the Incas or the Solomon Islanders, was fashionable at the 'Amarna period. This fashion seems not to have persisted for any length of time, but the royal women certainly continued to shave their heads, and go without wigs, in order to wear certain headdresses with convenience, for a long time afterwards. The female mummies of this and later time usually exhibit a mixture of real and false hair when the "hair" is not wholly a wig. But one woman, an unknown person buried in the tomb of Amenhotep II., has very long natural hair. Small girls often wore part of their natural hair plaited at the side to signify youth like the boy's sidelock, or even often had their heads partially shaved in complete imitation of the boys. The older tight dress which we see represented till the end in the case of goddesses, gave way under the 18th Dynasty to a more gracious costume of gauffred linen, on much the same lines as that of the men, but of a more flowing and robe-like character. Particoloured robes are worn by queens. Necklaces, ear-studs, sandals, etc., are the same as the men's, though the women do not wear sandals so often as the men. This general costume continued till the end, when colours came in; in the late Roman period elaborately-patterned caped or shawled garments were worn. Women often seem to have worn a lily on their heads, and both sexes at festivals were fond of placing a lump of highly scented unguent on the head, which is carefully represented in the tomb-paintings and stelae. In Roman times women (and men at feasts) wore large wreaths; Greek costume was then no doubt largely worn by both sexes. Otherwise only the queens wore anything in the way of a headdress *(see* above). (H. R. H.)

FROM "MONUMENTI ANTICHI" BY PERMISSION OF THE DIRECTOR OF THE REAL' ACCADEMIA DEI LINCEI

FIG. 7.— SIDE OF THE PAINTED POTTERY LARNAX FROM CRETE

GREEK AND ROMAN

Sources of information about the dress of the ancient Greeks and Romans are to be found in their literature, their sculpture and their painted vases. Existing examples, though mostly provincial and late in origin, are also of some historical interest. In primitive times, among both the Greeks and Romans one voluminous cloak was thought sufficient dress for a man, and even in later times it was the only garment regarded as indispensable. A tunic or shift was nevertheless worn by men, women and children. At first it appears to have been sleeveless, but individual fancy and variations due to colonization or conquest caused much diversity in apparel. Among the Romans the tunic was often ornamented. The *tunica palmata* was worn at triumphs. Men of senatorial rank wore a tunic with a double stripe in purple down the front (*tunica laticlavia*). Knights had a narrow stripe from each shoulder downwards (*tunica angusticlavin).* In this latter form the tunic went into common use. A man's linen tunic of Graeco-Roman times from Egypt has the two purple stripes as well as double sleeve-bands. Other tunics found in Egypt were more richly adorned. One for a child has in addition a roundel on each shoulder, and two others both on front and back. In course of time the simple slit for thrusting the head through was shaped or cut away in front. Two tunics were sometimes worn; as time passed (and probably always among the peasantry) no other garment was considered necessary.

The cloak, worn over the tunic, varied much at different times and places. Among the Greeks it usually took the form of a large oblong cloth wrapped about the body so as to envelop it from the neck to the ankles. The Romans used a similar garment, known as the *pallium.* But the distinctive Roman cloak was the toga, a large cloth in the form of the segment of a circle (rather less than a semi-circle) worn with the straight side uppermost. One end came forward over the left shoulder reaching nearly to the ground. The garment was then passed round the back, over (or under) the right arm, and across the front, the other end being thrown over the left shoulder to fall behind. There were variations in manner of wearing and in shape according to time and place. The toga was laid aside when there was work to be done. In later times it became a ceremonial garment, gradually losing its amplitude until it was no more than an ornamental band worn over the shoulder by certain officials. A few shreds of men's and women's garments, too incomplete to betray their form, have been excavated at various times from Greek graves of the 3rd to the 5th century B C. in the Crimea. They are chiefly of wool, though linen has been found *(see* TEXTILES AND EMBROIDERIES). Though apparently Greeks and Romans both favoured undyed wool for garments, these specimens from the Crimea

are mostly coloured (generally purple or green). Some are plain or striped; others have woven, embroidered or painted designs. The ornamentation includes deities, figures on horseback, chariots, birds, vines, honeysuckle and scrolls.

In Graeco-Roman Egypt the cloak is oblong, and often of ample dimensions. It is variously ornamented, with figures, animals, birds, fishes, trees, plants, foliage and conventional patterns. The Roman cloak was put to a variety of uses. It might be spread over a bed or couch or laid on the floor. It served also as a shroud for burial.

Those found in Egypt have all been used at last for enveloping the dead. The tunic and the cloak were the chief garments of Greek and Roman times, but various others were also worn in different places and on particular occasions. One among them, the chlamys, may be mentioned. It was a kind of short mantle or scarf, apparently more ornamented (as a rule) than the large cloak.

In shape it seems to have been either a narrow oblong or the segment of a circle. The garments of the Greek and Roman women were more voluminous than the men's, but otherwise they did not differ greatly in classical times. Instead of the toga, women wore the stola, with the *pallium* over it. Men often went barefooted, but leather or wood sandals and buskins were worn. Women wore shoes, and carried fans and parasols. Knitted socks, and knitted or netted caps, hair-nets and bags have been found in abundance in Egypt. Caps of fur and leather, and broad-brimmed hats, were worn on occasion. Brooches, clasps and girdles were used, especially by the women, but the skill of the wearer in adjusting the cloak seems to have been chiefly relied on for keeping it in position.

MEDIAEVAL AND MODERN

The tunic and cloak, which were the principal garments worn in Greek and Roman times, continued to hold their place, with modifications, for many centuries. As the tunic became the chief garment, it was sometimes elaborately decorated. One early Christian writer speaks of people wearing garments on which animals, forests, mountains or huntsmen were figured, while on others were biblical scenes. Late pagan and early Christian garments, found in Egypt, have ornamentation of this nature.

Mediaeval. — At the time of the Norman conquest of England the dress of men and women consisted of a couple of tunics and a loose cloak. The chief innovation was the tight "chausses" or hose enveloping the legs; in classical antiquity trousers were a barbarian garb. From the two tunics were evolved the jackets, pourpoints, jupons, jerkins and doublets of later times, and from the short cloaks the various over-garments, often taking fanciful shapes in the middle ages. Patterned materials were often used, though apparently not quite so much as they were afterwards. It is probable that the initials and devices personal to the wearer, seen in the 14th and 15th centuries, were for the most part of embroidery. They might occur once on the sleeve or shoulder, or they would be powdered over the whole garment. The large painted portrait of Richard II. of England in the sanctuary at Westminster Abbey shows his robe powdered with crowned R's, and presumably the letters sometimes to be seen on the dresses of unidentified individuals in paintings and tapestries had a personal significance. Another portrait of this king, on the celebrated diptych in the possession of the earls of Pembroke at Wilton, shows his mantle covered with crouching harts. The white hart was his personal badge. and again it explains other instances of such devices, though it should be remembered that fanciful representations of this kind formed part of the general repertory of the pattern-designer in mediaeval times. By the middle of the 15th century, rich velvets, with variations of the lobed "Gothic" pattern, often inwrought with gold thread, were much used for costume among the well-to-do.

Only a summary statement of the changes which dress went through during the middle ages and later times can be given here. The following outline has more particular reference to England, but generally speaking it holds good for western Europe, and (where applicable) to America. Some developments might occur earlier in France or Italy, where many fashions originated, and they would tend to survive later in the north.

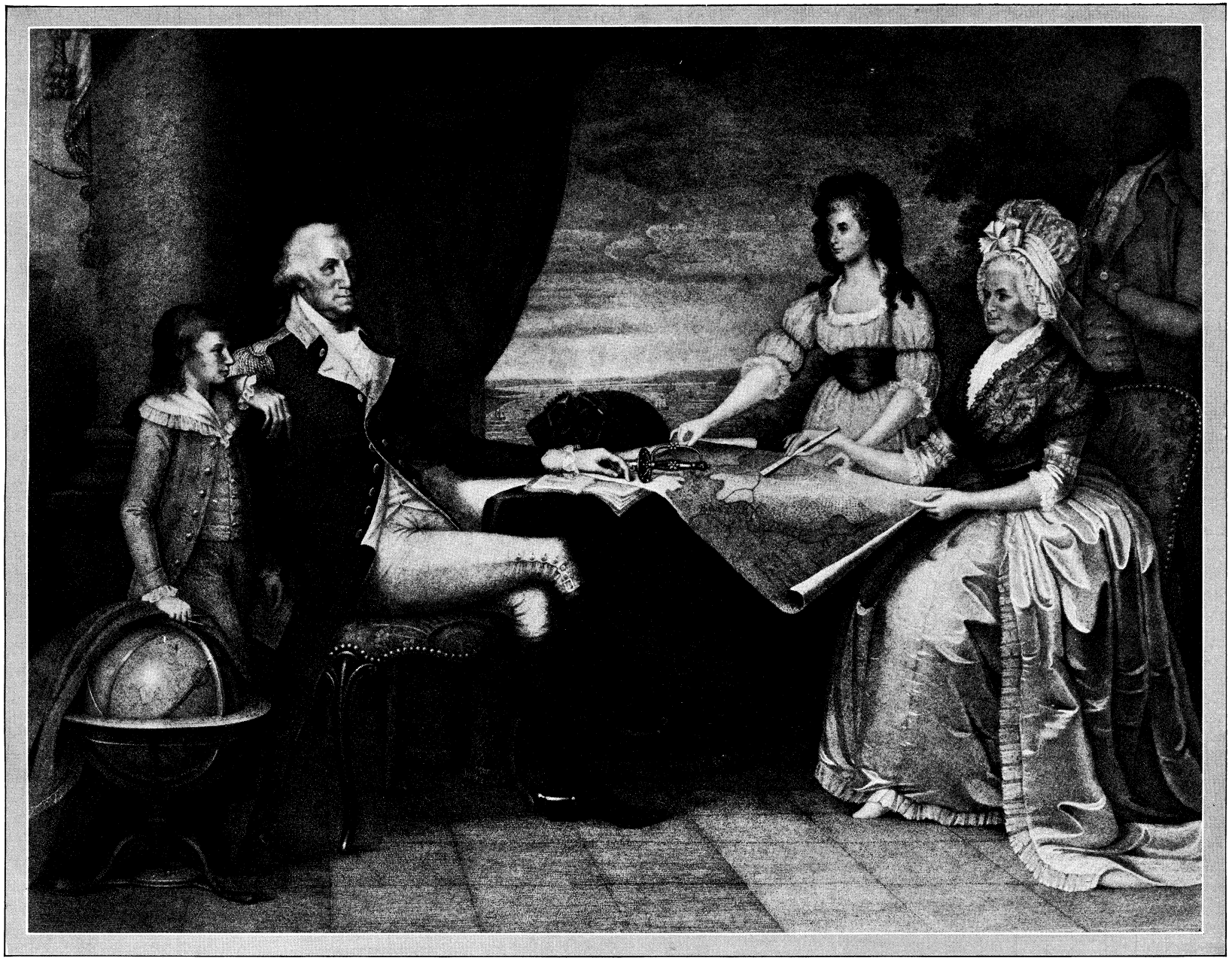
What may be described as "tailoring," as distinct from draping, comes into notice about the end of the 13th century. Garments then begin to be shaped more to the body, leaving less liberty of adjustment to the wearer. In the latter part of the 14th century "dagging" (the cutting of the edges of the garments into fanciful shapes) takes an exaggerated form, which it keeps for half a century or more.

For head-coverings the plain white wimple began to give way, towards the end of the 14th century, to elaborate head-dresses — the horned, the mitre, the turban — culminating in the fantastic steeple head-dress or "hennin" of the later 15th century, from France. In the 14th century men wore a kind of hood turned sideways on the head. This was followed by a closefitting cap which, towards the third quarter of the 1 jth century, was heightened so as to resemble the Turkish "fez" after which it became lower and flatter.

Shoes, which in early times were for the most part of fur or leather, tied by thongs round the instep or ankles, gradually took form with sole and uppers approximately more or less to the shape of the foot, until in the 14th century a tendency to bring the toes to a sharp point is noticeable. In the later years of this century the uppers were sometimes pierced in fanciful shapes Chaucer refers to this practice when he speaks of the priest Absalon having "Paul's windows carven on the shoes." Shoes with Gothic tracery over the instep were shown in the wall paintings representing King Edward III. and members of his family, formerly in St. Stephen's chapel at Westminster. At the end of the century the shoes of Richard II. are covered with quatrefoils and discs. The "Cracowe" or "poulaine," from Poland, with pointed toes of greatly exaggerated length, then followed, until at the end of the 15th century the fashion ran to the opposite extreme.

16th and 17th Centuries. — In the first half of the 16th century took place the meeting of the French and English kings at the "Field of the Cloth of Gold." This phrase only reflects general tendencies of the time, when fashionable men's clothes were loaded with jewels, and they are said to have spent their fortunes upon their clothes. Early in the 16th century the hose were divided into stockings (bas-de-chausses) and trunk-hose (*haut*-de-chausses). The trunk-hose went through various phases, looser or tighter, shorter or longer, following caprice rather than any progressive evolution.

The slitting of men's sleeves at the elbow or shoulder, to display the garment underneath, was not unusual in the 15th century, but "slashing" in small parallel cuts is a feature of the next century. By the time of Charles I. the slashes became long slits, sometimes extending for practically the whole length of the sleeves, before disappearing altogether. In the latter half of the 16th century men's garments began to be "bombasted" with cotton-wool, hair or sawdust. They form a contrast to the dress of Van Dyck's sitters a few years later. The air of elegant refinement, which must have been due in some degree to the dress itself, is so noticeable in this artist's portraits, that far on in the following century painters would endeavour to recapture some of this glamour by representing their sitters in similar garb. Women's farthingales, in the latter half of the 16th century, extended their skirts to very ample size. The euphuism of the time is reflected in dress, and exaggerated conceits form the subject of embroidery. In a portrait of Queen Elizabeth in the possession of the marquis of Salisbury at Hatfield house, her cloak is embroidered all over with human eyes and ears which, with a serpent on the sleeve, betokened the vigilance and wisdom of the wearer. A more restrained type of ornamentation, chiefly used for linen garments, such as tunics and men's and women's caps, was done entirely in black silk thread. Hence it gained the name of blackwork. It is said to have been brought to England by Catherine of Aragon. Naturalistic flowers were a favourite motive, but badges, rebuses, book-illustrations of enigmatic import, and all kinds of fanciful conceits were also included. As time went on, richness was added by the use of heavy gold thread for stems and other details, and later in the century bright colours replaced the black.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

AMERICAN DRESS, 18TH CENTURY

The Washington Family. Engraved by Edward Savage after his own painting. The powdered wig, high stock, jabot and frilled sleeves of the men, and the full skirts, elbow sleeves and the high-dressed and frequently powdered hair of the women are characteristic features

DRESS

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WOMEN'S DRESS, 18TH AND 19TH CENTURIES

1. Lady's dress of Chinese painted silk, England. The period is the second half of the 18th century
2. An American 19th century dress (1810), of checked blue silk
3. An American 18th century dress, "Robe a la Française," of flowered yellow silk
4. Late Victorian dress, England (1880), made of silk with flounces of tassel trimming
5. Gold gauze dress of the era of George IV. (1820–30)
6. Victorian dress, England (*c.* 1865–70). This evening gown of silk gauze shows the polonaise and the fringe trimming of the period

In this form, chiefly for floral patterns, it survived well into the 17th century.

The development of the frill at the neck into the great starched and pleated ruff, with its supporting standard, is a noticeable feature of the time. Completely encircling the neck at first, towards the end of the 16th century it was sometimes worn open in front. Soon afterwards it was replaced by the falling collar, but the encircling ruff and the open ruff were still worn well into the 17th century, as so many Dutch portraits bear witness.

Brims are added to men's caps early in the 16th century, and modifications rapidly succeed one another. In the second half of the century men and women wore higher and stiffer head-dresses. The 17th century brings in the "steeple" hat, and then the leather hat with broad brim and feathers. The broad-toed shoe with parallel slits or slashes is followed by a shoe in which the tilting at the heel begins. A solid corked sole comes first, then a space is cut through under the instep, to be followed by a separate heel-piece.

Children's portraits show that it was customary to dress boys and girls, even those of a tender age, very much in imitation of their elders.

About 1660 an important change took place in men's garments, when coat and vest were first evolved as distinct garments in France. This fashion was carried to England by Charles II. At first the vest was long, reaching to the knees and sleeved. The coat was slightly longer.

The coat and waistcoat of the present day are directly descended from these garments.

The trunk-hose are full, though very soon after they might have been worn narrower, anticipating the buckled knee-breeches of the 18th century. About this time, instead of the natural hair falling to the shoulders, men took to wearing the large periwigs so characteristic of the portraits of Louis XIQ. and his contemporaries; at the end of the century they tower over the brow, giving added height to the wearer. Cravats, often of rich lace, now replace the falling collar. A notable fashion originating in France took its name from the battle of Steinkerque, fought in 1692. The French officers dressing in haste, it is said, tied their fine lace cravats loosely about their necks. This fashion spread to other countries, both for men and women, and lasted some years.

Women's skirts were full at this time, and bodices were laced in front, sometimes with an embroidered stomacher. Hat-brims were now cocked, developing at the end of the century into the three-cornered hat.

Muffs were carried both by men and women in the 17th century, and in various forms they continued in use by women well into the present century. Gloves first became conspicuous in the 16th century, when they were often elaborately embroidered and sometimes embellished with pearls and jewels as well. In the 17th century, when the frill at the wrist gave place to the turned-back linen cuff, large gauntlets were added to the gloves, giving scope for embroidery in the style of the time. A pair of gloves was a customary gift at the New Year, and pains were taken to render them worthy of acceptance. Such gloves were usually of leather, but subsequently various lighter materials were used, and gloves might reach beyond the elbow when sleeves were short.

18th Century.— At the beginning of the 18th century the skirts of men's coats had become fuller and the sleeves had wide cuffs. The sleeved waistcoat was shortened, and at times it was richly embroidered. In course of time the sleeves disappear. As the century advances a distant approximation to the frock-coat of later times is discernible, but the materials continue to be rich. Velvet, often woven in tiny diaper patterns, was much used. When the material was plainer, elaborate embroidery in silk, often embellished with glass pastes and spangles, was usual for fashionable dress. During the course of the century, the skirts of the coat and the corners of the waistcoat were cut away in front, reducing the form more nearly to that of morning-dress of the present day.

Embroidery was used for ladies' dresses, especially for the underskirts rendered visible by the open front of the dress. The silk brocades of Lyons or Spitalfields, with floral patterns in bright colours, came into use. Indian dyed or embroidered cottons, and Chinese painted silks, witnesses to the growing commerce between the maritime nations of Europe and the far east, were made into dresses, causing much searching of heart among weavers at home, who succeeded in getting restrictive enactments put into force. Towards the middle of the century skirts became very ample, being supported by very wide hoops.

The sack or sacque, a loose dress falling straight from the shoulders, continued in use during the greater part of the century. It had originated about 30 years earlier, when Pepys's wife "first put on her French gown called a sac." Later dresses, too, came from France. A letter of the year 1715 from Sarah, duchess of Marlborough to Lord Stair, ambassador at Paris, is still extant—asking him to obtain "two pair more of bodys and a night-gown" for her, and a manteau and petticoat for her grandchild. In the latter half of the 18th century women wore their hair, or wigs, dressed high above the head and powdered, and again men's wigs became larger, but they were already doomed, and Pitt's powder tax of 1795 practically put an end to them.

19th Century.— By the opening of the 19th century, the change in men's outlook had swept away much of the overloaded finery of the past and garments more supple and better suited for active life came into use. Men's coats are cut away in front in a manner resembling the modern dress-coat, the lapels are large and the collar is high and deep. Waistcoats are short and cut square. Knee-breeches are lengthened into the modern trousers. The cocked hat of the 18th century is replaced by the top-hat. The old full dress, moreover, gradually gives way to what we now call the lounge suit, used more and more for all occasions.

Women's dress at the opening of the century is marked by a graceful simplicity, with high waist and low neck. A lower waist and puffed sleeves follow. Meanwhile skirts were widening, until the "crinolines" took their most exaggerated form shortly after the middle of the century. Then followed various adaptations of 18th century styles. About 1880 the projecting "bustle" at the back was in full popularity. Fringes, trimmings, flounces and long trains were in use during the latter part of the century.

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(A. F. K.)

FAR EASTERN

The appearance, customs and personal characteristics of Chinese, Japanese and Koreans are distinctly different, and this has consequently brought about dissimilarities in the dress. Only within the last few decades when European costumes have to some extent been adopted, has there been any tendency to uniformity in style.

China.—All classes in China wear a *san* (jacket) and *koo* (trousers), the combination being similar to the Western pyjamas. There are three kinds of each—the single, the lined and the wadded with cotton, to suit the season of the year. To the *san* is attached a narrow collar-band. The *ma kua* is the ordinary jacket with loose sleeves for the common people, and the *baishin,* a sort of vest, is worn over it. The *po* is a long gown and the *qua* a larger and longer *ma kua.* The *po kua* is the official full dress of men, while the *lung po,* or dragon gown, was worn by the emperor at State ceremonies. There are several other gowns in use—the *Chang san* in summer, *chiao* in spring and autumn and *taminou* in winter. When it is very cold the *pipao,* or fur coat, takes the place of the *taminou.* The *to pang,* another kind of overcoat of silk or fur, is worn by the wealthy.

There are all kinds of coats embroidered with dragons, moons, stars, hills, mountains, waters and flowers. Each design has its peculiar symbolism; frequently it is a Buddhistic emblem or the representation of some philosophical concept, such as the "waves of eternity." The mandarins were specially privileged to wear

gold-embroidered clothes, and sometimes the emperor granted the nine orders of mandarins the distinction of wearing a peacock feather on the hat.

Red is a symbol for happiness, and thus we find the bride wearing an elaborate gown of red; the tassel on the top of men's hats and the cord on their *queues* are red.

Japan.—In A.D. 283 two women weavers were sent from Korea to Japan to teach the making of figured silks and brocades. The *ho,* or ceremonial garment of the Japanese emperor and nobles, has an ancient origin; the Chinese seamstresses came to Japan, about A.D. 300 and made this with silk imported from China. Emperor Yuryaku (A.D. 457–479) reformed the national dress and, in the reign of Emperor Suiko (A.D. 593), rank was signified by distinctive head-gear, a custom imitated from that of the Chinese Tang dynasty (A.D. 618–906). Costumes were evolved for civilians, ecclesiastics and the militia, differing in colour, patterns, the length of sleeves and the style of hairdressing.

The *kasane,* or loose tunic, was worn with a short lower garment called the *akome.* The *hakama* was a loose skirt reaching only a few inches below the knees over the *shita-gutsu,* or socks. The whole style of head-gear was called *suberakashi. Kammuri,* a ceremonial headdress, was secured by *kanjashi,* or pins and the *yeboshi,* or cap, was worn over it.

The ladies always wear the *kimono,* a loose gown with a neck-piece called an *eri,* and long sleeves, the garment being fastened by a belt. Since the Heian period (794–1159) women have in general dispensed with the *hakama,* and to-day the female dress for social occasions consists of an underskirt, two or three outer garmects and a *haori,* or interlined silk coat, over the upper part. The *obi,* a belt about 3 yd. long and 10 in. wide, winds about the figure.

Men in rural districts are barefooted, seldom wear *zori* or the wooden clogs called *geta,* and in the hot season they wear almost no clothing. The common-jacket and trousers of cotton crêpe, blue or white in colour, a large grass hat called *kaza* and straw *zori* are the ordinary dress.

Korea.—Among the six departments of the Korean Government was the board of rites, whose duty was to regulate, describe and govern the ceremonial code of polite society, including dress. Koreans dressed according to their class, and in each class distinct costumes were used by those of different ages.

A *chugori* (jacket) and *baji* (trousers) are worn by all classes. The *tooroomaki,* a long flowing tunic, goes over these to anywhere between the knees and ankles; the higher the man's position, the more garments he wears. All these are of varying thickness to suit the weather. Women's *chugori* do not descend to the waist, leaving space for a waist-band, or *huridi,* which is embroidered and woven by hand. (Y. K.)

MODERN

The evolution of modern feminine dress, corresponding closely to the emancipation of women at the beginning of the 20th century, provides one of the most captivating pages in the history of modern civilization. One often considers ridiculous the fashions of other days, but one has only to live the past over impartially to understand that all changes in fashion are rungs in a ladder leading to an inconstant ideal.

Fashions of 1900–28.—In 1900 one could not breathe freely for dust raised by skirts. Women wore frilled underclothes unknown to-day. The body was imprisoned in a corset that pushed the bust forward and the lower part of the body out behind. The hair was dressed so as to follow the movement of the body. The neck was stiffened by a collar with whalebone stays. The sleeves. bodice and hat were trimmed with puffs and frills, details that at first view appeared useless but that helped to conceal the twisted line of the body. This silhouette remained without appreciable change up to 1905 when a step back to fin *de siècle* fashions occurred. Sleeves were again puffed at the top, bodices were shaped to a point in front and the complicated dresses were covered with a profusion of puffs and frills. The hat was perched on the side of the head above a display of hair extravagantly curled; it was frequently trimmed with a cluster of feathers, a mode of delicate hat-trimming that, changing place very often, lasted until 1914. In 1907 a slight Greek influence was felt in the soft materials often draped; tunics with points made heavy by tassels. The high collar made almost its last appearance. In 1909 a collar that freed the neck was popular. During the same year the short skirt appeared for the first time in the 20th century; a short skirt, however, that would have seemed very long in 1929. Enormous hats were loaded with huge, falling feathers. Already the silhouette was being slightly straightened; the bust was less bent and the body a little less deformed by the corset.

So far the few progressive changes in costume were the straightening of the silhouette and the freeing of the neck. They prepared the way for the *directoire* fashions which, already having made a few timid appearances, began to reign definitively in 1910. A bloom of delicate and varied colours was obtained during this period by concealing the dress beneath a transparent tunic of a different shade. Two years later, in 1912, under the influence of a few Russian ballets, the *directoire* began to *orientalize* itself. Trouser-skirts appeared, heads were turbaned and dresses of bright colours were trimmed with gold embroidery, pearls and diamonds. This fashion, taken from the theatre, could not last long, but by its boldness it had thoroughly changed taste; there was no more turning back to the past—the development of fashion traced new ways. It is since 1912 that dresses have no longer hidden the elegant woman's feet and that she has matched the colour of her shoes and dress. The oriental influence transmitted by the theatre became, in 1913, dazzling. The trouser-skirt persisted next to the skirt tightly draped round the legs; it was surmounted by a short and puffed tunic which very often took the shape of a small crinoline. One has only to compare the silhouettes of 1913 and 1900 to understand that the development of fashion was at its highest point, that the past had been forgotten. In the history of modern fashion the years 1912–14 are quite characteristic. The enormous influence of the theatre can be noticed. It attained its development about this time.

The period from 1914–20 is the least notable in the history of fashion. In 1914 the tight skirt surmounted by a wide and much longer tunic could still be seen. The following year the narrow skirt was suppressed and the tunic alone remained. From this period there is no general line of fashion; wide crinoline skirts were worn as well as tightly draped dresses with long trains. The year 1917 alone created a specific line in this period of revolution in fashion. It produced the *barrel dress* which was not seen the following year but which, nevertheless, for some time afterwards, left its traces in a draped movement, recalling draperies of the *paniers* of the 18th century. From 1914–20 there was nothing worthy of entry in the history of fashion; the theatres giving no new styles, old styles were recalled.

The New Line.—Still novelty was sought and in 1921 the new line—the low waist was found. At the same time the skirt was lengthened slightly. The hair, drawn away from the forehead, formed a high chignon often held by a Spanish comb. The Spanish influence made itself felt, not only in combs and headdress, and for a time women draped themselves in Spanish shawls, very often using these in place of evening cloaks. In 1923 the low-waist dress was transformed into a straight dress called the *tube dress,* and from this was born the costume—the straight and short dress—which was generally unchanged to 1929.

At its birth in 1924 it was quite simple; so much so, indeed, that it demanded equal simplicity in dressing the hair, which women began to cut like men. Dresses being simple in shape and trimming, the feminine costume tended to fall into a dreadful dullness. Feminine elegance was saved by research in accessories and by the use of new materials. Fashion began to demand matching not only the dress, coat and hat, but scarves, gloves, shoes and handbags also; the large dressmaking firms began to make false jewels to match models, and even to make perfumes to agree with the lines and colours of their models. The seeking of harmony in the smallest details proceeded further, appearing in the make-up which in days gone by was used simply to correct faults of nature.

Many new materials were created in the last few years. Embroideries on plain materials gave way to printed materials ready for the making of the dress. New furs, feathers, kid, lizard and snake skins appeared on dresses. (R. DE T.-E.)

Fashions from 1928 on.—With the arrival of 1928, the sil-

COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. DRAWING (1) BY POLLARD; PHOTOGRAPHS (2, 3, 4) BY STEICHEN

TRENDS IN WOMEN'S DRESS IN 1928

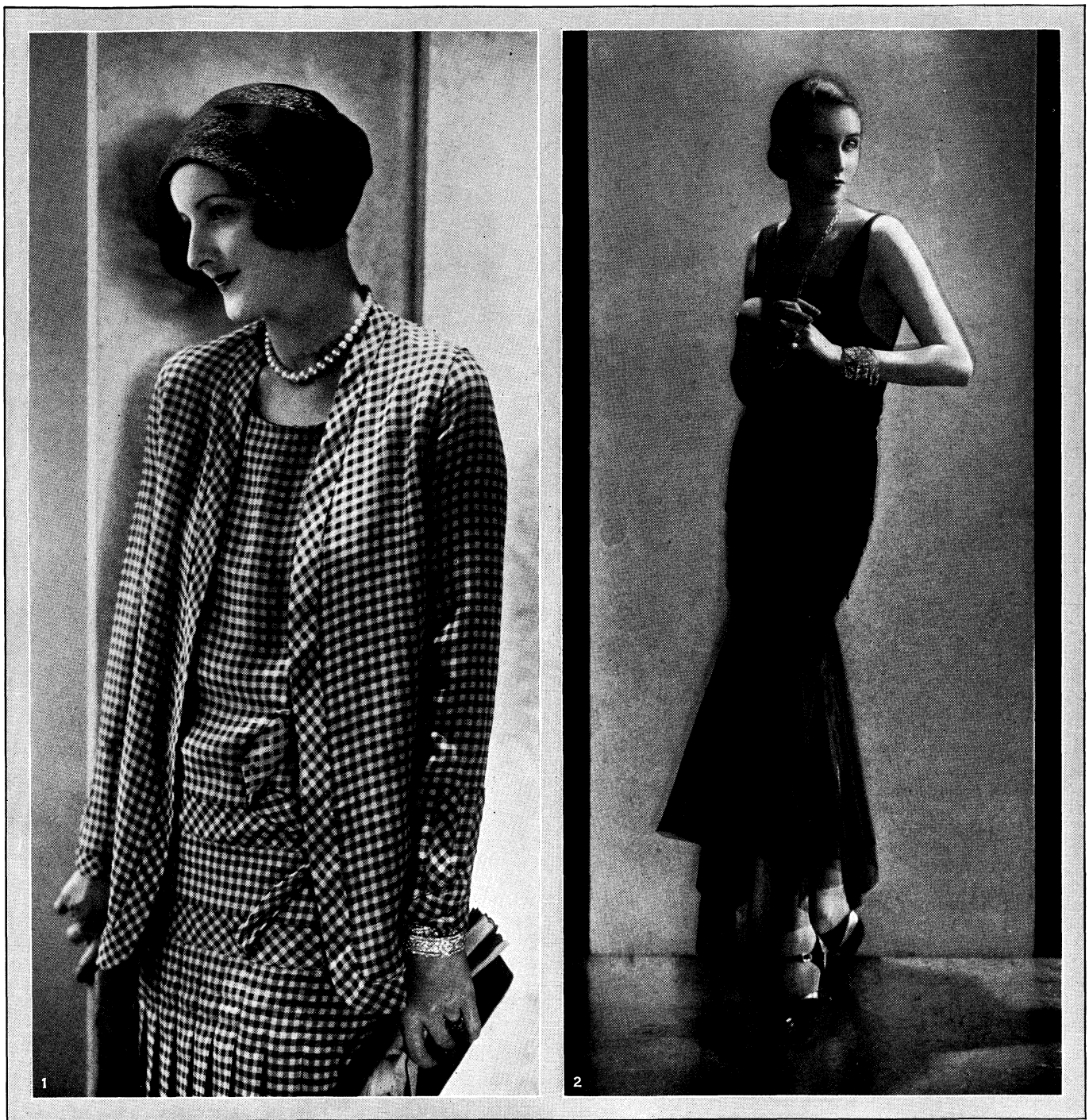
1. A Paquin suit, a good example of the slender active look required in women's clothes in 1928. The long peplum and the short daytime skirt were characteristic

2. A Paquin ensemble costume and an Agnes hat. The hat was worn a little off the face

3. A Chanel dress for evening, showing the longer line of the skirt in the back, to give a feeling of grace and slenderness

4. A daytime dress. A Lanvin hat showing the mode, just then going out, of having the hat completely cover the forehead and eyebrows

DRESS

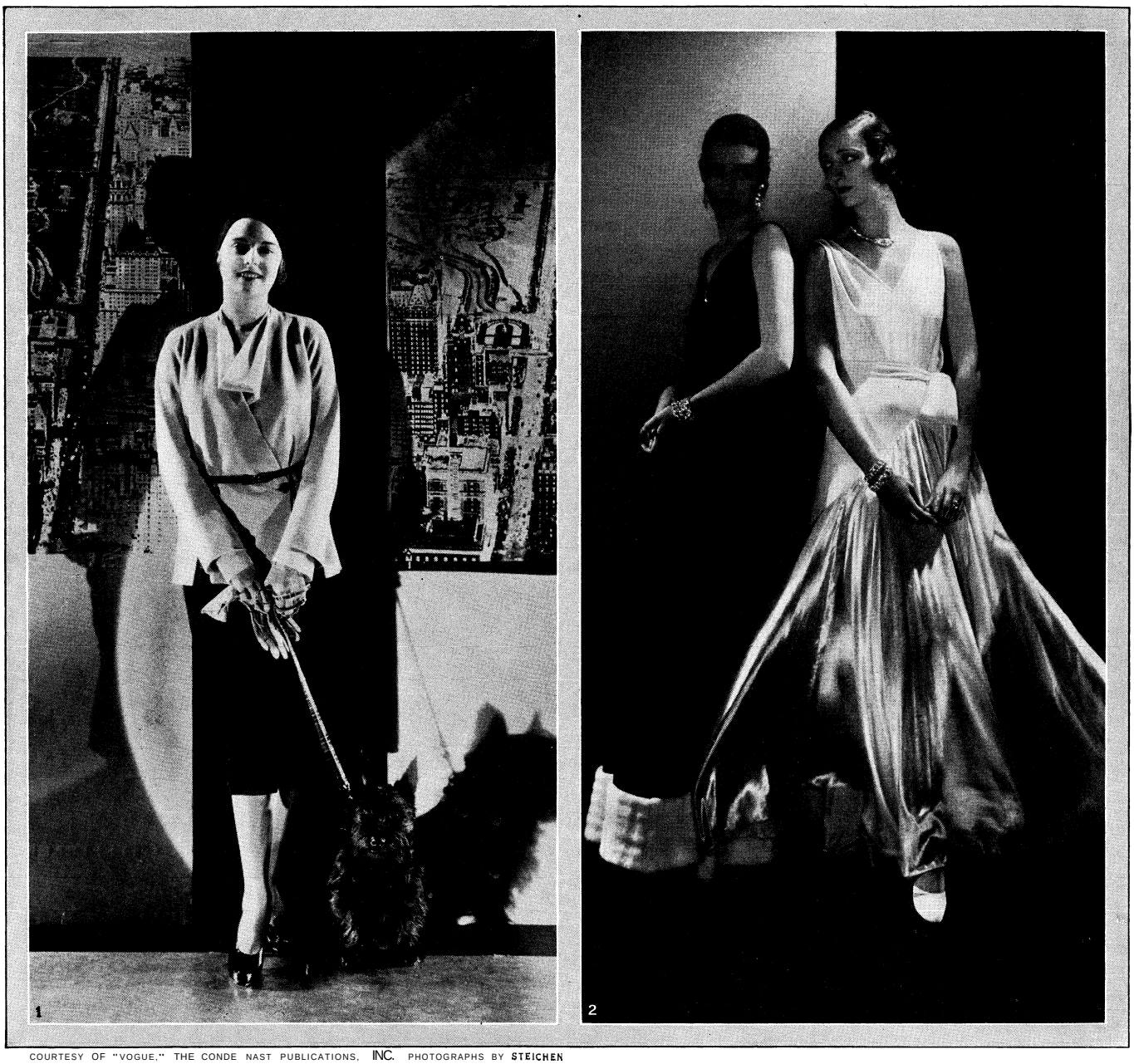


COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. PHOTOGRAPHS BY STEICHEN

TRENDS IN WOMEN'S DRESS IN 1929

1. Molyneux daytime costume with the slightly longer skirt. The hat showed the forehead but was pulled well down over the ears

2. Black net evening dress designed by Patou, showing the mermaid silhouette and the "flutter" hemline

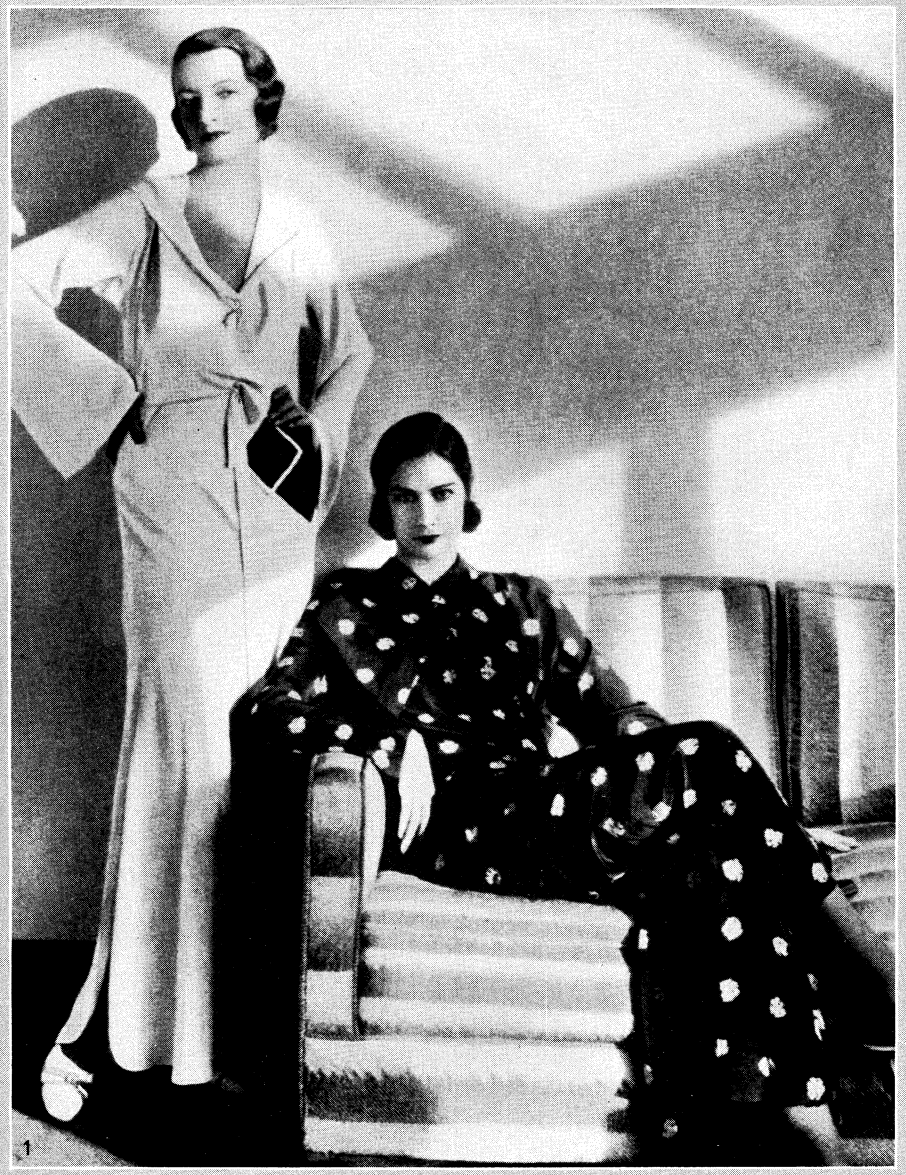


COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. PHOTOGRAPHS BY STEICHEN

TRENDS IN WOMEN'S DRESS IN 1930

1. Daytime costume designed by Vionnet. Skirts for daytime were then worn several inches below the knee. Contrast was obtained by using different colours for blouse and skirt

2. Vionnet designs for evening wear. The long flowing lines from hip to floor were obtained by bias cutting



COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. PHOTOGRAPHS BY (1) CECIL BEATON, (2) STEICHEN

TRENDS IN WOMEN'S DRESS IN 1931

1. Pajamas were becoming increasingly popular for home wear. Some, as in the figure on the left, because of the fullness of the trouser leg, gave the illusion of being a skirt

2. A Chanel velveteen dress with dramatic puff sleeves. An example of the spiral treatment in evening wear in 1931

houette introduced a "flutter" to its hem line. The uniformity which had nearly reached a banal monotony during the preceding years changed during 1928 to a silhouette with a great deal of movement. The hem line began to dip in back until it almost reached the floor—particularly in evening gowns. During the day, the "sports" feeling, which had continually increased during each successive year, became even more marked. Physical exercise and intelligent diet had given the athletic figure of the modern woman a slender, active look; and rhythm had taken the place of heartiness. The hip line remained moulded—with a flat front and back—while the waist line, above, was felt rather than defined. The longer line of the dresses in back succeeded in giving the feeling of grace and slenderness which had been very much lacking during the recent years. Hats which had completely covered the forehead and eyebrows were beginning to show them again. The introduction of what was known as "ensemble" became even more important in 1928 for daytime wear.

By 1929 the hat showing the forehead had arrived. The hemline continued to remain just below the knees in front, and flowing to the floor in back. For evening, peplums over bouffant editions of the silhouettes appeared—made of taffeta and faille. Day clothes remained approximately the same as the preceding year. The hard silhouette of 1925 and 1926 was completely overthrown. The subtle beginning of the higher waist line and longer skirt line was, bit by bit, insinuating itself into being. Sports clothes became longer—four inches below the knee being the popular length. Trains on evening gowns appeared, giving even greater grace to costumes—but the skirt remained short in front. Clothes were again becoming complicated—almost fussy. The uniform sort of costume of 1925 was forgotten.

Confusion began with the introduction of the very first long skirts. Women became bewildered. They trailed these long skirts through the streets in the daytime. However, in the course of time, the novelty of the long skirt—so confusing to them at first—was gradually adjusted, and it assumed its proper place—which was for evening. The daytime skirt was worn seven or eight inches below the knee. Tea gowns and pajamas for entertaining at home were popular. A softer treatment for bobbed hair ruled. By 1930 the long skirt had at last a sure foothold. The young so called "flapper" had become submerged. She had greeted as a new and exciting experience the feel of a long skirt swishing about her ankles—an experience which she had never felt. Her coats were fitted at the waist; her slouch became dignified rhythm; and legs and knees were completely things of a recent past. Actually beauty of line began to appear. A Greek feeling appeared—a flowing from hip to floor for evening. Evening wraps became much longer—many of them reaching to the floor. The classical Greek line became the edict. "Brittle" lines—both for evening and day—assumed a flowing movement. These last ten months were the most confusing for both women and dressmakers in ten years. The complete and revolutionary change of after-war severity had been one of turmoil and re-adjustment.

1931 ushered in a very graceful and flattering era of spiral treatments in evening dresses. These dresses clung to the figure and the women of 1931 suggested the classical figures on a Greek frieze. The pajama had become overpoweringly popular. During the summer at the watering places of the world the pajama was worn almost continuously, both for daytime and evening. Sometimes the evening pajama—because of the fullness of the trouser leg—gave the illusion of being a skirt. The motion picture had begun its powerful influence, and women were dramatizing their clothes far more than they ever had before. Dramatic clothes were no longer seen only on the actress. Ladies in the audience were equally exciting in their dress and frequently more so than their fasourite star. Inhibitions about colour were being abolished. Gaiety, undoubtedly a reaction from the drabness of more recent years, became the exciting gesture of the day. The financial crisis had caused a rather clever pseudo bravado. It was considered chic to be poor. Wealth was changing hands. Many of the smart women of the day were financially curtailed. Fewer clothes were in once overflowing wardrobes. This seemed to give an added impulse to inventive designers, and each month new ideas were offered. Fashion, unlike in its earlier history, changed almost fortnightly. The continual desire for something new, partly because of promotion in the great shops of the world, and because of the variety of ideas in the cinema and dressmaking houses, made a perpetual fireworks of ideas and variety of design during these latter years.

1932 introduced the pill-box hat, the beret, and the sporty felt. All of these had great popularity. Hats tilted over the left eye. Women remained slim and straight. The evening gown with a high neck in front, the low back, and long sleeves became ever present, even on those occasions when, several years before, only the lowest décolleté would have been correct. A casual look—a gracious look—was the keynote. Gradually a masculine note crept in. Mannish suits were worn for daytime; sport coats were adapted from various masculine sources; and evening clothes displayed a definite masculine trend. It was the beginning of the tailored evening mode.

The year of 1933 found the straight silhouette with a mannish feeling still in great favour. High necks predominated both for evening and day. An elongated "fish tail" appeared on a great many evening gowns, giving a narrow slender look to the lady of the day. What was known as "the dinner suit" appeared, and this tailored interpretation of a thoroughly masculinized dinner dress was worn most conspicuously by the chic woman. Jewels played a very important part with evening clothes—gold jewellery, huge and massive bracelets with a barbaric African feeling.

For daytime, hats suggested the "Cossack," or a modified form of the "fez." During the latter part of the year feathers—ostrich and other varieties—were of great importance. Trailing boas and short capes of feathers added grace and beauty to simple evening gowns. There was an ever increasing interest in shoulder treatments. Shoulders began to play an important part in the trend of fashion. Evening gowns displayed huge ruffled puff sleeves—a mode introduced by a motion picture which became international and returned to America again from Paris. Dinner hats were worn with dinner and theatre dresses. These dresses had a slender moulded look with a broad shoulder treatment.

1934 continued to bewilder its ladies by confusing them with odd materials. Silk was woven to look like wool; materials were made to look like glass; velvet became almost a soft fur. Attempts were made to shorten the evening gown. This was only mildly successful. A few appeared, but the evening dress remained graceful and dignified. A Victorian feeling was introduced in necklines, and a peasant influence found its way into evening gowns with huge spreading skirts and full sleeves. These were charming and becoming.

Fringe appeared, falling gracefully from shoulder and hip to floor. Romantic dresses full from the waist to the floor appeared. The picturesque dress which had been dormant for years became important and youthful as well.

Day clothes continued with a Russian Cossack influence, and also were adapted from the romantic men's costumes of the eighteenth century. Box suits were popular with younger women. Tunics appeared on day clothes and evening gowns. Trains for evening were longer than ever and slits in the skirts gave freedom of movement. Clothes had a gallantry, a dash, and a great deal of movement. Women had assurance and wore their clothes with knowledge and a feeling of freedom.

The silhouette also encouraged the revival and adaptation of fashions of 1910. This rather florid, but amusing era, was reconstructed with a simplified modern treatment. The clinging body flaring into a series of frothy flounces below the knee dominated the scene. The shoulder continued being the object of rejuvenation, arid also swirled into flounces in the form of short capes both double and single of layers of chiffon, organdie, or velvet.

Amusing details were introduced for sport and beach. Rope was applied to linen pocketbooks, made into bracelets with wooden ornaments, and used as dress trimming. Blouses and entire dresses were made of interestingly woven string. Cellophane was woven into wool and made into street dresses. Evening gowns were made of light weight wools and linens. All of these things were revolutionary and contradictory. It became a

year of inventiveness—a year of rather eccentric innovations.

1935 continued to emphasize the swagger gallantry in dress. It also ushered in great collars and foolish hats. For once in the history of fashion, the ridiculous was worn with serious acceptance. As we glance over the pages of fashion history it is not uncommon to be highly amused at some of the eccentricities of a past, but rarely do we recognize this humour as we go about wearing the costume of the present. 1935, however, proved an exception. The millinery of the day was often completely mad. Fantastic bonnets were worn, pancakes of velvet or straw, flaring into points or wings as if a bird had lighted on our ladies' heads. In fact, humour appeared everywhere.

Drapery appeared again with a 1913 feeling. Ladies preferred to return to a gracious pre-war style of dressing—particularly in their evening clothes. Everywhere one heard of the draped silhouette. An East-Indian influence appeared, suggested by the dresses worn by the wife of a visiting East-Indian potentate. These modern dresses were made with the Indian sari attached, which was thrown over the head and fell to the feet. The classical influence also continued, developing a sweeping back full of dignity and grace. Quaint and rather ultra-sophisticated very feminine clothes appeared, inspired by Dresden figures and Eugénie portraits. It was the revival of a romantic era treated in a modern way. It became amusing and charming at the same time.

The Italian exhibition of art in Paris influenced both the designers of clothes and materials throughout the world; and thirteenth, fourteenth, and fifteenth century Madonnas became modern ladies as seen through modern eyes. A military treatment crept into day clothes, "frogs" across the coat fronts, braid, broad shouldered short jackets, small felt hats with showers of black coq feathers giving the illusion of Italian army officers. These things were probably inspired by the war clouds over Italy and Ethiopia. A mediaeval influence and an Italian Renaissance influence were strongly felt in evening clothes. These period influences were always approached and adapted in a contemporary manner giving them an extremely modem viewpoint. A feeling of great luxury and extravagance, particularly in the use of furs appeared to be a foremost thought in 1935. Silver fox skins were used in a most prodigious manner, being made into entire short coats for day and great capes for evening. (G. AD.)

DRESSER, in furniture, a form of sideboard. The name is derived from the Fr. dressoir, a piece of furniture used to range or *dresser* the more costly appointments of the table. The appliance is the direct descendant of the credence and the buffet, and is, indeed, a much more legitimate inheritor of their functions than the modern sideboard, which, as we know it, is practically an 18th-century invention. It developed into its present shape about the second quarter of the 17th century, and has since then changed but little. As a piece of movable furniture it was made rarely, if at all, after the beginning of the 19th century until the revival of interest in what is called "farmhouse furniture" at the very beginning of the 20th century led in the first place to the construction of many imitation antique dressers from derelict pieces of old oak, and especially from panels of chests, and in the second to the making of avowed imitations. The dresser conformed to a model which varied only in detail and in ornament. Its simple and agreeable form consisted of a long and rather narrow table or slab, with drawers or cupboards beneath and a tall upright closed-in back arranged with a varying number of shallow shelves for the reception of plates; hooks for mugs were often fixed upon the face of these shelves. Towards the end of the 17th century small cupboards were often added to the superstructure The majority of these dressers were made of oak, but when, early in the Georgian period mahogany came into general use, they were frequently inlaid with that wood; holly and box were also used for inlaying, most frequently in the shape of plain bands or lines. A peculiarly effective combination of oak and mahogany is found in the dressers, as in other "farmhouse furniture," made on the borders of Staffordshire and Shropshire. The excellence of the work of this kind in that district and in the country lying west of it may perhaps explain the expression "Welsh dresser." which is now no more than a trade term, not necessarily suggestive of the place of origin, but applied to all dressers of this type. In Europe, they are most frequently found in the houses of small yeomen and substantial farmers, into which fashion penetrated slowly.

In the United States, the term dresser is more commonly applied to a piece of bedroom furniture consisting of a chest of drawers, or bureau, with a mirror attached—a sort of dressing-table. This application has no doubt been brought about by its use as a convenience in dressing or attiring one's self.

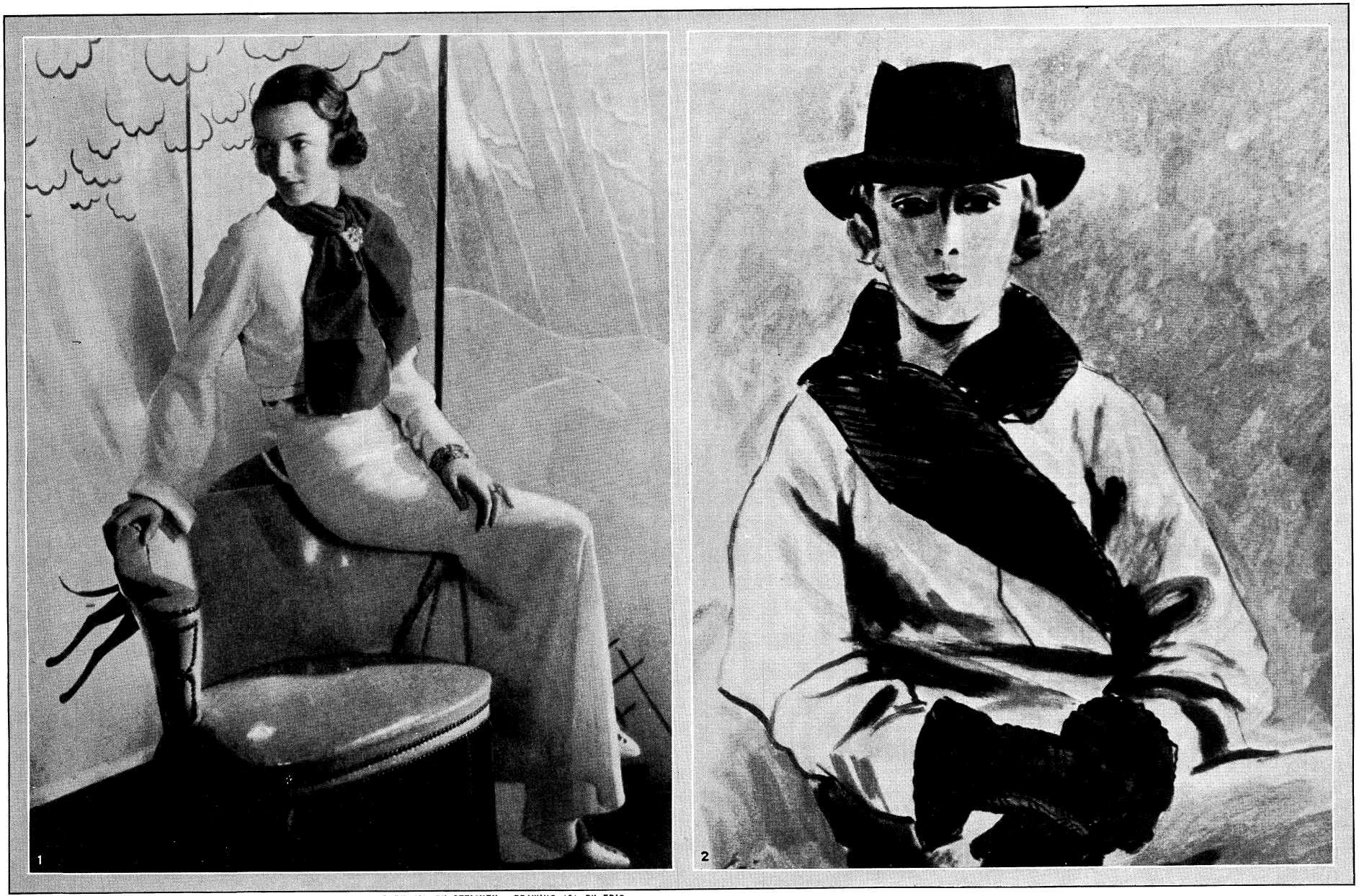
DRESSING STATION, a military term for the place where wounded are collected and attended to by the medical personnel of a field ambulance. It is thus normally next in rear of the "first-aid," or "regimental aid post."

DRESS MANUFACTURING. No phase in the history of dress is more remarkable than that which has been witnessed in the opening of the 20th century. Class distinctions, in so far as they are indicated outwardly by dress, have disappeared. It is not easy to detect differences of degree among the great bulk of the people. Partly, this is due to the spread of democratic ideas and institutions. Cheap means of transport, for example, bring all classes together. The intermixing produces similarity in style of attire. Partly, also, the cause is economic. There are more wage-earners, at better rates of pay. There has been a tremendous increase in the number of women wage-earners. Every one has more money available to spend on dress.

Mass-Production of Clothes.—A not less important cause is the mass-production of clothing. This both created a demand and developed in response to it. That section of the public of modest means who would have been slow to leave their clerical blue-serge, their homespun, their corduroys and large feathers—the mark of their occupation or class—have been educated into buying copies of the garments worn by the better-to-do, copies produced under the factory system by the hundred thousand. The men's ready-made clothing industry is a phenomenon; in the women's trade, dress everywhere has been completely revolutionized. Thirty years ago the woman of means had recourse exclusively to the dressmaker, the sempstress, the ladies' tailor. The latest fashions from Paris were reproduced for her by them, from actual models brought over or illustrated in the fashion journals. It was all hand process and slow, and "the latest" never percolated through to the mass of the female population. Then arose the trade movement which was to alter all this. It had actually begun in Germany two or three decades earlier, and was bound up with the improvements then being made in textile machinery and with the state of employment. A number of retail shopkeepers dealing in dress materials and articles of clothing found employment for their workers by starting the manufacture of "stock size" garments when orders for made-to-measure clothes were scarce. They were so successful and the service proved so popular that establishments were opened solely for this branch of manufacture. Factories were started in the provinces. Nearly the whole of the trade at first was confined to mantles, the basic and staple garment from which this now remarkable industry has grown.

The German Industry.—In the '70s the industry in Germany was well-established and important. In Berlin alone some 60 firms catered for it, and already were turning their attention from the home to the foreign market. The value of the total output in 1871 reached 30 million marks, and the number of workers employed, amounting to some 35,000, exceeded the number of those engaged in any other German industry at the time. In 1875 Great Britain bought three million marks' worth; in 1876 double that quantity; and two years later ten million marks' worth, the rate of importation thereafter steadily increasing until in 1897 the purchases reached a figure in excess of 88 million marks.

From that date Germany has been losing her monopoly of the world's markets. Almost every one of the chief importing countries—Great Britain, the United States, Austria, Italy, Switzerland, Holland, the Scandinavian countries—began to offer competition. Manufactories, one by one, were quickly opened; and although the German industry continued to grow, for only the "fringe" of the needs of the women of the world had yet been touched, manufacturers in other countries set themselves steadily



COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. PHOTOGRAPH (1) BY STEICHEN. DRAWING (2) BY ERIC

TRENDS IN WOMEN'S DRESS IN 1932

1. A long-sleeved tail redingote dress, which shows the 1932 tendency toward a masculine note, even in evening dress

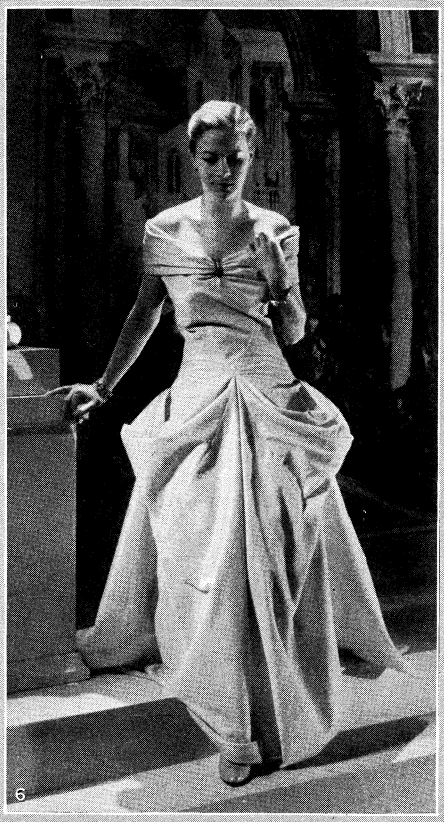
2. A Descat mannish felt hat, called "The Amazon," and an Augustabernard tweed coat. Both are examples of the masculine trend of 1932

DRESS

COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. PHOTOGRAPH (1) BY HOYNINGEN-HUENE. DRAWINGS (2) ERIC, (3) MOURGUE, (4) WILLAUMEZ

TRENDS IN WOMEN'S DRESS IN 1933

1. A Talbot fez hat, inspired by native African fashions
2. Coq and ostrich feathers were used to trim evening gowns in 1933. Designed by Schiaparelli
3. Daytime costumes, designed by Schiaparelli. These show the slender straight silhouette with broad shoulder treatment introduced in 1933
4. Evening gowns with huge ruffled puff-sleeves, designed by Chanel, a mode introduced by a motion picture, which became international and returned to America again from Paris



COURTESY OF "VOGUE," THE CONDE NAST PUBLICATIONS, INC. PHOTOGRAPHS BY (1) HORST, (2, 4, 6) HOYNINGEN-HUENÉ, (3) STEICHEN, (5) BRUEHL-BOURGES

TRENDS IN WOMEN'S DRESS IN 1934

1. A Creed suit and a Talbot hat, both emphasizing the trend toward the strictly tailored
2. The closely coifed head fashionable in **1934**
3. The fringed evening dress popular in **1934.** The fringe fell from the hip to the floor
4. Augustabernard evening dress. An example of the grace and dignity of evening clothes in **1934**
5. Beach costumes became important during **1934**
6. Picturesque evening dress, designed by Vionnet. This shows the Victorian influence in the treatment of the draping of the shoulders

DRESS

COURTESY OF (1, 2, 3, 4) "VOGUE," THE CONDE NAST PUBLICATIONS, INC., (5) "HARPER'S BAZAAR." PHOTOGRAPHS BY (1, 2, 3) HORST, (4) STEICHEN, (5) MORAL

TRENDS IN WOMEN'S DRESS SINCE 1934

1, 2, 3. Hats worn in 1935. The millinery of the day was often fantastic and sometimes humorous. On the left, a Louise Bourbon hat, showing Victorian influence. In the centre, a Talbot hat and a Creed suit. These show the military influence in fashion. On the right is a hat inspired by Italian Renaissance portraits

4. A Schiaparelli evening dress, the inspiration of which was the costumes worn by the wife of a visiting East Indian potentate. The *sari,* attached to the dress, was thrown over the head and fell to the feet

5. A 1938 peasant dirndl dress, designed by Molyneux

to supply the wants of the home consumer. They were handicapped on the score of prices, for the longer experience, lower wages, and higher organization of the Germans told heavily against them, but in another respect they had an advantage.

The German standard models were in the main not specially well-adapted to the non-German market. The women of Germany are heavier in build — "stockier" — than their sisters in the principal importing countries, and although the German manufacturers were quick to appreciate this and to modify the cut accordingly, still it was a compromise and benefited the maker on the spot who made exclusively for, and knew precisely, the needs of his own womenkind.

Growth of American and British Costume Trade — The industry abroad began to get into stride, particularly in the United States and the United Kingdom. For the latter, 1897 appears to have been the pivot year, for, after spending on German mantles no less than 88 million marks, British consumers bought from the same source in 1898 only 65.3 million marks' worth, while in 1899 the drop was bigger still — to 28.4 millions. The decline in subsequent years was in smaller ratio, but steady, until the World War, when the cutting off of supplies from Germany stimulated manufacturers elsewhere to supplant entirely the products of that country, not only at home but in foreign markets. After the War German "ready-mades" began very slowly to regain their former markets, the volume of imports from that country into the United Kingdom, *e.g.*, being valued at about half a million pounds sterling; the actual figure ten years after the outbreak of hostilities (1924) — as shown by the Board of Trade official import and export list classification of women's and girls' outer garments of woven fabrics: (a) costumes, dresses, coats, skirts and the like, and (b) mantles and cloaks — was £345,806.

Machine-made Clothes. — Concurrently with the rise of the industry throughout the world, manufacturing processes underwent remarkable development, and it may be said that there are now few figures and tastes which cannot be suited from the up-to-date manufacturer's stock. The style, fit and finish of even the cheapest "lines" have come to be a technical triumph. Costly and elaborate machinery and processes enable garments to be turned out markedly superior to the bulk of the old-time dressmaker's or hand-tailored product, and quality for quality (speaking of material) at about half cost. The term "mantle," originally in general use, by which was understood in the main a loose-fitting coat or cloak, usually sleeveless and worn over the dress, is becoming obsolete. It is still in some use, as broadly denoting the industry, but in England manufacturers prefer to be identified with the "coat and costume" and in America with the "cloak and suit" trade, in order to get away from a word which associates the product too closely with the early German cheap trade. The coat, deriving from the mantle, is now important, but the costume and suit, the complete dress consisting of coat and skirt, are the basis of the industry.

The trade owes much, however, in connection with the devising and perfecting of scientific, speedy and efficient processes of production to America. American manufacturers set a standard of excellence in this field, in the making of apparel, both for men and women, for all the world to follow. They were the first to realize the great possibilities of the trade and to determine to remove from it the deserved reproach which hitherto had attached to "ready-mades" and all too often had signified '(slop made." They saw that it need only be a question of research, organization and patient improvement of mechanical processes to enable their factories to turn out garments to suit the figure, purse and taste of every conceivable type and class of wearer, and it is well recognized now that in the United States, above all countries, the woman shopper can walk into a store and in the majority of cases be supplied from an immensely assorted stock with a costume or dress which not only exactly meets her fancy as regards fashion, material, colour and accessories, but fits her elegantly, no matter how widely she may diverge from the average or "stock" size.

Height, Width and Girth. — Quite in the early days of the garment industry in the United States steps began to be taken to allow for every variation of the human frame, in height, width, posture and girth, the requisite fullness or reduction of material and measurement being provided, in their minute differences, by no chance or rule-of-thumb methods but on a scientifically-based system of anthropometric variation — such as, for example, that propounded by the late Dr. Henry Wampen to the effect that, in the case of abnormal figures, height or depth quantities are to be calculated from a scale based on the height of the figure, while width quantities are to be based on the breast circumference.

In comparison, the manufacturers of other countries were slow to realize how much the future success of the trade depended upon their ability to cater for the almost infinite series of gradations in the human figure, with the result that for a long time, as in England, the chief customers for "ready-mades" were those of "stock size" proportions rather than those not of the average. Seeking to meet all requirements, the United States took the lead, and still retains it, so far as bulk production on the biggest scale is concerned, and to its enterprise in this particular section of the industry is due to no small extent the fact that American women are among the most smartly-dressed of any women in the world.

American methods of production in both the women's and men's ready-to-wear trade, involving 50 or more principal separate processes, hand and mechanical, and numerous minor operations, American methods of subdivision of labour, and also the types of plant used in the States, are now models for the apparel industry in all countries. It is difficult to estimate the precise extent of the trade in America, as the census returns associate together manufacturers in related branches of trade. Taking as some guide the corporation income tax returns which the United States authorities have published in recent years, we find that in 1924 the number of corporations in the women's and children's clothing and suit industry was put at 1,664, and that they paid tax on profits of $8,210,038. As the figure 1,664 is the fourth highest, in regard to the number of corporations engaged per industry, in a list taken from a report obtained for the purpose of this article, it is clear that the American cloak and suit trade, comprising private firms in addition to corporations, constitutes a very important part of the manufacturing activities of the United States as a whole.

English Styles. — There is a certain demand for English styles in women's costumes in the United States. In 1926 the purchases of such garments from the U.K. amounted to £59,330; the U.K. in return purchasing in 1925 (last available figures) £15,771 worth of U.S. costumes, etc.

To return to the trade of the United Kingdom, women's ready-to-wear garments of the category under discussion are bought principally from (in addition to Germany, figures for which have already been given) France, Belgium, Switzerland, Austria, the Netherlands, Italy and Czechoslovakia. In 1924 the British imports from France were valued at £3,087,000.

In estimating values, also, the course of the French franc since the World War needs to be borne in mind, together with the low cost of labour as compared with that of the United Kingdom.

In 1926 the British exports of fabric garments were worth £1,890,000. The British colonies and dominions are by far the best customers of the British costume manufacturer. As to the geographical distribution of the trade in the United Kingdom, London is an important centre as regards both manufacturing and distribution. For wholesale distribution, the earliest and still a considerable centre is St. Paul's churchyard, Cannon street, Friday street and Old Change, London. At the manufacturing end, the industry is also firmly established in a number of provincial towns and areas, including Manchester (where a speciality is the raincoat and waterproof), Leeds, Glasgow, Bristol, Birmingham and Bradford. (C. J. S.)

DREUX, a town of north-western France, capital of an arrondissement in the department of Eure-et-Loir, 27 m. N.N.W. of Chartres by rail. Pop. (1936) 12,387. Dreux was the capital of the Gallic tribe of the *Durocasses.* In 1188 it was taken and burnt by the English; and in 1562 Gaspard de Coligny, and Louis I., prince of Condé, were defeated there by Anne de Montmorency and Francis, duke of Guise In 1593 Henry IV. captured the town. It was occupied by the Germans in Oct. 1870,

was later evacuated, and again taken, on Nov. 17, by General von Tresckow. In the 10th century Dreux was the chief town of a countship, which Odo, count of Chartres, ceded to King Robert. Later, Louis VI. gave it to his son Robert, whose grandson Peter of Dreux, younger brother of Count Robert III., became duke of Brittany by nis marriage with Alix, daughter of Constance of Brittany by her second husband Guy of Thouars. By the marriage of the countess Jeanne II. with Louis, viscount of Thouars (d. 1370), the Capetian countship of Dreux passed into the Thouars family. In 1377 and 1378, however, Perronelle and Marguerite, two of the three co-heiresses of Jeanne, sold their shares of the countship to King Charles V. Charles VI. gave it to Arnaud Amanien d'Albret, but took it back in order to give it to his brother Louis of Orléans (1407); later he gave it back to the lords of Albret. Francis of Cleves laid claim to it in the 16th century as heir of the d'Albrets of Orval, but the parlement of Paris declared the countship to be crown property. It mas given to Catherine de' Medici (1539), then to Francis, duke of Alençon (1569); it was pledged to Charles de Bourbon, count of Soissons, and through him passed to the houses of Orléans, Vendbme and Condé. Dreux stands on the Blaise, which there divides into several arms. It is overlooked from the north by a hill with a ruined mediaeval castle, within the enclosure of which is a gorgeous chapel, begun in 1816 by the dowager duchess of Orléans and completed by Louis Philippe. It contains the tombs of the Orléans family, chief among them that of Louis Philippe, whose remains were removed from England to Dreux in 1876. The sculptures on the tombs and the stained glass of the chapel windows are masterpieces of modern art. The older of the two hbtels de ville of Dreux was built in the early 16th century, chiefly by Clément Métezeau, whose father, Thibault, was the founder of a famous family of architects, natives of the town. It is notable for the carvings of the façade and for the staircase. The church of St. Pierre is Gothic and contains good stained glass and other uorks of art. Dreux is the seat of a subprefect. Among the public institutions are tribunals of first instance and of commerce. There is also a well-known sanitarium The manufacture of boots and electric fittings and metal-founding are carried on. and there is also a trade in wheat and poultry. (X.)

Battle of Dreux (1562).—The battle of Dreux was the first regular engagement of the Huguenot Wars in France, and it was fought on Dec. 19, 1562. Henry II., king of France, was accidentally killed at a tourney in 1559, and was succeeded by his ten year old son, Charles IX., whose mother, Catherine de' Medici, claimed the right to conduct the government. On March 1, 1562, the duke of Guise massacred 60 Huguenots at Vassy and the leaders of the reformed faith, Condé and Admiral de Coligny, appealed to the Queen but received no satisfaction. War now began, the Huguenots being declared rebels. As they were vastly in the minority they sought assistance from England and Germany, obtaining promises of money from the first, and 9,000 reiters and landsknechts from the second. Leaving d'Andelot and his 9,000 Germans at Orléans, in November, Condé made a dash for Paris, but found Guise and Saint-André already there. To gain time to collect her forces, the Queen-mother made overtures for peace, but as no result was reached, on Dec. 10 Condé moved on Chartres, the royal army following and threatening Orléans. Condé now wished to counter-march on Paris, but Coligny persuaded him to move into Normandy and join hands with an English force which had landed there. Thus it came about that the army marched on Dreux. There the Huguenots found their road blocked, and though inferior in numbers were compelled to accept battle, for as Coligny said: "We must now look to our hands to save us, not to our feet." On each side the left wing was victorious. In all some 6,000 were killed or wounded, and though no true decision was gained the royalists held the field. Marshal Saint-André and the duke of Nevers were killed on the royalist side, and Condé was taken prisoner. After the battle Coligny withdrew his men in good order to Beaugency. The forces engaged were approximately 4,000 horse and 8,000 infantry on the side of the Huguenots, and 3,000 horse and 13,000 infantry on that of the royalists.

See Kervyn *de* Lettenhove, *Les Huguenots et les Gueux* (1885); Aumale, *Hist. des Princes de Condt pendant les XVI^me^ et XVII^me^ siècles* (1864); *The Cambridge Modern History,* vol. iii. (1904).

(J. F. C. F.)

DREW, the name of a family of American actors. JOHN DREW (1827–1862) was born in Dublin and made his first New York appearance in 1846. He played Irish and light comedy parts with success in all the American cities, and was manager of the Arch street theatre in Philadelphia. He visited England in 1855, and Australia in 1859; he died in Philadelphia. His wife, LOUISE LANE DREW (1820–1897), was the daughter of a London actor, and in 1827 went to America, appearing as the Duke of York to the elder Booth's Richard III., and as Albert to Edwin Forrest's William Tell. After this she starred as a child actress, and then as leading lady. She had been twice married before she became Mrs. Drew in 1850. From 1861 to 1892 she had the management of the Arch street theatre in Philadelphia. In 1880 she toured with Joseph Jefferson in his elaborate revivals of *The Rivals,* playing Mrs. Malaprop to perfection. She had three children, John, Sidney and Georgiana, wife of Maurice Barrymore (1847–1905), and mother of Lionel, Ethel and John Barrymore, all actors.

The eldest son, JOHN DREW (1853–1927), began his stage career under his mother's management in Philadelphia as Plumper in *Cool as a Cucumber,* March 22, 1873; and after playing with Edwin Booth and others, became leading man in Augustin Daly's company in 1879. His association with this company, and with Ada Rehan as the leading lady, constituted a brilliant period in recent stage history, his Petruchio being only one, though perhaps the most striking, of a series of famous impersonations. In 1892 he left Daly's company, and began a career as a "star," appearing among other plays in *A Marriage of Convenience, One Summer Day, Richard Carvel, Much Ado About Nothing, The Will, The Circle* (1921–23), *School for scandal* (1923), *Trelawney of the Wells* (1925–26–27). He died in San Francisco (Calif.), July 9, 1927, while on tour.

See Moses, *Famous Actor-Families in America* (1906); Winter, *Wallet of Time* (1913).

DREWENZ, a river of Germany, a right-bank tributary of the Vistula. It rises on the plateau of Hohenstein in East Prussia, 5 m. S.W. of the town of Hohenstein. After passing through the lake of Drewenz (7 m. long), it flows south-west through flat marshy country, and forms, from just below the town of Strassburg to that of Leibitsch, a distance of 30 m., the frontier between East Prussia and Poland. After a course of 148 m. it enters the Vistula from the right, a little above the fortress of Thorn.

DREWS, ARTHUR (1865–1935), German philosopher. was born on Nov. 1 at Utersen, Holstein, and was educated at Munich, Berlin, Heidelberg and Halle. From 1898 he was professor at the polytechnic academy in Karlsruhe. His contributions to the critical appreciation and history of philosophy are *Die deutsche Spekulation seit Kant* (1893); *Kants Naturphilosophie* (1894); *Das Ich als Grundproblem der Metaphysik* (1899); *Das Lebenswerk E. V. Hartmanns* (1907); *Nietzsches Philosophie* (1904); *Plotin* (1908); *Die Philosophie im 19. Jhr.* (1912); *Gesch. des Monismus im Altertum* (1913). His support of concrete monism and an ultimate Being devoid of consciousness and personality is best seen in his *Die Religion als Selbstbewusstsein Gottes* (1906); *Der Monismus* (1908) and *Freie Religion* (3rd ed., 1921).

DREXEL, ANTHONY JOSEPH (1826–1893), American banker, was born in Philadelphia (Pa.) Sept. 13, 1826. He was the son of Francis M. Drexel (1792–1863), founder of the banking-house of Drexel and Co. Anthony, with his brothers Francis and Joseph, succeeded to the control of the business, and organized the banking-houses of Drexel, Morgan and Co., New York, and of Drexel, Harjes and Co., Paris. In 1864 with George W. Childs he purchased the Philadelphia *Public Ledger,* and with him in 1892 founded the Printers' Home for union men at Colorado Springs. In 1891 he founded and endowed the Drexel institute of Art, Science and Industry in Philadelphia. He died at Carlsbad, Germany, June 30, 1893.

DREYER, JOHN LOUIS EMIL (1852–1926), Danish astronomer, was born at Copenhagen on Feb. 13, 1852, and was educated in his native town. In 1874 he became astronomer at

the earl of Rosse's observatory at Birr Castle, Ireland. He remained in Ireland, holding the post of assistant astronomer at the Royal Observatory, Dunsink, from 1878 to 1882, and of director of the observatory at Armagh from 1882 until he retired in 1916. Dreyer's work in astronomy falls into two groups—his observations on nebulae and on the motion of stars, and his work on the history of astronomy. His astronomical observations were started at the Rosse observatory, where the telescope was particularly suitable for his purposes, and continued at Dunsink and Armagh. Dreyer is the author of a number of papers on nebulae and stars, and of *Second Armagh Catalogue of 3,300 Stars* (1886). His "New General Catalogue of Nebulae and Clusters of Stars," published in the *Memoirs* of the Royal Astronomical Society (1888), with supplements in 1895 and 1908, is a standard work. He was particularly interested in the work of Tycho Brahe, and wrote *Tycho Brahe,* a *Picture* of *Scientific Life and Work in the 16th century* (1890), and prepared a complete edition of Tycho Brahe's work, *Tycho Brahe Opera Omnia.* The first volume was published in 1913; ten volumes appeared before Dreyer's death, and the remaining four were complete in manuscript. Dreyer held many academic honours. He died on Sept. 14, 1926.

DREYFUS, ALFRED (1859–1935), French soldier, was born on Oct. 9, 1859, the son of a Mulhouse manufacturer. After studying at the *école polytechnique,* he entered the army as a lieutenant of artillery. He became a captain in 1889, passed through the *école supérieure de la guerre* (staff college), and received an appointment in the Ministry of War. His name is famous because of the judicial error of which he was the victim, which was repaired only after an agitation which disturbed France for many years and aroused deep feeling all over the world. During the summer of 1894, an anonymous letter abstracted from the German embassy was communicated to the Ministry of War. It had been addressed to the military attaché, Col. von Schwarzkoppen. This letter known as the *bordereau,* or schedule, because it had originally been written as a covering letter to certain military memoranda, enumerated the documents which its writer hoped to send to Schwarzkoppen. A French officer was evidently betraying his country. It happened unfortunately that the writing of the *bordereau* was like that of Dreyfus. Suspicion fell upon him, and he was arrested on Oct. 15. He always maintained his innocence, but by reason of the similarity of the hand-writing, appearances were against him. Actual evidence was, however, extremely scanty. For this reason, Gen. Mercier, the minister of war, placed before the members of the court-martial secret documents, utterly valueless as evidence, but which could not fail to impress them. This was done unknown to the prisoner and his counsel, the famous M. Demange, and the fact did not leak out until several years later. On Dec. 22, 1894, Alfred Dreyfus was unanimously found guilty and condemned to detention for life in a fortified area. On March 15, 1895, he was interned on Devil's island, one of the archipelago of the Safety islands off the coast of Guiana. His family never ceased to believe in his innocence. His brother, Mathieu Dreyfus, convinced a terrible judicial error had been committed, strove incessantly to have the case reviewed. This could not be done, however, unless some new facts were brought to light.

An official at the Ministry of War, entirely unconnected with the Dreyfus family, made the necessary discovery. Col. Picquart was the head of the information branch which had to do with the affairs of the secret service. In March 1896 he became possessed of the fragments of an express letter which Col. von Schwarzkoppen, the German military attaché, had torn up unsent, and thrown into the waste-paper basket. It had been found by a French agent. This express letter, known as the *"petit bleu"* was addressed to a French officer, Maj. Esterhazy, and proved that he was in the pay of Schwarzkoppen. On making enquiry Picquart found that Esterhazy led a dissipated life and was heavily in debt. He then discovered that the *bordereau,* wrongly attributed to Dreyfus, was in Esterhazy's hand-writing. Convinced that Dreyfus was innocent and Esterhazy guilty, he laid his information before his superior officers, Gen. de Boisdeffre and Gen. Gonse, the chief and deputy chief of the general staff. They, however, still convinced of Dreyfus' guilt, and unwilling to have the matter reopened, forbade him to pursue his enquiries, and when he said he could not die with such information undisclosed, had him transferred to a distant part of Tunisia. About that time, Col. Henry, the deputy director of the information branch, brought forward a letter apparently from Col. Panizzardi, the Italian military attaché. Dreyfus was referred to in it in terms which, had it been genuine, would have left no doubt of his guilt. The letter was, however, a forgery, and the discovery of this fact led to the first revision of the case. Col. Picquart, before starting for Africa, had told the whole story to his friend the lawyer, M. Leblois. Leblois discussed it with Scheurer-Kestner, a well known politician who was vice president of the senate. He became convinced of Dreyfus's innocence, and began to agitate in his favour. At the same time (Nov. 1897) Mathieu Dreyfus had by the merest chance come to realize that the writing of the *bordereau* was that of Esterhazy. On Nov. 15, 1897, he wrote to the minister of war accusing Esterhazy of the crime for which his brother had been condemned. The general staff was unwilling to own that a mistake had been made. Esterhazy was formally court-martialled, but his acquittal was secured. At the same time a press campaign of extraordinary violence broke out against those who were working for the revision of the 1894 sentence. They were represented as traitors to their country. Col. Picquart was thrown into prison on the pretext that he had communicated confidential papers to a civilian (M. Leblois). The cause of Dreyfus had, nevertheless, gained many supporters, especially in intellectual circles. Georges Clemenceau and Francis H. Pressensé in the newly founded *l'Aurore,* and Yves Guyot, Joseph Reinach and others in the *Siècle* set on foot an agitation which did not cease till justice had been done. On Jan. 13, 1898, two days after Esterhazy's acquittal, Zola published in *l'Aurore* under the title *"J'accuse"* the famous open letter to the president of the republic, in which he denounced the efforts which were being made to stifle the truth. At the instance of the Ministry of War, proceedings were taken against him. The case was heard in February. His lawyers, Labori and Albert Clemenceau, brother of the statesman, called many witnesses to the innocence of Dreyfus and convinced a large section of the public. But opinion on the whole was still unfavourable. Zola was condemned to a year's imprisonment. He later took refuge in England for a time.

As the call for revision grew more and more insistent, Cavaignac, minister for war in Brisson's cabinet, tried to arrest it by reading aloud in the chamber on July 7, 1898, the alleged letter from Panizzardi which had been brought forward by Col. Henry some months before. Soon after, however, on Aug. 30, it was made clear that it had been forged by its seeming discoverer, who was arrested and committed suicide in his cell at Mt. Valérien. This decided the Government to lay the demand made by Mme. Dreyfus for revision of the original sentence before the court of appeal. After months of enquiry, the court annulled the sentence of 1894 and ordered a new trial before a court-martial at Rennes. Little by little the cause of Dreyfus was gaining ground. Loubet, who became president of the republic on the death of Felix Faure in Feb. 1899, was favourably inclined to it, as was also the cabinet of Waldeck Rousseau, which came into power in June. But feeling still ran high, especially in military circles. Dreyfus was brought back from Guiana. The new trial lasted a month. On Sept. 9, 1899, the court-martial at Rennes by five votes to two delivered an incoherent judgment by which Dreyfus was found guilty with extenuating circumstances, and condemned to ten years' imprisonment. This amazed the general public. On Sept. 19 the Government decided to pardon Dreyfus. He was immediately set at liberty, and after a short stay at Geneva, settled in Paris. At the end of 1903 further facts which came to light led to a demand for a second hearing by the court of appeal, and a further long and detailed enquiry. On July 12, 1906, the court of appeal finally quashed the sentence of 1894. Dreyfus was completely rehabilitated. A Government measure reinstating him in the army with the rank of major of artillery was immediately passed. He was employed for a year in a military office at St. Denis near Paris and resigned in July 1907. In June 1908, on the

occasion of the transfer of the ashes of Zola in the Pantheon, an anti-Semite journalist, Gregori, fired two shots at him, one of which wounded him slightly. He re-entered the army during the World War, was promoted lieutenant-colonel in 1918, and shortly afterwards an officer of the Legion of Honour. After that he lived in retirement until his death in Paris, July 12, 1935.

BIBLIOGRAPHY.—Dreyfus's letters written in captivity have been published under the title *Lettres d'un Innocent (1898)*. His memoirs entitled *Cinq années de ma vie* appeared in 1901. The shorthand reports of the various trials have been published (some by the Libraire Stack of Paris and others by the *Ligue des Droits de E'homme). See* also Joseph Reinach, *Histoire de l'affaire Dreyfus (7* vols., 1901–1911); Theodore Reinach, *Histoire sommaire de l'affaire Dreyfus* (1924); and an anti-Dreyfusite work by Dutrait-Crozon, *Précis de l'affaire Dreyfus* (1909). (P. B.)

DRIBURG, a town and spa of Germany, in Prussian Westphalia, pleasantly situated on the Aa and the railway Soest-Hoxter-Berlin. Population 3,000. **It** has glass manufactures. It is celebrated for its saline-ferruginous springs, discovered in 766, and since 1779 largely frequented in summer. In the vicinity are the ruins of Iburg, a castle destroyed by Charlemagne in 775, and bestowed by him upon the bishopric of Paderborn.

DRIESCH, HANS (1867–1941), German biologist and philosopher, was born on Oct 28, 1867, at Kreuznach. After studying at Hamburg, Freiburg, Munich and Jena, he travelled in the Far East, and from 1891 to 1900 worked in the zoological station of Naples. He then settled in Heidelberg where in 1909 he became privat-docent and in 1911 professor of philosophy. In 1920 he was made professor at Cologne and in 1921 at Leipzig. Driesch brgan as a disciple of Haeckel but through the influence of G. Wolff and W. Roux came to support a dynamic vitalism.

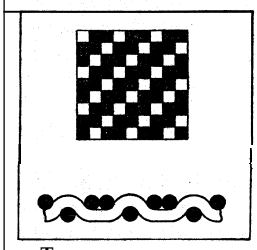
His doctrine that the functions of protoplasm cannot be explained mechanically was the outcome of experiments on the blastula of the sea-urchin, which showed that any fragment cut at random always gave a complete embryo and on the restitution of animal parts. From these he concluded that the organism must be a harmonious equipotential system possessing a vital individualizing entelechy which works through the matter with a view to the whole. He also maintained that instinct and action are inexplicable mechanically. His anti-mechanism in the psychological sphere is seen in his *Leib und Seele* (Leipzig, 1920. Eng. trans. with a full bibliography of his works, 1927). His other important works are *Analytische Theorie der organischen Entwicklung* (Leipzig, 1894); *Science and Philosophy of the Organism* (Gifford Lectures, 1907–8); *History and Theory of Vitalism* (1914); *The Problem of Individuality* (1914); *Wissen und Denken* (Leipzig, 1919); *The Crisis in Psychology* (Princeton Lectures, 1925). He died in Leipzig in Apr. 1941.

DRIFFIELD (officially Great Driffield), urban district, Buckrose parliamentary division, East Riding of Yorkshire, England. It is 19½ m. N. of Hull, with which it is connected by a navigable canal. Population of urban district (1938) 6,258. The town is served by the L.N.E. railway and is a junction for several branch lines. It is a market town, the centre of an agricultural district, and manufactures oil-cake. The town is rich in historical associations and has an excellent museum.

DRIFT: *see* GLACIAL PERIOD.

DRILL. In military science, the word *drillen* was used in Dutch, German and Danish from the 17th century for training in military exercises and was adopted into English in the same sense. The origin of the application seems to be in the primary sense of "to turn round," from the turning of the troops in their evolutions and from the turning of the weapons in the soldiers' hands. Drill is, formally, the preparation of soldiers for their duties in war by the practice or rehearsal of movements in military order and the handling of arms; and, psychologically, the method of producing in the individual soldier habits of self-control and of mechanically precise actions under disturbing conditions, and of rendering the common instinctive will of a body of men, large or small, amenable to the control of, and susceptible to a stimulus imparted by its commander's will. *(See* ARMY; INFANTRY; ROMAN ARMY.)

In textiles, drill is the name of a fabric made in both linen and cotton, and commonly bleached and finished stiff. The word is a shortened form of "drilling," from the German *drillich,* or "three-threaded," and is so named because the weave originally used in its construction is what is termed the three-leaf twill, nine repeats of which appear in the accompanying figure, while immediately below the design is an intersection of all the nine threads with the first pick. It is essentially a warp-faced fabric; that is, the upper surface is composed mostly of warp threads. In the figure it will be seen that two out of every three threads appear on the surface, and, by introducing a greater number of threads per inch than picks per inch, the weft is made to occupy a still more subordinate position so far as the upper surface of the cloth is concerned. Although the weave shown is still extensively used in this branch, there are others, *e.g.,* the four-thread and the five-thread weaves, which are employed for the production of this cloth. Large quantities of drill are shipped to the Eastern markets and to other subtropical centres. It is also used for military tropical uniforms, and for jackets, overalls, etc.



TWO DRILL DESIGNS
Three-leaf twill, a warp-faced fabric

In agriculture, a furrow in which seed may be sown is known as a drill. The word is somewhat doubtful in origin. It may be the same as an obsolete word "drill," to trickle, flow in drops, also a small stream or flow of water, a rill, and is possibly an altered form of "trill." Drill is also the name of an agricultural machine used for sowing seed or distributing manure *(see* CULTIVATING MACHINERY). *(See* also AGRICULTURE: AGRICULTURAL MACHINERY: SOWING.)

DRILL, *Papio leucophoeus,* **a** large baboon inhabiting the coast of Guinea. It is smaller and less fierce than its relative, the mandrill, and is further distinguished by the black colour of the bare face.

DRILLING, PETROLEUM. Modern automatic rotary drilling has supplanted to a remarkable extent former methods of cable tool or "rod and drop tool" systems. (For details of this, as well as other methods of boring, *see* BORING.) It is the extension and perfection of automatic drilling that has been responsible for the opening up of oil pools at greater and greater depths. Electric drive for both rotary and cable tool drilling has become common practice, whereas in the early 1920s it was an innovation and experimental. Before automatic machinery could be put to work on so complex and difficult an operation as deep-well drilling there was required the development of specially designed motors, Erst applied to well pumping, field water supply, pipe-straightening machines, cutting and threading machines, and finally to drilling. Rotary drilling required the development of adjustable speed motors and reduction gears of new type, and cable tool drilling, the development of an electric drive and control designed to give motion for drilling; power and high speed for pulling tools. bailing and setting casing, and slow speeds for ramming bits. With the first successful electric rotary deep-well drilling operation in California in 1923, a new era in drilling technique, based on automatic operation and simplicity of complete control, began. To see these modern plants in operation, drilling to depths of from 5,000ft. to 10,000ft. or even 15,000ft., is to get the full effect of the contrast between them and Drake's first steam-driven rig in 1859 or the first crude rotary operation at Spindletop. Texas, in 1901. Steel derricks tower 122ft. to 178 feet. Every step of raising the bit, unscrewing and screwing up again the lengths of steel tubing joined for a mile or more, is under control from the derrick floor.

On the derrick floor is an array of instruments resembling the instrument board of a power plant or of an aeroplane. A gyroscope compass determines whether the hole is being bored straight. Before its use there were cases of crooked holes drifting many hundreds of feet from the point vertically under the well site. Crooked holes meant trouble, delay, often loss of the well. An ingenious camera also is put to the same use as the gyroscope, taking photographs in the darkness far down in the well. It is the

only eye the production engineer has for seeing where he is travelling. Another instrument is the weight indicator, which shows the weight on the bit. The driller always watches it carefully, for it was found that there is some relation between the weight on the bit and the deflection of the hole, and that the deflection could be reduced by permitting less weight to rest on the bit when drilling. At frequent intervals the engineer in charge of the drilling operation consults charts of recordings from these various instruments.

In every modern operation similar contrasts from the old days are noted, whether the field be steam, Diesel, or electrically drilled. Improved devices for core drilling make it possible to obtain, for laboratory study, complete sections of the rocks and sands penetrated. In rotary drilling intensive studies of drilling fluids have resulted in compounds that greatly aid in the control of wells and the prevention of blow-outs. Methods of completing wells are greatly improved. It is important, in modern practice, to conserve gas pressure in an underground reservoir. Cementing methods are applied that seal off the gas sands underlying oil sands, so to conserve gas pressure. It is important also to case or cement off encroaching water from penetrated strata. Effective methods are applied to prevent water flooding by use of casing perforation, opposite oil zones only, leaving water zones cemented off. The major units for drilling—derricks, boilers, and pumps—are all of much heavier design. All tubular goods and drilling tools have reached a standard of strength and reliability consistent with the demands made upon them for deeper drilling. Failure of equipment, once a common occurrence, is rare. Wells may be drilled safely to depths exceeding 10,000ft., not as an unusual, but as an every-day occurrence.

As compared with 10 or 15 years before, well depths commercially reached in 1938 more than doubled. See Table I.

TABLE I.—Deepest Tests and Deepest Producing Wells, by Years

Year	Deepest Drilled Depth, Ft.	Deepest Producing Depth, Ft.	Year	Deepest Drilled Depth, Ft.	Deepest Producing Depth, Ft.
1938	15,004	13,206	1928	8,523	8,523
1937	12,786	11,302	1927	8,046	7,591
1936	12,786	9,950	1926*	8,046	7,591
1935	12,786	9,836	1925	.....	7,591
1934	11,377	9,710	1924	7,319	.....
1933	10,585	9,710	1909	5,660	.....
1932	10,585	9,710	1900	2,800	.....
1931	10,585	8,823	1895	1,200	.....
1930	9,753	8,550	1859	.....	69½
1929	9,280	8,523			

*Data prior to 1926 from records believed to be approximately correct.

TABLE II.—Wells Holding Drilling and Producing Depth Records (Dec. 31, 1938)

Record	Well	Depth (Feet)
Deepest well:	Continental Oil Co.'s KCL A-2, Wasco Field, Kern County, Calif.	15,004
Deepest well outside United States:	Holstein 14, Germany	12,726
Deepest producing oil well:	Fohs Oil Co.'s Buckley Bourg 1, West Dulac Field, Louisiana Gulf Coast	13,266
Deepest producing oil well outside United States:	Nippon Oil Co.'s Kinsui 32, Kinsui Field, Formosa, Japan	11,550

Authority: The Oil Weekly.

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(L. M. F.)

DRINK BILL. In Great Britain, this term has for many years been applied to an annual statement issued up to 1909 by the late Dr. Dawson Burns and since that date by George B. Wilson (in annual letter to the press, usually reproduced in substance in the Alliance Year Book, edit. by G. B. W. and published by the United Kingdom Alliance, London), showing the annual expenditure on and consumption of alcoholic liquors in the United Kingdom; since 1923 in Great Britain. The statement is based on the quantities of beer, spirits and wine retained for home consumption in Great Britain in the calendar year, as shown in the trade returns issued by the customs and excise, and does not include exports or re-exports of such liquors. The unit taken for beer is the 36 gal. barrel as sold. The number of such barrels is larger than the corresponding number of standard barrels which formerly were the unit of taxation. The materials which produce 1,000 standard barrels of 1,055° specific gravity before fermentation in 1938, in fact produced 1,344 selling barrels. The unit taken for spirits is the proof gallon. Spirits are, however, sold on the average at 30° under proof, or 142·8 selling gallons for every 100 proof gallons, so that the total gallons of liquid actually consumed as spirits in 1938 were not 10,098,000 as stated below but 14,420,000 gallons, or the equivalent of about 864 million bottles of whisky. The Drink Bill for 1938:—

Liquors	Consumption	Retail cost £
	(000's omitted)	
British spirits at 130s. per proof gal.	8,922	57,993
Other ditto	1,176	7,644
	10,098	65,637
Beer at 132s. per bulk barrel (including Irish imports)	24,861	164,080
Wine at 30s. per gallon	14,890	22,335
Cider, British Wines, etc.	.....	5,000
		£257,050
Per head		£5·11·6

The expenditure and consumption were about:

	England, Wales	Scotland
Expenditure	£234,716,000	£22,339,000
Per head	£5·14·0	£4·9·6
Spirits per head (proof gallon)	0·20	0·37
Beer per head (bulk gallons)	20·7	8·1
Absolute alcohol per head (gallons)	1·07	0·65

Of the absolute alcohol consumed about 12½% was taken in spirits, 78% in beer, and the balance in wine, etc.

The liquor taxation (duties and licences) collected in 1938 was about £109,400,000, or 42½% of the total Drink Bill.

The following figures compare the taxes on liquor and licences with the total tax revenue of the United Kingdom (Great Britain and N. Ireland since 1923):—

Year	Taxes on liquor and licences	Total tax revenue	Percentage borne by liquor taxation
	£	£	
1839	16,208,000	49,033,000	33·0
1899–1900	41,686,000	108,496,000	38·4
1919–1920	133,873,000	998,960,000	13·4
1938–1939	111,604,000	896,415,000	12·5

The use of industrial alcohol has greatly increased. In 1925 it was 7,529,000 proof gallons, but in 1938, 54,428,000 gallons. About two-thirds of the spirits annually distilled are now used for non-dutiable purposes. (*See* PROHIBITION; TEMPERANCE.)

(G. B. W.)

DRINKING VESSELS. Nature provided the primitive man with various forms of drinking vessels, such as the coco-nut, the gourd, eggs of the larger birds, shells and even the human skull, many of which have been of such practical use that they have lasted to the present day. The first artificial drinking vessels were so similar to those used for food, that it is difficult to make a definite line of distinction. The races of the Neolithic and Bronze ages furnished vessels of pottery of a beaker-like form, and later prehistoric times produced vessels of gold, bronze and other materials which seem to have been used as drinking vessels. A specimen, resembling an early Victorian tea-cup on a high foot, was found by Schliemann in his exploration of the superimposed cities of Troy. It is of clay, but similar forms found at Tiryns and Mycenae are of gold. Schliemann was especially interested in a tall, trumpet-shaped cup with two earlike loop handles; a sauce-boat shaped vessel of gold, made with a lip for pouring or drinking at each end, and with two loop handles; and others of gold, silver and electrum, three of which were shaped like 18th-century coffee cups without handles.

Gothic and Scandinavian Types.—The practice of burying with the dead warrior any property that he might need has preserved to our day the actual vessels in use by the pagan northmen who pervaded northern Europe from the 4th century onward. Among the belongings surrounding one Saxon chieftain were five cows' horns and four glass cups. The horns were 2 ft. long, and richly mounted at the mouth and at the point with silver bands embossed and gilt. The glasses were of a trumpet shape, with a

small foot, while the sides were ornamented with tubes bent downward and open on the inner side, so that the liquid would fill them. Another type was a simple cone of glass, sometimes ornamented with an applied spiral glass thread, or festoons of white glass imbedded in the body of the vessel. Still a third form was that of the "tumbler," a plain cup or bowl widely expanded at the mouth and with a rounded base, so that it could only be set down when empty. There are in the museums many other contemporary varieties, plain cylindrical goblets, generally with ornamental glass threads on the outside, and a more usual type has an orange-shaped body with a wide, plain mouth. In Belgium, France and Germany the same types occur, also additional forms that do not occur in England—one of which is a drinking glass in the shape of shunting horn with glass threads forming an ornamental design on the outside. These glass drinking vessels were popular, but a large number of small pottery vessels were found, and in one grave at Broomfield, in Essex, two small wooden cups were found. Horns as drinking vessels retained their popularity at all times, actual horns being supplanted later by horn-shaped vessels.

Church Vessels.—The drinking vessel possessing the most established history is doubtless the chalice of the Christian Church. Upon early Christian tombstones are found such vessels. apparently with a symbolic intention. But it is not until about the 6th century that the sacred vessels assumed a definite form. From that time date the lost golden chalices of Monza, representations of which still exist in that city; and the famous chalice of Gourdon in the Bibliothèque Nationale in Paris is probably of about the same time. All of these are two-handled with a vase-shaped body supported on a high base. Two glass vases of exactly this two-handled form are in the Slade collection at the British Museum, and may well have been chalices. This form seems to have been succeeded by a goblet with straight lines and without handles. Then came the rounded cup-shaped bowl as seen in the well-known Kremsmunster chalice. An interesting silver vessel, probably a chalice, found at Trewbiddle, in Cornwall, is in the British Museum. It is a plain semi-oval, and dates from the 9th century. The 13th century chalice was usually a broad, shallow cup, on a conical base. These gradually became taller, with a bowl smaller in proportion, so that in the 17th century both the civil and religious vessels had lost all sense of true artistic proportions. In Britain chalices ceased to be used in the English church in the reign of Edward VI. and were replaced by communion cups. The chalices of the early centuries were made of various materials. glass being more practicable, with gold and silver as preferences when they could be obtained.

Mediaeval Vessels **for Common** Uses.—Wooden vessels, of which mazer bowls seem to have predominated, were commonly used in the 14th, 15th and 16th centuries. In the latter century they began to take on elaborate mountings, and then, as other materials came into use among the wealthy, they began to lose their popularity. Crystal, agate and other hard stones, ivory and Chinese porcelain, were all in use, as well as the precious metals. Of the cups that are preserved in the British Museum, the royal gold cup of the kings of England and France is of interest. It is of nearly pure gold with a broad bowl and a high foot, the cover pyramidal. The subjects represented on its ornamentation are scenes from the life of St. Agnes, in two rows, one on the cover and one outside the bowl; on the foot are the symbols of the four Evangelists, and around the base a coronal of leaves alternating with pearls; the cover originally had a similar adjunct, but it has unfortunately been cut away. Its history has been traced from the time when it was made, about 1380, to the present time.

16th–18th Century Types.—Drinking vessels of the 15th and 16th centuries were of so many shapes, materials and decorations that most every type can be placed in that period. There were all sorts of adaptations, such as the ostrich egg mounted on elaborate silver, the coco-nut used in the same way and Chinese and other Oriental wares turned into cups and vases of various forms. Actual horns, provided with feet so as to serve as standing cups, were quite common. The elegant natural curve of the horn, often mounted with great richness, added still to the charm of the vessel. German silversmiths made many vessels in the forms of animals, the head generally removable so as to form a small cup. Stags, lions, bears and various birds are often found. **A** common type of Switzerland and South Germany was that of a figure of a peasant, generally in wood, carrying on his back a large basket, which edged with silver formed the drinking cup. A curious fancy was to make cups in the form of a globe. These are of historic value, because they show the state of geographical or astronomical knowledge at the time.

Glass cups were not common in England until the 16th century, Venice having practically a monopoly of the supply. The relations of Venice with the East were of so intimate a character that the earlier forms of Venetian glasses were nearly identical with those of the Mohammedan East. This period saw various kinds of wine glasses and goblets with enamelled and lace designs; tankards, practical but seldom graceful; beakers, resembling our modern tumblers and a common type among the Arabians.

In the 17th and 18th centuries a great impetus was given to the production of curious drinking vessels, not in the sense of supplanting the many varieties of the past, but as an interesting innovation. Cups of leather, generally in the form of a lady's shoe, were common. Flagons, or "black jacks" were also of leather. The material that lent itself to a greater possibility in the field of art was that of pottery. In England at various potting centres a great number of cups called "tygs" were made. These were large mugs with three or four handles, so that the cup could be passed from one to another. Some of these have quaint devices and inscriptions. "Puzzle jugs" afforded a good deal of amusement at this time. They were jugs with open-work around the neck, and a variety of spouts, only one of which led to the liquid. The Chinese still cling to the rhinoceros horn as an object of somewhat archaic form, believing it to be an antidote for poison. The beautiful amber hue and the thickness of the horn, together with the various carved decorations, make it a vessel of unusual interest. Tea-cups with no handles, and much thinner than coffee cups, were made in China in the 18th century.

The 19th and 20th centuries have seen the manufacture and use of most every form of drinking vessel that the ancient and mediaeval times produced, after changing the shapes and materials only as a matter of commercial interest. Glass is the most widely used material, being cheaper and more practicable, while clay is a better material when it comes to retaining heat or cold. *(See* also GLASS; POTTERY AND PORCELAIN; SILVERSMITHS' AND GOLDSMITHS' WORK.)

DRINKS, SOFT: *see* AERATED WATERS.

DRINK TRAFFIC: *see* LIQUOR LAWS.

DRINKWATER, JOHN (1882–1937), British poet, playwright and critic, born at Leytonstone, Essex, June 1, 1882, and educated at the Oxford high school. After 12 years' work as an insurance clerk, he devoted himself to theatrical enterprise, and became manager and producer to the Pilgrim Players, who developed into the Birmingham Repertory Theatre Co. His first volume of poems appeared in 1906 and his first play, *Cophetua* (in verse), in 1911. He subsequently published several volumes of verse, critical studies on *William Morris* (1912), *Swinburne* (1913) and others, and several plays, of which *Abraham Lincoln* (1918) was produced with great success both in London and in the United States. Among his later plays were the "chronicle dramas" *Oliver Cromwell* (1921), *Mary Stuart* (1922) and *Robert E. Lee* (1923), each of which was performed in London. In 1923 his *Collected Poems* (2 vol.) were published, and in 1925 *The Muse* in *Council,* a collection of essays, and his *Collected Plays* (2 vol.). In 1925 *The Pilgrim of Eternity: Byron—a Conflict,* a prose work, made its appearance. His autobiography appeared in two volumes, *Inheritance* (1931) and *Discovery* (1932). He wrote prolifically in the last years of his life, but none of his later work was of particular importance. He died March 25, 1937.

DRIP, DRIP-MOULD or **DRIPSTONE:** *see* HOOD MOULD.

DRIVER, SAMUEL ROLLES (1846–1914), English divine and Hebrew scholar, was born in Southampton on Oct. 2, 1846. He was educated at Winchester and New college, Oxford,

He was a fellow (1870) and a tutor (1875) of New college, and in 1883 succeeded Pusey as regius professor of Hebrew and canon of Christ Church He was a member of the Old Testament revision committee (1876–84) and examining chaplain to the bishop of Southwell (1884–1904). He died on Feb. 26, 1914. Dr. Driver devoted his life to the study, both textual and critical, of the Old Testament. Among his numerous works are commentaries on the books of the Old Testament. His *Introd. to the Literature of the Old Test.* (1897, 9th ed., 1913) became a standard work, and exercised great influence on younger scholars. His other most important work in Hebrew scholarship is to be found in his contributions to the Oxford *Heb. and Eng. Lexicon of the O.T.* (1906). A bibliography of his works is given in appendix B to Cooke's edition of *Ideals of the Prophets* (1915).

DRIVER'S INSURANCE: *see* INSURANCE, MISCELLANEOUS.

DRIVING, a word used in a restricted sense for the art of controlling and directing draught animals from a coach or other conveyance or movable machine to which they are harnessed for the purpose of traction (from "to drive"; *i.e.* generally to propel, force along or in, a word common in various forms to the Teutonic languages). This has been an occupation practised since domesticated animals were first put to this use. In various parts of the world a number of different animals have been, and still are, so employed; of these the horse, ox, mule and ass are the most common, though their place is taken by the reindeer in northern latitudes, and by the Eskimo dog in arctic and antarctic regions. The driving of each of these requires special skill, only to be acquired by practice combined with knowledge of the characteristics peculiar to the several animals employed.

Under all these different conditions driving is a work of utility, of economic value to civilized society. But from very early times driving, especially of horses, has also been regarded as a sport or pastime. This probably arose in the first instance from its association with battle. In the earliest historical records, such as the Old Testament and the Homeric poems, the driver of the chariot fills a place of importance in the economy of war; and on his skill and efficiency the fate of kings, and even of kingdoms, must often have depended. The statement in the Book of Kings that Jehu the son of Nimshi was recognized from a distance by his style of driving appears to indicate that the warrior himself on occasion took the place of the professional charioteer; and although it would be unsafe to infer from the story that the pleasure derived from the occupation was his motive for doing so, the name of this king of Israel has become the eponym of drivers. Among the Greeks at an equally early period driving was a recognized form of sport, to the popularity of which Horace afterwards made allusion. Racing between teams of horses harnessed to war-chariots took the place occupied by saddle-horse racing and American trotting races *(see* HORSE-RACING) in the sport of modern times. The element of danger doubtless gave pleasurable excitement to chariot racing and kept alive its association with incidents familiar in war; just as at a later period, when the institution of chivalry had given the armed knight on horseback a conspicuous place in mediaeval warfare, the tournament became the most popular sport of the aristocracy throughout Europe.

Driving as it is practised to-day for pleasure without profit, and without the excitement of racing, is of quite modern development. Oliver Cromwell, indeed, met with a mishap in Hyde Park while driving a team of four horses presented to him by the count of Oldenburg, which was the subject of more than one satirical allusion by contemporary royalist writers; but two things were needed before much enjoyment could be found in driving, apart from utility. These were the invention of carriages on springs, and the construction of roads with smooth and solid surface. The former did not come into general use till near the end of the 18th century, and it was about the same period that the engineering skill of Thomas Telford and the invention of John London Macadam combined to provide the latter. The influence on driving of these two developments was soon apparent. Throughout the 18th century stage-coaches, ponderous unwieldy vehicles without springs, had toiled slowly over rough and deeply rutted tracks as a means of communication between different parts of Great Britain; but those who made use of them did so as a matter of necessity and not for enjoyment. But by the beginning of the 19th century the improvement in carriage-building and road-construction alike had greatly diminished the discomfort of travel; and interest in driving for its own sake grew so rapidly that in 1807 the first association of amateur coachmen was formed. The two principal driving clubs in recent times have been the Four-in-Hand and Coaching Clubs. The former was founded in 1854 by the then duke of Beaufort, and such was its popularity that the club could not entertain a quarter of the applications for membership. In 1870 therefore the Coaching Club was formed with the duke of Beaufort as president. The meets of these two clubs in Hyde Park were in pre-war days a great feature of the London season, and on two or three occasions the Coaching Club mustered more than 30 coaches. The Four-in-Hand Club after an existence of over 70 years was dissolved in 1926, but the Junior Club in 1927 continued to be well supported, and in this year some 10 to 12 members drove their drags to the three meets which were held. The club at this time numbered 41 members.

Road-coaching has for long been a popular pastime amongst horsemen in the British Isles. Following the supersession of the stage-coaches by railways an important revival of coaching was initiated in 1866, and up to the time of the World War there were numerous well-appointed stage-coaches running daily in and out of London, notably on the Brighton and Portsmouth roads. On July 13, 1888, J. Selby, the well-known professional coachman, performed his celebrated feat of driving the "Old Times" coach from London to Brighton and back in 7hrs. and 50mins. This drive worked out at an average pace of 13·79m. per hour, horses being changed so smartly that with 8 teams and 14 changes the latter took altogether only 6mins. 12secs. Since the war, owing to economic conditions and the great increase in motor traffic most of these coaches have been compelled to come off the road, but in 1927 the "Old Berkeley" and "Venture" coaches, running respectively to Boxhill and Hampton Court had successful seasons *(see* COACHING).

In modern driving, one, two or four horses are usually employed. When a greater number than four is put in harness, as in the case of the state equipages of royal personages on occasions of ceremony, the horses are not driven but are controlled by "postillions" mounted on the near-side horse of each pair. When two horses are used they may either be placed side by side, in "double harness," which is the commoner mode of driving a pair of horses, or one following the other, in a "tandem." Four horses, or "four-in-hand," are harnessed in two pairs, one following the other, and called respectively the "leaders" and the "wheelers."

Though it is a less difficult accomplishment to drive a single horse than a tandem or four-in-hand, or even a pair, it nevertheless requires both knowledge and the skill that practice alone confers. The driver should have some knowledge of equine character, and complete familiarity with every part of the harness he uses. and with the purpose which each buckle or strap is intended to serve. The indefinable quality known in horsemanship as "good hands" is, partly at least, the result of learning the correct position for the arm and hand that holds the reins. The reins are held in the left hand, which should be kept at about the level of the lowest button of the driver's waistcoat, and near the body though not pressed against it. The driving hand should never be reached forward more than a few inches, nor raised as high as the breast. The upper arm should lie loosely against the side, the forearm horizontal across the front of the body, forming a right angle or thereabouts at the elbow-joint, the wrist bent inwards, and the back of the hand and knuckles facing outwards towards the horses. In this position the three joints of the arm form a kind of automatic spring that secures the "give" to the movement of the horse's mouth which, in conjunction with firmness, is a large part of what is meant by "good hands." But this result is only obtained if the reins be also held with the proper degree of bearing on the bit. What the proper degree may be depends greatly on the character of the horses and the sever-

ity of the bit. Pulling horses must be restrained by a strong draw on their bits, such as would bring other animals to a standstill. But under no circumstances, no matter how sluggish the horses are, should the reins be allowed to lie slack. The driver should therefbre always just "feel his horse's mouth" as lightly as possible; he then has the animal well under control in readiness for every emergency, while avoiding such a pull on the mouth as would cause a high-spirited horse to chafe and fret.

These principles are common to all branches of the art of driving, whether of one, two or four horses. When they are observed no great difficulty confronts the coachman who is content with single or double harness, provided he has acquired the eye for pace and distance, and the instinctive realization of the length of the carriage behind him, without which he may suffer collision with other vehicles, or allow insufficient room in turning a comer or entering a gateway. For before he can have had the practice by which alone this knowledge is to be gained, the beginner will have learnt such elementary facts as that his horses must be held well in hand going down hill and given their heads on an ascent, and to be sparing in the use of the hand-brake, with which most modern carriages are provided. This apparatus is most useful in case of emergency, or for taking weight off the carriage on a really steep descent; but the habit which too many coachmen fall into of using the brake on every trifling decline should be avoided. Its effect is that the horses are continually doing collar-work, and are thus deprived of the relief which ought to be given them by occasional light pole or shaft work instead.

Tandem and Four-in-hand.—When the ambition of the amateur coachman leads him to attempt a tandem or four-in-hand he enters on a much more complex department of the art of driving. In the first place he has now four reins instead of two to manipulate, and the increase of weight on his hand, especially when four horses are being driven, requires considerable strength of wrist to support it without tiring. It is of the first importance, moreover, that he should know instinctively the position in his hand of each of the reins, and be able automatically and instantaneously to lay a finger on any one of them. The driver who has to look at his reins to find the off-side leader's rein, or who touches the near-side wheeler's in mistake for it, is in peril of a catastrophe. It is therefore essential that the reins should be correctly disposed between the fingers of the left hand, and that the driver should as quickly as possible accustom himself to handle them automatically. The coachman should take the reins in his hand before mounting the box-seat, as otherwise his team may make a start without his having the means to control them. It is customary to hitch the reins, ready for him to take them on or through the off-side terret (the ring on the pad through which the rein runs) of the wheeler—the off-side wheeler in four-in-hand. Standing on the ground beside the off-side wheel of his carriage, ready to mount to the box-seat, the coachman, after drawing up his reins till he almost feels the horses' mouths, must then let out about a foot of slack in his off-side reins, in order that when on his seat he may find all the reins as nearly as possible equal in length in his hand. The reins should then be transferred to the right hand disposed as they will be in the left when ready to start, but one finger lower down; the first finger will then be free to hold on to the footboard in mounting the box. When replaced in the left hand after mounting, the leaders' reins should be separated by the forefinger, and the wheelers' by the middle finger. The near-leader's rein will then be uppermost of the four, between the forefinger and thumb; then between the forefinger and middle finger are two reins together—the off-leader's and the near-wheeler's in the order named; while at the bottom, between the middle and third fingers, is the off-wheeler's rein. It will be found that held thus the reins spread immediately in front of the hand in such a way that each several rein, and each pair of reins—two near-side, two off-side, two wheelers', or two leaders'—can be conveniently manipulated; and the proficient driver can instinctively and instantaneously grasp any of them he chooses with his right hand without having to turn his eyes from the road before him to the reins in his hand. Having seated himself on the bolt and transferred the reins, thus disposed, from the right to the left hand, the coachman should shorten them till he just feels his wheelers' mouths and hold back his leaders sufficiently to prevent them quite tightening their traces. Then, when he has taken the whip from its socket in his right hand, he is ready to start. This is an operation requiring careful management, to secure that leaders and wheelers start simultaneously; for if the leaders start first they will be drawn up sharp by their bits. The moment it is desired to start, the team should be given their heads and the "office" to start by the coachman at once easing his left hand. When once started a further adjustment of the reins is usually necessary. The driver should see that his team is going straight. If the leaders and wheelers are not exactly on the same line, this or that rein must be shortened or lengthened as the case may require; and it is to be noticed that as the near-wheeler's and off-leader's reins lie together between the same fingers, a simultaneous shortening or lengthening of these two reins will usually produce the desired result. With rare exceptions, reins should be shortened or lengthened by pushing them back or drawing them forward with the right hand in front of the driving hand, and not from behind it. As soon as the team is in motion the leaders may be let out till they draw their traces taut; but draught should be taken off them on falling ground or while rounding a corner. In rounding a comer a loop of the leaders' rein, on the side to which the turn is to be made, is taken up by the right hand and placed under the left thumb. This "points the leaders," who accordingly make the required turn, while at the same time the right hand bears lightly on the reins of the opposite side, to prevent them making the turn too sharply for safety to the coach behind them. When the turn is made the driver's left thumb releases the loop and the team returns to the straight formation. A circumstance useful to bear in mind is that the swingle-bars are wider than the maximum width of the coach; consequently the driver knows that provided the team and coach are going straight, wherever the bars can pass through with safety—and as they are before his eyes the calculation is easy—the coach will safely follow.

The Use of **the** Whip.—A necessary part of driving four horses or tandem is the proper use of the whip. The novice, before beginning to drive, should acquire the knack—which can only be learnt by practical instruction and experiment—of catching up the thong of the whip on to the stick by a flick of the wrist. Practice and considerable dexterity are required in using the whip on the leaders without at the same time touching, or at all events, alarming or fretting, the wheelers. The thong of the whip should reach the leaders from beneath the swingle-bar. This demands skill and accuracy, especially when striking the near leader, but no coachman is competent to drive four horses until he is able to touch with the whip any particular horse that may require it, and no other.

Essential as is proficiency in the use of the whip when driving four horses, it is even more imperative for the driver of tandem. For in four-in-hand the leaders act in some measure as a restraint upon each other's freedom of action, whereas the leader in tandem is entirely independent and therefore more difficult to control.

In the usual method of harnessing a tandem the lead traces draw direct from the wheeler's trace buckles. They should never be attached to the shafts, as this is a dangerous practice. The above method entails a considerable length of trace, and a trace-bearing-strap passing over the leader's loins is a necessity. Another method consists in having two swingle-bars similar to those used in four-in-hand, by means of which the leader's traces can be reduced to the same length as those of the wheeler.

A tandem, owing to the greater freedom of the leader from control, requires in a sense more delicate handling than a four-in-hand, but the latter supplies the coachman with problems of greater difficulty, and so of greater interest, if only for the reason that he has to deal with the various temperaments of four horses instead of only two, while the weight on the hand is obviously more severe, and a heavy coach load entails extra precautions for safety, especially in driving down hill. In Great Britain the coach-and-four is the more popular.

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Donald Walker, *British Manly Exercises: in which Riding, Driving, Racing are now first described* (1834); William Bridges Adams, *English Pleasure Carriages: their Origin, History, Materials, Construction* (1837); *The Equestrian: A Handbook of Horsemanship, containing Plain Rules for Riding, Driving and the Management of the Horse* (1854); J. H. Walsh ("Stonehenge"), *Riding and Driving* (1863); A Cavalry Officer, *The Handy Horse Book; or Practical Instruction in Driving, and the Management of the Horse* (1865–67, 1871–81); H. J. Helm, *American Roadsters and Trotting Horses* (1878); E. M. Stratton, *The World on Wheels* (1878); F. H. Huth, *Works on Horses and Equitation: A Bibliographical Record of Hippology* (1887); The Duke of Beaufort, *Driving* (The Badminton Library, 1889), containing a bibliography; Capt. C. Morley Knight, *Hints on Driving* (1894); James A. Garland, *The Private Stable* (2nd ed., 1902).

(X.; G. W.)

DROBISCH, MORITZ WILHELM (1802–1896), German philosopher and mathematician, was born on Aug. 16, 1802, in Leipzig, where he became professor of mathematics in 1826, professor of philosophy in 1842 and where he died on Sept. 30, 1896. He regards logic, whose business is the establishment of the general laws of thought, as a formal science independent of psychology. Religion is, for him, the expression of man's desire to escape from the impulses of nature to a divine being whose existence is better demonstrated by the ethical than the teleological proof. Drobisch's support of Herbart appears in his *Beiträge zur Orientirung über Herbart's System der Philosophie* (1834) and in *Neue Darstellung der Logik* (1836). He also wrote *Grundlehren der Religions-philosophie* (1840); *Empirische Psychologie* (1842); *Quaestionum mathematico-psychologicarum spec. I.–V.* (1836–39) and *Über die mathematisclze Bestimmung der musikalischen Intervalle* (1846).

See Neubert, *M. W. Drobisch* (Leipzig, 1902).

DROESHOUT, MARTIN, engraver, born in 1601 and baptized in London on April 26, 1601, was son of Michiel Droeshout and probably the pupil of his father and elder brother John, both engravers. Martin's title to fame is his engraved portrait of William Shakespeare (signed *Martin Droeshout sculpsit*), which appeared in the precious first folio edition of Shakespeare's plays printed in London in 1623. The engraver was only 15 years old at the time of Shakespeare's death and the portrait was therefore not done from life. (*See* SHAKESPEARE PORTRAITS.) Martin Droeshout's later work is superior to this portrait. We may mention his portraits of John Howson, Bishop of Durham, and of John Donne. He also illustrated Captain John Smith's "True Travels" (1630).

See S. Colvin, *Early Engravings in England, 1905; A. M.* Hind, *List of the Works of Line-Engravings in England* (1905); *Cat. of Engr. Brit. Portraits in the British Museum.*

DROGHEDA (drŏch'ĕ-dă), municipal borough and seaport, on the southern border of Co. Louth, Eire, on the river Boyne, about 4 mi. from its mouth in Drogheda bay, and 31½ mi. N. by W. from Dublin by rail. Pop. (1936), 14,494.

The earliest notices call the town Inver-Colpa or the Port of Colpa; the present name signifies "The Bridge over the Ford." A synod was convened here in 1152 by the papal legate, Cardinal Paparo; in 1224 was founded a Dominican friary, of which there are still remains; and in 1228 the two divisions of the town received separate incorporation from Henry III. In 1412, Henry IV. granted a charter authorizing the combination of the two towns. In the reign of Edward III. Drogheda was classed with Dublin, Waterford and Kilkenny as one of the four staple towns of Ireland. Richard II. received in its Dominican friary the submissions of O'Neal, O'Donnell and other chieftains of Ulster and Leinster. The right of coining money was bestowed on the town, and several parliaments were held there, including one in 1495, when Poyning's laws were enacted. In the civil wars of 1641 the place was besieged by O'Neal, but was relieved. In 1649 it was captured by Cromwell and the inhabitants brutally massacred. In 1690 it was garrisoned by King James's army, but after the battle of the Boyne it surrendered without a struggle. Drogheda ceased to be a parliamentary borough in 1885, and a county of itself in 1898.

From the close of the 12th century, and for some time after the Reformation, the primates of Ireland lived in Drogheda. Its proximity to Dublin, the seat of government and of the Irish parliament, induced them to prefer it to *Ardmacha inter Hibernicos.* Near Drogheda, in later times, was the primate's castle and summer palace at Termonfeckin, some ruins of which remain.

The ancient fortifications of Drogheda have disappeared save that St. Lawrence gateway remains almost perfect, and there are ruins of the West or Butler gate. St. Peter's chapel formerly served as the cathedral of the modern Roman Catholic archbishopric of Armagh. There was formerly an archiepiscopal palace in the town, built about 1620; and the Dominicans, the Franciscans, the Augustinians, the Carmelites and the Knights of St. John had monastic establishments. Of the Dominican monastery (1224) there still exists the Magdalen tower; while of the Augustinian abbey of St. Mary d'Urso (1206) there are the tower and a pointed arch. There is a blue-coat school, founded about 1727; present buildings, 1870. The industrial establishments comprise cotton, flax and flour mills, sawmills, tanneries, salt and soap-works, breweries, chemical manure, engineering works and the big cement works, one of the largest of its kind in the world. The town is the headquarters of the valuable Boyne salmon-fishery. A brisk sea trade is carried on in agricultural produce.

DROHOBYCZ, a Polish town in the province of Lwow, capital of a district which contains the largest oilfield in Poland. Pop. (1931), 32,622. Oil was first found at Boryslaw and Tustanowice in 1904, and reached its highest production in 1909. Drohobycz has a factory of mineral oil, the largest oil refinery in Poland, and is connected by pipe lines with the chief wells. It also produces mineral gas, gasoline and ozokerite. Russian troops conquered Drohobycz in Sept. 1939 and it fell to Germany in 1941.

DROIT, a legal title, claim or due; a term used in English law in the phrase *droits of admiralty,* certain rights or perquisites assigned by the Crown to the lord high admiral. (*See* also WRECK.) The most important of these in modern times consisted of ships and goods captured in port in time of war; others were flotsam, jetsam, ligan, treasure, deodand, derelict within the admiral's jurisdiction; all fines, forfeitures, ransoms, recognizances and pecuniary punishments; all sturgeons, whales, porpoises, dolphins, grampuses and such large fishes, with the share of some prizes—such shares being afterwards called "tenths," in imitation of the French, who gave their admiral a *droit de dixième.* The droits of admiralty were definitely surrendered to the Crown by Prince George of Denmark, when lord high admiral of England in 1702. In prize law droits of admiralty are distinguished from droits of the Crown which, before 1914, were granted to the captors of ships and cargoes captured at sea by duly commissioned ships of war. (*See* H. C. Rothery, *Prize Droits,* being *A Report to H.M. Treasury on Droits of the Crown and of Admiralty in Time of War* [1915]; also the *Law Quarterly Review,* vol. xxxii., p. 38, and the Naval Prize Act, 1918; also Holdsworth, *History of English Law,* vol. i. pp. 559–561.)

The term *droit* is also used in various legal connections (for French law, *see* FRENCH LAW), such as the *droit* of angary (*q.v.*), the *droit d'achat* (right of pre-emption) in the case of contraband (*q.v.*), the feudal *droit de bris* (*see* WRECK), the *droit de régale* or ancient royal privilege of claiming the revenues and patronage of a vacant bishopric, and the feudal droits of seigniory generally.

DROIT ADMINISTRATIF. French administrative law may be described as that section of law which establishes the different administrative organs of the State and defines their powers as regards individuals. It will thus be noticed at once that there is a very close connection between French constitutional and administrative law since in the former the general plan of the operation of the powers inherent in the State is set out whereas in the latter the various organizations by which these powers are enforced are detailed, or—in another phrase—in constitutional law are to be found the principles whose application is enacted through the channels of administrative law.

France is for administrative purposes divided into "départements" which are subdivided into "arrondissements." The latter are again subdivided into "cantons" with a further subdivision into "communes." These different administrative divisions are

not, however, of equal importance. The "départements" and the "communes" are at the same time electoral constituencies, administrative units and so-called "personnes morales." The "arrondissements" are neither "personnes morales" nor administrative units. The "cantons" are neither legal nor administrative units although they elect a councillor to the conseil *général* and to the conseil *d'arrondissement*. The "communes" form an administrative centre of great activity.

"Droit administratif" is, therefore, concerned with the general interests of the State, the regional interests of the "départements" and the local interests of the "communes," although for reasons of economy it is often enforced by the same agents as in the case of the "préfet" of a "département" who is at the same time an agent of the State and of the "département."

There are several classes of administrative organs, the authorities entrusted with the execution of administrative decisions ("prefets" and "sous-prefets"), mayors, deliberative councils, which must be subdivided into deliberative councils proper, namely, those who have power to take executive decisions (conseil *général*, conseil *d'arrondissement* and conseil municipal) and consulting councils (conseil de *préfecture*, conseil d'e'tat), and finally administrative tribunals entrusted with jurisdiction.

The acts of administrative authority are fundamentally divided into two classes, acts of authority proper or, as they are sometimes called, unilateral administrative acts, by means of which the administration orders or prohibits some action by the subject of its administration, as for instance the order of a mayor prohibiting processions in the territory of his commune, and acts of administration proper by means of which the administrative authorities ensure the safeguard of the property of "personnes morales administratives" and enforce contracts, the nature of these acts being from a legal point of view the same as those of a private citizen. Appeals against acts of so-called authority proper are, however, within the jurisdiction of the administrative tribunals, whereas disputes arising out of acts of so-called administration proper are tried before the ordinary judicial tribunals.

Acts of authority proper are subdivided into "actes individuels" and "actes réglementaires." "Actes individuels" are those concerning a particular individual in connection with a defined object. "Actes réglementaires" are those by which the administrative authority imposes certain restrictions on a body of individuals. The right to do "actes réglementaires" is entrusted as regards the whole State to the president of the republic, as regards the "départements" to the "préfets" and as regards the "communes" to the mayors. This subdivision of acts of authority proper is important as regards jurisdiction, for only "actes individuels" can be appealed against before the ordinary administrative tribunals. The sole means of attacking an "acte réglementaire" is before the conseil *d'état* which may order it to be cancelled as ultra vires.

Private individuals are protected against officials by their power of prosecution before the Criminal Courts in certain cases (Art. 166–195, Crim. Code) and their right of bringing an action before the ordinary judicial tribunals where an official is personally liable, as the responsibility for acts done by an official is only assumed by the administration in cases where the fault is inherent in the service, and thirdly by appeal to the administrative tribunals.

It is true that in case of tort French citizens can only sue officials of the State in their official capacity in the ordinary courts when the act complained of is alleged to have been committed "with malice," and that in the absence of "malice" the private citizen must seek his remedy before an administrative tribunal. It is, however, interesting to compare generally the rights of a French citizen with those of a British subject who, in dealing with State officials or civil servants, finds that he is, in many cases, powerless owing to the immunity these persons enjoy as regards the consequences of acts done in their official capacity. French Administrative Law may be said to be based on the recognition of the fact that the State, regarded as a "personne morale," has two distinct entities, and that in its politic capacity it is a "person" who is responsible for the torts of its servants as well as for contracts made by them on its behalf, and that consequently it may be sued, if not in the ordinary courts, before the administrative tribunal whose existence consequently constitutes a protection for the subject against arbitrary decisions of individuals acting officially, whereas English jurisprudence, as already stated, regards acts done by officials or servants of the Crown still on the mediaeval assumption that as "the king can do no wrong" and "the State is the king," it is not responsible for the torts of its servants. This comparison between the English and French system of jurisprudence may be further emphasized by a consideration of the fact that the French administrative tribunals are real tribunals, acting independently of the executive, whose functions and powers are defined in the Code *Administratif*, whereas under the English rule of law Government departments often exercise *in* camera, and without an oral hearing of the applicant, semi-judicial functions under Statutory Powers which, in practice, confer on them the power of judging their own cause without appeal.

Only cases in which a definite right has been violated can be heard before the administrative tribunals; where private interests only are concerned appeal can be made only to representatives of the administration, following the hierarchical order upwards. As regards the cases which come before the administrative tribunals these are divided into four classes: first, those in which the tribunal examines the matter as regards both law and fact, and decides if a decision is to be upheld or replaced by another; secondly, those in which the tribunal has to decide if any administrative act was ultra vires, in which case it quashes the decision; thirdly, those in which the tribunal is called upon to interpret the scope and intention of an administrative act; and, fourthly, those in which the tribunal has power to impose a penalty in cases where public property has been encroached upon, or a legal usufruct of public utility unobserved. It must be noticed that this last class of case constitutes an infraction of the rule that every illegal act of any kind, the commission of which entails a penalty, falls within the provisions of the Penal Code and must be tried before the ordinary judicial tribunals.

The fundamental principle of the separation of the judicial and administrative authorities was enacted by the law of Aug. 24, 1790, sec. 2 Art. 13 which enacts that the judges may not in any may interfere with the operations of the administrative corps, or summon before them administrators to answer for acts done in carrying out their proper duties. This principle has been so far developed that if during the course of an action before the ordinary judicial tribunals a question arises which might prejudice a decision of the administrative tribunals, the hearing must be suspended pending a decision by the latter. In cases, however, of "expropriation" on grounds of public utility, in which a decision must be given by the judicial tribunal, the latter may refuse to make an order if all the legal formalities required have not been duly carried out by the administrative authorities.

Finally certain matters which should, according to their nature, be brought before the judicial tribunals have by law been allotted to administrative tribunals, *e.g.*, questions arising out of the contracting for public works, the sale of any part of the national domain and the declaration of the State as a debtor.

Administrative tribunals are divided into tribunals of first instance and those of appeal. The mayor and the council of the prefecture always constitute tribunals of first instance. The "prefets" and the competent minister constitute sometimes tribunals of first instance and sometimes tribunals of appeal. The conseil d'e'tat is in principle an appeal tribunal, although in certain cases it is a court of first and last instance, and even a court of cassation. The *cour des comptes* except in one instance is a court of first and last instance. These tribunals are also subdivided into tribunals competent to hear and determine all matters which have not been specially reserved, and special tribunals for the trial of the latter class of cases.

Ordinary tribunals are in the first instance that of the competent minister and in the second instance the conseil d'e'tat. Special tribunals for the hearing of general cases are the council of the prefecture. the "prefet," the "sub prefet" and the mayor.

Special tribunals with special functions are those of the *cour des comptes*, the maritime prefects, the council of public instruction, the tribunals with jurisdiction concerning the issue of coinage,

that of the sanitary police, that for excess values and that for the colonies.

Administrative judges are removable, with the exception of those of the *cour des comptes.* (F. No.)

DROITWICH, market town and municipal borough, Evesham parliamentary division, Worcestershire, England, 5½ mi. N.N.E. of Worcester, and 126 mi. N.W. from London by the G.W.R., but served also by the L.M.S.R. Pop. (1938) 4,662. Area 2.7 sq.mi. It stands on the river Salwarpe, a tributary of the Severn, being connected with the latter by canal. There are three parish churches, St. Andrew, St. Peter and St. Michael, of which the first two are fine old buildings in mixed styles. The principal occupation is the manufacture of the salt obtained from the brine springs or *wyches,* to which the town probably owes its name and origin. The springs also give Droitwich a considerable reputation as a health resort. There are Royal Brine baths (with a clinic), St. Andrew's baths and a private bath hospital. Owing to the pumping of the brine there is a continual subsidence of the ground, detrimental to the buildings, and new houses are mostly built in the suburbs. In the pleasant well-wooded district surrounding Droitwich the most noteworthy points are Hindlip Hall, 3 mi. S., where (in a former mansion) conspirators in the Gunpowder Plot defied search for eight days (1605); and Westwood. a fine hall of Elizabethan and Carolean date on the site of a Benedictine nunnery, 1 mi. west of Droitwich, which offered a retreat to many royalists during the commonwealth.

A Roman villa, with various relics, has been discovered here. but it is doubtful how far the Romans made use of the brine springs, which are also mentioned in several charters before the conquest. At the time of the Domesday survey all the salt springs belonged to the king, who received a yearly farm of £65, but the manor was divided between several churches and tenants-in-chief. The burgesses of Droitwich (*Wic, Saltwic, Wich, Drightwich*) are mentioned in the Domesday survey. The town is first called a "burgus" in the pipe roll of 1155–56, but the burgesses did not receive their first charter until 1215, when Ring John demanded a fee-farm of £100. The payment of the fee-farm gradually lapsed in the 18th century. In mediaeval times Droitwich was governed by two bailiffs and twelve jurats. Queen Mary granted the incorporation charter in 1553–54 under the name of the bailiffs and burgesses. James I in 1625 granted fuller charter, which remained the governing charter until the Municipal Reform act. King John's charter granted the burgesses a fair on May 9, to last for eight days, but Edward III in 1330 granted instead two fairs, on Dec. 29 and Oct. 28 and three days after. Queen Mary granted three new fairs. In recent times fairs were held in June and December, but these have lapsed and now none is held. James I changed the market day from Monday to Friday.

DRÔME, a department of south-east France, formed of parts of Dauphiné and Provence, and bounded on the west by the Rhone, which separates it from Ardkche, north and north-east by Iskre, east by Hautes-Alpes, south-east by Basses-Alpes and south by Vaucluse; area 2,533 sq.mi ; pop. (1936) 267.281. Drôme is watered by tributaries of the Rhone, including the Iskre in the north, the DrBme in the centre and the Aygues in the south, flowing from spurs of the Alps westwards to the alluvial plains on the left bank of the Rhone. North of the Drôme lie the Vercors and the Royans, a region of forest-clad north to south ridges. South of that river the mountain system is intersected everywhere by torrents. In the east of the department the mountains of the Dévoluy reach 7,890 ft. North of the Iskre a district of low hills stretches to the limits of the department in the Valloire, its most productive portion. The climate, except in the valleys bordering the Rhone, is cold, and winds blow incessantly. Snow lies on the mountain-tops during the greater part of the year.

The agriculture of the department is moderately prosperous. The main crops are wheat, grown chiefly on the banks of the Isère and Rhone, oats and potatoes. Large flocks of sheep feed on the pastures in the south; cattle-raising is carried on principally in the north-east. Good wines, among which the famous Hermitage growth ranks first, are grown on the hills and plains near the Rhone and DrBme. Fruit culture is much practised. Olives and figs are grown in the south; the cultivation of mulberries and walnuts is more widely spread. The rearing of silkworms in Drôme is very important. The Montélimar district is noted for its truffles. Mineral products include lignite, blende, galena, calamine, freestone, lime, cement, potter's clay and kaolin. Brick and tile works, potteries and porcelain manufactories exist in several localities. Industries comprise flour-milling, distilling, wood-sawing, turnery and dyeing. The chief textile industry is the preparation and weaving of silk, which is carried on in a number of towns. Woollen and cotton goods are also manufactured. Leather working and boot-making, carried on on a large scale at Romans, are important, also the manufacture of machinery, hats, confectionery and paper. Drôme exports fruit, nuts. oil. cheese, wine, wool, live stock and its manufactured articles; the chief import is coal. It is served by the Paris-Lyon railway, and the Rhone and Iskre furnish over 100 m. of navigable waterway. The canal de la Bourne, the only one in the department, is used for purposes of irrigation only. Drôme is divided into the arrondissements of Valence, Die and Nyons, comprising 29 cantons and 378 communes. The capital of the department of Drôme is Valence, the seat of a bishopric of the province of Avignon. The department forms part of the académie (educational division) of Grenoble, where its court of appeal is also located. and of the region of the XIV army corps (Lyons).

Besides Valence, the chief towns of the department are Die, Montélimar, Crest and Romans. Nyons is a small industrial town with a mediaeval bridge and remains of ramparts. Suze-la-Rousse is dominated by a fine chbteau with fortifications of the 12th and 14th centuries; in the interior the buildings are in the Renaissance style. At St. Donat there are remains of the palace of the kings of cisjuran Burgundy; though but little of the building is of an earlier date than the 11th century, it is the oldest example of civil architecture in France. The churches of Léoncel, St. Restitut and La Garde-Adhémar, all of Romanesque architecture, are also of antiquarian interest. St. Paul-Trois-Chbteaux, an old Roman town, once the seat of a bishopric, has a Romanesque cathedral. At Grignan there are remains of the Renaissance château where Madame de Sévigné died. At Tain there is a sacrificial altar of A.D. 184.

DROMEDARY, a name for swift riding camels (q *v.)* of the Arabian (one-humped) or the Bactrian (two-humped) species.

DROMICEIDAE: *see* **EMU.**

DROMORE, a market town of Co. Down, Ireland, on the Upper Lagan, 17½ mi. S.W. of Belfast by rail. Pop. of urban district (1926), 2,229. The bishopric here grew out of an abbey of Canons Regular attributed to St. Colman in the 6th century and was united in 1842 to Down and Connor. The town and cathedral were wholly destroyed during the insurrection of 1641, and the present church was built by Bishop Jeremy Taylor in 1661. Remains of a castle and earthworks are to be seen, together with a large rath, or encampment, known as the Great Fort. The town gives its name to a Roman Catholic diocese. Manufacture of linen is the chief industry.

DROMOS, the open air passage, enclosed between stone walls, leading down to the entrance of Greek "beehive" tombs.

DRONE, in music, the bass pipe or pipes of instruments of the bagpipe type, having no lateral holes and therefore giving out the same note without intermission as long as there is wind in the bag, thus forming a continuous pedal, or drone bass. The drone pipe has, instead of a mouthpiece, a socket fitted with a beating reed, and inserted into a stock or short pipe immovably fixed in an aperture of the bag. The Greek classics allude to the existence of a pipe with a drone, either of the arghool or the bagpipe type.

DRONFIELD, a town and urban district of Derbyshire, England, 6 mi. S. of Sheffield, on the L.M.S. railway. Pop. (est. 1938) 6,609. Area, 5.4 sq mi. It is on the river Drone, a tributary of the Rother. There are extensive foundries. Spades, shovels, reaping hooks, sickles and scythes are made. Coal is mined in the neighbourhood. The church of St. John the Baptist, with a lofty spire, is a good example of Decorated work, with

Perpendicular additions.

DRONGO or King Crow, an Old World group of birds of the family *Dicruridae;* the plumage is usually black and the tail forked. The drongos inhabit Africa, south-eastern Asia and the Malayan region to Australia. The largest genus, *Dicrurus*, includes the black drongo (D. ater), the ashy drongo (D. longicaudatus), and the white-bellied drongo. Drongos are mimicked by three species of drongo-cuckoos (*Surniculus*), which lay their eggs in the drongos' nests.

DROP FORGING. Drop forging is the production in quantity of articles in metal by means of a falling weight forcing the heated material into a die. It is only within the last 60 years or so that drop forging as it is known to-day has been practised. Since the beginning of this century great development has taken place owing to the growth of the motor industry and the increasing demand for mechanical transport. An enormous number of the parts of an automobile are now drop forged, *e.g.,* the engine crankshaft, connecting rods, bearing caps, tappets, rockers, valves, flywheels, gears, actuating forks, couplings, levers and lever brackets. On the chassis. the front axles, back axle casings, swivels, stub axles, wheel hubs, steering levers, brake levers, pedal levers and plates, differential gears and pinions, brake shoes and brackets are all made by this method, even small articles such as wind-screen pillars, wing-nuts and stainless door-handles being made under the drop hammer. The development of aviation finds much employment for drop forging in connection with propeller hubs, crankshafts, connecting rods, valves, brackets, gears, etc. Great accuracy is demanded for this work, both for weight and strength; very fine limits are imposed, and the forgings are subjected to severe tests by the Aeronautical Inspection Directorate. Many other industries use drop forged articles, common products being scissor blanks, surgical instruments and heavy gears for railway work.

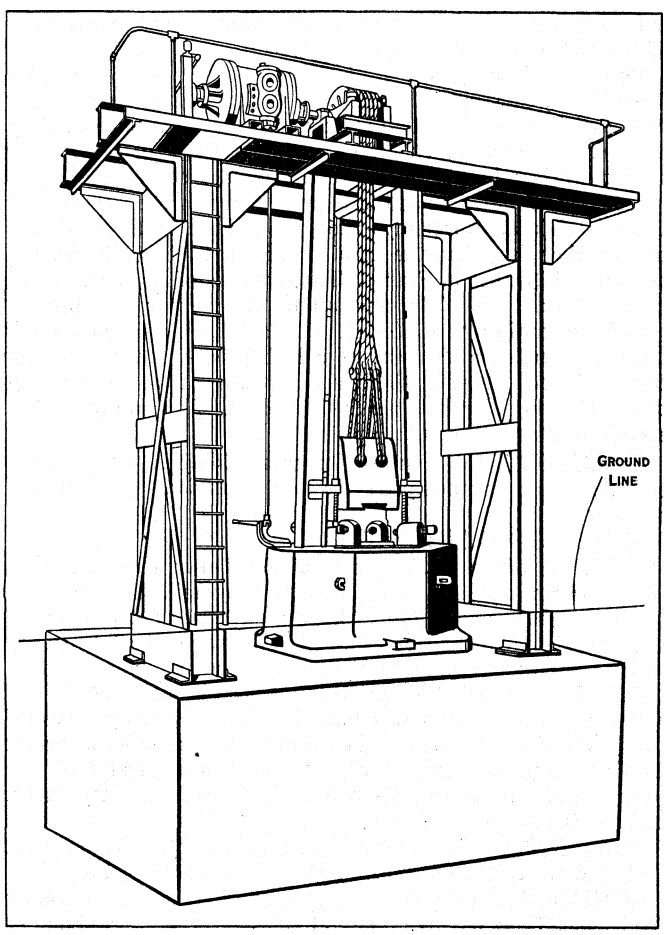


FIG. 1.— DIAGRAM OF TYPICAL DROP HAMMER WITH STEAM LIFTER
Weighing anything from 1 cwt. to 4 tons, the anvil being at least 15 times as heavy, the hammer or "tup" is raised by lifting arms operated by steam power. Guide rods fixed in the anvil control its fall

Drop forging is essentially a moulding operation, the metal being worked with the aid of machines at a sufficient heat to bring it to a plastic condition, but never to the molten condition necessary for the production of castings. Drop forged articles are frequently confused with castings, but the manufacturing process is entirely different.

The hammer used in drop forging operations consists of a forged or cast block of steel, commonly called the "tup" and weighing anything from 1 cwt. to 3 or 4 tons, which is lifted to a height and then allowed to fall or "drop" on to the anvil block by its own weight. The fall is controlled by guide rods or slides bolted to, or fixed in, the anvil block. The lifting apparatus varies in detail, but in its essentials consists of pulleys exerting a variable friction pull on a belt connected with the tup, manipulated with cords or levers usually by hand (fig. 1). The hammers mostly used in Great Britain are those delivering a gravitation blow by a falling weight impinging on an unyielding anvil, but steam hammers are also used, where the tup is attached to a piston rod and propelled downwards and lifted up by means of steam or compressed air. The anvil receives the whole of the energy delivered by the hammer whenever a blow is struck except the small amount absorbed in compressing the stamping, and therefore the ratio of the weight of the hammer to the weight of the anvil block is of great importance; a minimum ratio of 15 to 1 is usual, *i.e.,* a 1 ton hammer will have a 15 ton anvil block and so on.

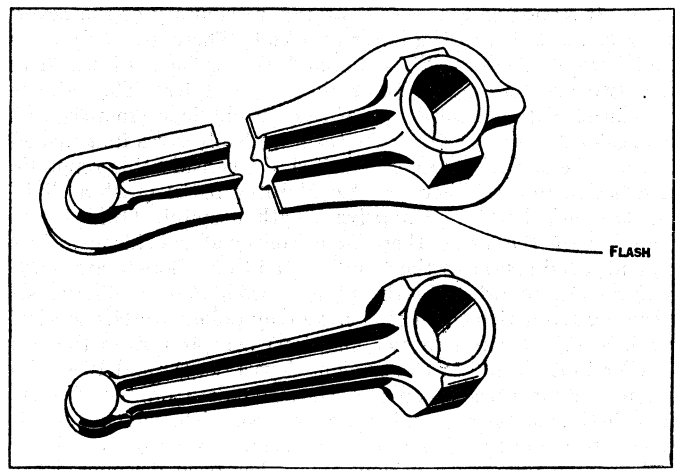
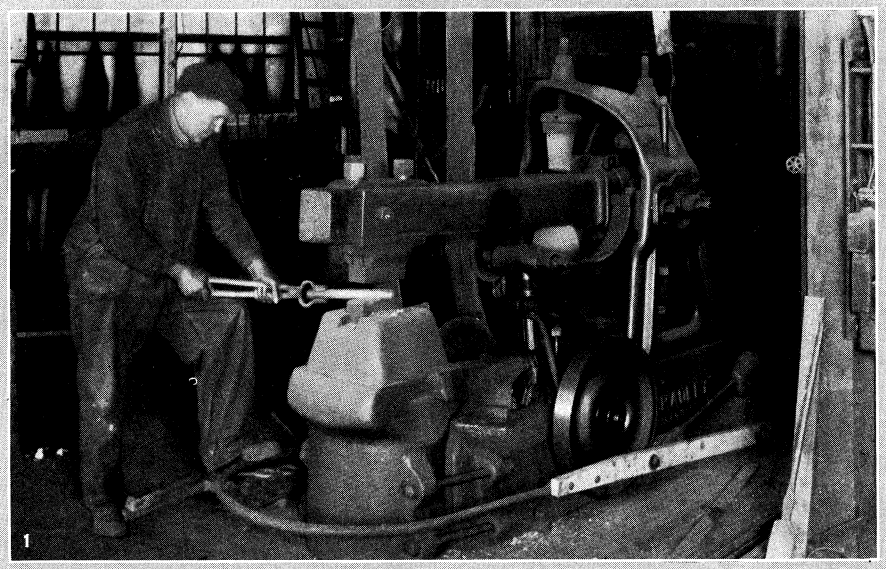
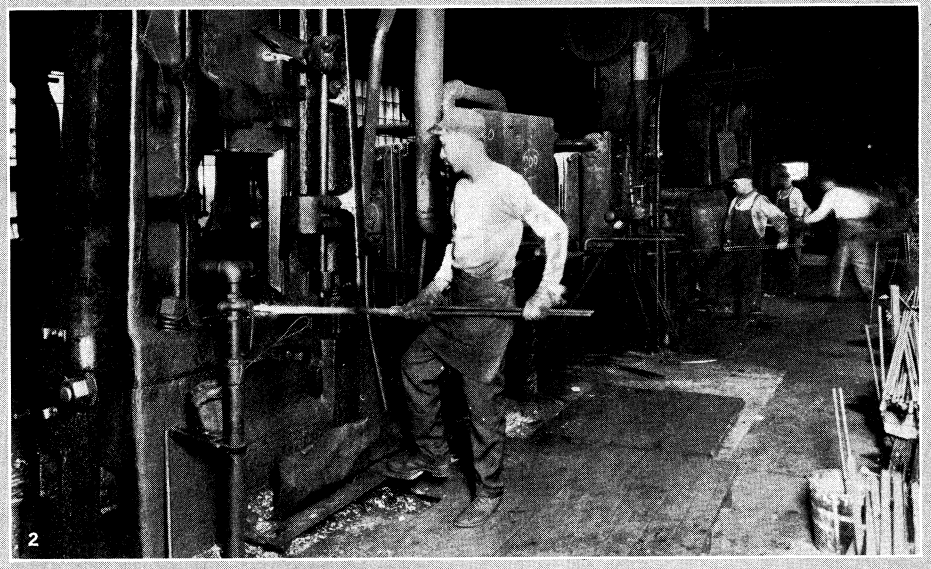
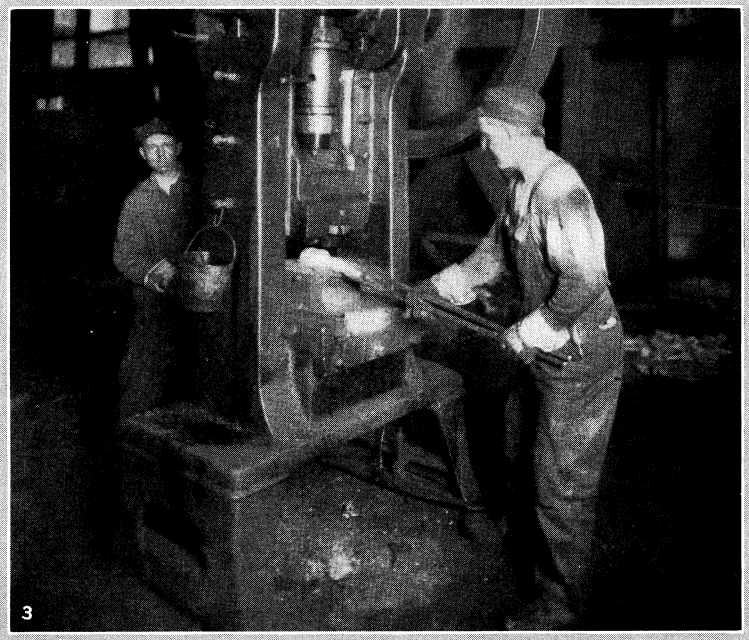


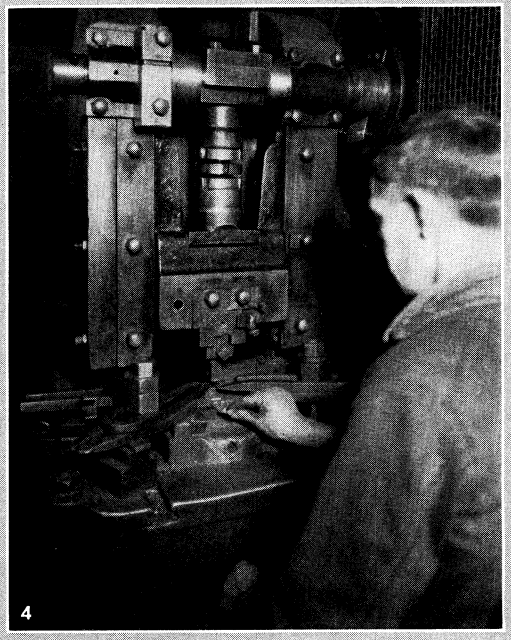
FIG. 2.— DROP-FORGED ROD BEFORE AND AFTER FLASH HAS BEEN REMOVED
When the metal is being forged, a certain amount, known as the "flash," is pressed out at junction of dies (upper figure). It is removed by trimming tools, and the finished forging is then ready for machining (lower figure)

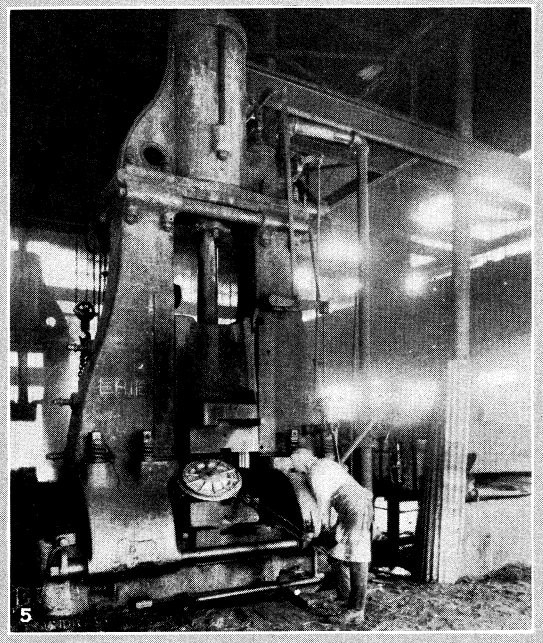
Die Block.—For the manufacture of a drop forged article, impressions are sunk in two die blocks to the exact shape and size of the pattern required. Careful attention is paid to the cutting of these dies which are frequently of a very intricate pattern; very expensive steel is usually employed and highly skilled workmen are engaged. One die is fixed in the tup and the other is fixed on to the anvil block by means of poppet pins or keys; the metal to be forged, which has previously been heated in an adjacent furnace to a malleable condition, is placed between these dies, and several blows in quick succession are struck by the hammer, thus forcing the metal evenly into the die impressions. The number of blows required must be gauged with some accuracy by the stamper; too few blows will not obtain uniform strength in the forging, while too many will shorten the life of the dies. A certain quantity of metal is extruded at the point where the two dies meet, and this surplus metal, called the "flash" or "fin," is removed on completion of the forging operation by means of a pair of trimming tools fixed in a press; one of these tools resembles the pattern of the article required and the other is made hollow to the outline of the pattern at the point of the flash (fig 2). The forging, placed in the press, is forced through the hollow tool by the solid one and the flash is cut off, the forging being subsequently returned to the hammer for one more blow to correct any possible distortion or bending which may have taken place during the trimming operation.











BY COURTESY OF (1) C. C. BRADLEY AND SON, INC., (2) THE CHAMBERSBURG ENGINEERING COMPINY. (3) E. W. BLISS COMPANY, (4) THE KILBORN AND BISHOP COMPANY, (5) THE ERIE FOUNDRY COMPANY

DROP–FORGING HAMMERS AND TRIMMING PRESSES

1. Trip hammer forger; a substitute for sledge hammer
2. Board drop hammer; lifts by power, drops by gravity
3 and 4. Trimming presses: 3, hot trimming; 4, cold trimming
5. Steam drop hammer; force of each blow under direct control of operator

On the completion of the forging operation, the forgings are usually subjected to heat treatment to relieve the metal of any strains set up during stamping and also to render it most suitable for machining operations should these be required. Heat treatment is an integral part of the manufacture and is carried out by highly experienced workmen; perfect control and knowledge of temperature is vital, as the necessary strength and hardness can only be obtained if the treatment is correct.

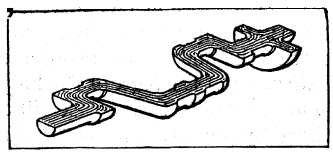


FIG. 3.—DROP-FORGED CRANK-SHAFT. SHOWING GRAIN ARRANGED TO FOLLOW CONTOUR OF CRANK-SHAFT

All wrought metals have in a marked degree "grain" or "fibre" and great care has to be taken in forging to see that the grain is worked into a position parallel to the principal stresses likely to occur in the article to be forged. Grain must never be allowed to run transversely to the axis of the greatest bending stress (fig. 3). This is one of the great advantages of drop forgings over castings. In a casting, where the metal is melted down and poured into a mould, the structure becomes crystalline and not fibrous; but in a drop forging, always made from bars or billets which have the grain running longitudinally, very careful attention is paid to the disposition of this grain, so that if there is a bending stress it goes across the longitudinal grain and not between it.

Drop forgings are made in many metals; besides the various alloy steels, stainless steels and iron, brass, yellow metal, cupro-nickel, aluminium, duralumin, magnesium, etc., are used. Considerable progress has been made with the forging of these light allovs. Some of them are exceedingly difficult to forge, and the greatest accuracy in gauging the forging temperatures is required.

(K. R. C.)

IN THE UNITED STATES

Drop forging is divided into four classes, dependent on the type of machine used. They are: (1) trip hammer forging; (2) drop hammer forging; (3) upsetting; and (4) press forging.

Trip hammer forging is done with a power-driven sledge hammer so arranged that successive blows strike in exactly the same place. The helve type of trip hammer consists of (1) a base or anvil on which there is held a die; and (2) an arm or helve fixed at one end, the other end of which is mechanically raised and lowered. On the moving end of the helve there is fastened a second die which strikes against the die held on the anvil. Another type of helve hammer makes use of an auxiliary ram between the helve and the upper die. The ram operates between vertical guides and is loosely connected to the helve. The advantages of a trip hammer are the rapidity with which it delivers its blows and the ease with which the operator can instantly change the force of the blow from zero to the maximum of the machine. Typical examples of the type of forgings made by this process are the various types of chisels, punches and picks.

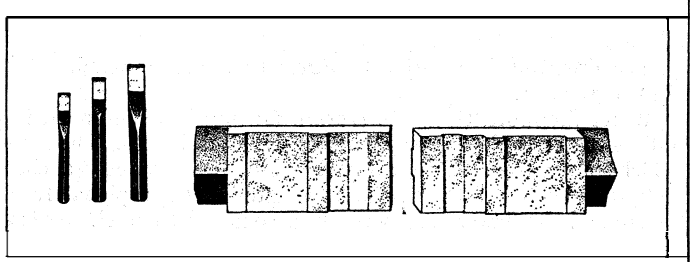


FIG. 4.— TRIP HAMMER DIES FOR FORGING COLD CHISELS. SHOWING THREE SIZES OF CHISELS PRODUCED IN SUCH DIES

Fig. 4 shows a typical pair of trip hammer dies used to forge cold chisels. This pair of dies is designed to forge three sizes of chisels.

Drop hammer forging is that branch of the forging industry which utilizes a machine called a drop hammer. A drop hammer consists of a base, a hammer or ram which strikes the base and which travels vertically between side guides, and the overhead mechanism for lifting the hammer and releasing it. In the board drop hammer (Plate I. fig. 2), a board, generally of maple, raises the ram. The lower end of the board is fastened to the upper portion of the ram and the upper end of the board travels between two rolls which revolve in opposite directions. Automatic mechanism is provided so that the rolls alternately squeeze the board and, revolving, lift it. The rolls are then spread apart, allowing the ram to fall. The steam drop hammer (Plate I. fig. 5) utilizes a steam cylinder for the lifting mechanism, the piston rod taking the place of the board and the ram being fastened to the lower

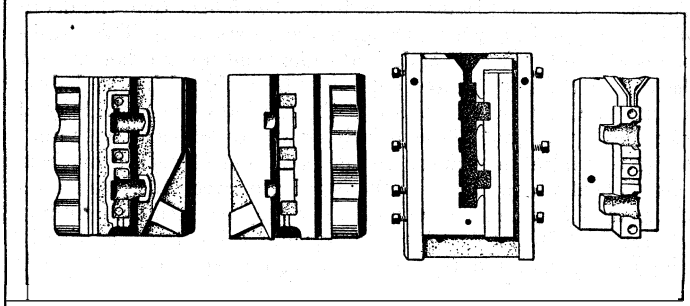


FIG. 5.— FORGING AND TRIMMING DIES FOR A CROSSHEAD SUPPORT FORGING

end of the piston rod. The air drop hammer is fundamentally the same as the steam hammer, but uses compressed air instead of steam.

For forging with the drop hammer there is used a set of tools known as forging dies, which are blocks of steel used in pairs. The dies are cut or dug out so that when the two cut-out blocks are put face to face, the hollow included between them has the exact shape of the forging which they are designed to produce. (See fig. 5.) One of the dies is solidly fastened to the base or anvil, while the other is fastened to the lower end of the ram. The overhead mechanism of a drop hammer is automatic. The hammer travels to the top of its stroke and is released, causing the die block fastened to it to strike against the one on the base, after which the ram is instantly raised. The operation of drop forging consists of heating any suitable metal to a temperature at which it is malleable, placing it on the lower die block and allowing the upper die block to fall on it repeatedly, forcing the metal into the shape defined by the sunk or cut-out portion of the dies. The making of drop forgings can be considered as divided into (1) the making of the dies and (2) the production of the forgings.

Die Making.— In making dies it must be remembered that it is not possible to forge all shapes. No hole or depression in a drop forging may be larger at the bottom than at the top, although it may be smaller. In actual practice it must be slightly smaller by an amount equal to the "draft," as the angle at the side of every depression is called. No surface of a drop forging may be parallel to the path of travel of the dies, but must depart from parallelism by an amount not less than the draft angle and in the direction which will make all parts of the forging smaller at the bottom of the impression in each die than at the top. The usual draft angle in drop forging is 7°.

It is possible to forge many different kinds of materials, among them being iron, copper, certain of the brasses, bronze, aluminium, monel metal, nickel and a great number of alloys of these and similar metals. By far the greatest number of forgings are made from steel and its alloys. Typical examples are wrenches, pliers, chisels, hammers, parts of machines of all kinds and automobile connecting rods, crank shafts, manifold flanges and clevis bolts. The die design is influenced by the quantity which is to be made at one setting of the dies as well as by the quantity eventually wanted. Dies may be so designed as to make two or more forgings at once, later to be cut apart by trimming. Since metal is forged while hot and shrinks in cooling, that fact must be allowed for when making dies. All forging dies are made larger than the size which the piece is to be when cold, by an amount equal to the shrinkage. The cutting of die blocks proceeds in several stages, each designed to the end that the final or finishing stage will produce the exact forging wanted.

After the finishing cut is made and the impression is completed,

the accuracy of the work is tested by placing the two die blocks face to face and pouring melted lead into the impression and allowing it to harden; afterwards, this lead cast which has the shape of the desired forging is examined. The quantity of forgings which one pair of dies will produce varies from perhaps 100 pieces under the worst to perhaps 500,000 under the best conditions. The normal life for steel pieces lies between 10,000 and 40,000.

Upsetting is done with a drop hammer by making a hole in the bottom die and placing in the hole a bar longer than the depth of the hole and allowing the upper die to strike it. This mushrooms the end. When it is desired to have an upset other than at the end of the bar the lower die may be designed in two halves so that one may be removed and the forging taken out. Special machines embodying these principles are called upsetters, bulldozers or forging machines. In the operation of such a machine a bar is heated and placed in the opening between the two halves of a pair of gripping dies, one of which may be fixed or both may be movable. The two halves of the die come together tightly gripping the bar and then the ram is forced against the end, upsetting it and also forcing the metal to fill any shaped impression which may be in the gripping dies. The ram then returns and the gripping dies open for the operator to remove the piece.

Press forgings are made in toggle joint or hydraulic presses using dies in the same general manner as in the drop hammer method, the difference being that a slow push is used instead of the quick, heavy blow of a ram. Presses are also used for sizing forgings, taking the place of cold striking in a drop hammer. *(See* PRESSES and PRESSWORK.) (H. K.)

DROPSY, the name given to a collection of serous fluid in all or any of the cavities of the body, or in the meshes of its tissues. Dropsy of the subcutaneous connective tissue is termed *oedema* when it is localized and limited in extent; when diffuse it is termed *anasarca;* the term *oedema* is also applied to dropsies of some of the internal organs, notably the lungs. *Hydrocephalus* signifies an accumulation of fluid within the ventricles of the brain or in the arachnoid cavity; *hydrothorax,* a collection in the pleural cavities; *hydropericardium,* in the pericardium; *ascites,* in the peritoneum.

Dropsy (excluding "epidemic dropsy," for which *see* below) is a symptom and not a specific disease, being the exaggeration of a normal condition. Fluid, known as lymph, is continually passing through the capillary walls into the tissues, and in health this is removed as fast as it is exuded, in one or more of three ways; part is used in the nutrition of the tissues, part is returned to the general circulation by the veins, and part by the lymphatics. Any accumulation constitutes dropsy and is a sign of disease, though not a disease in itself. The serous effusions due to inflammation are not included under the term dropsy. A dropsical fluid varies considerably in composition according to its position in the body, but only slightly according to the disease which has given rise to it. Its specific gravity ranges betwen 1,008 and 1,018; the mineral salts present are the same in amount and kind as those of blood and do not vary with the position of the exudation. The quantity of albumin, however, depends much on the position of the fluid, and slightly on the underlying disease. In oedema the fluid contains only traces, whereas a pleural or peritoneal effusion is always highly albuminous. Also an effusion due to heart disease contains more albumin than one due to kidney disease. In appearance the fluid may be colourless, greenish or reddish from the presence of blood pigment, or yellowish from the presence of bile pigment; transparent or opalescent or milky from the presence of fatty matter derived from the chyle.

The simplest cause of dropsy is purely mechanical, blood pressure being raised beyond a certain point owing to venous obstruction. This may be due to thrombosis of a vein as in phlegmasia dolens (white leg), retardation of venous circulation as in varicose veins, or obstruction of a vein due to the pressure of an aneurism or tumour. Cardiac and renal dropsy are more complicated in origin, but cardiac dropsy is probably due to diminished absorption, and renal dropsy, when unassociated with heart failure, to increased exudation. But the starting-point of acute renal dropsy, of the dropsy sometimes occurring in diabetes, and that of chlorosis is the toxic condition of the blood. For accounts of the various local dropsies *see* HYDROCEPHALUS; ASCITES; LIVER; etc. General dropsy, or dropsy which depends on causes acting on the system at large, is due chiefly to diseases of the heart, kidneys or lungs, occasionally to lardaceous disease, more rarely still to diabetes or one of the anaemias.

The natural tendency of all heart diseases is to transfer the blood pressure from the arteries to the veins, and, so soon as this has reached a sufficient degree, dropsy in the form of local *oedema* begins to appear at whatever may be the most dependent part of the body—the instep and ankle in the upright position, the lower part of the back or the lungs if the patient be in bed—and this tends gradually to increase till all the cavities of the body are invaded by the serous accumulation. The diseases of the lungs which produce dropsy are those which obstruct the passage of the blood through them, such as emphysema and fibrosis, and thus act precisely like disease of the heart in transferring the blood pressure from the arteries to the veins, inducing dropsy in exactly a similar manner. The dropsy of renal disease is dependent for the most part on an excess of exudation, due largely to an increase of arterial and cardiac tension. This in its turn produces arterial thickening and cardiac hypertrophy, which, if the case be sufficiently prolonged, brings about a natural removal of the fluid. In kidney cases, in the absence of cardiac disease, the dropsy appears first about the loose cellular tissue surrounding the eyes.

For the treatment of dropsy the reader is referred to the articles on the diseases of which it is a symptom. Briefly, tapping of the abdomen or puncture of the legs are resorted to in severe cases. Dehydration by diet may be valuable when the dropsy is other than renal. And there is the routine treatment by drugs, purgative, diaphoretic and diuretic as the symptoms of the case may demand.

Differing from the preceding is *epidemic dropsy,* the first recorded outbreak of which occurred in Calcutta in the year 1877. It disappeared during the hot weather of the following year, only to recur over a wider area in the cold months of 1878 to 1879, and once again in the cold of 1879 to 1880. Since then only isolated cases have been recorded in the immediate neighbourhood of Calcutta, though epidemics have broken out in other places. At thk end of 1902 an outbreak occurred in the Barisal gaol, Bengal, in which nearly one-third of the cases ended fatally. Dropsy was an invariable feature, and was either the first symptom or occurred early. The lower limbs were first affected, trunk and upper limbs later in severe cases, the face very rarely. It was accompanied by pyrexia, gastro-enteritis, deep-seated pains in limbs and body, and burning and pricking of the skin. Various rashes appeared early in the attack, while eczema, desquamation and even ulceration supervened later. Anaemia was very marked, giving rise in Mauritius to the name of acute anaemic dropsy. Death was often sudden, resulting chiefly from cardiac and respiratory complications. Probably it is a vitamin-deficiency disease akin to beri-beri.

DROPWORT, in botany, the common name for *Filipendula ulmaria* (family Rosaceae), found in dry pastures. It is a perennial herb, with much-divided, radical leaves and an erect stem, 2 to 3 ft. high, bearing a loose terminal inflorescence of small white flowers.

The dropwort is a native of Europe and Asia, introduced in North America.

Water dropwort, *Oenanthe crocata* (family Umbelliferae), is a tall, herbaceous plant growing in marshes and ditches. The stem, which springs from a cluster of thickened roots, is stout, branched, hollow and 2 to 5 ft. high; the leaves are large and pinnately divided, and the flowers are borne in a compound umbel, the long rays bearing dense, partial umbels of small white flowers. The plant, which is very poisonous, is often mistaken for celery.

DROSERACEAE, a family of dicotyledenous plants, remarkable in that all its members are insectivorous. There are four genera and about 90 species. *Drosera,* a cosmopolitan genus including about 85 species, has three British and seven North American representatives, known as sundews (*q.v.*). *Dionaea,* with a single species, is Venus' fly-trap (*q.v.*). *Aldrovanda,* also with only one species, is a water plant, lacking roots.

For a monographic treatment see L. **Diels, Droseraceaa** Pflanzenreich 26 (iv, 112); 1–136 fig. 1–40 (1906).

DROSOPHILA, a genus of flies (*Diptera, q.v.*). Several species, and in particular the fruit-fly, D. *melanogaster,* have become widely known on account of the exhaustive investigation of their hereditary constitution by T. H. Morgan and others. (*See* GENE; GENETICS; HEREDITY.)

DROSTE-HÜLSHOFF, ANNETTE ELISABETH, FREIIN VON (1797–1848), German poet, was born at the family seat of Hiilshoff near Munster in Westphalia on Jan. 10, 1797. Her early mental training was largely influenced by her cousin, von Droste zu Vischering, archbishop of Cologne (*see* below), and she received a liberal education. After prolonged visits among the intellectual circles at Coblenz, Bonn and Cologne she retired to the estate of Ruschhaus near Munster, belonging to her mother's family. In 1841, owing to delicate health, she went to reside in the house of her brother-in-law, the well-known scholar, Joseph, Freiherr von Lassberg (1770–1855), at Schloss Meersburg on the lake of Constance, where she met Levin Schucking (*q.v.*), and there she died on May 24, 1848. Annette von Droste-Hiilshoff is, beyond doubt, the most gifted and original of German women poets. Her verse is strong and vigorous, but often unmusical even to harshness; one looks in vain for a touch of sentimentality or melting sweetness in it. As a lyric poet she is at her best when she is able to attune her thoughts to the sober landscape of the Westphalian moorlands of her home. Her narrative poetry, and especially *Das Hospiz auf dem Grossen St. Bernard* and *Die Schlacht im Loener Bruch* (both 1838), belongs to the best German poetry of its kind. She was a strict Roman Catholic, and her religious poems, published in 1852, after her death, under the title *Das feistliche Jahr, nebst einem Anhang religioser Gedichte,* enjoyed great popularity.

Annette von Droste-Hulshoff's *Gedichte* were first published in 1844 during her lifetime. Collected editions of her works were edited by E. von Droste-Hulshoff (Munster, 1886). The *Ausgewahlte Gedichte* were edited by W. von Scholz (Leipzig, 1901). *See,* among the many monographs on Annette von Droste-Hulshoff, those by Levin Schücking (2nd ed., Hanover, 1871), by H. Hueffer (Gotha, 1871; 3rd ed. by Cardauns, 1911), Gabriele Reuter (1905), and A. Balkenhol (1916). For her correspondence *see* the *Samtliche Briefe* (edit. Cardauns, 1909), and 23 *Neue Droste-Hülshoff Briefe* (edit. M. Schneider, 1923).

DROSTE-VISCHERING, CLEMENS AUGUST, BARON VON (1773–1845), German Roman Catholic divine, was born at Munster on Jan. 21, 1773, and entered the priesthood in 1798, being elected vicar-general by the local chapter in 1807. This office he resigned in 1813 through his opposition to Napoleon, but assumed it again after the battle of Waterloo (1815) until a disagreement with the Prussian Government in 1820 led to his abdication. In 1835, he was appointed archbishop of Cologne, but a further quarrel with the Prussian Government over mixed marriages led to his imprisonment for two years. Droste was not re-installed but was obliged to accept *a* coadjutor. His chief works were: *Über die Religionsfreiheit der Katholiken* (1817), and *Vber den Frieden unter der Kirche und den Staaten* (1843).

See Herzog-Hauck, *Realencyk.,* and H. Kipper, "Droste-Vischering" in *Frankfurter Zeitgemässe Broschüren* (Hamm, 1908).

DROUAIS, JEAN GERMAIN (1763–1788), French historical painter, was born in Paris. His father, François Hubert Drouais, and his grandfather, Hubert Drouais, were well-known portrait painters; and he studied first under his father, then under Brenet, and finally under David. He accompanied David to Rome, where he was influenced by the remains of ancient art and by the works of Raphael. Goethe, who was at Rome when the picture mas finished, has recorded the deep impression made by his "Marius at Minturno." The last picture which he completed was his "Philoctetes on the Island of Lemnos."

DROUET, JEAN BAPTISTE (1763–1824), French revolutionary, was born at Ste.-Menehould, where his father was postmaster. The carriages conveying Louis XVI. and his family on their flight to the frontier stopped at his door on tbe evening of June 21, 1791; and the passengers were recognized by Drouet, who took steps which led to their arrest and detection on reaching Varennes. For this service he declined a reward. In Sept. 1792 he was elected deputy to the Convention. He voted the death of the king without appeal, showed implacable hostility to the Girondins, and proposed the slaughter of all English residents in France. He was captured at the siege of Maubeuge, and imprisoned at Spielberg till the close of 1795. He then became a member of the Council of Five Hundred, and was named secretary. Drouet was implicated in the conspiracy of Babeuf, and was imprisoned; but he made his escape into Switzerland, and thence to Teneriffe. There he took part in the successful resistance to the attempt of Nelson on the island, in 1797, and later visited India. The First Empire found in him a docile sub-prefect of Ste.-Menehould. After the second Restoration he had to leave France. Returning secretly he settled at Mâcon, under the name of Merger and a guise of piety, and died there on April 11, 1824.

See G. Lenôtre, *Le Drnme de Varennes* (Paris, 1905).

DROWNING AND LIFE SAVING. To "drown" is to suffer or inflict death by submersion in water, or figuratively to submerge entirely in water or some other liquid. As a form of capital punishment it persisted in Europe till the 18th century.

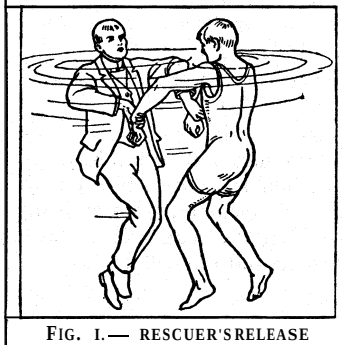


FIG. 1.— RESCUER'S RELEASE
When held by wrists, rescuer should turn both arms simultaneously against drowning person's thumbs

Death from drowning is the result of asphyxia from inhalation of water during the violent efforts to breathe. Owing to lack of oxygen and accumulation of carbonic acid gas the blood soon becomes intensely venous and by poisoning the respiratory and cardiac centres in the medulla oblongata brings them to a standstill. Sometimes death occurs from primary syncope.

When a person unable to swim falls into the water, he usually rises to the surface, throws up his arms and calls for help. This, with the water swallowed, will make him sink. Struggling will be prolonged a few seconds, and then probably cease for a time, allowing him to rise again, though perhaps not sufficiently high to get another breath of air. If still conscious, he will renew his struggle, more feebly perhaps, but with the same result. As soon as insensibility occurs, the body sinks altogether, owing to the loss of air and the filling of the stomach with water. The general belief that a drowning person must rise three times before he finally sinks is a fallacy.

FIG. 2.—RESCUER'S RELEASE
If clutched around the neck, rescuer places one hand behind drowning person's back and, with palm of other hand on chin, pushes away the head

Before diving in to rescue a drowning person the boots and heavy clothing should be discarded if possible, and where a leap has to be made from a height, or the depth of the water is unknown, it is best to drop in feet first. Where weeds abound progress should be made in the direction of the stream. The danger of being clutched by a drowning man is best avoided by approaching him from behind, but if seized, the rescuer must keep uppermost, as this makes the effort of effecting a release much easier.

If the rescuer be held by the wrists, he must turn both arms simultaneously against the drowning person's thumbs, and bring his arms at right angles to the body (fig. 1). If he be clutched round the neck he must take a deep breath, lean well over the drowning person, place one hand in the small of his back and pass the other over the drowning person's arm, pinch the nostrils and at the same time with the palm of the hand on the chin push the head away with all possible force (fig. 2). One of the most dangerous clutches is that round the body and arms or round the body only. When so tackled the rescuer should lean well over the drowning person, take a breath as before, and either withdraw both arms in an upward direction in front of his body, or else act in the same way as when releasing oneself when clutched

round the neck. In any case one hand must be placed on the drowning man's shoulder, and the palm of the other hand against his chin, and at the same time one knee should be brought up against the lower part of his chest. Then, with a strong and sudden push, the arms and legs should be stretched out straight and the whole weight of the body thrown backwards. This sudden and totally unexpected action will break the clutch (fig. 3).

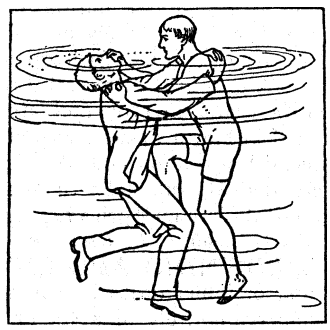


FIG. 3.—RESCUER'S RELEASE
If seized round body and arms, place one hand on drowning man's shoulder, the other on his chin, and press knee against lower part of his chest. Then push backward suddenly

There are several methods of carrying a person through the water, the easiest being that applied to a quiescent person. Then the person assisted should place his arms on the rescuer's shoulders, close to the neck, with the arms at full stretch, lie on his back perfectly still, with the head well back. The rescuer will then be uppermost, and having his arms and legs free can, with the breast stroke, make rapid progress to the shore (fig. 4).

When a drowning person is not struggling, but seems likely to do so when approached, the best method is to turn him on his back, place the hands on either side of his face and swim with the back stroke, always taking care to keep the man's face above water (fig. 5). If the man be struggling and difficult to manage, he should be turned on his back as before, and a firm hold taken of his arms just above his elbows. Then the man's arms should be drawn up at right angles to his body and the rescuer should use the back stroke (fig. 6). If the arms be difficult to grasp, or the struggling prevent a firm hold, the rescuer should slip his hands under the armpits of the drowning person, and place them on his chest or round his arms, which he should raise at right angles to his body (fig. 7). In carrying a person through the water, it is advantageous to keep his elbows well out from the sides, as this expands the chest, inflates the lungs and adds to his buoyancy. If the drowning person has sunk the rescuer should look for bubbles before diving in and remember that in running water they rise obliquely. When a drowning person is recovered on the bottom, the rescuer should seize him by the head or shoulders, place the left foot on the ground and the right knee in the small of his back, and then, with a vigorous push, come to the surface.

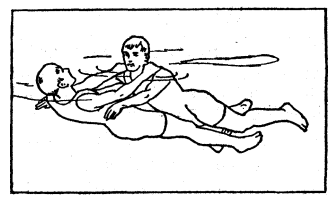


FIG. 4.— METHOD OF RESCUING A QUIESCENT PERSON
The drowning person should lie on his back, with arms on rescuer's shoulders. Rescuer is uppermost and, with arms and legs free, can use the breast stroke

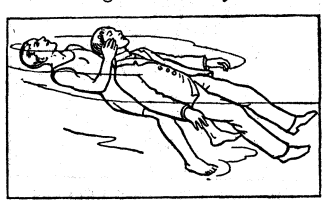


FIG. 5.—METHOD OF RESCUING PERSON LIKELY TO STRUGGLE
Turn drowning person on back and, keeping his head above water, use back stroke

When the rescuer reaches land with an insensible person, artificial respiration must be employed. The system first in vogue (1774) was inserting the pipe of a pair of bellows into one nostril and closing the other. Air was forced into the lungs and then expelled by pressing the chest, thus imitating respiration. About the middle of the 19th century came the methods of Marshall Hall, of Silvester, and of Howard. These have been superseded by the simpler and more effective method, worked out experimentally by Professor E. A. Schäfer of Edinburgh and adopted by the Royal Life Saving Society.

Professor Schafer describes the method as follows: Lay the subject face downwards on the ground, then without stopping to remove the clothing the operator should at once place himself in position astride or at one side of the subject, facing his head and kneeling upon one or both knees. He then places his hands flat over the lower part of the back (on the lowest ribs), one on each side (fig. 8), and then gradually throws the weight of his body forward onto them so as to produce firm pressure (fig. 9)—which must not be violent—upon the patient's chest. By this means the air, and water if any, are driven out of the patient's lungs. Immediately thereafter the operator raises his body slowly so as to remove the pressure, but the hands are left in position. This

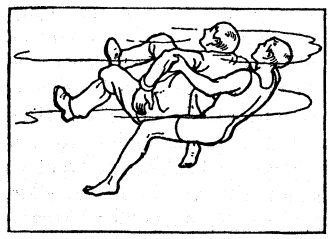


FIG. 6.—METHOD OF RESCUING PERSON WHO STRUGGLES VIOLENTLY
Turn drowning person on back and support his arms above elbow in a *lifted position*. Use back stroke

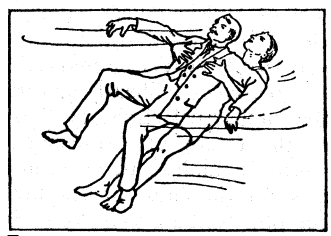


FIG. 7.—RESCUING PERSON WHO RESISTS METHOD SHOWN IN FIG. 6
Slip hands under armpits, then raise arms at right angles to body and proceed as before

forward and backward movement is repeated every four or five seconds; in other words, the body of the operator is swayed slowly forwards and backwards upon the arms from twelve to fifteen

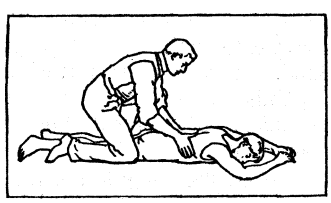


FIG. 8.—ARTIFICIAL RESPIRATION, 1ST MOVEMENT (SCHÄFER METHOD)
Straddle person, face downward and place hands on lower part of back

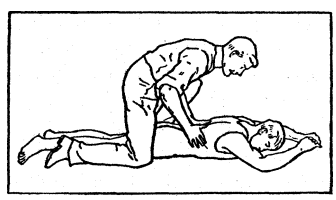


FIG. 9.—ARTIFICIAL RESPIRATION, 2ND MOVEMENT (SCHÄFER METHOD)
Throw body forward, producing firm pressure. Then resume first position

times a minute, and should be continued for at least half an hour, or until the natural respirations are resumed. Whilst one person is carrying out artificial respiration in this way, others may, if there be opportunity, busy themselves with applying hot flannels to the body and limbs, and hot bottles to the feet, but no attempt should be made to remove the wet clothing or to give any restoratives by the mouth until natural breathing has recommenced.

In his paper read before the Royal Society of Edinburgh in December, 1903, Professor Schäfer gave the following table of the relative exchanges of air under different methods:—

Mode of respiration.	Number per minute.	Amount of air exchanged per respiration.	Amount of air exchanged per minute.
		c.c.	c.c.
Natural respiration (supine)	13	489	6357
Natural respiration (prone)	12·5	422	5275
Prone (pressure), "Schafer"	13	520	6760
Supine (pressure), "Howard"	13·6	295	4012
Rolling (with pressure), "Marshall Hall"	13	254	3302
Rolling (without pressure), "Marshall Hall"	12	192	2304
Traction (with pressure), "Silvester"	12·8	178	2278

These experiments show that by far the most efficient method known of performing artificial respiration is that of intermittent pressure upon the lower ribs with the subject face downward. It is the easiest to perform, and has the further great advantage that it can be effectively carried out by one person. (*See* also ARTIFICIAL RESPIRATION.)

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ing artificial respiration in man" (vol. 23, part i. *Proceedings of the Royal Society of Edinburgh)*; R. S. Bowles, *A Method for the Treatment of the Apparently Drowned* (1903); *Handbook of Instruction,* Royal Life Saving Society (1908).

DROYSEN, JOHANN GUSTAV (1808–1884), German historian, was born on July 6, 1808 at Treptow, Pomerania, son of an army chaplain. In his childhood Droysen witnessed some of the military operations during the War of Liberation, for his father was pastor at Greifenhagen, near Stettin, occupied by the French in 1813. The impressions of these early years laid the foundation of his ardent attachment to Prussia. He was educated at the gymnasium of Stettin and at the University of Berlin. Droysen occupied various positions in the schools as well as at the University of Berlin until 1840, and there his early works, on Alexander the Great and on Hellenism, were mainly written.

In 1840 Droysen succeeded F. C. Dahlmann (*q.v.*), professor of history at Kiel, and was drawn into the political movement for the defence of the rights of the Elbe duchies. In 1848 he was elected a member of the Frankfort parliament, and acted as secretary to the committee for drawing up the constitution. A determined supporter of Prussian ascendancy, he retired after the king of Prussia refused the imperial crown in 1849. In 1850, with Carl Samwer, he published a history of the dealings of Denmark with Schleswig-Holstein, *Die Herzogthümer Schleswig-Holstein und das Königreich Danemark seit dem Jahre 1806* (Hamburg, 1850; Eng. trans. 1850), a book formative of German public opinion on the rights of the duchies in their struggle with Denmark. After 1851 he had to leave Kiel, and he was appointed to a professorship at Jena; in 1859 he was called to Berlin, where he remained till his death. In 1851 he brought out his admirable biography of Count Yorck von Wartenburg (1851–52) and then began his great work on the *Geschichte der preussischen Politik* (7 vols., 1855–86). It forms a complete history of the growth of the Prussian monarchy down to the year 1756. This, like all Droysen's work, shows a strongly marked individuality, and a great power of tracing the manner in which important dynamic forces worked themselves out in history. Droysen died in Berlin on June 19, 1884. His eldest son, Gustav (1838–1908) wrote *Gustav Adolf* (Leipzig, 1869–70); *Herzog Bernhard von Weimar* (Leipzig, 1885); an admirable *Historischer Handatlas* (Leipzig, 1885), and several writings on various events of the Thirty Years' War.

See M. Duncker, *Johann Gustav Droysen, ein Nachruf (1885)*; and Dahlmann-Waitz, *Quellenkunde der deutschen Geschichte* (Leipzig, 1906).

DROZ, ANTOINE GUSTAVE (1832–1895), French man of letters, son of the sculptor J. A. Droz (1807–1872), was born in Paris. He was educated as an artist, and first exhibited in the Salon of 1857. A series of sketches dealing gaily and lightly with the intimacies of family life, published in the *Vie parisienne* and issued in book form as *Monsieur, Madame et Bébé* (1866, Eng. trans. 1887) won for the author immediate recognition and great success. *Entre nous* (1867) was built on a similar plan, and was later followed by a series of novels: *Le Cahier bleu de Mlle Cibot* (1868); *Autour d'une source* (1869); *Un Paquet de lettres* (1870); *Babolein* (1872); *Les Étangs* (1875); *L'Enfant* (1885); *Tristesses et sourires* (1884). Droz died on Oct. 22, 1895.

DROZ, FRANÇOIS-XAVIER JOSEPH (1773–1850), French writer on ethics and political science, was born at Besançon, of a legal family. He gained the Montyon prize in 1823 by his work *De la philosophie morale ou des différents systèmes sur la science de la vie.* The main doctrine inculcated in this treatise is that society will never be in a proper state till men have been educated to think of their duties and not of their rights. It was followed in 1825 by *Application de la morale à la philosophie et à la politique,* and in 1829 by *Economie politique, ou principes de la science des richesses,* which was edited by Michel Chevalier in 1854. His greatest work was a *Histoire du règne de Louis XVI* (3 vols., 1839–42). As he advanced in life Droz became more religious, and his last work was *Pensdes du Christianisme* (1842). He had been admitted to membership in the Academy some time during 1824.

See Guizot, *Discours acade'miques;* Montalembert, "Discours de réception," in *Me'moires de l'Académie française;* Sainte-Beuve, *Causeries du lundi,* t. iii.; Michel Chevalier, Notice prefixed to the *Economie politique.*

DROZ, NUMA (1844–1899), Swiss statesman, was born on Jan. 27, 1844, at La Chaux-de-Fonds. After teaching school, he became editor of *National Suisse* in 1864. Four years later he was made a member of the council of Neuchâtel, in 1875 of the Federal chamber, and in 1881 and again in 1887 was president of the Swiss Confederation. His works are *L'Instruction civique* (1886), *Essais économiques* (1895) and *Études et portraits politiques* (1895).

DRUDE, PAUL KARL LUDWIG (1863–1906), German physicist, was born at Brunswick on July 12, 1863. He studied at Gottingen, Freiburg and Berlin. Drude was extraordinary professor of physics at Leipzig (1894- goo), professor of physics at Giessen (1900–05), and finally, professor of physics at Berlin. His most important work was his application of Maxwell's electromagnetic theory, as developed by Herz, to the problems of light, and a series of papers appeared between 1896 and 1899. Some of these were on the theory of magneto-optical phenomena of iron, nickel and cobalt (1897), on the theory of anomalous dispersion (1898), on electric dispersion (1899), and on the optical constants of metals (1899). Later, Drude worked on electromagnetic oscillations. He also wrote two well-known books, which have passed through many editions and have been translated into English, *Physik des Äthers* (1894) and *Lehrbuch der Optik* (1900). In 1900 he succeeded Wiedemann as the editor of the *Annalen der Physik.* Drude committed suicide on July 5, 1906.

DRUG, a district and town of British India in the Chhattisgarh division of the Central Provinces. The district was formed in 1906 from portions of the districts of Bilaspur and Raipur (*qq.v.*). It has an area of 4,645 sq.m. and at that time the population, 676,000, showed a large decrease on the preceding census, but by 1931 it had recovered to 817,924. The district belongs to the Chhattisgarh rice plain and has the same undulating character, but contains more wheat land than its neighbours. Several irrigation storage reservoirs and the Tandula canal have been constructed by Government since the great famine of 1900. There are nine Zamindari estates in the district covering an area of 1,800 sq. miles.

Drug, the capital of the district, is the only town among 2,533 villages. Its population has greatly increased since it was made a district headquarters, namely, from 4,033 in 1901 to 13,172 in 1931. It is a station on the Bengal-Nagpur railway and a rice market has been established there, but its local industries are petty.

DRUG, any organic and inorganic substance used in the preparation of medicines, by itself or in combination with others, and either prepared by some method or used in a natural state (*see* PHARMACOLOGY and PHARMACOPOEIA). In a particular sense "drug" is often used synonymously for narcotics or poisonous substances, and hence "to drug" means to stupefy or poison.

DRUG ADDICTION may be defined as an overpowering impulse for narcotism or intoxication by any drug possessing narcotic or intoxicating properties. It is best exemplified by the overpowering influence possessed by opium and its preparations, and its alkaloids or derivatives such as morphine and heroin, and by cocaine and substances containing it. Persons who have become habituated to the continued use of these drugs find that they have become enslaved to them, and that it is with the greatest difficulty that their use can be abandoned. Addiction drugs cause very great mental and moral deterioration, usually progressive in character.

Drug addiction is by no means confined to the above-named drugs. Other examples are well known; thus, the barbituric acid derivatives (*q.v.*), the sulphonal group of hypnotics (*q.v.*), cannabis indica (Indian hemp, bhang or hashish), may give rise to addiction. It has been observed in the use of paraldehyde chloral, ether and chloroform.

It is with the first group of drugs that addiction is very dangerous and most marked, and where a habit is produced which it is most difficult to eradicate.

In Sept. 1924 a Departmental Committee was appointed by the British Minister of Health to enquire into morphine and heroin addiction, and specially to consider the circumstances under which these drugs may be supplied to persons suffering from addiction and the precautions necessary for the avoidance of abuse. This Committee took evidence and finally issued its report on Jan. 21, 1926.

Occurrence.—The universal opinion of those most competent to judge is that drug addiction is rare in Great Britain. In America special attention has been devoted to the subject during recent years and many official reports on it have been issued.

Laws and Regulations.—Drug addiction has become an international problem and the laws and regulations in Great Britain are not due to the special or peculiar needs of the country but are the reflection of international opinion and ideals.

The "opium problem" has been before the world for many years. Thus Warren Hastings, the first Governor General of India, in 1788 declared opium to be "a pernicious article of luxury which ought not to be permitted but for the purpose of foreign commerce only." The United States became directly concerned in the Far East opium problem when the Philippine Islands were ceded to them by Spain in 1898. The International Opium Commission of Shanghai was largely the result of President Roosevelt's initiative and in consequence of this the International Opium Convention at The Hague in 1911 and 1912 resulted. The recommendations of the Convention formed part of the Peace Treaty of Versailles and the consenting nations agreed to frame Acts dealing with the dangerous drugs under consideration.

As a result, in Britain "the Dangerous Drugs" Act was passed in Sept. 1920. In May 1921 regulations were passed dealing with the carrying out of the provisions of the Act and further minor regulations were made in 1921 and 1923. In May 1923 the Dangerous Drugs and Poisons Amendment Act was passed. Thus the motive factor for this legislation was the international problem and not the evil of drug addiction in Great Britain.

Legislation when once passed by Parliament in Great Britain is, as a matter of course, rigidly enforced, and in consequence of this the regulations as regards the sale of dangerous drugs are efficiently carried out in Britain. Pharmacists and medical practitioners have, it is true, experienced great difficulty and inconvenience in the carrying out of the many regulations entailed, but they have loyally complied with their requirements.

Classes of Drug Addicts.—Drug addiction occurs in two classes of persons:

(1) Those who might be called the *vicious group*, which includes those who devote their lives to so-called pleasure seeking and the search for new excitements and sensations. Cocaine, morphine and heroin employed either hypodermically or orally or inhaled as snuff, are the drugs commonly used by this type of addict. This group is found in London and the great cities. Fortunately it is small and its influence is not extensive. Addiction of this type requires to be stamped out but it is not such a serious menace to the national well-being as that affecting the main population.

(2) Members of the *general population*. The commonest cause of drug addiction in the ordinary case is undoubtedly prescription of the drug for medical purposes. This may arise from *(a)* necessity of relieving pain; (b) the necessity of inducing sleep.

The Relief of Pain.—In the former case it is necessary often after a surgical operation, particularly abdominal cases, for a hypodermic injection of morphine or heroin to be prescribed. This is a perfectly desirable and legitimate procedure but use of the narcotic drug should be limited to a few administrations. Otherwise the risk of the formation of an addiction habit is great.

Again for the relief of pain of a neuralgic type the drugs morphine and heroin often act as a charm. But should they be continuously prescribed an addiction habit is almost certain to develop. Much to be preferred therefore is the employment of other drugs such as phenacetin, pyramidon and aspirin whose use is not attended with this danger.

Employment in Insomnia Cases.—In certain conditions it may be necessary to ensure sleep at all costs and for this purpose the administration of morphine or heroin may be advisable. The frequent repetition of this is to be avoided. Too often the terrors of insomnia are impressed upon the patient and he comes to regard the administration of a hypnotic as part of his daily life. The habitual use of hypnotics is greatly to be deprecated. It is entirely unnecessary, and no instance has yet been recorded of a fatal result from insomnia in human beings. The terrors of insomnia are not to be compared with those of drug addiction, and a little sleep following natural methods of treatment is of far greater benefit than the more prolonged abnormal condition of sleep produced by narcotic drugs.

Psychological Aspects.—The psycho-neurotic factor looms largely in drug addiction. Given an exciting cause—for example the repeated daily administration of a narcotic drug—the danger of addiction is much greater in patients with a neuropathic temperament. **A** family history of insanity, neurosis or of alcoholism is usual amongst drug addicts, and they themselves previous to their addiction often present signs of nervous instability.

Often a psychological complex of a depressing type exists in patients of this group who are affected with mental worry and anxiety. There is a subconscious cry for relief from mental suffering. This is temporarily obtained by means of a narcotic drug, and as surely as this occurs so inevitably does a still deeper stage of mental agony develop which is only to be relieved by the further resort to the narcotic and so drug addiction becomes established.

Toxaemic conditions due to toxic absorption from septic teeth, or to some naso-pharyngeal infection such as septic tonsils or an infected antrum, may lead to low conditions of physical or mental health and so establish a neuropathic condition which prepares the soil for drug addiction. Such patients should be treated on general lines and their focus of infection eradicated as far as possible. The symptoms should not be masked by the administration of alcohol or addiction drugs.

One Drug Habit Leads to **Another.**—When an addiction habit has developed for one drug, *e.g.* morphine, there is a great tendency for the patient to switch off from the primary addiction drug and to take as an alternative another drug such as cocaine. Alcohol addiction is frequently combined with that of morphine or heroin or cocaine.

Symptoms.—After the daily use of an addiction drug such as morphine, heroin or cocaine for about four weeks in most cases an addiction habit develops. The patient's health becomes impaired, the complexion sallow, the tongue furred, the skin irritable, particularly in the case of cocaine where a constant sense of itching and discomfort arises. The mental and moral sense become affected. **A** constant state of deep mental depression results which is only very temporarily relieved by further and increasing doses of the drug. Appointments are not kept, all responsibilities are neglected, and no reliance can be placed on any statements made, since drug addicts usually exhibit an utter disregard for truth.

Withdrawal symptoms occur when the drug is withheld in cases of confirmed addiction; these comprise tremors, vomiting, diarrhoea and even collapse. Pains in the body and limbs may occur and mental symptoms of restlessness and apparent mental sufferingare exhibited in a marked degree. The symptoms at once disappear after a further dose of the drug but recur when its effect passes off. Withdrawal symptoms are most marked in the cases of morphine and heroin, but they occur also, although to a somewhat less degree, in the case of cocaine. Withdrawal symptoms in the case of drug addiction are now accepted as forming a definite symptom complex of characteristic type. And objective symptoms of definite type show that the symptoms are not purposely assumed by the patient with the object of obtaining further doses of the drug.

Treatment.—Drug addiction is to be regarded as a disease rather than a vice. When it has developed it requires special care and medical treatment just as would a case of organic disease such as typhoid fever. The first and most essential part of the treatment is complete and thorough supervision and care of the patient. This can only be ensured by treatment in an institution

or nursing home. In early cases sudden withdrawal of the drug may be adopted, but where the addiction has continued for long periods, such as a year or more, gradual withdrawal is advisable so that after one to three weeks no drug is being given. A long further period of treatment is still required to improve the general health of the patient and above all to educate and restore his will power. For this purpose psychotherapeutic treatment (*q.v.*) is of value. The prospect of cure depends on the extent to which the will power of the patient is restored and on the establishment of confidence and hopefulness so that he is able to resist the desire to take the drug again.

In some cases of drug addiction hyoscine treatment has been advocated. This consists in the hypodermic administration of frequently repeated small doses of hyoscine so that a condition of mild delirium lasting from 36 to 48 hours is produced. When this passes off no addiction drug is given. The hyoscine treatment is not free from risk, since some fatal cases from its use have been recorded and in general it does not appear to possess any advantages over the carefully regulated gradual withdrawal method.

Drug Addiction **of** Long Duration.— When an addiction drug such as morphine or heroin has been taken over a period of many years the prospect of cure is not good. In such cases it is probable that organic changes have resulted in the nervous system and other changes of a biochemical nature have occurred which alter the metabolic processes of the body. Where repeated attempts at cure have failed the situation has to be faced that the only way in which a person can carry on his normal avocations is to allow a minimal daily allowance of the drug to which he is addicted. The allowance should be so fixed that increase in dosage is prevented. Patients of this type are often able to carry on their daily work on a fixed allowance of the drug and to keep in fair health for years.

The Departmental Committee above referred to accepted the view that certain cases of drug addiction of long duration could only be regarded as incurable and that in such cases a daily minimal allowance of the addiction drug might wisely be permitted.

Prevention.— There is no doubt that the dangerous drugs regulations, irksome as they are to pharmacists and physicians, have done much in reducing drug addiction. Their rigid enforcement must prevent the development of fresh cases of addiction owing to the great difficulties entailed in obtaining constant supplies of the drugs in question.

The control of production of opium and of coca leaves, and the alkaloids obtained from them, strikes at the very root of the problem. An international control of the production of the "dangerous drugs" is required but has not yet been attained. There should be no surplus available for non-medicinal and non-scientific purposes.

Care on the part of medical practitioners in the prescription of drugs of addiction is a most important factor in prevention of the drug habit. and there is every reason to believe that in point of fact the utmost care is being taken in this respect.

Illegal trafficking in dangerous drugs such as morphine, heroin and cocaine undoubtedly occurs to some extent, and this must be stamped out at all costs. Fortunately the full penal powers given by The Dangerous Drugs Acts are such as to render this trafficking a most dangerous pursuit, and the number of those actually engaged in it in Great Britain is consequently very small.

(W. H. WI)

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In the United States, about 95% of all narcotic addicts use opium in the form of heroin or morphine. Heroin addicts are found only in a few States along the Atlantic seaboard, and morphine addicts outnumber them by about 12 to 1. Opium smoking was once fairly common, but is now confined to a few Chinese in the large cities. Cocaine is used sporadically by about 50% of the more dissipated type of morphine and heroin addicts, but continued addiction to cocaine alone is very unusual. Most normal subjects, who became addicted years ago through self-medication with opium, and many of the less unstable of the abnormal group have been cured permanently, leaving a very unstable group who constantly relapse because of the instability that was responsible for their original addiction. Many of these have been "cured" from 10 to 20 times.

A study of delinquent addicts has shown that their original psychopathic character, rather than mental and moral deterioration due to the use of narcotics, is responsible for the offences they commit; but some of them lie and steal in order to supply themselves with opium. Normal addicts do not suffer appreciable mental or moral deterioration. In hospitals for the insane only a small fraction of one per cent have psychoses attributable to the use of narcotics.

The trend of drug addiction was upward from 1860 to about 1900, at which time addicts totalled 250,000 to 300,000. The number remained practically stationary during the next decade, after which drug addiction declined to about one-third what it used to be. In 1924 the division of the Bureau of Internal Revenue having charge of narcotic law enforcement estimated the total number of addicts to be 110,000; the U S. Public Health Service set the figure as between 110,000 and 150,000. In 1926 the number was estimated at less than 95,000 and it is constantly declining. The United States enforces all the recommendations of the Hague International Opium Convention of Jan. 23, 1912. In 1909 the Federal Government forbade the importation of smoking opium, but the first restrictive legislation was the Ohio Anti-Opium Smoking Law of 1885. Practically all other anti-narcotic legislation has been enacted since 1897. By 1912 every State except Delaware had an anti-narcotic law. At present every State and Territory has such a law, but the most important one is the Federal anti-narcotic law known as the Harrison Act, which became effective in 1915. It has been amended and supplemented so that the Federal Government now traces opium and cocaine from the time a permit to import the crude drug is issued, until the finished product reaches the consumer. Violations of the narcotic laws are punished by large fines and imprisonment of from one to ten years.

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(L. K.)

DRUIDISM was the faith of the Celtic inhabitants of Gaul until the time of the Romanization of their country, and of the Celtic population of the British Isles either up to the time of the Romanization of Britain, or, in parts remote from Roman influence, up to the period of the introduction of Christianity. From the standpoint of the available sources the subject presents two distinct fields for enquiry, the first being pre-Roman and Roman Gaul, and the second pre-Christian and early Christian Ireland and Pictland. In the present state of knowledge it is difficult to assess the interrelation of druidic paganism.

Gaul.— The earliest mention of druids is reported by Diogenes Laertius (Vitae, intro., 1 and 5) and was found in a lost work by a Greek, Sotion of Alexandria, written about 200 B.C., a date when the greater part of Gaul had been Celtic for over two centuries and the Greek colonies had been even longer established on the

south coast. The Gallic druids subsequently described by Caesar were an ancient order of religious officials, for when Sotion wrote they already possessed a reputation as philosophers in the outside world. Caesar's account, however, is the mainspring of our information, and it is an especially valuable document as Caesar's confidante and friend, the Aeduan noble Divitiacus, was himself a druid. Caesar's description of the druids (B.G., *vi.)* emphasizes their political and judicial functions. Although they officiated at sacrifices and taught the philosophy of their religion, they were more than priests; thus at the annual assembly of the order near Chartres, it was not to worship nor to sacrifice that the people came from afar, but to present their disputes for lawful trial. Moreover, it was not only minor quarrels that the druids decided, for their functions included the investigation of the gravest criminal charges and even inter-tribal disputes. This, together with the fact that they acknowledged the authority of an archdruid invested with supreme power, shows that their system was conceived on a national basis and was independent of ordinary inter-tribal jealousy; and if we add to this political advantage their influence over educated public opinion as the chief instructors of the young, and, finally, the formidable religious sanction behind their decrees, it is evident that before the clash with Rome the druids must very largely have controlled the civil administration of Gaul.

Of druidism itself, little is said except that the druids taught the immortality of the human soul, maintaining that it passed into other bodies after death. This belief was identified by later writers, such as Diodorus Siculus, with the Pythagorean doctrine, but probably incorrectly; for there is no evidence that the druidic belief included the notion of a chain of successive lives as a means of ethical purification, or that it was governed by a doctrine of moral retribution having the liberation of the soul as the ultimate hope, and this seems to reduce the druidic creed to the level of ordinary religious speculation. Of the theology of druidism, Caesar tells us that the Gauls, following the druidic teaching, claimed descent from a god corresponding with Dis in the Latin pantheon, and it is possible that they regarded him as a Supreme Being; he also adds that they worshipped Mercury, Apollo, Mars, Jupiter and Minerva, and had much the same notion about these deities as the rest of the world. In short, Caesar's remarks imply that there was nothing in the druidic creed, apart from the doctrine of immortality, that made their faith extraordinary, so that it may be assumed that druidism professed all the known tenets of ancient Celtic religion and that the gods of the druids were the familiar and multifarious deities of the Celtic pantheon. The philosophy of druidism does not seem to have survived the test of Roman acquaintance, and was doubtless a mixture of astrology and mythical cosmogony. Cicero *(De Divin.* i., xli., *go)* says that Divitiacus boasted a knowledge of *physiologia,* but Pliny decided eventually (N.H. xxx., *13)* that the lore of the druids was little else than a bundle of superstitions. Of the religious rites themselves, Pliny (N.H. xvi., 249) has given an impressive account of the ceremony of culling the mistletoe, and Diodorus Siculus (*Hist.,* v., 31, 2–5) describes their divinations by means of the slaughter of a human victim, Caesar having already mentioned the burning alive of men in wicker cages. It is likely that these victims were malefactors, and it is accordingly possible that such sacrifices were rather occasional national purgings than the common practice of the druids.

The advent of the Romans quickly led to the downfall of the druidic order. The rebellion of Vercingetorix must have ended their inter-tribal organization, since some of the tribes held aloof or took the Roman side; furthermore, at the beginning of the Christian era their cruel practices brought the druids into direct conflict with Rome, and led, finally, to their official suppression. At the end of the 1st century their status had sunk to that of mere magicians, and in the 2nd century there is no reference to them. A poem of Ausonius, however, shows that in the 4th century there were still people in Gaul who boasted of druidic descent.

British Isles.—There is one mention of druids in Great Britain as contemporaries of the Gallic clergy, and that is the reference to them by Tacitus *(Annals,* xiv., *30)* from which we learn that there were elders of that name in Anglesey in A.D. 61; but there is no mention of the druids in the whole of the history of Roman England, and it may be questioned whether there ever were any druids in the eastern provinces that had been subjected, before the Roman invasion, to German influence. On the other hand, there were certainly druids in Ireland and Scotland, and there is no reason to doubt that the order reaches back in antiquity at least to the 1st or 2nd century B.C.; the word *draí* (druid) can only be traced to the 8th century Irish glosses, but there is a strong tradition current in Irish literature that the druids and their lore (*druidecht*) were either of an aboriginal or Pictish origin. As to Wales, apart from the existence of druids in Anglesey, there is little to be said except that the earliest of the bards (the Cynfeirdd) very occasionally called themselves *derwyddon.*

The Irish druid was a notable person, figuring in the earliest sagas as prophet, teacher and magician; he did not possess, nevertheless, the judicial powers ascribed by Caesar to the Gallic druids, nor does he seem to have been a member of a national college with an archdruid at its head. Further, there is no mention in any of the texts of the Irish druids presiding at sacrifices, though they are said to have conducted idolatrous worship and to have celebrated funeral and baptismal rites. They are best described as seers who were, for the most part, sycophants of princes.

Origin.—Some confusion is avoided if we distinguish between the origin of the druids and the origin of druidism. Of the officials themselves, it seems most likely that their order was purely Celtic, and that it originated in Gaul, perhaps as a result of contact with the developed society of Greece; but druidism, on the other hand, is probably in its simplest terms the pre-Celtic and aboriginal faith of Gaul and the British Isles that was adopted with little modification by the migrating Celts. It is easy to understand that this faith might acquire the special distinction of antiquity in remote districts, such as Britain, and this view would explain the belief expressed to Caesar that the *disciplina* of druidism was of insular origin.

The etymology of the word *druid* is still doubtful, but the old orthodox view taking *dru* as a strengthening prefix and *uid* as meaning *knowing,* whereby the druid was a *very learned* man, has been abandoned in favour of a derivation from an oak-word. Pliny's derivation from Greek δεῦς is, however, improbable.

A great revival of interest in the druids, largely promulgated by the archaeological theories of Aubrey and Stukeley, and by Romanticism generally, took place in the 18th and 19th centuries. One outcome of this interest was the invention of *neo-druidism,* an extravagant mixture of helio-arkite theology and Welsh bardic lore, and another result is that more than one society has professed itself as inheriting the traditional knowledge and faith of the early druids. The *Ancient Order of Druids,* however, a friendly society founded in the 18th century, makes no such claim.

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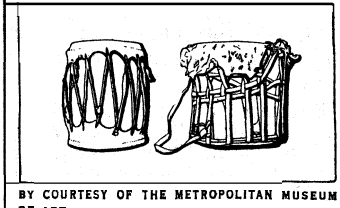
DRUIDS, ANCIENT ORDER OF, a friendly society founded, as an imitation of the ancient Druids, in London in 1781. They adopted Masonic rites and spread to America *(1833)* and Australia. Their lodges are called "Groves." In 1872 the Order was introduced into Germany. *(See* FRIENDLY SOCIETIES.)



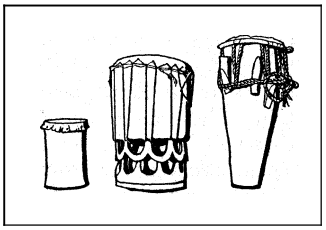
BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

DRUMS FROM NEW MEXICO

DRUM, the name given to a well-known percussion musical instrument and also to many objects resembling it in shape. Early forms of the word are *drome* or *dromme,* a word common to many Teut. languages, *cf.* Dan. *tromme,* Ger. *Trommel;* the word is ultimately the same as "trumpet," and is probably onomatopoeic in origin; it appears late in Eng. about the middle of the 16th century. The word is used, in connection with machinery, of a revolving cylinder, round which belting is passed;

of the tympanum or cylindrically-shaped middle ear, and specially of the membrane that closes the external auditory meatus; and in architecture, of the sub-structure of a dome when raised to some height above the pendentives. The term is also applied to the circular blocks of stone employed in columns of large dimensions.

In music the drum (Fr. tambour; Ger. *Trommel;* Ital. *tamburo*) is an instrument of percussion common in some form to all nations and ages. It consists of a frame or vessel forming a resonant cavity, over one or both ends of which is stretched a skin or vellum set in vibration by direct percussion of hand or stick. Drums fall into two divisions according to the nature of their sonority:—(1) instruments producing sounds of definite musical pitch, and qualified thereby to take part in the harmony of the orchestra, such as the kettle drum (*q.v.*); (2) instruments of indefinite pitch, and therefore excluded from the harmony of the orchestra; such are the bass drum, the side or snare drum, the tenor drum, the tambourine, all used for marking the rhythm and adding tone colour.



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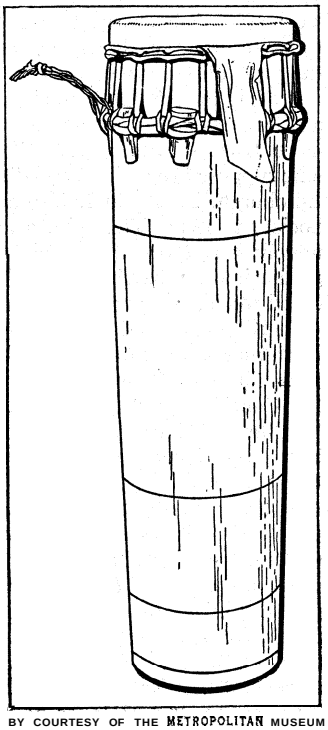
LEFT TO RIGHT: THE AFRICAN DRUM, HAWAIIAN DRUM AND SOUTH AMERICAN DRUM

The bass drum or Turkish drum (Fr, grosse *caisse;* Ger. Grosse *Trommel;* Ital. gran cassa or tamburo grande) consists of a short cylinder of very wide diameter covered at both ends by vellum, the tension of which is controlled by means of leather braces. It gives out no definite note, but has a place in every orchestra, although it is used but sparingly to accentuate the rhythm. Wagner did not once score for the bass drum after he composed *Rienzi.*

The side or snare drum (Fr. tambour *militaire;* Ger. *Militär-trommel;* Ital. tamburo *militare*) is an instrument consisting of a small wooden or brass cylinder with a vellum at each end. Across the lower vellum are stretched two or more catgut strings called snares, which produce a rattling sound at each stroke on the upper head, owing to the sympathetic vibration of the lower head, which jars against the snares. The presence of the snares gives the side drum its peculiar timbre, changing the nature of the vibrations, for the snares form a kind of nodal contact, inducing double the number of vibrations, and a sound approximately an octave higher than would be the case were the heads left to vibrate freely.

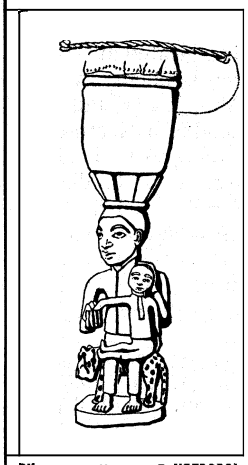


BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

A JAVANESE DRUM

The tenor *drum* (Fr. caisse roulante; Ger. Roll- or *Rühr-trommel;* Ital. *tamburo rulante*) is similar to the side drum, but has a larger cylinder of wood and no snares; consequently its timbre lacks the brilliancy and incisiveness of the side drum.

The popularity of all kinds of drums in the most ancient civilizations is established beyond a doubt by the numerous representations of the instrument in a variety of shapes and sizes on the monuments and paintings of Egypt, Assyria, India, and Persia. The *tympanon,* under which name seem to have been included tambourines and kettle drums, as well as the dulcimer (during the middle ages), was in use among Greeks and Romans chiefly in the worship of Cybele and Bacchus; it was introduced through the medium of the Roman civilization into western Europe. It is often said that the drum was introduced by the crusaders, but it was certainly known in England long before the crusades, for Bede (*Musica practica*) mentions it in his list of instruments, and Cassiodorus (ii. p. 507) describes it. An actual drum with two curved drum-sticks belonging to the ancient Egyptians was found during the excavations at Thebes in 1823.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

FRENCH CONGO DRUM

The side drum was admitted into the orchestra in the 17th century, when Marais (1636–1728) scored for it in his opera Alcione.

DRUM, the name given to certain fishes belonging to the family Sciaenidae, so called because they make a peculiar grunting noise. The sea drum (Pogonias cromis), found along the Atlantic coasts of North and South America, attains a length of four feet. The body, which is oblong, with an elevated back, has large scales except on the breast. The throat is paved with stony teeth adapted for crushing shell-fish. In colour the sea drum is brownish-grey or brownish-red, the young being marked with broad, vertical bands of a darker shade. It is not valued for food and, as it destroys great quantities of oysters, is much dislikedby oystermen. The very similar freshwater drum (*Aplodinotus grunniens*), called also sheep-head and thunder pumper, is a greyish, silvery fish sometimes attaining $3\frac{1}{2}$ ft. in length and 50 lb. in weight. It occurs from Georgia and Texas to the Great Lakes but is especially abundant in the streams and lakes of the Mississippi valley. Its scales are thin and deep, with the larger ones on the breast. The freshwater drum is a popular food fish in the South but is little used in the North.

In architecture, a drum is a vertical wall, usually cylindrical, supporting a dome, commonly limited to walls carried at a considerable height by pendentives, or similar forms. The drum first appears in a developed form in Byzantine architecture (see BYZANTINE AND ROMANESQUE ARCHITECTURE). It later became a characteristic feature of almost all Renaissance dome design (see DOME).

DRUMMOND, HENRY (1786–1860), English banker, politician and writer, best known as one of the founders of the Catholic Apostolic or "Irvingite" Church, was born at the Grange, near Alresford, Hants., on Dec. 5, 1786, the eldest son of Henry Drummond, a prominent London banker. He was educated at Harrow and at Christ Church, Oxford. From 1847 until his death he represented West Surrey in parliament. In 1817 he met Robert Haldane at Geneva, and continued his movement against the Socinian tendencies then prevalent there. In later years he was intimately associated with the origin and spread of the Catholic Apostolic Church. Meetings of those who sympathized with the views of Edward Irving were held for the study of prophesy at Drummond's seat, Albury Park, in Surrey; he contributed very liberally to the funds of the new church; and he became one of its leading office-bearers, visiting Scotland as an "apostle" and being ordained as an "angel" for that kingdom. He died on Feb. 20, 1860. His works include Social Duties on Christian Principles (1830); Abstract *Principles* of *Revealed* Religion (1844); *The* Fate of Christendom (3rd ed. 1854); Discourses on the *true Definition* of the *Church* (1858); and Speeches in Parliament (ed. Lord Lovaine, 1860).

DRUMMOND, HENRY (1851–1897), Scottish evangelical writer and lecturer, was born in Stirling on Aug. 17, 1851. He was educated at Edinburgh university, and in 1877 became lecturer on science in the Free Church college, Glasgow. His principal work was Natural Law in the Spiritual *World* (1883), the argument of which was that the scientific principle of continuity extended from the physical world to the spiritual. In 1888 he published Tropical Africa, a valuable digest of information based on a visit to Africa in 1883. In 1890 he travelled in Australia, and in 1893

delivered the Lowell Lectures at Boston, which were printed in 1894 under the title of *The Ascent of Man*, in which he argued that the disinterested care and compassion of animals for each other played an important part in effecting "the survival of the fittest," a thesis previously maintained by Prof. John Fiske. Drummond died on March 11, 1897.

See the *Life* by Sir G. A. Smith (1898).

DRUMMOND, JAMES (1835–1918), Unitarian scholar, was born in Dublin on May 14, 1835, and was educated at Trinity college, Dublin, and Manchester New college, London. In 1860 he became pastor of Cross Street chapel, Manchester, but nine years later returned to his old college in London as lecturer in biblical and historical theology. From 1885 to 1906 he held the principalship, moving with the college to Oxford where he died on June 13, 1918. As a Unitarian, Drummond advocated doctrinal freedom. He regarded Christ as the highest revelation from God but rejected the Resurrection and the nature miracles. His acceptance of the Johannine authorship of the fourth gospel is elaborated in his *Inquiry into the Character and Authorship of the Fourth Gospel* (1903).

His other chief works ara *The Jewish Messiah* (1877); *Philo-Judaeus* (1888); *Via, Veritas, Vita* (Hibbert lectures, 1894), and *Studies in Christian Doctrine* (1908). His *Pauline Meditations*, published posthumously in 1919, has a memorial introduction.

DRUMMOND, SIR JAMES ERIC (16th EARL OF PERTH) (1876–), British statesman, first secretary-general of League of Nations, half-brother of the 15th earl of Perth, was educated at Bedford Grammar school and Eton, and entered the British Foreign Office in April 1900. Later he became private secretary to the prime minister, Mr. Asquith, to Sir Edward Grey, and to Mr. Balfour during his term of office as foreign secretary. He accompanied Balfour on his special mission to the United States in 1917 and remained with him during the first months of the Peace Conference in Paris, until, on the proposal of President Wilson, he was appointed secretary-general of the League.

The appointment lasted from the acceptance of the text of the Covenant, April 29, 1919, until 1933, when Drummond became British ambassador in Rome.

Although the treaty was not signed and did not in fact come into force until Jan. 1920, the new secretary-general began immediately to organize the Secretariat of the League. Several different systems had been suggested; but Drummond decided from the first that it must be a basic principle of the new organization that none of its members should be there as representatives of the interests of their own countries, but should form an international civil service, each member of which should consider himself as the servant of the League as a whole, and as bound to do his best to carry out its decisions with regard to national interests or desires.

Sir Eric Drummond made it his chief aim to establish the organization on a basis of unimpeachable solidarity. Following the traditions of the British Civil Service he adopted the principle that the duty of the Secretariat was to act strictly in accordance with the decisions taken by the responsible authorities, *i.e.*, by the members of the League acting through their constitutional organs, and to avoid all action which was not clearly based on authority constitutionally given. Drummond was ambassador to Rome from 1933 to 1939, and was created G.C.M.G. in 1934. He served as chief adviser on foreign publicity of the Ministry of Information in 1939–40.

He succeeded as 16th earl of Perth in 1937, and became a representative peer of Scotland in 1941.

DRUMMOND, THOMAS (1797–1840), British inventor and administrator, was born at Edinburgh, on Oct. 10, 1797, and was educated at the high school there. He was appointed to a cadetship at the Royal Military Academy, Woolwich, in 1813; and in 1815 he entered the Royal Engineers. In 1820 he received an appointment on the trigonometrical survey of Great Britain. In 1825, when he was assisting T. F. Colby in the Irish survey, his lime-light apparatus ("Drummond light") enabled observations to be completed between Divis mountain, near Belfast, and Slieve Snaght, a distance of 67 miles. About the same time he also devised an improved heliostat, and in 1829 he was employed in adapting his light for lighthouse purposes. In 1835 he was made under-secretary of State for Ireland, where he proved himself a most successful administrator. It was he who in 1838 told the Irish landlords that "property has its duties as well as its rights." In 1836 he proposed the appointment of a commission on railways in Ireland, and took a large share in its work. Drummond died at Dublin on April 15, 1840.

See J. F. M'Lennan, *Life of Thomas Drummond* (1867); *R.* Barry O'Brien, *Life and Letters of Thomas Drummond* (1889).

DRUMMOND, WILLIAM (1585–1649), called "of Hawthornden," Scottish poet, was born at Hawthornden, near Edinburgh, the son of John Drummond, first laird of Hawthornden. Drummond received his early education at the high school of Edinburgh, and graduated in July 1605 as M.A. of the recently founded university of Edinburgh. He spent two years at Bourges and Paris in the study of law; but in 1609, he was again in Scotland, where, by the death of his father in 1610, he became laird of Hawthornden. In 1612 began his correspondence with Sir William Alexander of Menstrie, afterwards earl of Stirling (*q.v.*), which ripened into a life-long friendship.

Drummond's first poem appeared in 1613, an elegy on the death of Henry, prince of Wales, called *Teares on the Death of Meliades (Moeliades*, 3rd. ed. 1616). In 1616, the year of Shakespeare's death, appeared *Poems; Amorous, Funerall, Divine, Pastorall: in Sonnets, Songs, Sextains, Madrigals*, being substantially the story of his love for Mary Cunningham of Barns, who was about to become his wife when she died in 1615. The poems bear marks of a close study of Sidney, and of the Italian poets. He sometimes translates direct from the Italian, especially from Marini. *Forth Feasting: A Panegyricke to the King's Most Excellent Majestie* (1617), a poem written in heroic couplets, celebrates James's visit to Scotland in that year. In 1618 Drummond began a correspondence with Michael Drayton. The two poets continued to write at intervals for 13 years, the last letter being dated in the year of Drayton's death. In the winter of 1618–19, Drummond had included Ben Jonson in his circle of literary friends, and at Christmas 1618 was honoured with a visit of a fortnight or more from the dramatist. The account of their conversations, long supposed to be lost, was discovered in the Advocates' Library, Edinburgh, by David Laing, and was edited for the Shakespeare Society in 1842. The publication of what was obviously intended merely for a private journal has given Jonson an undeserved reputation for harsh judgments, and has cast blame on Drummond for blackening his guest's memory.

In 1623 appeared *Flowers of Sion: By William Drummond of Hawthornedenne; to which is adjoyned his Cypresse Grove.* From 1625 till 1630 Drummond spent much of his time travelling on the Continent, but in 1627 he presented about 500 volumes to the library of the university of Edinburgh. In 1630 he again began to reside permanently at Hawthornden, and in 1632 married Elizabeth Logan, by whom he had five sons and four daughters. About 1635 he began his *History of Scotland during the Reigns of the Five Jameses*, a work which did not appear till 1655. His next work, entitled *Irene: or a Remonstrance for Concord, Amity, and Love amongst His Majesty's Subjects* (1638), embodies his political creed of submission to authority as the only logical refuge from democracy, which he hated. In 1639 he had to sign the Covenant in self-protection, but was uneasy under the burden, as several political squibs by him testify. In 1643 he published *Σκιαμαχία: or a Defence of a Petition tendered to the Lords of the Council of Scotland by certain Noblemen and Gentlemen*, a political pamphlet in support of those royalists in Scotland who wished to espouse the king's cause against the English parliament. Its burden is an invective on the intolerance of the then dominant Presbyterian clergy. His later works may be described briefly as royalist pamphlets, written with more or less caution, as the times required. Drummond took the part of Montrose; and a letter from the Royalist leader in 1646 acknowledged his services. He died on Dec. 4, 1649, and was buried in his parish church of Lasswade.

Drummond's most important works are the *Cypresse Grove* and the poems. *The Cypresse Grove* exhibits great wealth of illustra-

tion, and an extraordinary command of musical English. It is an essay on the folly of the fear of death. "This globe of the earth," says he, "which seemeth huge to us, in respect of the universe, and compared with that wide pavilion of heaven, is less than little, of no sensible quantity, and but as a point." This is one of Drummond's favourite moods; and he uses constantly in his poems such phrases as "the All," "this great All." Even in such of his poems as may be called more distinctively Christian, this philosophic conception is at work. Drummond was called "the Scottish Petrarch;" and his sonnets, which are the expression of a genuine passion, stand far above most of the contemporary Petrarcan imitations.

BIBLIOGRAPHY.—Drummond's *Poems*, with *Cypresse Grove*, the *History*, and a few of the minor tracts, were collected in 1656 and edited by Edward Phillips, Milton's nephew. *The Works of William Drummond, of Hawthornden* (1711), edited by Bishop Sage and Thomas Ruddiman, contains a life by the former, and some of the poet's letters. A handsome edition of the *Poems* was printed by the Maitland Club in 1832. Later editions are by Peter Cunningham (1833), by William R. Turnbull in "The Library of Old Authors" (1856), by W. C. Ward (1894) for "The Muses' Library," and by Prof. Kastner (Scot. Text Soc. 1913). The standard biography of Drummond is by David Masson (1873). Extracts from the Hawthornden mss. preserved in the Library of the Society of Antiquaries of Scotland were printed by David Laing in *Archaeologia Scotica*, vol. iv.

DRUMMOND, WILLIAM HENRY (1854–1907), Canadian poet, was born at Mohill in Co. Leitrim, Ireland, the son of an officer in the Royal Irish Constabulary, who emigrated with his family to Canada in about 1864. In 1869 Drummond obtained work as a telegraph operator at Bord-à-Plouffe on the Rivière des Prairies; but he afterwards studied medicine at Bishop's college, Lennoxville, where he took his degree in 1884. From 1888 he practised medicine in Montreal, where he wrote verse in his leisure time. In 1905 he left his Montreal practice to look after the Drummond mines which he owned in conjunction with his brothers. His poems, some of the best known of which are *The Habitant* (1897), Phil-0-Rum's *Canoe* (1898) and *Johnnie Courtneau* (1901) have been collected, with an introduction by Louis Fréchelte and an appreciation by Neil Munro (1912).

See J. F. Macdonald, *William Henry Drummond* (1925).

DRUMRIGHT, a city in one of the oil and gas fields of Creek county, Oklahoma, U.S.A., 60 mi. N.E. of Oklahoma City, near the Cimarron river, and served by the Santa Fe railway. The city was founded in 1912 and incorporated in 1914. By 1920 the population was 6,460 (94% native white), in 1930 it was 4,972 and in 1940, 4,303 by the federal census. The principal manufacturing industry is the refining of petroleum.

DRUNKENNESS, a state resulting from excessive drinking, usually of alcohol (see ALCOHOL, PATHOLOGICAL EFFECTS OF). It may represent either an act or a habit, the latter consisting in frequent repetitions of the former.

What appears to be "intoxication" may arise from many different causes, *e.g.*, epilepsy, fractured skull, intracranial haemorrhage, the toxaemic coma of diabetes and uraemia and intense cold. The police records supply many instances of this statement. But, as a rule, the phenomena of drunkenness are actually due to excessive consumption of intoxicants. Some individuals have a special susceptibility to alcohol, due to heredity or to one of the sequelae of sunstroke or cranial injury.

The immediate effect of all intoxicants is a cumulative production of paralysis of various parts of the nervous system, but this effect varies with the amount of the dose and also with the agent, the race and the individual. In short, from tea to haschisch we have, through hops, alcohol, ether, tobacco and opium, a graduated scale of intoxicants, which stimulate in small doses, and narcotize in larger—the narcotic dose having no stimulating properties whatever, and only appearing to possess them because the agent is gradually absorbed from the stomach, and the system comes primarily under the influence of a stimulant dose. In chloroform narcosis the stage of stimulation may be shortened or eliminated; while with tea, the narcotic stage is not readily produced.

In the case of alcoholic intoxication the senses gradually become hazy, articulation difficult, a filmy haze obscures the vision, the head seems lighter than usual, the equilibrium unstable. Soon ocular co-ordination fails, objects appear double or unstable, judgment ceases, the victim babbles with unrestrained communicativeness; becomes quarrelsome or boisterous, till at last he falls on the ground insensible—dead drunk (alcoholic coma)—a state from which, after profound slumber, he at last awakes feverish, exhausted, sick and giddy, with ringing ears, a throbbing heart and a violent headache.

The poison primarily affects the cerebral lobes, and the other parts of the cerebro-spinal system are consecutively involved, till in dead-drunkenness the only parts at work are those automatic centres in the medulla oblongata which regulate and maintain the circulation and respiration. But even these are not unaffected, the coma of drunkenness sometimes terminating in death.

The discomforts following an act of drunkenness are readily removed for the time by a repetition of the cause. Thus what has been an act may become a habit, all the more readily as the will and the judgment are progressively impaired. From this condition there is no hope of relief but in enforced abstinence; the drunkard must be regarded as temporarily insane (see INSANITY and NEUROPATHOLOGY), and ought to be placed in a home for inebriates till he regains his self-control.

For the law concerning drunkenness the reader is referred to INEBRIETY, LAW OF. Its prevalence as a vice has varied considerably according to the state of education or comfort in different classes of society and according to the mere facilities for obtaining drink. Speaking generally, it may be said that in Great Britain drunkenness appears chiefly prevalent in the seaport and mining districts.

Analysis of the prosecutions for drunkenness shows that about a quarter of the total number of offences are committed by women. But there are important local differences. Whether intemperance is increasing among women is uncertain. There is no satisfactory way of determining the point, but the opinion is widely held in the United Kingdom that drunkenness in women, as in men, is less common, but spirit drinking is commoner than formerly. There is no doubt that during the World War for a variety of reasons, including compulsory closing of taverns and restricted sale of alcohol during certain hours, prosecutions for drunkenness diminished considerably and that they have increased during the years since.

See also LIQUOR LAWS and TEMPERANCE.

DRURY, SIR WILLIAM (1527–1579), English statesman and soldier, was a son of Sir Robert Drury of Hedgerley, Bucks., and grandson of another Sir Robert Drury (d. 1536), who was speaker of the House of Commons in 1495. He was born at Hawstead, Suffolk, on Oct. 2, 1527, and was educated at Gonville hall, Cambridge. In 1559 he was sent to Edinburgh to report on the condition of Scottish politics, and five years later he became marshal and deputy-governor of Berwick. He was frequently sent on errands to Scotland, and conducted raids over the border; and he commanded the force which compelled Edinburgh castle to surrender in May 1573. In 1576 he was sent to Ireland as president of Munster, and in 1578 he became lord justice to the Irish council, taking the chief control of affairs after the departure of Sir Henry Sidney. Drury's letters to Lord Burghley and others are invaluable for the story of the relations between England and Scotland at this time.

DRUSES, the adherents of an esoteric religion founded in the 11th century after Christ by the Fatimid Caliph of Egypt, Al-hakim bi'amrillahi, the son of a Russian mother, who proclaimed himself an incarnation of God, established a reign of terror at Cairo and finally disappeared mysteriously (A.D. 1021). They take their name from his missionary, Ismail Ad-darazi, who preached the cult of Al-hakim among the Syrians. Their origin is probably mixed; their traditions derive them from Arab colonists, but some of their chief families claim Turkoman or Kurdish descent and there is an obvious North Syrian (Armenoid) infusion among some of the Druses in the Lebanon. They have always been confined to Syria, and like other small and often persecuted Near Eastern sects, such as the Yazidis and the Assyrian Christians, have preferred the relative security of the mountains to the insecure advantages of the plains. They have

three strongholds—the districts of Shuf and Metn in the Lebanon, the western slopes of Mt. Hermon, and the mountains which separate the cornlands of the Hauran from the Syrian desert. There are Druse villages on Mt. Carmel, and small outliers of no political importance in Northern Syria and in the Anti-Lebanon. French statistics estimate their numbers at 48,000 in the Hauran mountains, which are generally known as the Jabalu'd-Duruz (*i.e.*, mountain of the Druses), 7,000 in the Hermon area, and 43,000 in the Lebanon. There are about 7,000 Druses in the British mandated territory of Palestine, and an unknown number in the United States of America, where the Druse immigrant usually passes as a Syrian Christian. The permission given to a Druse to conform outwardly to the faith of the unbelievers among whom he dwells, which is an interesting feature of their religion, makes it difficult to attempt an estimate of the number of Druses living outside the Syrian strongholds of the sect.

The name Druse is first mentioned by Benjamin of Tudela (*c.* A.D. 1170) and little is known of the beginnings of the political power of the great families whose history is that of the Druse community. The Druses first appear in Arab records as mountain villagers of Lebanon, Hauran and West Hermon, yielding feudal service in return for military and political protection to various families of seigneurs (Al-umara) who quarrelled incessantly for the headship of the community. Their chief political centre lay in the southern Lebanon. Khalwatu'l-Bayadh in the Hermon was their religious centre at a very early date; the Hauran community was unimportant. Religious proselytism has been discouraged or forbidden by their spiritual chiefs in recent centuries; but the fact that Maliku 'l-Ashraf, the Mameluke sultan of Egypt compelled the Lebanese Druses to conform outwardly to Sunni Islam about A.D. 1300 suggests that their leaders, the Tnuh House, had sought more than political domination over the mixed population of "the mountain." After their defeat by the Mamelukes the power of the Tnuh waned, to the advantage of the Maan family, recent immigrants from northern Arabia who may have been proselytes.

The Maan amirs were shrewd and politic; the family threw its influence and retainers into the scale against the Mamelukes when Selim the Grim invaded Syria in 1516. The victor recognized their supremacy over the Druse, Muslim and Maronite chiefs of the Lebanon, and for three generations they throve mightily under Turkish protection. The reign of Fakru'd-din Maan II. marked the zenith of their power. By treaties, by the protection of small chiefs against great, and by successes in various baronial wars, he extended the feudal sway of his house nearly as far as Antioch in the north, built a castle at Palmyra in the eastern desert and drew a large revenue from the ports of Beirut, Saida (Sidon), Latakia and Tripoli in Syria. Success, however, turned his head; he intrigued against the Turk, and in 1614 was defeated by the pasha of Damascus and fled to Italy, where he intrigued with the rulers of Tuscany and Naples and apparently invented the propagandist myth that the Druses were descendants of a crusading count of Dreux. In 1619 he returned, recovered his power and ruled as an independent prince until 1633, when a Turkish army defeated and captured him with his sons. The bow-string terminated their lives at Constantinople.

After a welter of civil war, in which the combatants were divided into the ancient Arab factions of Yemenis and Qaisis—the Shanavests and Caravats of the Arab world—a new family, the Shehab of Mt. Hermon, became master of the mountain. They were descendants of early Arab governors of Hauran, had intermarried with the Maan family, and deserted them when they fell. But they never adopted the Druse creed and several of them appear to have become Maronite Christians in the 18th century, thus causing the dangerous suspicion of apostasy to fall on the house. From Haidar, third of the line, who defeated the Turks and Druse rivals at Ain Dara in 1711, to Beshir the last great Shehab amir, they played the old game, now rebelling against the weak sultans of the decadence, now bribing their governors, and constantly at war with the rival house of Jumblat. Beshir became amir of the mountain in 1786 and for 54 years, with two brief intervals of exile, held his own by the time-honoured expedient of aiding and betraying one rebel satrap after another. He successively supported and betrayed Ahmad Jezzar and Abdullah of Acre, and cultivated the friendship of infidel admirals; threw in his lot with Mohammed Ali of Egypt and his son Ibrahim, but deserted them in 1839 when the Powers, save France, were turning against them. But Ibrahim held Druse hostages, and so Beshir, though he promised much, gave little help to Powers or Porte. After Ibrahim's expulsion from Syria the Turks called him to account. He fled to Malta on a British ship but was induced to go to Constantinople, where he died in 1851.

Beshir may have been a crypto-Christian; his successor Beshiru'l-Qassim openly joined the Maronites, hoping to defeat Druse rivals with their aid. It was a suicidal policy; even the Druses of the Shehab faction distrusted and disliked their Christian allies; the rest became perforce pro-Muslim, and the Turkish Government, which was carrying out the centralizing policy initiated by Mahmud the Reformer, saw danger in the alliance. For the next 20 years the history of the Lebanon is a monotonous record of murder, intrigue and civil war. The Maronites rebelled once, the Druses twice, against the Turks, who half-heartedly attempted or pretended to impose reforms desired by the European Powers upon the turbulent mountain chiefs. Three constitutions were successively bestowed upon the Lebanon, which was twice "disarmed"; European interference increased the exasperation of Druses and Muslims against the Maronites, and the scandal culminated in massacres of Christians which extended to the coast and to Damascus, where some 2,500 Christians were slaughtered and foreign consulates sacked (July 9, 1860). The Powers intervened. A French army occupied the Lebanon for nearly a year, and the Porte, after appointing a Christian governor-general of the Lebanon, conferred a large measure of autonomy on the province by the Organic Statute of Sept. 6, 1864. The change made an end of the political importance of the Lebanese Druses. Beshiru'l-Qassim had been murdered; his family had lost wealth and prestige, and henceforth Druse political interests in Lebanon were mainly confined to such harmless subjects as the rivalry between a Jumblat or an Arslan for the governorship of a county. Those who found the change too distasteful migrated to the Hauran. The rest made the best of it, and till 1918 remained a conservative, rather aloof community, influential in the parish politics of the southern Lebanon.

The Hauran **Druses.**—By 1840 the influx of malcontents from the Lebanon had increased the small Druse community in the Hauran to 7,000 souls. For some time they remained independent and held out successfully in their stronghold, the lava field of the Leja, against Ibrahim Pasha's Egyptians in 1839, and Kibrisli Pasha's Turks in 1852. Their government was then theocratic under the ***Rais*** (chief) of the *'Uqqala* (initiated) in Suwayda. In 1879 Midhat, the reforming governor-general of the Damascus province, found them troublesome and formidable neighbours. Their numbers had increased to over 20,000 and their repression required an army corps. He imposed a qaimaqam (lieutenant-governor) upon them and the office after a while became vested in the house of Atrash (pl. Turshun), but the majority of the clans refused taxes and military service. In 1896 the contumacious clans were defeated and their country ravaged by a Turkish army; but the campaign was costly and the Turks agreed to a compromise whereby the Druses were to pay taxes and serve as frontier guards on the desert edge in their own territory. A governor with a small Turkish force was stationed at Sheikh Saad, outside Druse territory proper, and the clans were left to fight as they pleased with the Beduin whom they usually defeated. After the Turkish revolution of 1908 the Government decided to garrison points in Druse territory. Some of the Turshun revolted in 1910 but the rebels were defeated and their chief, Yahya, executed. (D. G. H.; G. BE.)

The French Mandate.—The Druse polity in the Hauran at the end of the World War remained feudal. The cultivated land attached to each village was communally owned and re-allotted at varying periods among the cultivators. The lords had prescriptive rights to the produce of certain demesne lands which

their peasants cultivated for them, but a peasant revolt late in the 19th century had restricted these demesnes. The ten noble families kept open house and maintained armed retainers. Clan solidarity and the sense of obligation between nobles and peasants were strong, but family jealousies usually prevented the chiefs from acting in unison.

During the World War the Druses, who had gained economic advantages by the opening of the Hejaz railway on the western edge of their territory, sat prudently on the fence and made money out of their crops until Sept. 1, 1918, when a section led by Sultan Pasha Al-Atrash assisted Feisul and Col. Lawrence during their advance on Damascus. There Sultan Pasha gave the Sherifians trouble, and Lawrence has recorded that he was well-nigh strangled during a conference by the redoubtable Auda abu-Tayyi. The Druses maintained an attitude of reserve towards the Sherifian Government and after its overthrow by the French under Gen Gouraud in July 1920, refused to join the Hauran Muslims in resisting the French mandate. Late in the year they entered into negotiations with the French, and on March 4, 1921, an agreement was signed by the acting high commissioner, M. de Caix, and sealed by a number of Druse spiritual and temporal chiefs, whereby the Druse mountain (Jabalu'd-Duruz) was granted an independent national government headed by an elected native governor under the French mandate. On May 1 an informal assembly of notables elected Salim Pasha Al-Atrash governor at Suwayda, the capital of the new state. His relatives gave trouble, and in the same year his kinsman, Sultan Pasha, exasperated by the arrest in his house of a suppliant who had attempted to murder Gen, Gouraud and was seeking asylum, revolted with his retainers. Next year he was amnestied after some skirmishing. In Sept. 1923 Salim died, and the Druse council, which had not been constitutionally elected but appointed by private understanding among the lords, could not agree concerning the election of a governor, and unconstitutionally elected Capt. Carbillet the French adviser to the Druse state as their provisional governor.

War with France.—In Prof. Toynbee's words (Toynbee, *Survey* of *International* ***Affairs,*** vol. i., pp. 412–413, 1925), the new governor, while sincere, disinterested and energetic, was "tyrannical in his methods and psychologically blind . . . to a degree which made it inevitable that his well-meant efforts should end in disaster. . . ." He filled the treasury, supplied the country with roads, schools, irrigation channels, reservoirs, and justices of the peace, founded a museum, and in the autumn of 1924 gave effect to Article 4 of the de Caix Agreement by conducting elections for a new council, which promptly violated Article 3 of the agreement by electing him as the regular governor. Capt. Carbillet's policy was directed against the chiefs, notably the Turshun, but his strict imposition of forced labour and of a rigid system of passes, and his imprisonment of recalcitrants, who were occasionally incarcerated in his coal-cellar, exasperated the peasantry.

In April 1925 Druse delegates waited on Gen. Sarrail, the new French high commissioner in Syria, to complain of their governor, and to point out that his election was a violation of the de Caix Agreement. The general brusquely dismissed them, and subsequently stated in writing that he repudiated the agreement. Meanwhile the governor went on leave. His French *locum tenens* warned Sarrail of the growing excitement among the Druses and was dismissed. Druse petitions remained unheard, and another delegation was rebuffed. On July 11 Gen. Sarrail ordered his delegate at Damascus to summon the Druse "conspirators . . . on the pretext of receiving their demands" and then hold them as hostages. Three confiding notables appeared, and were exiled to Palmyra. On July 20 Sultan Pasha rebelled, and having surprised and defeated a small French force next day, invested Suwayda on July 22. Gen. Sarrail made light of the revolt, and on Aug. 2–3 a column 3.000 strong, comprising some unreliable colonial troops, was attacked near Azra' while marching to relieve Suwayda, and lost its transport, most of its guns, and more than a quarter of its men. A general Druse rising followed.

The rebels promptly established contact with the pro-Sherifian elements in Damascus and with the nationalist and anti-French "People's Party." Its leader, Dr. A. Shahbandar, and other chiefs fled to the Druses to avoid arrest, and early in September proclaimed a "National Syrian Government." The French repulsed a Druse raid on Damascus on Aug. 24 and relieved Suwayda a month later, but were unable, owing to transport difficulties, to force the Sultan to a general action. The retreats that followed their advances encouraged the hostile Muslim elements in their rear, and the revolt in Damascus and the bombardment of the city (Oct. 18–20) marked the beginning of the Syrian Nationalist revolt, the history of which is narrated elsewhere. *(See* SYRIA: History.) In the course of this unequal struggle the Druses proved themselves far better fighters than the Muslim insurgents, and they were the last to submit. At one moment they seemed likely to inflict a grave disaster upon the French. The Hermon Druses joined the revolt late in Sept. 1925; Zaydu'l Atrash son of the Sultan came to their aid, surprised Hasbayya on the night of Nov. 9–10, and prepared to invade the Lebanon, where he expected to be joined by the local Druses and the Shiah Muslims (Matawilah) of the Sidon hinterland. The heroic defence of Rashayya by a handful of troops saved the situation, and French reinforcements cleared the Hermon region in December. Thenceforward the Hauran Druses fought a losing battle. Abdu'l-Ghaffar Al-Atrash and other chiefs opened negotiations with Gen. Andrea in Oct. 1926, which ended after some months in their surrender on honourable terms. The Leja was conquered in the spring of 1927, and Sultan, who had established a camp at Qasru'l Azraq, in the British mandatory territory of Transjordan, was compelled by British armoured cars and Transjordanian police to withdraw into Ibn Sa'ud's desert dominions with the remnant of his followers, and their families. He settled at Qurayyatu'l-Milh in the Wadi Sirhan with, perhaps, 500 families, who were well received by the Wahabi king, though a lasting friendship between the "Puritans of Islam" and the non-Muslim Druses seems improbable. Col. Clément Grandcourt was appointed governor of the Hauran in 1927 and the French military chiefs, who respected Druse valour, did their best to restore good relations.

Customs.—The Hauran Druses have some of the vices and all the virtues of oriental mountaineers. They are intelligent, self-respecting, and hospitable, but cruel and, by Western standards, treacherous. The women enjoy much consideration; polygamy is forbidden, and they join the men in religious functions. Divorce may be initiated by the wife. The veil is obligatory; some Druse women, indeed, will not unveil in the presence of a foreign woman. Feminine dress is black, with red slippers. The men usually wear a black under-robe with white girdle, and a white roll round the red fez, which is now almost the sole distinguishing mark of the Lebanon Druses. (For religious observances *see* above.)

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RELIGION

Druses, a term for the Muwahhidin (Unitarians), as the Druses call themselves, who believe that there is one and only one God, indefinable, incomprehensible, ineffable, passionless. He has made himself known to men by successive incarnations, of which the last was Ḥākim, the sixth Fatimite caliph. How many these incarnations have been is stated variously; but 70, one for each period of the world, seems the best-attested number. Jesus appears to be accepted as one such incarnation, but not Muḥammad. No further incarnation can now take place: in Ḥākim a final appeal was made to mankind, and after the door of mercy had stood open to all for 26 years, it was finally and for ever closed. When the tribulation of the faithful has reached its height, Ḥākim will reappear to conquer the world and render his religion supreme. Druses, believed to be dispersed in China, will return to Syria. The combined body of the Faithful will take Mecca, and finally Jerusalem, and all the world will accept the Faith. The first of the creatures of God is the Universal Intelligence or Spirit, impersonated in Ḥamza, Ḥākim's vizier. This Spirit was

the creator of all subordinate beings, and alone has immediate communion with the Deity. Next in rank, and equally supporting the throne of the Almighty, are four Ministering Spirits, the Soul, the Word, the Right Wing and the Left Wing; and beneath these again are spiritual agents of various ranks. The material world is an emanation from, and a "mirror" of, the Divine Intelligence. The number of human beings admits neither of increase nor of decrease, and a regular process of metempsychosis goes on continually. The souls of the virtuous pass after death into ever new incarnations of greater perfection, till at last they reach a point at which they can be re-absorbed into the Deity itself; those of the wicked may be degraded to the level of camels or dogs. All previous religions are mere types of the true, and their sacred books and observances are to be interpreted allegorically. The Gospel and the Qur'ān are both regarded as inspired books, but not as religious guides. The latter function is performed solely by the Druse Scriptures. As the admission of converts is no longer permitted, the faithful are enjoined to keep their doctrine secret from the profane; and in order that their allegiance may not bring them into danger, they are allowed to make outward profession of whatever religion is dominant around them. To this latter indulgence is to be attributed the apparent indifferentism which leads to their joining Muslims in prayers and ablutions, or sprinkling themselves with holy water in Msronite churches. Obedience is required to the seven commandments of Ḥamza, the first and greatest of which enjoins truth in words (but only those of Druse speaking with Druse); the second, watchfulness over the safety of the brethren; the third, absolute renunciation of every other religion; the fourth, complete separation from all who are in error; the fifth, recognition of the unity of "Our Lord" in all ages; the sixth, complete resignation to his will; and the seventh, complete obedience to his orders. Prayer, however, is regarded as an impertinent interference with the Creator; while, at the same time, instead of the fatalistic predestination of Islam the freedom of the human will is distinctly maintained Not only is the charge of secrecy rigidly obeyed in regard to the alien world, but full initiation into the deeper mysteries of the creed is permitted only to a special class designated 'Āqils (Arabic *'Aql,* intelligence), in contradistinction from whom all other members of the Druse community, whatever may be their position or attainments, are called *Jāhil,* the Ignorant. About 15% of the adult population belong to the order of 'Aqils. Admission is granted to any Druse of either sex who expresses willingness to conform to the laws of the society, and during a year of probation gives sufficient proof of sincerity and stability of purpose. There appears to be no formal distinction of rank among the various members. Exceptional influence depends upon exceptional sanctity or ability. All are required to abstain from tobacco and wine; the women used not to be allowed to wear gold or silver, or silk or brocade, but this rule is commonly broken now; and although neither celibacy nor retirement from the affairs of the world is either imperative or customary, unusual respect is shown to those who voluntarily submit themselves to ascetic discipline. The 'Āqils are distinguished by the wearing of a white turban, emblematic of the purity of their life. Their food must be purchased with money lawfully acquired; and lest they should unwittingly partake of any that is ceremonially unclean. they require those Jāhils, whose hospitality they share, to supply their wants from a store set apart for their exclusive use. The idea1 'Āqil is grave, calm and dignified, with an infinite capacity of keeping a secret, and a devotion that knows no limits to the interests of his creed. On Thursday evening, the commencement of the weekly day of rest, the members of the order meet together in the various districts, probably for the reading of their sacred books and consultation on matters of ecclesiastical or political importance. Their meeting-houses, *khalwas,* are plain, unornamented edifices, in which the women assemble at the same time as the men, a part of the space being fenced off for them by a semi-transparent black veil. It has been frequently asserted that the image of a calf is kept in a niche, and traces of phallic and gynaecocratic worship have been vaguely suspected; but there is no authentic information in support of either statement; and it is certain that the sacred books of the religion contain moral teaching of a high order on the whole.

As a formulated creed, the Druse system is not a thousand years old. In the year A.D. 996 (386 A.H.) Ḥākim Biamrillāhi (*i.e.* he who judges by the command of God), sixth of the Fatimite caliphs (third in Egypt), began to reign; he believed that he held direct intercourse with the deity, or even that he was an incarnation of the divine intelligence; and in A.D. 1016 (407 A.H.) his claims were made known in the mosque at Cairo; in 1017 (408 A.H.) the new religion found a successful apostle in the person of Hamza ibn 'Alī ibn Ahmad, a Persian mystic, who became Ḥākim's vizier, gave form and substance to his creed, and by an ingenious adaptation of its various dogmas to the prejudices of existing sects, finally enlisted an extensive body of adherents. In 1020 (411 A.H.) the caliph was assassinated; but it was given out by Hamza that he had only withdrawn for a season, and his followers were encouraged to look forward with confidence to his triumphant return.

It is possible, even probable, that the segregation of the Druses as a people dates only from the adoption of Hamza's creed. But when it is recalled that other inhabitants of the same mountain system *e.g.,* the Maronites, the Ansarieh, the Metawāli and the Isma'ilites, also profess creeds which, like the Druse system, differ from Sunni Islam in the important feature of admitting incarnations of the Deity, it is impossible not to suspect that Hamza's emissaries only gave definition and form to beliefs long established in this part of the world. Many of the fundamental ideas of Druse theology belong to a common West Asiatic stock; but the peculiar history of the Mountain is no doubt responsible for beliefs, held elsewhere by different peoples, being combined there in a single creed. Some allowance, too, must be made for the probability that Hamza's system owed something to doctrines, Christian and other, ,with which the metropolitan position of Cairo brought Fatimite society into contact.

(See *Encyclopaedia* of *Islam,* ii., 255.)

DRUSUS, MARCUS LIVIUS, Roman statesman, was colleague of Gaius Gracchus in the tribuneship, 122 B.C. The proposal of Gracchus (*q.v.*) to confer the full franchise on the Latins had been opposed not only by the senate but also by the mob, whose privileges would thereby be diminished. Drusus threatened to veto the proposal. Encouraged by this, the senatorial party put up Drusus to outbid Gracchus. Gracchus had proposed to found colonies abroad; Drusus provided twelve in Italy, to each of which 3,000 citizens were to be sent. Gracchus had proposed to distribute allotments to the poorer citizens subject to a state rent-charge'; Drusus promised that they should be free, and inalienable. In addition to the franchise, immunity from corporal punishment (even in the field) was promised the Latins. The absence of Gracchus, and the inefficiency of his representative at Rome, led to the acceptance of these proposals, which were never intended to be carried. Drusus himself declined all responsibility in connection with carrying them out. He was rewarded for his services by the consulship (112), and the title of *patronus senatus.* He received Macedonia for his province, and he was the first Roman general to reach the Danube. He is possibly the Drusus mentioned by Plutarch as having died in 109, the year of his censorship.

See Appian, *Bell. Civ.* i. 23; Plutarch, *Gaius Gracchus,* 8–11; Florus iii. 4; **A. H. J.** Greenidge, *Hist. of Rome,* vol. i. (1904).

MARCUS LIVIUS DRUSUS, son of the former, tribune of the people in 91 B.C. was a man of high integrity and recognized the need of reform. At that time an agitation was going on for the restoration of the judicial functions from the *equites* to the senate; Drusus proposed as a compromise a measure which restored to the senate the office of *iudices,* while its numbers were doubled by the admission of 300 equites. Further, a special commission was to be appointed to try all *iudices* guilty of taking bribes. But the senate was lukewarm, and the equites offered violent opposition. In order, therefore, to catch the popular votes, Drusus proposed the establishment of colonies in Italy and Sicily and an increased distribution of corn at a reduced rate. By help of these riders the bill was carried. Drusus then sought a closer alliance with the Italians, promising them the long-coveted boon of the Roman franchise.

The senate broke out into open opposition. His laws were abrogated as informal, and each party armed its adherents for the civil struggle which was inevitable. Drusus was murdered, and his assassin was never discovered.

See ROME: History; also Appian, Bell. *Civ.* i. 35; Florus iii. 17; Diod. Sic. xxxvii. 10; Livy, Epit. 70; Vell. Pat. ii. 13.

DRUSUS, NERO CLAUDIUS (38–9 B.C.), Roman general, son of Tiberius Claudius Nero and Livia Drusilla, stepson of Augustus and younger brother of the emperor Tiberius. In 13 B.C. in conjunction with Tiberius, he subdued the Raeti and Vindelici. The credit of the decisive victory, however, must be assigned to Tiberius. (See Horace, Odes IV. 4 and 14.) In 13 B.C. Drusus was sent as governor to the three Gauls, where discontent had been aroused by the exactions of the Roman governor Licinius. Drusus made a fresh assessment for taxation purposes, and summoned the Gallic representatives to a meeting at Lugdunum to discuss their grievances. It was important to pacify the Gauls, in order to have his hands free to deal with the German tribes, one of which, the Sugambri, on the right bank of the Rhine, had seized the opportunity, during the absence of Augustus, to cross the river (12). Drusus drove them back and pursued them to their own territory, which he devastated. Sailing down the Rhine, he subdued the Frisii and, in order to facilitate operations against the Chauci, dug a canal (Fossa Drusiana) leading from the Rhenus (Rhine) to the Isala (Yssel) into the lacus Flevus (Zuider Zee) and the German Ocean. Making his way along the Frisian coast, he conquered the island of Burchanis (Borkum), defeated the Bructeri in a naval engagement on the Amisia (Ems), and went on to the mouth of the Visurgis (*Weser*) to attack the Chauci. On the way back his vessels grounded on the shallows, and were only got off with the assistance of the Frisii.

In his second campaign (11), Drusus defeated the Usipetes, threw a bridge over the Luppia (*Lippe*), attacked the Sugambri and advanced to the Weser, where he defeated the Cherusci. While making his way back he fell into an ambush but managed to defeat his enemy. In view of future operations, he built two forts, one at the junction of the Luppia and Aliso (Alme), the other in the territory of the Chatti on the Taunus, near Moguntiacum (*Mainz*).

The third campaign (10) was of little importance; and, after some insignificant successes, Drusus returned to Rome, and was elected consul for the following year.

In 9 B.C. he defeated the Chatti, Suebi, Marcomanni and Cherusci, and penetrated as far as the Albis (*Elbe*). Here trophies were set up to mark the farthest point ever reached by a Roman army. To secure the conquered territory, fortresses were erected along the Elbe, Weser and Maas (*Meuse, Mosa*), a flotilla was placed upon the Rhine, and a dam built upon the right arm of its estuary to increase the flow of water into the canal mentioned above. On his return, his horse threw him, and he died thirty days after the accident (Sept. 14). The body was carried to the winter quarters of the army, whence it was escorted by Tiberius to Rome, the procession being joined by Augustus at Ticinum (Pavia). Tiberius delivered the funeral oration.

Drusus was one of the most distinguished men of his time. His agreeable manners, handsome person and brilliant military talents gained him the affection of the troops, while his liberal principles endeared him to the people. He married Antonia, the daughter of Marcus Antonius the triumvir, by whom he had three children: Germanicus, adopted by Tiberius; Claudius, afterwards emperor; and a daughter Livilla.

The chief ancient authorities for the life of Drusus are Dio Cassius, the epitomes of Livy, Suetonius (Claudius), Tacitus (Portions of the *Annals*), Florus (whose chief source is Livy), Velleius Paterculus and the *Consolatio* ad Liviam. The German campaigns were described in the last books of Livy and the lost *Bella Germaniae* of the elder Pliny. They have produced an extensive literature in Germany, J. Asbach's "Die Feldzüge des Nero Claudius Drusus" (Rhein. Jahrb. lxxxv. 14–30) being especially recommended; *see* also Mommsen's History of the Roman Provinces, i.; Merivale, History of the Romans *under the Empire*, ch. 36; A. Stein in Pauly-Wissowa's *Realencyclopädie* (1899), where other authorities are given; J. C. Tarver, Tiberius the Tyrant (1902).

DRUSUS CAESAR (c. 15 B.C.–A.D. 23), commonly called Drusus junior, to distinguish him from his uncle Nero Claudius Drusus, was the only son of the Emperor Tiberius. He was consul elect in A.D. 14, and on the accession of Tiberius was sent to put down a mutiny of the troops in Pannonia (Tacitus, Annals, i. 24–30). As governor of Illyricum (17 A.D.), he set the Germanic tribes against one another. On his return Drusus was consul a second time (21 A.D.) and in the following year received the tribunician power which indicated him as heir to the throne. Seianus, who also aspired to the supreme power, determined to remove Drusus. He seduced Drusus's wife and persuaded her to assist him in murdering her husband. A slow poison was administered, from the effects of which Drusus died after a lingering illness. Drusus was a man of violent passions, but not entirely devoid of better feelings, as is shown by his undoubtedly sincere grief at the death of Germanicus.

See Tacitus Annals, i. 76, iv. 8–11; Dio Cassius lvii. 13, 14; Suetonius *Tiberius*, 62; J. C. Tarver *Tiberius* the *Tyrant* (1902).

DRYADES (drī'ăd-ez), or HAMADRYADES, in Greek mythology, nymphs of trees and woods. It is sometimes said by late authors that a dryad is a nymph who lives among trees (Gr. δρῦς, tree, especially oak), a hamadryad the spirit of a tree, living and dying with it.

DRYANDER, JONAS (1748–1810), Swedish botanist, was educated at Gothenburg, Lund and at Uppsala under Linnaeus. He visited England in 1782 and became librarian to Sir Joseph Banks. He was librarian to the Royal Society and also to the Linnean Society, of which he was one of the founders in 1788. He was vice-president of the society till his death in London on Oct. 19, 1810. Besides various papers Dryander published Dissertatio gradualis fungos *regno* vegetabili vindicans (Lund, 1776) and Catalogus bibliothecae *historico-naturalis Josephi* Banks, Bart. (London, 1796–1800, 5 vols.), and edited Aiton's Hortus *Kewensis* and Roxburgh's Plants of the Coast of *Coromandel*.

DRY-CLEANING, sometimes termed French or chemical cleaning, is the process of removing dirt and stains from materials by organic solvents and special soaps and detergents. Greasy and resinous substances collected by wearing apparel, house furnishings and other articles are first dissolved, and then any insoluble soil is removed mechanically or by detergents. The process was first employed in France about the middle of the 19th century. The work was done by hand and the operations were simple. Elaborate machinery was gradually introduced, providing the basis for an industry which requires not only skill but much capital.

Liquids employed in dry-cleaning are inert toward textile fibres. Water, on the other hand, causes the fibres to become limp and in many cases to alter in shape and size. For this reason, carefully fitted and accurately draped upholstery and hangings can be successfully cleaned only by dry-cleaning methods. Various dry-cleaning solvents and dry-cleaning soap are supplemented by ethyl alcohol, acetone, carbon tetrachloride, acetic acid, etc., for removing spots that do not respond to the ordinary treatment. Most dry-cleaning fluids are inflammable and, unless proper precautions are observed, static electrical discharges will ignite the volatile fluid and cause serious injury to life and property. For this reason, dry-cleaning can be practised with safety only in plants designed for the purpose. The demand for a special naphtha for the industry has resulted in the adoption by the National Association of Dyers and Cleaners of the United States and Canada of specifications for a product known as Stoddard solvent, which has eliminated most of the fire hazard and simplified the process of cleaning. Non-inflammable chlorinated hydrocarbons, namely carbon tetrachloride, perchlorethylene, and trichlorethylene are also used as dry-cleaning solvents. In general the process of dry-cleaning is as follows: articles made of strong materials are placed in mechanically revolved washers with petroleum naphtha or chlorinated hydrocarbon solvent and dry-cleaning soap. This operation is followed by several rinsings in fresh diy-cleaning solvents. The articles are then freed from most of the solvent in centrifugal extractors and are dried in a current of warm air.

Delicate materials are cleaned by hand. After drying they are inspected, and any remaining spots are removed by special cleaning agents. The dry-cleaning solvent used is reclaimed and, after renovation, is used again.

The dry-cleaning industry in the United States and Canada has supported industrial fellowships in the Mellon Institute of Industrial Research and in the National Bureau of Standards. Specifications for a special dry-cleaner's naphtha have been developed, improved methods for naphtha recovery have been devised, more efficient detergents have been made available and many other advances have been made in the art. In 1927 the National Association Institute of Dyeing and Cleaning built a model plant, research laboratories and school at Silver Spring, Md., to advance the technical side of the industry. There were in 1938 approximately 9,500 power dry-cleaning plants in the United States and Canada, employing 150,000 people doing a total business for the year of about $560,000,000. European dry-cleaning practice is similar to that of the United States, except that there are fewer plants per unit of population. The plants are much larger, however, and some of them have several thousand employees.

(L. E. J.; X.)

DRYDEN, JOHN (1631–1700), English poet, born at Aldwinkle, in Northamptonshire, of a family with Puritan and antimonarchial leanings, was educated at Westminster school under Dr. Busby, and at Trinity college, Cambridge, where he took his degree in 1654. In that year his father died, leaving him a small estate worth about £60 a year, and he seems to have remained in Cambridge another three years before establishing himself in London, where he is said to have lived in the house of his publisher, Herringman, with whom he was connected until 1679, when Jacob Tonson became his publisher. He had written some elegiac and commendatory verses while he was at school, but the first work which showed the measure of his genius was the *Heroic Stanzas* (1659) to the memory of Oliver Cromwell. This is a fine tribute to the Protector, and shows Dryden as a disciple of John Donne indeed, but as a direct student of the Latin classics. With the coronation of Charles II. Dryden, the hereditary Puritan and the panegyrist of the Protector hailed the new order in his *Astraea Redux* (1660), followed by a *Panegyric on the Restoration* (1661).

For a livelihood Dryden turned to the stage. Having failed with a tragedy on the fate of Henry, duke of Guise, he turned to comedy, for which he admitted he had little taste. The age demanded comedies, and he endeavoured to supply the kind of comedy that the age demanded. His first attempt was unsuccessful. He then wrote *The Wild Gallant*, acted in Feb. 1663, by Thomas Killigrew's company in Vere street. Pepys showed good judgment in pronouncing the play "so poor a thing as ever I saw In my life." Dryden never learned moderation in his humour; but he took a lesson from the failure of *The Wild Gallant;* his next comedy *The Rival Ladies*, produced before the end of,1663, and printed in the next year, was correctly described by Pepys as "a very innocent and most pretty witty play." But he never quite conquered his tendency to extravagance. *The Assignation, or Love in a Nunnery*, produced in 1673, was another failure; and even in 1680, after 20 years' experience to guide him, *The Kind Keeper, or Mr. Limberham*, was prohibited after three representations as being too indecent for stage presentation. The undisciplined force of the man carried him to an excess from which more dexterous writers held back. After the production of *The Rival Ladies* in 1663, Dryden assisted Sir Robert Howard in the composition of a tragedy in heroic verse *The Indian Queen*, produced with great splendour in Jan. 1664. Its success, one of the greatest since the reopening of the theatres, was largely due to the magnificent scenic accessories—the battles and sacrifices on the stage, the spirits singing in the air, and the god of dreams ascending through a trap. Dryden followed it up with *The Indian Emperor, or the Conquest of Mexico by the Spaniards*, acted in 1665. Immediately after the success of *The Indian Queen*, in the preface to an edition (1664) of *The Rival Ladies*, Dryden took up the question of the propriety of rhyme in serious plays. Rhyme was not natural, some people had said; to which he answers that it is as natural as blank verse, and that much of its unnaturalness is not the fault of the rhyme but of the writer. Rhyme at once stimulates the imagination, and prevents it from being too discursive in its flights.

In 1668 he published his *Essay of Dramatick Poesie*. The essay takes the form of a dialogue between Neander (Dryden), Eugenius (Charles, Lord Buckhurst, afterwards earl of Dorset), Crites (Sir R. Howard), and Lisideius (Sir C. Sedley), who is made responsible for the definition of a play as a "just and lively image of human nature, representing its passions and humours, and the changes of fortune to which it is subject, for the delight and instruction of mankind." Dryden's form is of course borrowed from the ancients, and his main source is the critical work of Corneille in the prefaces and discourses contained in the edition of 1660, but he was well acquainted with the whole body of contemporary French and Spanish criticism. Crites maintains the superiority of the classical drama; Lisideius supports the exacting rules of French dramatic writing; Neander defends the English drama of the preceding generations, including, in a long speech, an examination of Ben Jonson's *Silent Woman*. Neander argues, however, that English drama has much to gain by the observance of exact methods of construction without abandoning entirely the liberty which English writers had always claimed. He then goes on to defend the use of rhyme in serious drama. Howard had argued against the use of rhyme in a "preface" to *Four New Plays* (1665), which had furnished the excuse for Dryden's essay. Howard replied to Dryden's essay in a preface to *The Duke of Lerma* (1668). Dryden at once replied in a masterpiece of sarcastic retort and vigorous reasoning, *A Defence of an Essay of Dramatique Poesie*, prefixed to the second edition (1668) of *The Indian Emperor*. It is the ablest and most complete statement of his views about the employment of rhymed couplets in tragedy.

Before his return to town at the end of 1666, when the theatres (which had been closed during the disasters of 1665 and 1666) were reopened, Dryden wrote a poem on the Dutch war and the Great Fire entitled *Annus Mirabilis* (ptd. 1667). The poem is in quatrains, the metre of his *Heroic Stanzas* in praise of Cromwell, which Dryden chose, he tells us, "because he had ever judged it more noble and of greater dignity both for the sound and number than any other verse in use amongst us." From the reopening of the theatres in 1666 till Nov. 1681, the date of his *Absalom and Achitophel*, Dryden produced nothing but plays. The stage was his chief source of income. *Secret Love, or the Maiden Queen*, a tragi-comedy, produced in March 1667, was based on an episode in the *Artambne, ou le Grand Cyrus* of Mlle. de Scudéry, the historical original of the "Maiden Queen" being Christina, queen of Sweden. His next play *Sir Martin Mar-all, or the Feigned Innocence*, an adaptation in prose of the duke of Newcastle's translation of Molibre's *L'Étourdi*, was produced at the Duke's theatre, without the author's name, in 1667. It was about this time that Dryden became a retained writer under contract for the King's theatre, receiving from it £300 or £400 a year, till it was burnt down in 1672, and about £200 for six years more till the beginning of 1678. His co-operation with Davenant in a new version (1667) of Shakespeare's *Tempest* (for his share in which Dryden can hardly be pardoned on the ground that the chief alterations were happy thoughts of Davenant's, seeing that he affirms he never worked at anything with more delight) must also be supposed to be anterior to the completion of his contract with the Theatre Royal. He was engaged to write three plays a year, and he contributed only 10 plays during the 10 years of his engagement, finally exhausting the patience of his partners by joining in the composition of a play for the rival house. Comedies produced by him in this period are *An Evening's Love, or the Mock Astrologer*, an adaptation from *Le Feint Astrologue* of the younger Corneille, produced at the King's theatre in 1668; *Ladies à la Mode* (1668); *Marriage à la Mode* (1672); *The Assignation, or Love in a Nunnery* (1673); *The Kind Keeper, or Mr. Limberham* (1678); but only *Marriage à la Mode* was really successful.

While Dryden met with such indifferent success in his willing efforts to supply the demand of the age for low comedy, he struck upon a really popular and profitable vein in heroic tragedy. *Tyrannic Love, or the Royal Martyr*, a Roman play dealing with the

persecution of the Christians by Maximin, was produced in 1669. It is in rhymed couplets, but the author again did not trust solely for success to them; for, besides the magic incantations, the singing angels, and the view of Paradise, he made Nell Gwyn, who had stabbed herself as Valeria, start to life again as she was being carried off the stage, and speak a riotous epilogue, in violent contrast to the serious character of the play. *Almanzor and Almalzide, or the Conquest of Granada*, a tragedy in two parts, was written in 1669 to 1670. This piece seems to have given the crowning touch of provocation to the wits, who ridiculed the popular taste for these extravagant heroic plays. *The Rehearsal* (1671) written by the duke of Buckingham, with the assistance, it was said, of Samuel Butler, Martin Clifford, Thomas Sprat and others, was a severe and just punishment for Dryden's boast in the epilogue to the second part of *The Conquest of Granada* of the superiority of Restoration comedy over that of the Elizabethan age. Davenant was originally the hero, but on his death in 1668 the satire was turned upon Dryden, who is ridiculed under the name of Bayes, the name being justified by his appointment in 1670 as poet laureate and historiographer to the king (with a pension of £300 a year and a butt of canary wine). It is said that *The Rehearsal* was begun in 1663, but this probably only means that Buckingham and his friends had resolved to burlesque the extravagant heroics of *The Indian Queen*. Later Dryden fully avenged himself on Buckingham by his portrait of Zimri in *Absalom and Achitophel*. His immediate reply is contained in the preface "Of Heroic Plays" and the "Defence of the Epilogue," printed in the first edition (1672) of his *Conquest of Granada*.

His next tragedy *Amboyna* (1673), put on the stage to inflame the public mind in view of the Dutch war, was written, with the exception of a few passages, in prose, and those passages in blank verse. An opera which he wrote in rhymed couplets, called *The State of Innocence, and Fall of Man*, an attempt to turn part of *Paradise Lost* into rhyme, as a proof of its superiority to blank verse, prefaced by an "Apology for Heroique Poetry and Poetique Licence," was entered at Stationers' Hall in 1674, and printed in 1677, but never acted. Dryden praises his original as "undoubtedly one of the greatest, most noble and most sublime poems which either this age or nation has produced." He is said to have had the elder poet's leave "to tag his verses." In *Aurengzebe*, which was Dryden's last, and also his best rhymed tragedy, he borrowed from contemporary history, for the Great Mogul was still living. In the prologue he confessed that he had grown weary of his long-loved mistress rhyme and retracted, with characteristic frankness, his disparaging contrast of the Elizabethan with his own age. But the stings of *The Rehearsal* had stimulated him to do his utmost to justify his devotion to his mistress, and he claims that *Aurengzebe* is "the most correct" of his plays. It was entered at Stationers' Hall and probably acted in 1675, and published in the following year.

After the production of *Aurengzebe* Dryden seems to have reconsidered the principles of dramatic composition, and to have made a particular study of the works of Shakespeare. The fruits of this appeared in *All for Love, or the World Well Lost*, a version of the story of Antony and Cleopatra, produced in 1678, which must be regarded as a very remarkable departure for a man of his age, and a wonderful proof of undiminished openness and plasticity of mind. In his previous writings on dramatic theory, Dryden, while admiring the rhyme of the French dramatists as an advance in art, did not give unqualified praise to the regularity of their plots; he was disposed to allow the irregular structure of the Elizabethan dramatists, as being more favourable to variety both of action and of character. But now, in frank imitation of Shakespeare, he abandoned rhyme, and, if we might judge from *All for Love*, and the precepts laid down in his "Grounds of Criticism in Tragedy," prefixed to *Troilus and Cressida* (1679), the chief point in which he aimed at excelling the Elizabethans was in giving greater unity to his plot. He upheld still the superiority of Shakespeare to the French dramatists in the delineation of character, but he thought that the scope of the action might be restricted, and the parts bound more closely together with advantage. *All for Love* and *Antony and Cleopatra* are two excellent plays for the comparison of the two methods. Dryden gave all his strength to *All for Love*, writing the play for himself, as he said, and not for the public. The action of his play takes place wholly in Alexandria, within the compass of a few days; it does not, like Shakespeare's, extend over several years, and present incessant changes of scene. Dryden chooses, as it were, a fragment of a historical action, a single moment during which motives play within a narrow circle, the culminating point in the relations between his two personages. He devotes his whole play, also, to those relations; only what bears upon them is admitted. In Shakespeare's play we get a certain historical perspective, in which the love of Antony and Cleopatra appears in its true proportions beneath the firmament that overhangs human affairs. In Dryden's play this love is our universe; all the other concerns of the world retire into a shadowy, indistinct background. If we rise from a comparison of the plays with an impression that the Elizabethan drama is a higher type of drama, taking Dryden's own definition of the word as "a just and lively image of human nature," we rise also with an impression of Dryden's power such as we get from nothing else that he had written since his *Heroic Stanzas* 20 years before.

It was 12 years before Dryden produced another tragedy worthy of the power shown in *All for Love*. *Don Sebastian* was acted and published in 1690. In the interval he wrote *Oedipus* (ptd. 1679) and *The Duke of Guise* (ptd. 1683) in conjunction with Nathaniel Lee; *Troilus and Cressida* (1679); *The Spanish Friar* (1681); *Albion and Albanius*, an opera (1685); *Amphitryon* (1690). In *Troilus and Cressida* he follows Shakespeare closely in the plot, but the dialogue is rewritten throughout, and not for the better. The versification and language of the first and the third acts of *Oedipus*, which with the general plan of the play were Dryden's contribution to the joint work, bear marked evidence of his recent study of Shakespeare. The *Duke of Guise*, in which he used one scene from his earliest dramatic attempt, provided an obvious parallel with contemporary English politics. Henry III. was identified with Charles II., and Monmouth with the duke. The lord chamberlain refused to license it until the political situation was less disturbed. The plot of *Don Sebastian* is more intricate than that of *All for Love*. It has also more of the characteristics of his heroic dramas; the extravagance of sentiment and the suddenness of impulse remind us occasionally of *The Indian Emperor;* but the characters are much more elaborately studied than in Dryden's earlier plays, and the verse is sinewy and powerful. It would be difficult to say whether *Don Sebastian* or *All for Love* is his best play; they share the palm between them. Dryden's subsequent plays are not remarkable. Their titles and dates are: *King Arthur*, an opera (1691), for which Purcell wrote the music; *Cleomenes* (1692); *Love Triumphant* (1694).

Soon after Dryden's abandonment of heroic couplets in tragedy, he found new and more congenial work for his favourite instrument in satire. As usual the idea was not original to Dryden, though he struck in with his majestic step and energy divine, and immediately took the lead. The pioneer was Mulgrave in his *Essay on Satire*, an attack on Rochester and the court, which was circulated in ms. in 1679. Dryden himself was suspected of the authorship, and he may have given some help in revising it; but it is not likely that he attacked the king on whom he was dependent for the greater part of his income, and Mulgrave in a note to his *Art of Poetry* (1717) expressly asserts Dryden's ignorance. Dryden, however, was attacked in Rose street, Covent Garden, and severely cudgelled by a company of ruffians who were generally supposed to have been hired by Rochester. Towards the close of 1681 Dryden took the field as a satirist on the side of the court, at the moment when Shaftesbury, baffled in his efforts to exclude the duke of York from the throne as a Papist, and to secure the succession of the duke of Monmouth, was waiting his trial for high treason. *Absalom and Achitophel* produced a great stir. Nine editions were sold in rapid succession in the course of a year. There was no compunction in Dryden's ridicule and invective. Delicate wit was not one of Dryden's gifts; the motions of his weapon were sweeping, and the blows hard and trenchant. The advantage he had gained by his recent studies of

character was fully used in his portraits of Shaftesbury and Buckingham, Achitophel and Zimri. In a play produced in 1681 (*The Spanish Friar)* he had written on the other side, gratifying the popular feeling by attacking the Roman Catholic priesthood.

Three other satires followed *Absalom and Achitophel,* one of them hardly inferior in point of literary power. *The Medall;* a *Satyre against Sedition* (March 1682) was written in ridicule of the medal struck to commemorate Shaftesbury's acquittal. Then Dryden had to take vengeance on the literary champions of the Whig party who had opened upon him with all their artillery. Their leader, Shadwell, had attacked him in *The Medal of John Bayes,* which Dryden answered in Oct. 1682 by *MacFlecknoe, or a Satyr upon the True-Blew Protestant Poet, T. S.* This satire, in which Shadwell filled the title-rôle, served as the model of the *Dunciad.* To the second part of *Absalom and Achitophel* (Nov. 1682), written chiefly by Nahum Tate, he contributed a long passage of invective against Robert Ferguson, one of Monmouth's chief advisers, Elkanah Settle, Shadwell and others. *Religio Laici,* which appeared in the same month, though nominally an exposition of a layman's creed, and deservedly admired as such, was not without a political purpose. It attacked the Papists, but declared the "fanatics" to be still more dangerous.

Dryden's next poem in heroic couplets was in a different strain. On the accession of James, in 1685, he became a Roman Catholic. There has been much discussion as to whether this conversion was or was not sincere; but it is worth while to notice that in his earlier defence of the English Church he exhibits a desire for the definite guidance of a presumably infallible creed, and the case for the Roman Church brought forward at the time may have appeared convincing to a mind singularly open to new impressions. At the same time nothing can be clearer than that Dryden always regarded his literary powers as a means of subsistence, and had little scruple about accepting a brief on any side. *The Hind and the Panther,* published in 1687, is an ingenious argument for Roman Catholicism, put into the mouth of "a milk-white hind, immortal and unchanged." Prior and Montagu, the future earl of Halifax, ridiculed it in *The Hind and the Panther transversed to the story of the Country Mouse and the City Mouse.* Dryden's other literary services to James were a savage reply to Stillingfleet (who had attacked two papers published by the king) and a translation of a life of Xavier in prose. He had written also a panegyric of Charles *Threnodia Augustalis* (1685), and a poem in honour of the birth of James II.'s heir, under the title of *Britannia rediviva* (1688).

Dryden did not abjure his new faith on the Revolution, and so lost his office and pension as laureate and historiographer royal. His rival Shadwell reigned in his stead. Dryden was once more thrown mainly upon his pen for support. He turned again to the stage and wrote the plays already enumerated. In the last decade of his life his translations from the classics occupied much of his attention. *Ovid's Epistles translated* appeared in 1680; and numerous translations from Virgil, Horace, Ovid, Lucretius and Theocritus appeared in the four volumes of *Miscellany Poems— Miscellany Poems* (1684), *Sylvae* (1685), *Examen poeticum* (1693), *The Annual Miscellany* (1694 by the "most eminent hands"); in 1693 was published the verse translation of the *Satires* of Juvenal and of Persius by "Mr. Dryden and several other eminent hands," which contained his "Discourse concerning the Origin and Progress of Satire"; and in 1697 Jacob Tonson published his most important translation, *The Works of Virgil.* The book, which was the result of three years' labour, was a vigorous, rather than a close, rendering of Virgil into the style of Dryden. Among other notable poems of this period are the two "Songs for St. Cecilia's Day," written for a London musical society for 1687 and 1697, and published separately. The second of these is the famous ode on "Alexander's Feast." The well-known paraphrase of *Veni, Creator Spiritus* was printed in the *Examen Poeticum,* and his "Ode to the memory of Anne Killigrew," called by Dr. Johnson the noblest ode in the language, was written in 1686.

His next work was to render some of Chaucer's and Boccaccio's tales and Ovid's *Metamorphoses* into his own verse. These translations appeared in 1700, a few months before his death, and are known by the title of *Fables, Ancient and Modern.* The preface, which is an admirable example of Dryden's prose, contains an excellent appreciation of Chaucer, and, incidentally, an answer to Jeremy Collier's attack on the stage. Thus a large portion of the closing years of Dryden's life was spent in translating for bread. Besides, his three sons held various posts in the service of the pope at Rome, and he could not well be on good terms with both courts. However, he was not molested by the government and in private he was treated with the respect due to his age and his admitted position as the greatest of living English poets. He held a small court at Wills's coffee-house, where he spent his evenings; here he had a chair by the fire in winter and by the window in summer; Congreve, Vanbrugh and Addison were among his admirers, and here Pope saw the old poet of whom he was to be the most brilliant disciple. He died at his house in Gerrard street, London, on May 1, 1700 and was buried on the 13th of the month in Westminster Abbey. Dryden's portrait, by Sir G. Kneller, is in the National Portrait gallery.

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DRY DOCK: *see* DOCKS.

DRY-FARMING. In many parts of the world there are large tracts of land suitable for the growth of crops but in which the rainfall is deficient. They lie in a different category from actual desert areas which are, for the most part, so lacking in plant food as to require more than water to make them capable of producing vegetation. What are commonly termed "arid" or "semi-arid" districts need only an adequate supply of water to make them productive. A district is usually classed as "arid" when its annual rainfall is less than 10in. and "semi-arid" when the rainfall exceeds 10 and is less than 20 inches. These limits are elastic, as other factors of climate and of soil have to be taken into account.

Dry-farming is a system of cultivation designed to conserve and utilise to the utmost possible extent the limited amount of moisture falling upon the land in arid regions, without resorting to extraneous supplies of water. It is practised in those regions of low rainfall where, for physical or economic reasons, irrigation is not practicable. The conservation of moisture is effected by careful tillage of the surface-soil and the subsoil separately. The surface is kept loose and finely pulverised to allow the ready percolation to the subsoil of such moisture as may fall in rain or snow. The subsoil is also finely pulverised but it is made as firm and compact as possible to increase its capacity for holding water and render its condition suitable for the germination of seed and the development of plant roots.

By this system of cultivation the land is first deeply ploughed, and the subsoil consolidated by a machine termed a sub-soil packer. The surface soil is thoroughly harrowed and scarified. The best results are obtained if the land is left fallow for a year. During the winter and early spring it is covered with snow. When the snow melts, the water, instead of draining away or evaporating, is collected and stored in the packed subsoil. As soon as the surface is sufficiently dry it is harrowed over, and this operation is

repeated after every rainfall until seed-time. The seed is drilled at the right depth to place it in the packed subsoil where the moisture has been accumulated. After sowing, the land is harrowed after each rainfall until the crop is so far advanced that this cannot be done without injuring it. As soon as the crop is harvested preparation for the next seeding begins. The plough follows close on the harvester and cuts a furrow seven inches deep. The subsoil packer follows immediately after the plough. The land is then harrowed after every rainfall, but never when it is dry, until the sowing of the next crop.

Crops are grown under this system either annually or biennially, this being determined mainly by the amount of rainfall, and also by the nature and texture of the soil.

Wheat is the crop mainly grown by the dry-farming system. W. P. Rutter in *Wheat-growing in Canada, tize United States and the Argentine* (1911) states that under dry-farming the nitrogen content of the wheat is large and the grains flinty and transparent, whereas under irrigation the grain is light-coloured, opaque, starchy and soft. The yield on irrigated land is greater but the quality of the wheat is better on land which is dry-farmed.

Area of Dry-farming.— The system of dry-farming was started by a few individuals in the State of Utah in 1875 and its practice has increased rapidly since 1900. The State of Utah and other States support a number of experiment stations where new varieties of wheat are tested, especially for their drought-resisting qualities. The rapid advance in the science of plant-breeding in recent years bids fair to have an important influence on the extension of wheat and other crops to regions formerly regarded as outside the possibilities of commercial production. In arid and semi-arid regions where irrigation is not now practicable, the system of dry-farming enables the fullest possible use to be made of drought-resisting wheats in extending the area of cultivation.

The United States Department of Agriculture *(Yearbook,* 1923) estimates that 587 million acres, or nearly one-third of the total area in America available for crops, pasture and forest, are arid or semi-arid pasture and range. About 51 million acres were stated to be irrigable, of which 20 million acres had been irrigated in 1920. California, Colorado and Idaho have the largest areas of irrigated land, comprising more than half the area irrigated. Dry-farming is practised chiefly in the Great Basin, the Columbia river valley, the interior valley of California and portions of the Great Plains.

The arid or semi-arid region of the United States extends over the Canadian border, a tract of some 80,000 square miles west of the 102nd meridian and east of the Rocky mountains being subject more or less to these conditions. Here also dry-farming is practised and methods of cultivation to conserve moisture in the soil are continuously studied.

The system of dry-farming has been mainly developed in North America, but in other areas having deficient rainfall it is also practised although on a less extensive scale.

See W. Macdonald, Dry Farming: Its Principles and Practice (1909); J. A. Widtsoe, Dry-farming (1913); D. E. Stephens, "Experiments in Wheat Production on the Dry Lands of the Western United States," U.S. *Dept. Agvic. Bull.* No. 1173 (1923); R. A. Oakley, "Forage Crops in Relation to the Agriculture of the Semi-arid Portion of the Great Plains," *U.S. Dept. Agvic. Bull.* No. 1244 (1924). (R. H.R.)

DRY-ICE, the trade-name for solid carbon dioxide, is a dense, snow-like substance having a temperature of 109° F. below zero or lower. Carbon dioxide gas is changed to a liquid when subjected to a pressure over five times that of the ordinary atmosphere and at 70° F. below zero. When this liquid is allowed to expand rapidly from the high pressure to atmospheric pressure, carbon dioxide snow results. This snow is compressed into cakes. Instead of melting it evaporates to a dry gas that has no corrosive action if moisture free. It makes possible the shipping of perishable products (meats, ice cream) long distances. One pound of dry-ice will absorb a little less than twice as much heat as one pound of water ice. A block of dry-ice 10in. x 10in. x 10in. in size weighs about 45 lb.

DRYNESS, CHEMICAL. The majority of chemical actions take place in the presence of water or some other solvent which plays an important part in the reaction; in fact, water appears to be a substance whose presence in minute amounts is essential for the occurrence of most chemical reactions. So far back as 1794, Mrs. Fulhame, in "An Essay on Combustion with a View to a New Art of Dyeing and Painting," recognized that presence of water, either as liquid or vapour, was necessary for the reduction of salts of gold and silver by hydrogen. In 1812 Cluzel discovered that the reaction between sulphuretted hydrogen and sulphur dioxide would not take place unless liquid water was present.

In 1869 Wanklyn brought together pure chlorine gas and metallic sodium without any appreciable interaction taking place even when the sodium was molten, but he did not realize that the impurity which he had removed was water.

Some of the earliest experiments on the effect of moisture on gaseous combustion were carried out in 1880 by H. B. Dixon, who discovered that a mixture of carbon monoxide and oxygen which had been most carefully dried would not explode when an electric spark was passed through the mixture, but on addition of a drop of water a violent explosion took place on again passing the spark. In 1888 H. B. Baker showed that water exerts some influence on the combustion of charcoal, since the carefully dried substance could be heated to redness in dry oxygen without appearance of a flame and only underwent partial oxidation to carbon monoxide and dioxide. He also showed that the elements boron, sulphur and phosphorus do not burn in dried oxygen, the latter not even becoming luminous. He further showed (1902) that a well-dried mixture of hydrogen and chlorine does not explode on exposure to sunlight, as does an undried one; similarly, the gases ammonia and hydrogen chloride, if perfectly dry, do not combine when mixed at the ordinary temperature, whilst pure dry electrolytic gas may be heated to redness or exposed to ultra-violet light without any measurable amount of water being formed. The introduction of a mere trace of moisture, *e.g.,* by allowing a small bubble of ordinary moist air to enter the apparatus, causes the normal action to take place. In 1887 E. W. Morley showed that the mere passing of a gas slowly through a long tube of such a vigorous dehydrating agent as phosphoric oxide leaves in it only 3 milligrams of water vapour per million litres, and yet this is sufficient to allow chemical action to proceed.

Not only is the rate of a chemical reaction materially retarded by removal of water from the system, but in many cases the physical properties of substances are modified by intensive drying. Carefully purified liquids of such widely different constitution as nitrogen trioxide, nitrogen tetroxide, bromine, mercury, hexane, benzene, carbon bisulphide, carbon tetrachloride, ether and various aliphatic alcohols were submitted to the influence of the drying agent, phosphorus pentoxide, for a period of several years. They were then examined and their boiling points showed a very considerable rise. In the case of mercury the rise was 62°, *i.e.,* the boiling point was 420–425° C. instead of 358° C.; for benzene the rise was 38" (from 80° to 118° C.). The melting point of bromine dried for 10 years, was found to be −4·5° C., while that of bromine dried for only a few days was −7·3° C.; that of sulphur was 117·5° C., showing a rise of 5·5°. The melting point of pure, dried sulphur trioxide was found to be 61° C., compared with 50° C. for the undried sample, and the dried sulphur trioxide changed on melting into the β-modification which had a melting point of 15·5° C. compared with the normal 14° C. The vapour densities of dried ether and methyl alcohol were 81.7 and 45 respectively, *i.e.,* more than double and treble the normal values; this is in agreement with the change of surface tension for these and other intensively dried liquids.

These results point to a change, generally an increase in the complexity of the molecule, which is due to the removal of the last traces of water from the substance. In the same way that particles of water vapour collect together and condense to form droplets which in their turn coalesce to give large drops, so the single molecules of a substance may coalesce into aggregates of molecules. This aggregation of single molecules into a more complex molecule is termed association (*q.v.*) and the breaking up of complex molecules into more simple ones is dissociation. It is

obvious, then, that the effect of intensively drying a substance is to increase its molecular association to such an extent as to cause a modification of its physical properties. Since in every instance drying has produced increased association, it is evident that association is less affected by the process of desiccation than is dissociation.

Practically all gases, liquids, and solids are soluble in water, some being very soluble, whereas others dissolve to such a small extent that only the most searching examination will give any indication of their presence in water. Conversely, water is soluble to a similar extent in most substances. This fact, and also the property of water of condensing in a thin film on liquid and solid surfaces — as observed in the "sweating" of walls in wet weather — in such a way that complete removal of the liquid film of water from surfaces is very difficult, gives some idea of the difficulty of removing the last, generally invisible, traces of water from substances. A clean, dry, polished glass carries on its surface an invisible film of water.

This property of retaining liquids or gases in an invisible form on the surface of solids is known as occlusion, and it is this power, which all substances possess, of occluding water to a greater or less extent, which renders so difficult the exact determination of the part played by water, both liquid and vapour, in chemical actions.

It has been shown above that a carefully dried mixture of certain gases will not react under ordinary conditions, whereas introduction of a trace of water causes instantaneous reaction. That the presence of liquid water is essential to the reaction between sulphuretted hydrogen and sulphur dioxide is demonstrated by an experiment described by H. B. Baker. The gases in question were dried by calcium chloride before mixing. This leaves about 4 milligrams of water vapour per litre of gas. The gases were then mixed and a small, open tube introduced containing about 2 milligrams of dried radium bromide. There was no apparent change after six hours; *i.e.*, no sulphur had been deposited on the walls of the jar, and it seemed as if no reaction had taken place. On opening the jar, however, there was an inrush of air and on heating the radium tube a large quantity of water was driven off and there was a considerable sublimate of sulphur. The whole of the gaseous contents of the jar had condensed in the small tube of radium bromide, and this was due to the fact that the ions from the radium salt cause condensation of the water vapour (left after desiccation with calcium chloride), to drops of liquid water in which the chemical action takes place.

This property possessed by water of helping a chemical action without itself being changed in the process is also characteristic of other substances, and the phenomenon is known as catalysis (*q.v.*).

Desiccation, or the removal of water from a substance, may be performed either by mechanical devices such as centrifuging, freezing or evaporation, or by chemical means. The choice of agent in this case is determined by the degree of dryness required and the nature of the substance to be dried. The most generally useful substances are anhydrous calcium chloride, concentrated sulphuric acid and phosphorus pentoxide, the last being the most powerful desiccator known. By its action over varying periods of time the degree of intensive dehydration described above has been attained.

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DRYOPITHECUS (drī-ō-pĭth'ē-kŭs), a genus of fossil Anthropoids which inhabited Europe, North Africa and North India in the Miocene. Seven species have been described and these, with four allied genera from the Siwalik formation of India, are believed to represent the ancestral stock of the anthropoids.

See C. F. Sonntag, *Morphology and Evolution of the Apes and Man* (1924).

DRY-POINT. Though generally classed as a variety of etching, and in practice often combined with that process, dry-point is, strictly speaking, a kind of engraving.

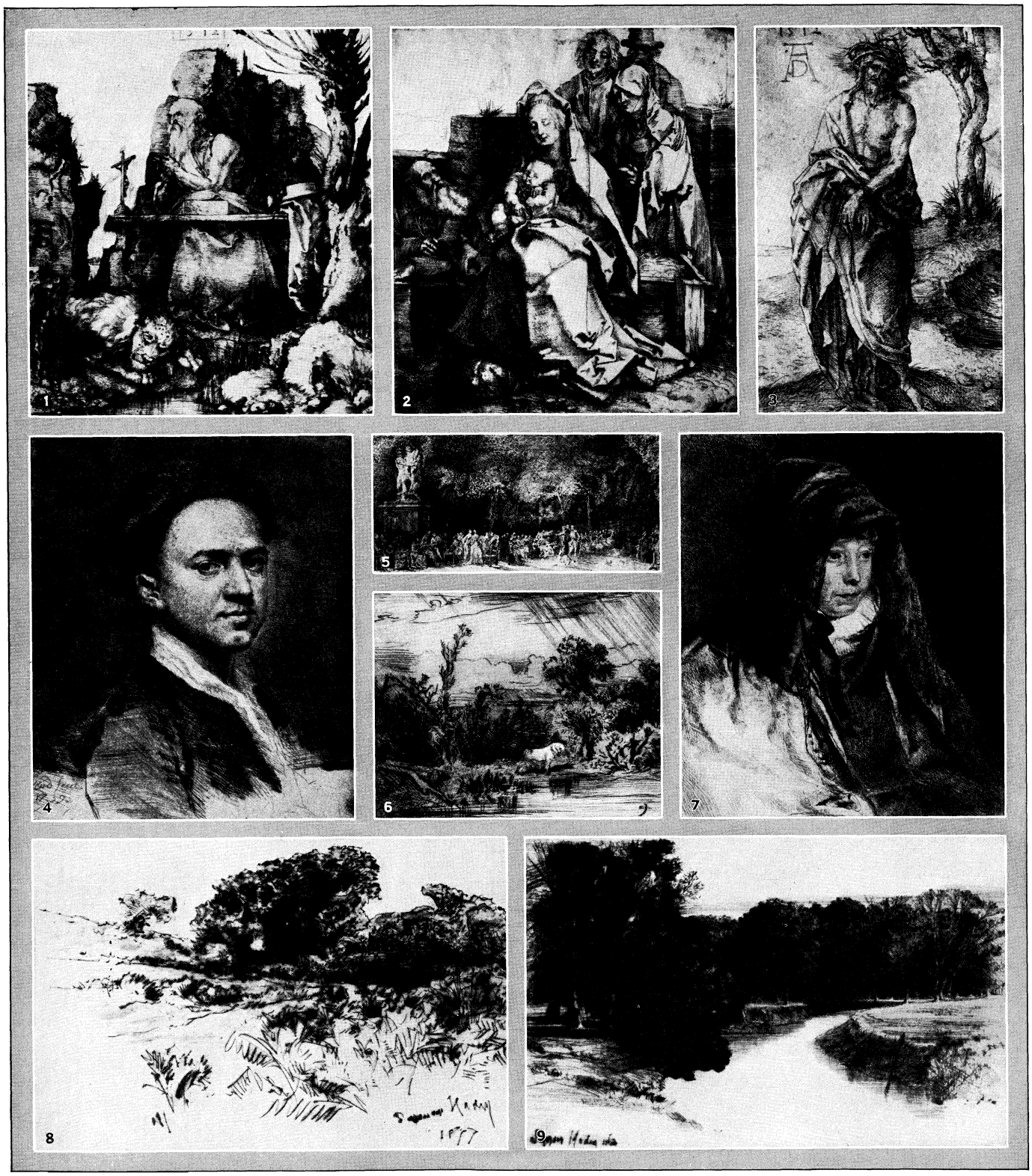
In etching the needle scratches only through the etching ground and exposes the surface of the plate; the latter is then placed in a bath of acid, and it is the chemical action of the acid that eats out in the copper a line of sufficient depth to hold printing ink. In dry-point, on the contrary, as in line-engraving, the lines are hollowed out by the tool itself in direct contact with the copper, as directed by the engraver's hand, without the intervention of any chemical action. Zinc can be used instead of copper, but this metal wears out quickly.

Methods. — The "dry" point, so called because no bath of acid supplements its use, is a tapering pointed instrument of steel, of stronger build than the point or needle used by the etcher and sometimes sharpened at both ends; but many modern engravers have substituted for steel a diamond point, or more rarely a ruby, fixed in a vectal handle. With one of these instruments the engraver works directly upon a plate of hard and polished copper, either shiny or blackened, ploughing up a line, shallow or deep, according to the amount of pressure used. Along one edge of this line, if the point is slanting, or along both edges if it is held upright, a raised edge of copper is turned up by the tool, and this ridge is termed the "burr." The burr, when the plate is inked for printing, becomes clothed with ink and produces in the impression the rich, soft and velvety effect which constitutes the peculiar charm of a dry-point proof. If the burr is removed (as it easily can be, should the engraver desire it, with a scraper) the somewhat thin line thus produced is less easily distinguished except by a practised eye, from the characteristic lines produced by the burin or the etching point. The burr is delicate and is easily worn out, either by too vigorous wiping when the plate is inked (experienced printers of dry-point use the palm of the hand for wiping the plate in preference to rag or muslin) or by too great pressure in the printing press. In any case the burr does not last long and the "bloom" of the early proofs of a dry-point soon wears off. The first two or three proofs, though they may be rough and uneven, often have a charm which can never be replaced by the more even printing of the bulk of the edition, and at some stage, it may be after a dozen proofs, or 20 or 50, according to the manipulation of the plate and the depth to which the lines have been sunk, deterioration inevitably becomes noticeable, unless the plate has been protected from wear by steel-facing. Some engravers assert that this precaution in no way affects the beauty of the proofs, and of some dry-point plates this may be true. But most engravers and most collectors are of opinion that there is an appreciable difference and that, according to Prof. H. W. Singer, "a trained eye can distinguish between the good, warm impressions taken from the copper and the hard, cold ones, taken from the plate after it has been steeled."

There can be no doubt that dry-points printed from the steel-faced plate for book illustration, such as André Dunozer de Segouzac's illustrations to *Les Croix de Bois* by *R.* Dorgelès (1921), can ill sustain comparison with the few artist's proofs taken before the steel-facing. In fact the process is thoroughly unsuitable for any purpose that requires the production of a large edition printed with mechanical regularity, and the dry-point only yields its essential charm in the hands of a sensitive and conscientious printer — none is better than the artist himself, if he understands the art of printing also — who knows when to stop, at the moment when the plate begins to show signs of wear, and does not feel bound to fulfil a contract by delivering a certain number of proofs, whether the plate will bear it or not. The dry-point, more than any other process of engraving, needs to be under the direct control, at every stage, of the artist who has invented the design to which he feels this process, rather than another, to be appropriate.

Corrections. — Two advantages which the dry-point process offers to the original etcher are the power which he possesses when using it of seeing exactly what he is doing with his tool upon the plate, and the comparative ease with which he can

DRY-POINT



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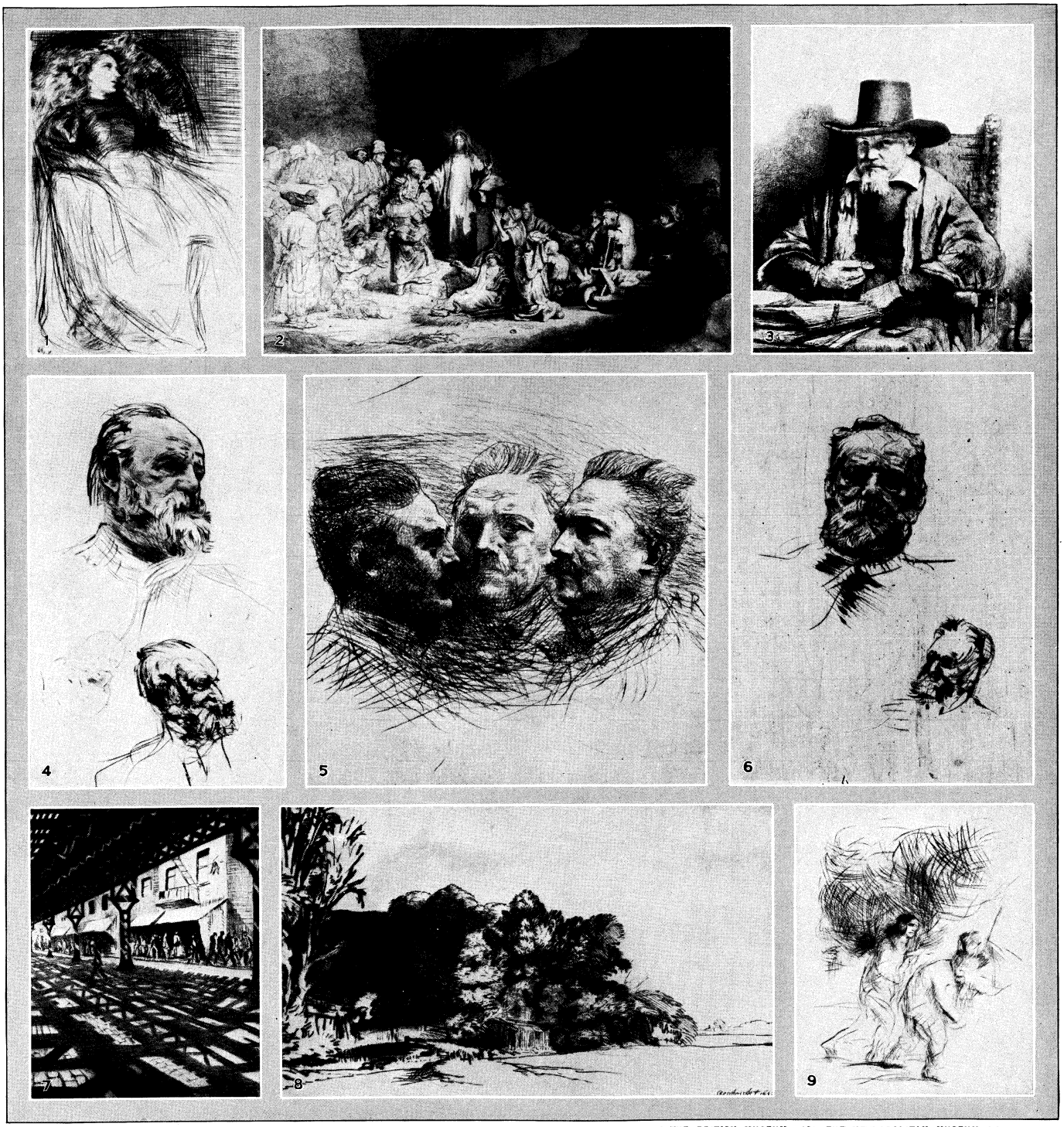
DRY-POINTS BY ENGRAVERS AND ETCHERS FROM THE 16TH TO THE 19TH CENTURY

1. "St. Jerome seated near a Pollard Willow" (1512) by Albrecht Durer, the first of three dry-points. From the impression of the second plate in the Albertina Museum, Vienna
2. "Holy Family" by Albrecht Diirer. Undated, probably about 1512
3. "The Man of Sorrows" (1512) by Albrecht Durer. This plate and the two preceding were the only dry-points made by Durer
4. "Portrait of Himself" (1739) by Arthur Pond, one of the English painter-etchers of the 18th century who used the dry-point technique with success
5. "Spectacle des Tuileries" (1760) by Gabriel de St. Aubln. Touched up in dry-point in 1763
6. "L'Orage" (1848) by Charles Jacque, a French etcher who produced a number of dry-point landscapes with figures of horses
7. "Portrait of the Artist's Mother" (1822) by Andrew Geddes
8. Trial proof (Oct. 7, 1877) of "Windmill Hill," dry-point by Seymour Haden, one of the leading English etchers of the 19th century
9. "Sunset in Ireland" (from a very rich imprint) by Seymour Haden, 1863

DRY-POINT



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EXAMPLES OF THE DRY-POINT TECHNIQUE

Dry-point is generally classed as a variety of etching though actually a kind of engraving. In dry-points no acid is used on the plate, as in pure etching, but the lines are hollowed out of the copper with a sharp pointed instrument. The raised edge of copper turned up by the tool is called the "burr." This, in the printing, produces the soft velvety effect peculiar to dry-points

1. "Weary" by James Abbott McNeill Whistler, finished in 1872
2. "Christ Healing the Sick" (the "Hundred Guilder Print") by Rembrandt. An etching of his middle period (1640–50) retouched with dry-point
3. Portrait of Arnold Tholinx by Rembrandt, 1656
4. Portrait of Victor Hugo by Auguste Rodin (1840–1917)
5. Portrait of Henry Becque by Auguste Rodin
6. portrait of Victor Hugo by Auguste Rodin
7. "Third Avenue" by C. W. R. Nevinson, British
8. "The Vista" by Rembrandt, 1652
9. "La Route d'Emmaus" by J. L. Forain (1852–1931), French

make alterations if he changes his mind or requires to correct a fault. Lines already made can be almost entirely obliterated with the burnisher or worked over with other lines, whereas in etching such alterations can only be effected by the much more difficult operation of laying a new ground. To quote E. S. Lumsden, "Corrections are very easily made in dry-point, because so little metal is *removed* from the surface, the strength depending principally upon the upturned ridges. This means that the sides of the lines are comparatively easily closed up by pushing them together with the burnisher. If the passage is to be reworked with heavy strokes, there is no difficulty at all; but if the original surface has to be recovered in order to print a clean tone from it, there is often considerable labour to erase the scratches altogether, as under heavy pressure the faintest indications of a line will show up in the proof. With care and patience anything can be done, and the freshness of the surface kept intact."

The comparative ease with which changes can be made results, in the case of some modern original artists whose work is done in dry-point, in a multiplicity of states. Of a celebrated recent dry-point by Muirhead Bone "A Spanish Good Friday," there are no less than 39 states, the engraver having repeatedly changed his mind about some detail, or thought of a fresh improvement that he could introduce, after he had begun to take proofs.

Dry-point and Etching.—Dry-point has sometimes been used by line-engravers, instead of etching to which they far more frequently resort, in the first preparatory stage (outline) of plates which are subsequently to be finished with the burin. Much more usual is the combination of dry-point with etching. Such a combination may be made either for the purpose of the general enrichment of an etched plate, in a second or subsequent state, by the addition of the dry-point burr, or for the sake of introducing small corrections, which can be made far more easily, though less permanently, by the addition of a few touches or lines with the dry-point than by an additional biting of the etched plate, which involves stopping out or the laying of a fresh ground. Dry-point additions to an etched plate can be readily distinguished by a trained eye in early impressions, but they wear away gradually till all trace of them is lost, and it is the presence of a clearly visible dry-point work, with all the richness that it was intended to impart, that confers value on early impressions of such an etching as the "Hundred Guilder Print" of Rembrandt, in its second state, or on the single state of "Christ Healing the Sick" by the same artist, though both the rich early impressions and the bare late ones from the worn plate which has lost its burr have to be described as belonging to the same state.

HISTORY

In a retrospect of the use of pure dry-point during the centuries which have elapsed since the invention of engraving, it will appear that its popularity has been intermittent, and that there have been prolonged periods during which, in one country or another, if not in all countries, it has quite fallen out of favour.

Earliest Work.—Its first appearance is earlier than that of etching, for there can be no doubt that the scarce and valuable prints of the "Master of the Hausbuch," a painter-engraver who worked in western Germany (probably on the middle Rhine) about 1480, were produced with the dry-point or possibly with the burin used in the same way, so as to scratch the surface of the copper and throw up a burr, which was not scraped away. This engraver is also called the "Master of the Amsterdam Cabinet" from the fact that the largest collection of his prints, numbering about 80 in all, is in that collection, but the name is to be deprecated, as it suggests that he was a Dutchman. He was a very original artist, and a keen observer of nature, with a technique quite unlike that of any other 15th century engraver.

Dürer.—The next engraver whom we find employing dry-point is Albrecht Dürer, who resorted to this process only in or about the year 1512, and probably abandoned the experiment when he discovered how few good proofs a plate engraved in this manner could yield. There are only three dry-points by Durer, "The Man of Sorrows" 1512 (Bartsch 21, Dodgson 65), "St. Jerome seated near a Pollard Willow," 1512 (Bartsch 59, Dodgson 66), and its companion print, the undated "Holy Family" of similar dimensions (Bartsch 43, Dodgson 67). Of the two latter dry-points very few good impressions are extant, for the burr wore off rapidly and the majority of extant specimens have been taken from the worn-out plates. Of Dürer's first work in this technique, "St. Jerome," two proofs only exist of a first state before the monogram (in the British Museum, and the Albertina, Vienna). These are of superior quality; the Albertina impression of the second plate is also very fine indeed. A fourth dry-point, "St. Veronica" (Bartsch 64), dated 1510, which figures in the older catalogues as one of the great rarities in Diirer's work, for only two impressions are known, is now discredited, for it has been proved to be a copy of an unsigned woodcut published at Nuremberg in a *Salve Animae* of 1503. Hans Sebald Beham alone of the followers of Durer used dry-point, and that but sparingly. It is hardly found again in the history of German engraving until a much later date.

Italy.—In Italy also the process was used in early times, chiefly by Andrea Schiavone, or Meldolla (1522?–82), an engraver who worked at Venice, and perhaps also by the monograminist H.E., for early impressions of his prints show signs of burr which in the usual later prints would not be suspected.

Rembrandt.—In the Netherlands dry-point was hardly used, if at all, before the 17th century. Its varied uses, as described above, for the enrichment of the etched plate by the addition of burr to the etched line as well as for the production of pure dry-points, were first discovered and exploited by the greatest of all painter-etchers, Rembrandt, who in his middle period, from about 1639 onwards, used this technique increasingly, in a thoroughly personal manner, for the sake of substituting "colour" and warmth for the drier effect of the pure etchings of his earlier period. From 1640–50 Rembrandt used dry-point extensi ely for retouching his etched plates—"The Death of the Virgin" and the "Hundred Guilder Print" are examples taken from the beginning and close of this period—while in his last period (1650–61), plates wrought wholly in dry-point became more and more frequent. Among the finest of these must be reckoned "The Goldweigher's Field" (1651); "The Vista" (1652); the two large plates, '(The Three Crosses" and "Christ Presented to the People," of 1653 and 1655 respectively and the "Portrait of Arnold Iboliux," 1656. An impression of the exceedingly rare first state of this portrait, in the Rudge collection, sold at auction in Dec. 1924, realized the large sum of 3,600 guineas, the highest price hitherto paid at an auction for an etching, if not for a print of any kind.

The 18th **Century.**—After Rembrandt, no very considerable use of the dry-point was made by any of the great engravers for a lengthy period. The 17th century was in all countries an age of line-engraving and etching, while in the Low Countries, Germany and England, the invention and development of mezzotint were claiming attention. In the 18th century dry-point was used here and there by a number of painter-etchers, amateurs in their technique as compared with the professional engravers, who found the medium congenial and probably took hints in their use of it from their study of Rembrandt. A beautiful example of such an 18th century dry-point is the portrait of himself, dated 1739, by Arthur Pond (reproduced, *Print Collectors' Quarterly,* 1922, ix. 324). One of the little subjects illustrating the destruction by fire of the Foire de Saint Germain in 1762, by Gabriel de St. Aubin, is a dry-point which seems in its modernity a precursor of the 19th century. In the period which preceded what is known as "the revival of etching," that is to say, during the first half of the 19th century, several English and Scottish etchers produced dry-points of remarkable merit. Among these were D. C Read, of Salisbury (1790–1821), E. T. Daniell, of Norwich (1804–42), and especially the two Scottish painter-etchers Andrew Geddes (1783–1844) and Sir David Wilkie (1785–1841). Of the last two, catalogues describing all the states of their plates with reproductions of five specimens, will be found in the fifth and eleventh publications of the Walpole Society, 1917 and 1923. Geddes' "Portrait of the Artist's Mother," his "Peckham Rye" and some other landscapes, and Wilkin's one pure dry-point, "The Lost

Receipt" are of conspicuous merit if compared with the dry-points of any period. The French etcher, Charles Jacque, also produced, long before 1850 a number of dry-point landscapes, with figures or horses, of great beauty.

Modern Work.—The etchers of the "revival," both in France and England soon brought the dry-point, as well as etching, into renewed favour. In the hands of Haden it yielded masterpieces like "Windmill Hill" and "Sunset in Ireland"; in those of Whistler "Finette," the "Portrait of Axenfeld," "Weary" and many more. Legros, soon after 1860, produced "La Promenade du Convalescents," "Femme se baignant les pieds," "Pecheurs d'écrevisses," and many beautiful landscapes. His pupil, Strang, half a century later, did much fine work in dry-point; so has Sir D. Y. Cameron, especially in his later work since 1903, and especially after 1910. Another master of the technique was Theodore Roussel (1847–1926). Of outstanding excellence among French dry-points of the late 19th century are those of the sculptor Auguste Rodin, whose portraits of Victor Hugo, of Henri Becque, of A. Proust, and "Allégorie du Printemps" and "La Ronde," are among the masterpieces of the medium. The French painter and etcher, J. L. Forain, produced some superb dry-points about 1909–10 and later. Among modern British engravers, Sir Muirhead Bone is pre-eminent as a master of dry-point, in which medium almost the whole of his numerous plates since 1898 have been wrought. His brother-in-law, Francis Dodd, since 1907, has done much good work in dry-point, and among later followers Henry Rushbury has come into the front rank. Another excellent engraver in dry-point is Edmund Blampied; C. R. W. Nevinson produced work of great merit in this medium during the World War.

(C. Do.)

ADVANCED TECHNIQUE

Some dry-point artists use a plate prepared or blackened as for etching, taking care to cut through the varnish to the metal surface underneath, and using the varying emphasis required by their design; for in dry-point everything must be drawn delicately or strongly by the artist himself as in ordinary drawing. The difficulty of working on the blackened plate is that it is not easy to judge exactly what emphasis has been used in making the lines, so the bare plate is more often used and a little weak black paint rubbed into the lines to mark their progress. Great care should be taken to do such inking of the lines as gently and as sparingly as possible, as the burr is easily injured during the progress of an elaborate plate with the result that the earlier portions of the work may look quite different from the later. Another difficulty will be found in the varying degrees of sharpness of the point used. A steel point requires resharpening frequently and the sharpening may not be exactly the same each time and this difference will be found reflected in the work. To obviate this, a diamond or ruby point is frequently used and works very smoothly when in good condition. It is, however, somewhat brittle and apt to flake away in strong cross-hatching or by striking the edge of the plate.

Dry-point has several striking advantages over etching: (a) The work can be more easily judged on the bare plate, being positive in character, *i.e.*, the lines appearing black (if filled in with black paint) exactly as in the print. (b) Corrections are more easily made as the lines are shallower and the metal being thrown up in furrows and not removed from the plate, can be forced back into the groove with a burnisher. Additions to the work can be easily made since the plate requires no regrounding and rebiting as in etching. (c) A trial print can be easily taken at any stage of the work, though it should be remembered that the fewer trial proofs that are taken the better, as a dry-point may easily be worn out in the course of a protracted series of trial proofs.

The point, the burnisher and the scraper are the three instruments used in dry-point: the use of the scraper is of much more importance than it is in etching, as the burr can be wholly or partly removed by it and the whole significance of the line altered. Some artists even remove the burr altogether and depend on the "nervous" character of the dry-point line for their effect.

One great disadvantage of dry-point is the difficulty of obtaining a large number of prints of equal excellence, owing to the delicate character of the work compared with etching or line-engraving. This has been largely overcome by the practice of steel-facing the plate before printing. It has led (especially in recent years) to the mixed plate, where dry-point is strengthened and stiffened by engraved lines done with the burin. The result is work obviously clearer and firmer in character than many pure dry-points, but lacking the particular charm of the best dry-point prints where spontaneity and vivacity (not characteristics of the burin) are most important assets. The best qualities of the two mediums are really incompatible. We cannot imagine a burin line introduced into the masterpieces of dry-point without fatal results. Dry-point is also used to lend to etched plates a "warmth" or "accent," or simply as the easiest method of making necessary additions. The difficulty then is that the dry-point lines wear out under the pressure of printing much earlier than the etched lines, and it becomes necessary to renew the dry-point work from time to time. From the pictorial point of view dry-point has the disadvantage of producing a picture too often "out of tone" and "spotty," owing to the somewhat accidental emphasis of the burr. From the point of view of style the dry-point needle is capable of too many different kinds of strokes; yet these difficulties only add to the fascination of trying to overcome them as they have been overcome by the great masters of the art.

Steel-facing and Printing Dry-points.—The question of steel-facing is surrounded by a prejudice in the eyes of collectors because it allows of larger editions being printed. The old steel-facing was heavy and clumsy compared with what is used to-day, and must have injured the dry-point on its application. Then, too, editions used to be printed from the copper and only after that steel-faced for a commoner kind of print. And the steel-faced plate being considered "fool-proof" was handed over to unintelligent printing—the fact not being recognized that a steel-faced plate really requires more and not less care in printing. For the delicate tones of the printing ink are more difficult to estimate with nicety on the less "sympathetic" surface of the steel. Still, it is true that for certain plates requiring delicate tones of printing-ink to supplement the line work steel-facing is not appropriate. If steel-facing is determined on, this should be done immediately the plate is completed and it should be remembered that the cleaner the plate and its lines have been kept during working the better, as the plate has to be made chemically clean before the electro-steeling and the smaller the amount of cleaning required the better for the preservation of the burr and the delicate lines.

Printing dry-points is a difficult art for the line and its burr lends itself to many different styles of printing. Care should be taken to give a clearness and purity to lines which so easily become clogged and heavy. The aim should be, while retaining the ink caught by the burr, to remove all the smudginess and heavy tone between the lines. This can best be done by repeated hand-wiping of the plate from all directions while the plate is fairly warm. Dry-point printing—or rather the preparing of the plate for the press—is thus a much slower process than etching printing, as so much more careful hand-wiping is required. "Retroussage" should be sparingly used, as the ink on the burr is easily smudged. A soft paper shows a dry-point to most advantage.

Because of its very simplicity, dry-point is a peculiarly "autographic" medium, very sensitive to the display of the temperament of the artist. All etched work bears a strong family resemblance, and still more so work with the burin. But a collection of the best dry-points shows an astonishing difference in the mere appearance of the lines. This is the great fascination of the craft, as a peculiarly personal style has been attained in it again and again. It is as capable of as many styles as drawing itself, to which indeed it is the nearest of all methods of making prints. There is no chemistry to overcome—no accidentals—the old gibe, levelled at etching, of "a blundering art" does not apply. If the student studies carefully the dry-points of Rembrandt, Whistler, Haden and Rodin, the immense range and possibilities of the medium should be clearly grasped. The inimitably natural stroke of the first, the sweeping "silky" line of the second, the abrupt strokes so suggestive of painters' colour of the third, the chisel-

like cutting of the fourth—there is no range comparable to this in any other system of making prints, and new triumphs of individual method in dry-point may yet have to be recorded. (See ETCHING, ENGRAVING.)

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(Mu. B.)

DRY **QUENCHING** is a process of cooling a hot solid substance without using a liquid in direct contact with the substance to be quenched. The sensible heat in most of the cases can thereby economically be converted into useful energy and the quality of the product improved. This process has been applied and developed primarily for the quenching of coke as it is discharged from coke ovens at temperatures of 1,800° to 2,000° F. It was for a long time common practice to sprinkle this hot coke with water or to submerge it in water to reduce its temperature sufficiently to prevent it from re-igniting and to facilitate handling and transportation. This method, however, has several disadvantages. The coke takes up water, thereby considerably reducing its heating value. The wet quenching vapours are corrosive and affect steel and concrete construction, thereby largely increasing maintenance costs. They also carry coke dust high into the air and scatter it widely over the plant and the community.

Methods.—In the Sulzer system, the process of dry quenching of the hot coke is accomplished by circulating an inert mixture of gases in a closed cycle, first through the hot coke mass where the gases extract the sensible heat, thence through a steam boiler where the hot gases transfer the heat to the water in the boiler and convert it into steam. The cooled gases leaving the boiler are conducted back to the fan and again forced through the coke.

The hot coke is conveyed to the dry quencher in more or less regular intervals depending upon the schedule of discharge of the coke ovens. It is introduced through the top door of the coke container which holds a number of loads Before a new load of coke is charged, an equal amount of cooled coke is withdrawn from the bottom of the apparatus. The coke, therefore, is allcwed to remain in the container for several hours gradually reaching lower cooling zones. The cooling gas is circulated by means of a fan continuously operating and flows through the coke mass in an upward direction, thereby performing the cooling in accordance with the counterflow principle.

The inert mixture of gas is formed when starting up the plant. A small portion of coke is converted into a mixture of carbon monoxide and carbon dioxide whereby the oxygen of the air within the system is completely consumed. The cooling gas therefore consists mainly of these products of combustion and nitrogen. Care must be taken that two doors are never open at the same time in order to prevent air entering the system causing combustion of coke. As long as only one door is open at a time, the pressure in the system adjusts itself to atmospheric pressure at that point, but no gas is pushed out nor air sucked in. However, on discharging cooled coke an equal volume of air enters the system.

Advantages.—The principal benefit in dry quenching is the production of 400 to 500 lb. of steam per 1,000 lb. of coke quenched, this representing a saving that equals 25 to 40% of the fuel required to carbonize the coal. The steam may be used in the by-product plant or for generating of power which may either cover the needs of the plant or be fed into the lines of a power company.

The specific heat of coke has been determined by many investigators and can be considered as sufficiently established for practical use. It depends upon the temperature, the ash content and the amount of volatile matter still contained in the coke. The thermal efficiency of a dry quenching plant taking the inlet and outlet temperatures of the coke as limits is about 90 to 95%; there is no loss due to combustible matter in the ash, stack waste gases, etc., as is the case in direct fired boilers; the only loss is through radiation. Dry quenched coke has a higher thermal value than wet quenched coke owing to absence of water. Considerable improvement in operation of gas-producers, water-gas plants, blast furnaces, foundry cupolas and domestic furnaces is the benefit resulting from the use of dry quenched coke. Breeze from this coke can still be considered as a high quality fuel, while wet quenched coke breeze due to high moisture is very likely to cause trouble in furnace operation. The dry-quenching process may also be adapted for the purpose of cooling other hot products of the chemical industry such as calcium carbide, lime, cement clinker, etc., saving the sensible heat and improving the quality of the product.

(H. D. S.)

DRY ROT, a term applied to the decay of wood caused by various kinds of fungi. Frequently the term is applied solely to such decay as takes place in timber that has been worked or is in actual use: the present article deals solely with dry rot in this restricted sense. The fungi feed upon the wood, and thus cause it to become lighter in weight, weaker, more brittle and less elastic, so that when struck the wood emits a muffled sound and readily snaps. In more advanced stages of rot the wood is apt to warp, and may show cracks ("cross-shakes") at right angles to the grain and can greedily absorb liquids, *e.g.,* water, and, comparatively early, the wood may show discolourations and lose any characteristic scent.

The fungi causing dry rot belong to the great class that includes the familiar toadstools and mushroom. They are composed of very slender, hollow, jointed, closed tubes (hyphae) which grow in length and emit branches. These tubes permeate the wood, and outside this may also produce loose mould-like coatings, or by interweaving can give rise to denser sheets, nets, strings or more massive fruit-bodies shaped like cakes, brackets or mushrooms.

The fruit-bodies, which are easily visible to the naked eye, eject myriads of microscopic infectious germs, termed spores. But spores are likewise produced by certain species of these fungi quite apart from the fruit-bodies.

Infection of wood may also take place by means other than by spores. Certain species of fungi, including the most malignant causal agent of dry rot in houses in Europe, *Merulius* lacrymans (*domesticus*), not only grow inside the wood but can more rapidly spread over its surface, and advance over non-wooden surfaces, and, in the form of strings penetrate or perforate brick walls, attacking wood that they reach. Contrasting with such *contagious* species are other merely *infectious* species that usually live only in the interior of the wood until they thrust their fruit-bodies outside it; such internal decay is often difficult to detect, as the superficial wood may be quite sound and normal in appearance.

Wood may be protected against dry rot by one or both of two methods: (1) sanitation; (2) antiseptic (fungicidal) treatment.

Sanitation.—Sanitation is the cheapest method of preventing, and sometimes of arresting, dry rot. One essential condition for activity is a sufficient supply of air, as these fungi absorb oxygen and give out carbonic acid and water. Although they can grow in the absence of oxygen, they are readily killed by an accumulation of carbon dioxide. During respiration certain species of fungi can produce water so vigorously that dry wood is thoroughly moistened and drops of water appear on the fungus itself (hence the specific name of *Merulius* lacrymans).

An adequate supply of water is required by the fungus, which owes the main part of its weight to water and cannot take in food unless this be dissolved in water. So far as dry rot in temperate regions is concerned, in the dry air of deep coal pits and of warmed rooms wood may last for decades or centuries; whereas dry rot is common in moist, shallower coal-pits, in moist cellars and damp ground-floors; especially can it appear near escapes of water from water pipes or steam pipes, and in stuffy, feebly ventilated places; for instance under floors covered with linoleum. In a house fungus causing dry rot may be luxuriant on the hidden faces of floor-boards, panels and skirting-boards, but be entirely lacking on the visible faces of these in contact with drier air of rooms; so that dry rot may be widespread through a building although no fungus be visible until the wood-work is disturbed.

Fungi causing dry rot cannot attack wood that is either too wet or too dry. Some species demand much moisture: among such

are *Coniophora* cerebella (whose slender black threads are common on the surface of damp wood in houses) and a number of fungi that do not grow over the surface of the wood. These species are probably largely responsible for "wet rot," a popular term apparently applied to discoloured wood showing to the naked eye no fungus inside or outside the wood, no external cross-shakes, but giving evidence of weakness and possibly former or present wetness (which caused the death and disappearance of any fungus formerly outside the wood).

Other fungi, including Merulius lacrymans, produce considerable amounts of water and, transporting this, can thus moisten distant wood; thus they can feed on drier wood.

Where dry rot in a building is caused by fungi demanding much moisture, it may be arrested by merely cutting off the excessive supply of water; this will not suffice when *Merulius* lacrymans is the causal agent. Moreover cutting off the excess of moisture does not necessarily cause death of the fungus inside the wood: when wood attacked by *Merulius* or when certain internal feeders have been thoroughly dried for months, the fungus inside the wood may awaken into activity if the wood be remoistened.

Arrangements to secure a house against excess of dampness include: erection on a light pervious soil, provision of efficient dampcourses; care against absorption or condensation of water by and on the walls; under the ground floor, adequate ventilation and provision of a water-tight coating over the concrete; obviation of leakage or overflow from rain-water pipes and gutters outside the house, and water pipes and steam pipes indoors; proper construction of window casements to allow water to flow properly away from them; renewal of paint on external woodwork; and adequate maintenance of the roofing.

Fungi causing dry rot are active only within certain ranges of temperature; but inasmuch as the temperatures prevailing in all parts of a building, from cellar to roof, in temperate regions at times enable these fungi to be active, temperature from the practical point of view intervenes only as a means of eradication. Low temperatures (for instance the freezing point of water) at least in the case of *Merulius* lacrymans do not suffice to kill fungus or spores. Higher temperatures (over 50° C.) are much more effective, so that infected wood can be sterilized by heat, especially by steam, at temperatures below the boiling point of water. A painter's lamp suffices to sterilize infected surfaces, but an oxy-acetylene flame, or some equivalent, is required for rapid sterilization of walls permeated with fungi causing dry rot.

Antiseptic (Fungicidal) Treatment.— The decay of wood can be combated by the application of disinfectants and especially by substances that are powerful fungicides.

Among organic wood-preservatives the most familiar is so-called coal-tar "creosote oil," which is very widely used out of doors to preserve railway-sleepers, paving blocks, telegraph-poles, etc. Its scent is too powerful and persistent to permit of its use indoors, so that in houses, etc., "creosote" is often replaced by somewhat similar preservatives from which the more volatile and strong-scented oils have been removed. Extremely powerful organic fungicides suitable for use on wood are dinitrophenol and sodium dinitrophenate, to which are added other substances, such as sodium fluoride, designed to render the mixture non-explosive. On the other hand carbolic acid and formalin are too evanescent; and many other disinfectants used to destroy bacteria causing disease are too weak in action on fungi to act as timber preservatives.

Among aqueous solutions of *inorganic* salts used to preserve wood are copper sulphate (which attacks iron), zinc chloride (which easily washes out and when too warm or strong destroys wood), corrosive sublimate (very poisonous), sodium fluoride, and acid (commercial) magnesium silico-fluoride (which attacks metals and glass). Of these inorganic salts the last two may be generally regarded as the best for use in houses.

It is generally true that with increasing depth of penetration of the preservative into the wood the greater is the durability conferred, but the more costly is the process of treatment. Out of doors the preservative (usually "creosote") is driven deep into thick pieces of timber (such as sleepers, poles or paving-blocks) by pneumatic pressure or by immersion in hot tanks. Whereas wood-work in buildings is usually merely coated with the preservative, reliance being more economically based upon sanitation including proper methods of construction. (P. GM.)

DRY TOWTUGAS, a group of 10 coral islets or keys 65 m. west of Key West, Florida. The largest are East Key, Bird Key and Loggerhead. Fort Jefferson, the site of a military prison during the Civil War, is a quarantine station. Loggerhead has a Carnegie laboratory of marine biology. The group forms a Federal bird reservation.

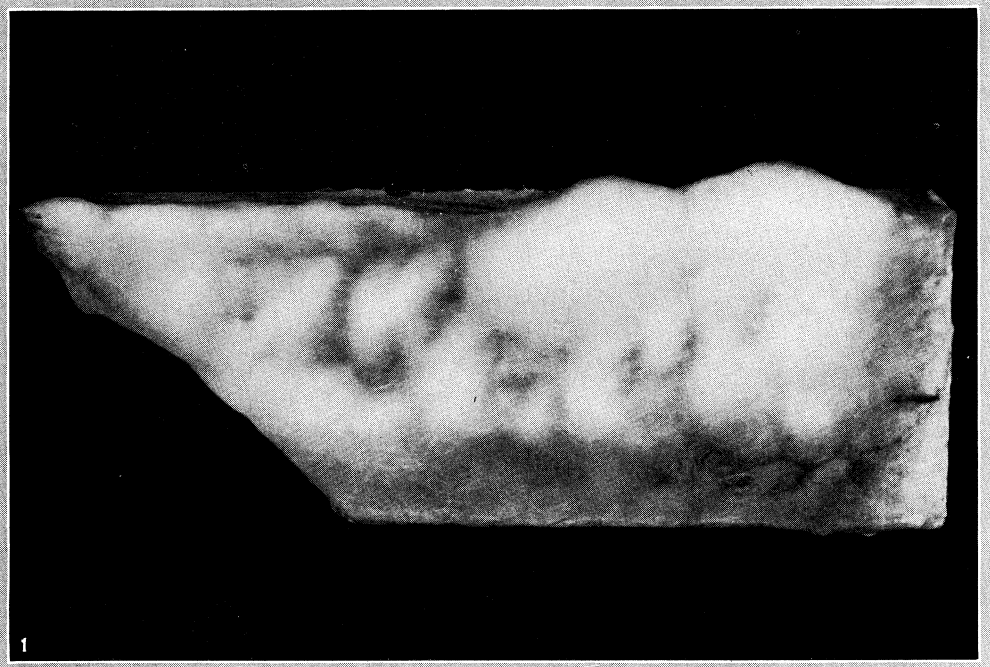
DUAL IGNITION: see INTERNAL COMBUSTION ENGINES.

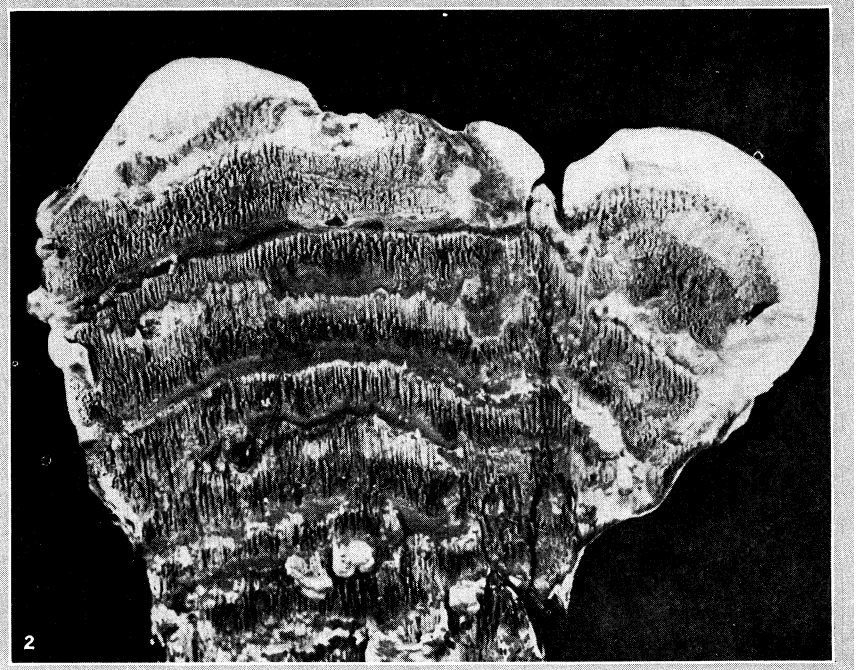
DUALISM. In metaphysics, dualism postulates the eternal coexistence of mind and matter, as opposed to monism both idealistic and materialistic. Two forms of this dualism are held. It is said that (1) mind and matter are absolutely heterogeneous, thus making any causal relation between them ex *hypothesi* impossible, (2) there is a hypothetical dualism, so that mind cannot bridge over the chasm so far as to *know* matter in itself, though it is compelled by its own laws of cause and effect to postulate matter as the origin, if not the cause, of its sensations. It follows that, for the thinking mind, matter is a necessary hypothesis. Hence the theory is a kind of monism, inasmuch as it confessedly does not assert the existence of matter save as an intellectual postulate for the thinking mind. Matter, in other words, must be assumed to exist, though mind cannot know it in itself. From this question there emerges a second and more difficult problem. Consciousness, it is held, is of two main kinds, sensation and reason. Sensation alone is insufficient to explain all our intellectual phenomena; all sensation is momentary and individual (cf. EMPIRICISM). HOW then are we to account for memory and the principles of necessity, similarity, universality? It is argued that there must be in the mind an enduring, primary faculty whereby we retain, compare and group the presentations of sense. This faculty is a priori, transcendental, and entirely separate from all the data of experience and sense-perception. Here then we have a dualism within experience. The mind is not to be regarded as a sensitized film which automatically records the impressions of the senses. It contains within itself this co-ordinating power which reacts upon and arranges the sense-given presentations.

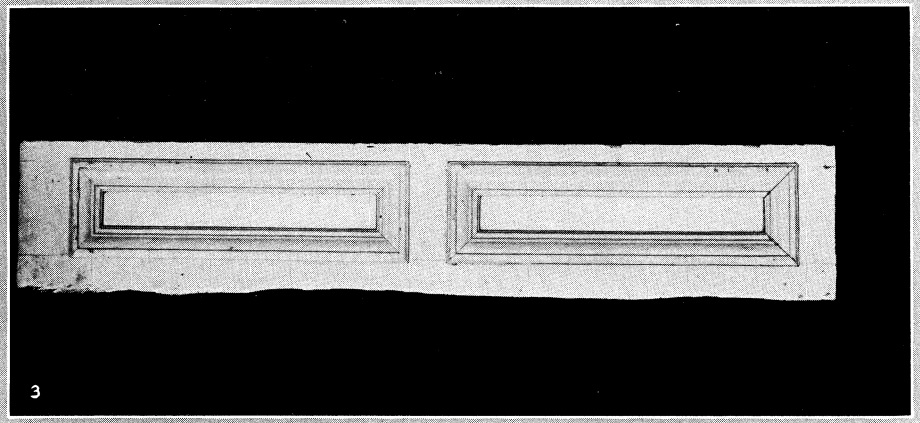
In Ethics and Theology.— In the domain of morals, dualism postulates the separate existence of Good and Evil, as principles of existence. In theology the appearance of dualism is sporadic and has not the fundamental, determining importance which it has in metaphysics. It is a result rather than a starting-point. The old Zoroastrianism, and those Christian sects (*e.g.,* Manichaeism) which were influenced by it, postulate two contending deities Ormuzd and Ahriman (Good and Evil), which war against one another in influencing the conduct of men. So, in Christianity, the existence of Satan as an evil influence, antagonistic to God, involves a kind of dualism. But generally speaking this dualism is permissive, inasmuch as it is always held that God will triumph over Satan in His own time. So, in Zoroastrianism, the dualism is not ultimate, for Ahriman and Ormuzd are represented as the twin sons of Zervana Akarana, *i.e.,* limitless time, wherein both will be finally absorbed. The postulate of an Evil Being arises from the difficulty, at all times acutely felt by a certain type of mind, of reconciling the existence of evil with the divine attributes of perfect goodness, full knowledge and infinite power. John Stuart Mill (Essay on Religion) preferred to disbelieve in the omnipotence of God rather than forgo the belief in His goodness. It follows from such a view that Satan is not the creation of God, but rather a power coeval in origin, over whose activity God has no absolute control.

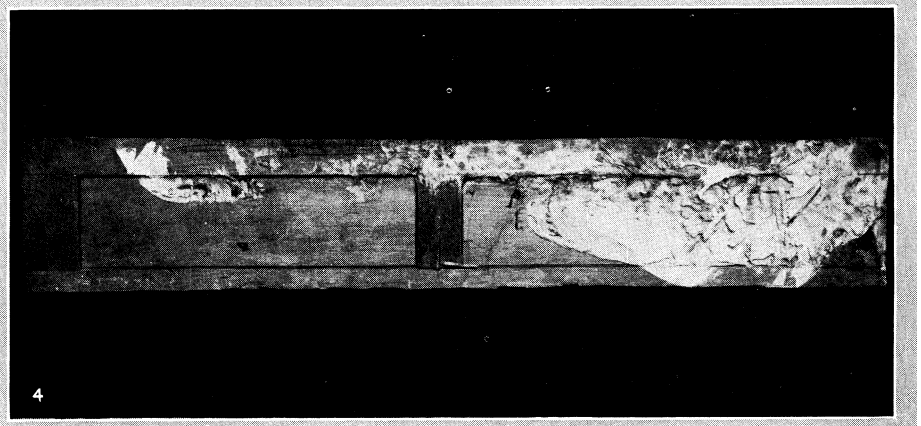
In Christology.—Dualism is also used in a special theological sense to describe a doctrine of the Nestorian heresy. According to this doctrine the personality of Christ is twofold; the Divine Logos dwells as a distinct personality in the man Jesus Christ, the union of the two natures being analogous to the relation between the believer and the indwelling Holy Spirit.

History of Metaphysical Dualism.— The earliest European thinkers (see IONIAN SCHOOL OF PHILOSOPHY) endeavoured to









FORMS OF DRY ROT (MERULIUS LACRYMANS)

1. Cushion-like growth of *Merulius lacrymans*, so called because it is covered with drops of water. During the process of respiration this fungus produces a considerable amount of water with which it moistens dry wood
2. Bracket-like fruit-body of *Merulius lacrymans*, a form of this fungus easily visible to the naked eye. It ejects myriads of microscopic germs called spores, which infect the surrounding wood
3. The sound exposed face of a panel infected with *Merulius lacrymans*. The visible faces of woodwork which are in contact with the comparatively dry air of rooms often appear sound, although the hidden faces of the same woodwork may be covered with fungous growth
4. The reverse of the panel in figure 3, showing infection with *Merulius lacrymans*

reduce all the facts of the universe to a single material origin, such as Fire, Water, Air. It is only gradually that there appears any recognition of a spiritual principle exercising a modifying or causal influence over inert matter. Anaxagoras was the first to postulate the existence of Reason (*νοῦς*) as the source of change and progress. Yet even he did not conceive this Reason as incorporeal; it was in reality only the most highly rarefied form of matter in existence. In Plato for the first time we find a truly dualistic conception of the universe. Asserting that Ideas alone really exist, he yet found it necessary to postulate a second principle of not-being, the groundwork of sensuous existence and of imperfection and evil. Herein he identified metaphysics and ethics, combining the good with the truly existent and evil with the non-existent. Aristotle rebels against this conception and substitutes the idea of *πρώτη ὕλη* and development. Nevertheless he does not escape from the dualism of Form and Matter, *νοῦς* and *ὕλη*. The scholastic philosophers naturally held dualistic views resulting from their extreme devotion to formalism. This blind dualism found its natural consequence in the revolt of the Renaissance thinkers, Bruno and Paracelsus, who asserted the unity of mind and matter in all existence and were the precursors of the more intelligent monism of Leibniz and the scientific metaphysics of his successors. The birth of modern physical science on the other hand in the investigations of Bacon and Descartes obscured the metaphysical issue by the predominance of the mechanical principles of natural philosophy. They attempted to explain the fundamental problems of existence by the unaided evidence of the new natural science. Thus Descartes maintained the absolute dualism of the *res cogitans* and the *res extensa*. Spinoza realized the flaw in the division and preferred to postulate a single substance *(unica substantia)* of which mind and matter are ultimate attributes, while Leibniz explained the universe as a harmony of spiritual or semispiritual principles. Kant practically abandons the problem. He never really establishes a relation between pure reason and things-in-themselves *(Dinge an sich)*, but rather seeks refuge in a dualism within consciousness, the transcendental and the empirical. Since Kant there are, therefore, two streams of dualism, dealing, one with the radical problem of the relation between mind and matter, the other with the relation between the purely rational and the empirical elements within consciousness. To the first problem one answer commonly given is that matter in itself is inherently unthinkable and comes within the vision of the mind only as an intellectual presentation, so that philosophy is in a sense both dualist and monist; it is a cosmic dualism inasmuch as it admits the possible existence of matter as a hypothesis, though it denies the possibility of any true knowledge of it, and is hence with regard to the only possible knowledge an idealistic monism. It is a self-destructive dualism, a confessedly one-sided monism, agnostic as to the fundamental problem. To the second problem there are two main answers, that of Associationism which denies to the mind any *a priori* powers and asserts that sensation is the only source of knowledge, and that which admits the existence of both transcendental and empirical knowledge.

DUALITY. A statement capable of two different meanings, both of them true, one obtained from the other, by simply interchanging two words, is an illustration of the principle of duality. An important application of the principle is found in projective geometry. In the plane this is accomplished by interchanging the words "point" and "line"; it is well illustrated by the theorem of Pappus, which may be stated as follows:

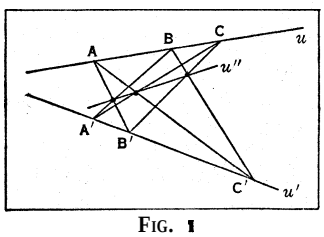


FIG. 1

Given any two straight lines u, u' in the plane; choose any three points A, B, C on u, and any three points A', B', C', on u'. The three points of intersection AB', $A'B$; AC', $A'C$; BC', $B'C$ lie on a straight line u''. The dual theorem is:

Given any two points U, U'; draw any three lines a, b, c through U and a', b', c' through U'. The three lines joining the points ab', $a'b$; ac', $a'c$; bc', $b'c$ all pass through a point U''. If the first proof has been established, the second follows by duality, since the determining elements of lines in terms of points are identical with those of points in terms of lines. The principle was first recognized by Poncelet in the *Journal für Mathematik* (1829), and by Gergonne in the *Annales de Mathématiques pures et appliquées* (1825–27), and first generally applied by Steiner in his *Systematische Entwickelungen*, (1832).

In geometry of three dimensions there is a corresponding duality between points and planes. In this case the line is self dual, as it is determined by any two distinct points on it or by any two distinct planes through it.

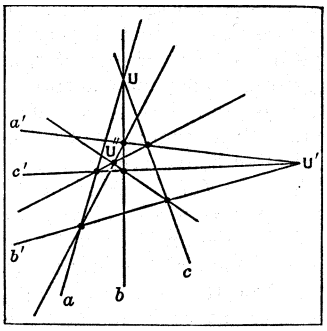


FIG. 2

Many other illustrations of the principle can be given. A geometry can be constructed in the plane by replacing the word "line" wherever it occurs in a proposition by the word "circle," if the circle associated with any given line is constructed as follows:

Given a fixed circle C with centre O. Let a given line meet it in A, B. Draw the circle through A, B, O. After this has been done for every line, think of the point O being removed from the plane. The resulting system of incomplete circles furnishes a non-euclidean interpretation of plane geometry. The line-sphere transformation of Lie is an illustration of a complete duality between lines and spheres in space. Much of higher geometry is concerned with the principal of duality; every new application practically doubles the extent of existing knowledge.

DUALLA, one of the principal negro peoples of Cameroon estuary, west Africa. *(See* CAMEROONS.)

DUAL ORGANIZATION. A distinctive feature in the social structure of certain simple communities is their division into two complementary sections which have important functions in the social and ceremonial life of the people. This system of dual organization occurs most typically in many parts of Australia, Melanesia and N. America, and has been recorded from India and Assam; its existence elsewhere has not been definitely established. The two sections, usually termed moieties or phratries, are unilateral in character, membership being determined by descent through either the father or the mother. In Melanesia matrilineal descent predominates, elsewhere both matrilineal and patrilineal descent are common. An exceptional case is found among the Fox and Kickapoo of N. America, where the father usually, but not always, determines which moiety his child shall enter, so that often the first-born child will belong to one moiety and the next child to the other. The structure of the moieties also varies: in some communities they are simple undivided groups; in others they are each composed of a number of smaller sub-divisions or clans, *e.g.*, among the Winnebago of N. America, where the one moiety consists of 28 clans and the other of *26*.

Functions.— The dual organization is very frequently connected with the regulation of marriage. In most communities the moieties are exogamous, and consequently a man belonging to one moiety must always marry a woman belonging to the other. This feature is sometimes regarded as the distinctive characteristic of the dual organization, but although it is of most frequent occurrence there are several exceptions. Among certain N. American tribes, *e.g.* the Hidatsa, Yuchi, Western Mono and Iroquois, marriage between members of the same moiety is not prohibited. When the moieties are exogamous a man is never permitted to marry any woman he chooses in the opposite moiety. The form of marriage is always dependent upon other factors, such as age, status and kinship, where certain relatives are prescribed as eligible mates while marriage between others is not permitted. Thus the form of marriage most frequently found with the dual organization is that between cross-cousics; and, where the moieties are exogamous, it follows (whether descent be patrilineal or matrilineal) that cross-cousins belong to different moieties, while parallel cousins between whom marriage is not permitted, become mem-

bers of the same moiety. The dual organization in such cases does not determine but merely systematizes the form of marriage. Only under exceptional circumstances can cross-cousin marriage result from the division of the community into moieties (see COUSIN MARRIAGE).

Other functions of the dual organization vary according to the community in which it is found. .In the daily life of the people, the members of the two moieties are very commonly separated at games, feasts, contests, etc., and may even inhabit different parts of the settlement. Often there is also a striking development of reciprocal services between the two moieties, so that they assist each other, *e.g.*, at the initiation and burial of their members, at the building of houses and in various other economic enterprises, while communal ceremonies are usually so arranged that one moiety is conceived as giving them to the other. The symmetry of structure characteristic of the dual organization here serves as the indispensable basis of reciprocal obligations (cf. B. Malinowski, Crime and *Custom* in Savage Society, chap. iv.). Thus among the Iroquois of N. America, the two moieties are always represented at the great annual festivals and at the ceremonial meetings of the medicine or religious societies, and in the ceremonial Long House they are spatially separated, the speakers on each side addressing the other in the course of the ceremony; games, such as ball and lacrosse, are also played between the two moieties; they have the obligation of burying each other's members; and they also exercise political functions, each moiety, *e.g.*, having the right of veto over the choice of the other in the election of chiefs (cf. L. H. Morgan, *The* League of the Iroquois).

Again, there is sometimes to be found a theoretical dichotomy of the universe whereby all natural phenomena are divided between the two moieties; and, especially where the moieties are subdivided into clans, this system of classification is frequently accompanied by totemism (*q.v.*). Thus the Wotjobaluk of S.E. Australia have two moieties called Rrokitch and Gamutch, each of which is sub-divided into a number of clans. Associated with each moiety in rather arbitrary fashion is a long list of animals, plants, etc.; in fact, the native concept is that everything in the world is either Krokitch or Gamutch. This classification is carried still further, so that objects regarded as belonging say to Krokitch are sub-divided among the clans composing that moiety. Moreover, suppose a man is a member of a certain clan in the Krokitch moiety to which the white cockatoo also belongs, then the white cockatoo is his totem, and he has a series of special observances to fulfil towards it, while he also has a general ritual relation towards all the other objects belonging to his moiety (cf. A. W. Howitt, Native Tribes of S.E. Australia).

Frequently also the dual division of the community seems to stimulate a tendency to emphasize contrasts between the two moieties. One moiety, *e.g.*, is believed to be of local origin, the other to have come from elsewhere; or they are supposed to have different physical and mental characters; or their mythologies and traditions differ; or the one is regarded as superior to the other; or their names are antithetical, *e.g.*, the widespread Australian names "Eaglehawk" (white) and "Crow" (black).

Sometimes, as in Melanesia, the moieties are apparently even hostile, and each regards the other with dislike and suspicion. All such distinctions bring out the fundamental significance of the dual organization in the structure of the community.

Theories **of** Origin. — The dual organization is ascribed sometimes to a process of fission whereby a single group came to be divided into two moieties. On the other hand, Rivers (The History of Melanesian Society, chap. xxxviii.), emphasizing the ideas of contrast between the two moieties as found in Melanesia, believed that the dual organization there developed as the result of the intermixture of two distinct peoples, one of which migrated into the region and set up a social system in co-operation with the communities it found there. This idea is carried still further, by not restricting the term "dual organization" to the moiety system, to which alone it applies, but extending it to dualism of every form—economic, political, religious, mythological, etc.—regarded as having originated in Egypt as the result of a process whereby a duality of ruling groups became completely superposed on a duality of a territorial nature (Upper and Lower Egypt), and as having spread with these characteristics to all parts of the world where it is now found (cf. W. J. Perry, The Children of the Sun.) This theory however, suffers from defects which render it unacceptable.

All theories which attempt to find a single origin for the dual organization are inadequate. This mode of social structure cannot be regarded either as the invention of one people or as the result of one particular social process. It is a recurring institution that has arisen many times in different places — now by the reduction of clans, now by the fusion of two inter-marrying groups, and again by other processes. No one theory of origin can be laid down as conclusive: each occurrence must receive special investigation. (I. S.)

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DUARS, a tract of country in north-east India consisting of the Western and the Eastern Duars, both of which belonged to Bhutan prior to the Bhutan War of 1864–65; as a result of this they passed into possession of the British, when the Eastern Duars were assigned to Assam and the Western to Bengal. The Eastern Duars, 1,570 sq.m., are in the Goalpara district of Assam, forming a strip of flat country lying beneath the Bhutan mountains. It is but slightly developed and sparsely populated. The Western Duars, 1,862 sq.m., lie at the foot of the Himalayas in the north-east of the Jalpaiguri district of Bengal. They are traversed by the Bengal-Duars railway and are an important centre of the tea-planting industry.

DU BARRY, MARIE JEANNE BECU, COMTESSE (1746–1793), French adventuress, mistress of Louis XV., was born at Vaucouleurs on Aug. 19, 1746, the illegitimate daughter of a tax collector. She lived as a courtesan in Paris under the name of Mdlle. Lange, and Jean, comte du Barry, took her into his house to make it more attractive to the dupes whose money he won by gambling. Through Lebel, valet de chambre of Louis XV., and the duc de Richelieu, he succeeded in installing her, in 1769, as official mistress of the king, after a nominal marriage with Guillaume du Barry. The duc de Choiseul, who refused to acknowledge her, was disgraced in 1771; and the duc d'Aiguillon, who had the reputation of being her lover, took his place, and in concert with her governed the monarch. Louis XV. built for her the mansion of Luciennes. At his death in 1774 an order of his successor banished her for a brief period to the abbey of Pont-aux-Dames, near Meaux. She led a retired life at Luciennes with the comte de Cossé-Brissac. Having gone to England in 1792 to endeavour to raise money on her jewels, she was on her return accused before the Revolutionary Tribunal of having conspired against the republic. She was condemned to death on Dec. 7, 1793, and guillotined the same evening. Her contemporaries, scorning her low birth rather than her vices, attributed to her a malicious political rôle of which she was at heart incapable, and have done scant justice to her quick wit, her frank but gracious manners and her seductive beauty. The volume of Lettrcs et Anecdotes (1779) which bears her name was not written by her.

See E. and *J.* de Goncourt, *La du Barry* (Paris, 1880); C. Vatel, *Histoire de Madame du Barry* (1882–83), based on sources; R. Douglas, *The Life and Times* of *Madame du Barry* (1896); Saint-André, *Madame du Barry* (1908).

DU BARTAS, GUILLAUME DE SALLUSTE, SEIGNEUR (1544–1590), French poet, was born near Auch. He was employed by Henry IV. of France in England, Denmark and Scotland; and he commanded a troop of horse in Gascony, under the marshal de Martingan. He was a convinced Huguenot, and cherished the idea of writing a great religious epic in which biblical characters and Christian sentiment were to supplant the pagan mise *en scène* then in fashion. His first epic, Judith, appeared in a volume entitled La Muse *chrétienne* (Bordeaux, 1573). This was followed five years later by his principal work, La *Sepmaine,* a poem on the creation of the world. This work was held by admirers of du Bartas to put him on a level with Ronsard, and

30 editions of it were printed within six years after its appearance. Its religious tone and fanciful style made it a great favourite in England, where the author was called the "divine" du Bartas, and placed on an equality with Ariosto. Spenser, Hall and Ben Jonson all speak of it in the highest terms. King James VI. of Scotland tried his "prentice hand" at the translation of du Bartas's poem *L'Uranie,* and the compliment was returned by the French writer, who translated, as La *Lepanthe,* James's poem on the battle of Lepanto. Du Bartas began the publication of the Seconde *Sepmaine* in 1584. He aimed at a great epic, never completed, which should stretch from the story of the creation to the coming of the Messiah. Du Bartas died in July 1590 in Paris from wounds received at the battle of Ivry. He maintained a reputation abroad long after he had ceased to be read, except by students, in France, where his prolixity proved fatal to his fame.

Joshua Sylvester translated the *Sepmaine* in 1598; other English translations from du Bartas are *The Historie of Judith* . . . (1584), by Thomas Hudson; of portions of the "Weeks" (162j) by William Lisle (1569–1637), the Anglo-Saxon scholar; *Urania* (1589), by Robert Ashley (1565–1641); and Sir Philip Sidney *(see* Florio's dedication of the second book of his translation of Montaigne to Lady Rich) wrote a translation of the first "Week," which is lost. The *Oeuvres complètes* of du Bartas were printed at Paris (1579), Paris and Bordeaux (1611); a selection, *Choix de poésies,* was edited by Benetric and de Gourcutt in 1890. *See* also G. Pellissier, *La Vie et les oeuvres de du Bartas* (1883); H. Ashton, *Du Bartas en Angleterre* (1908).

DUBAWNT or **DOOBAUNT** (Indian Toobaung, *i.e.,* turbid), a river of Mackenzie and Keewatin districts, Canada. It rises in Wholdaia (or Daly) Lake, in 104° 20′ W. and 60° 15′ N., and flows northward to its confluence with the Thelon river, and thence eastward to Chesterfield Inlet, an arm of Hudson Bay.

DUBBO, a municipal town of Lincoln county, Mew South Wales, Australia, on the Macquarie river, a flourishing manufacturing town in a pastoral district with coal and copper in the neighbourhood.

DU BELLAY, GUILLAUME, SIEUR DE LANGEY (1491–1543), French soldier and diplomat, was born at the chbteau of Glatigny, near Montmirail in 1491, of the Angevin family which gave many soldiers to France. Guillaume, the eldest of six brothers, was a soldier, humanist, historian, and the most able diplomat at the command of Francis I. He was taken prisoner at Pavia (1525) and shared the captivity of Francis I. He was sent three times to England in 1529–1530, was occupied with the execution of the treaty of Cambrai and also with the question of Henry VIII.'s divorce. With the help of his brother Jean, then bishop of Paris, he obtained a decision favourable to Henry VIII. from the Sorbonne (July 2, 1530). From 1532 to 1536, though he went three times to England, he was principally employed in uniting the German princes against Charles V.; in May 1532 he signed the treaty of Scheyern with the dukes of Bavaria, the landgrave of Hesse, and the elector of Saxony, and in Jan. 1534 the treaty of Augsburg. During the war of 1537 Francis I. sent him on missions to Piedmont; he was governor of Turin from Dec. 1537 till the end of 1539, and subsequently replacing Marshal d'Annebaut as governor of the whole of Piedmont, he displayed great capacity in organization. But at the end of 1542, overwhelmed by work, he was compelled to return to France, and died near Lyons on Jan. 9, 1543. Rabelais, an eye-witness, has left a moving story of his death (Pantagruel, iii. ch. 21, and iv. ch. 27). Charles V. is said to have remarked that Langey, by his own unaided efforts, did more mischief and thwarted more schemes than all the French together.

Without actually joining the reformers Guillaume du Bellay defended the innovators against their fanatical opponents. In 1534–35 he even tried, unsuccessfully, to bring about a meeting between Francis I. and Melanchthon; and in 1541 he intervened in favour of the Vaudois. Rabelais was the most famous of his clients, and followed him to Piedmont from 1540 to 1542. Guillaume was himself a clear and precise writer. He imitated Livy in his Ogdoades, a history of the rivalry between Francis I. and the emperor from 1521, of which fragments were inserted by his brother Martin du Bellay (d. 1559) in his *Mémoires* (1569). The celebrated *Instructions,* reprinted as Trait6 de la discipline *militaire* in 1554 and 1592 and translated into Italian, Spanish and German, are not his (see Bayle, *Dict. Hist.,* i. 502, and Jahns, *Geschichte* der Kriegswissenschaf ten, i. 498 seq.).

See also the edition of Martin du Bellay's *Mémoires* by Michaud and Poujoulat (1838), and Bourrilly's *Fragments de la première Ogdoade* (Paris, 1905). There is an excellent study of Guillaume du Bellay by V. L. Bourrilly (Paris, 1905).

DU BELLAY, JEAN (c. 1493–1560), French cardinal and diplomat, younger brother of Guillaume du Bellay, appears as bishop of Bayonne in 1526, member of the privy council in 1530, and bishop of Paris in 1532. He carried out several missions in England (1527–34) and Rome (1534–36). In 1535 he received his cardinal's hat; in 1536–37 he was nominated "lieutenant-general" to the king at Paris and in the Île de France, and was entrusted with the organization of the defence against the imperialists. When Guillaume du Bellay went to Piedmont, Jean was put in charge of the negotiations with the German Protestants, principally through the humanist Johann Sturm and the historian Johann Sleidan. In the last years of the reign of Francis I., Cardinal du Bellay was in favour with the duchesse d'Étampes, and received many benefices. Under Henry II., being involved in the disgrace of all the servants of Francis I, he was sent to Rome (1547), and he obtained eight votes in the conclave which followed the death of Pope Paul III. After three quiet years passed in retirement in France (1550–53), he was charged with a new mission to Pope Julius III. and took with him to Rome his young cousin the poet Joachim du Bellay (q v.). In 1555 he was nominated bishop of Ostia and dean of the Sacred College. He died at Rome on Feb. 16, 1560. The cardinal had brilliant qualities, was on the side of toleration and protected the reformers. Budaeus was his friend, Rabelais his faithful secretary and doctor; men of letters, like Étienne Dolet, and the poet Salmon Macrin, were indebted to him for assistance. He left three books of graceful Latin poems (printed with Salmon Macrin's Odes, 1546, by R. Estienne), and some other compositions, including Francisci *Francorum regis epistola apologetica* (1542).

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DU BELLAY, JOACHIM (c. 1522–1560), French poet and critic, member of the Pléiade, was born at the chbteau of La Turmelikre, not far from Liré, near Angers, being the son of Jean du Bellay, seigneur de Gonnor, cousin-german of the cardinal Jean du Bellay and of Guillaume du Bellay. Both his parents died while he was still a child, and he was left to the guardianship of his elder brother, René du Bellay, who neglected his education, leaving him to run wild at La Turmelière. When he was 23, however, he went to Poitiers to study law, no doubt with a view to obtaining preferment through his kinsman the cardinal. At Poitiers he came in contact with the humanist Marc Antoine Muret. and with Jean Salmon Macrin (1490–1557), a Latin poet famous in his day. There too he probably met Jacques Peletier, who had published a translation of the Ars *poëtica* of Horace, with a preface in which much of the programme advocated later by the Pléiade is to be found in outline.

It was probably in 1548 that du Bellay met Ronsard in an inn on the way to Poitiers, an event which may justly be regarded as the starting-point of the French school of Renaissance poetry. The two immediately became fast friends. Du Bellay returned with Ronsard to Paris to join the circle of students of the humanities attached to Jean Daurat (*q.v.*) at the Collkge de Coqueret. While Ronsard and Antoine de Baïf were most influenced by Greek models, du Bellay was more especially a Latinist, and perhaps his preference for a language so nearly connected with his own nad some part in determining the more national and familiar note of his poetry. In 1548 appeared the Art *poétique* of Thomas Sibilet, who championed the cause of Clément Marot and his disciples, and poured scorn on the sonnet and on new-fangled ideas.

The famous manifesto of the Pléiade, the *Dkfense et Illustration de la langue française* (1549), was at once a complement and a refutation of Sibilet's treatise. This book was the expression of the literary principles of the Pléiade as a whole, but although Ronsard was the chosen leader, its redaction was entrusted to du Bellay. To obtain a clear view of the reforms aimed at by the Pléiade, the *Deffense* should be further considered in connection with Ronsard's *Abrégé d'art poétique* and his preface to the *Franciade.* Du Bellay maintained that the French language as it was then constituted was too poor to serve as a medium for the higher forms of poetry, but he contended that by proper cultivation it might be brought on a level with the classical tongues. He condemned those who despaired of their mother tongue and used Latin for their more serious and ambitious work. For translations from the ancients he would substitute imitations. Not only were the forms of classical poetry to be imitated, but a separate poetic language and style, distinct from those employed in prose, were to be used. The French language was to be enriched by a development of its internal resources and by discreet borrowing from the Latin and Greek. Both du Bellay and Ronsard laid stress on the necessity of prudence in these borrowings, and both repudiated the charge of wishing to latinize their mother tongue. The book was a spirited defence of poetry and of the possibilities of the French language; it was also a declaration of war on those writers who held less heroic views.

The violent attacks made by du Bellay on Marot and his followers, and on Sibilet, did not go unanswered. Sibilet replied in the preface to his translation (1549) of the *Iphigenia* of Euripides; Guillaume des Autels, a Lyonnese poet, reproached du Bellay with ingratitude to his predecessors, and showed the weakness of his argument for imitation as opposed to translation in a digression in his *Réplique aux furieuses dkfenses de Louis Meigret* (Lyons, 1550); Barthélemy Aneau, regent of the Collège de la Trinité at Lyons, attacked him in his *Quintil Horatian* (Lyons, 1551), the authorship of which was commonly attributed to Charles Fontaine. Aneau pointed out the obvious inconsistency of inculcating imitation of the ancients and depreciating native poets in a work professing to be a defence of the French language. Du Bellay replied to his various assailants in a preface to the second edition (1550) of his sonnet sequence *Olive,* with which he also published two polemical poems, the *Musagnaeomachie,* and an ode addressed to Ronsard, *Contre les envieux poktes. Olive,* a collection of love-sonnets written in close imitation of Petrarch, first appeared in 1549. With it were printed 13 odes entitled *Vers lyriques.* Du Bellay did not actually introduce the sonnet into French poetry, but he acclimatized it.

About this time du Bellay had a serious illness of two years' duration, from which dates the beginning of his deafness. He had further anxieties in the guardianship of his nephew. The boy died in 1553, and Joachim, who had up to this time borne the title of sieur de Liré, became seigneur of Gonnor. In 1549 he had published a *Recueil de poësies* dedicated to the Princess Marguerite. This was followed in 1552 by a version of the fourth book of the *Aeneid,* with other translations and some occasional poems. In the next year he went to Rome as one of the secretaries of Cardinal du Bellay. To the beginning of his four and a half years' residence in Italy belong the 47 sonnets of his *Antiquités de Rome,* which were rendered into English by Edmund Spenser (*The Ruins of Rome,* 1591). These sonnets were more personal and less imitative than the *Olive* sequence, and struck a note which was revived in later French literature by Volney and Chateaubriand. His stay in Rome was, however, a real exile. His duties were those of an intendant. He had to meet the cardinal's creditors and to find money for the expenses of the household. Nevertheless he found many iriends among Italian scholars, and formed a close friendship with another exiled poet whose circumstances were similar to his own, Olivier de Magny. Towards the end of his sojourn in Rome he fell violently in love with a Roman lady called Faustine, who appears in his poetry as Columba and Columbelle. This passion finds its clearest expression in the Latin poems. Faustine was guarded by an old and jealous husband, and du Bellay's eventual conquest may have had something to do with his departure for Paris at the end of Aug. 1557. In the next year he published the poems he had brought back with him from Rome, the Latin *Poemata,* the *Antiquités de Rome,* the *Jeux rustiques,* and the 191 sonnets of the *Regrets,* the greater number of which were written in Italy. The *Regrets* show that he had advanced far beyond the theories of the *Deffense.* The simplicity and tenderness specially characteristic of du Bellay appear in the sonnets telling of his unlucky passion for Faustine, and of his nostalgia for the banks of the Loire. Among them are some satirical sonnets describing Roman manners, and the later ones written after his return to Paris are often appeals for patronage. His intimate relations with Ronsard were not renewed; but he formed a close friendship with the scholar Jean de Morel, whose house was the centre of a learned society. In 1559 du Bellay published at Poitiers *La Nouvelle Manière de faire son profit des lettres,* a satirical epistle translated from the Latin of Adrien Turnèbe, and with it *Le Pokte courtisan,* which introduced the formal satire into French poetry. These were published under the pseudonym of J. Quintil du Trousay, and the courtier-poet was generally supposed to be Melin de Saint-Gelais, with whom du Bellay had always, however, been on friendly terms.

A long and elequent *Discours au roi* (detailing the duties of a prince, and translated from a Latin original written by Michel d l'Hôpital, now lost) was dedicated to Francis II. in 1559, and is said to have secured for the poet a tardy pension. In Paris he was still in the employ of the cardinal, who delegated to him the lay patronage which he still retained in the diocese. In the exercise of these functions Joachim quarrelled with Eustache du Bellay, bishop of Paris, who prejudiced his relations with the cardinal, less cordial since the publication of the outspoken *Regrets.* His chief patron, Marguerite de Valois, to whom he was sincerely attached, had gone to Savoy. Du Bellay's health was weak; his deafness seriously hindered his official duties; and on Jan. 1, 1560, he died. There is no evidence that he was in priests' orders, but he was a clerk, and as such held various preferments.

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DUBLIN, a county of Eire, in the province of Leinster, bounded north by Co. Meath, east by the Irish sea, south by Wicklow, and west by Kildare and Meath. The area is 355.9 sq.mi. and the population (1936) 118,822, apart from Dublin city. Of the population over 70% are Roman Catholics. The county is divided into 100 parishes and its towns include Rathmines, Rathgar, Pembroke, Blackrock. The central and northern portions of the county are low-lying and composed chiefly of carboniferous limestone, with some millstone grit to the north and north-west, and some Silurian and Ordovician rocks behind Balbriggan. The peninsula of Howth, connected by a raised beach with the mainland, is formed of old quartzites and shales, crushed and folded, and probably of Cambrian age. The rocks of the county show many signs of ice-action.

The mountains which occupy the southern border of the county are the extremities of the great group belonging to the adjacent Co. Wicklow (*q.v.*). The principal summits are the group containing Glendoo (1,919 ft.) and Two Rock (1,699 ft.) within the county, and the border group of Kippure, reaching in that summit a height of 2,473 feet.

The mountains are chiefly covered with heath, except where a

subsidence in the ground affords a nucleus for the formation of bog, with which about 2,000 ac. are covered. There are also a few small tracts of bog in the northern part of the county. The mountain district is well adapted for timber. The northern coast of the county from Balbriggan to Howth has generally a sandy shore, and affords only the small harbours of Balbriggan and Skerries. In the promontory of Howth, the coast suddenly assumes a bolder aspect; and between the town of Howth and the rocky islet of Ireland's Eye an unsuccessful artificial harbour was constructed. Kingstown harbour on the south side of Dublin bay superseded this, and is by far the best in the county. The chief river is the Liffey, which rises in the Wicklow mountains about 12 m. S.W. of Dublin, and empties itself into Dublin bay. The course of the river is so tortuous that 40 m. may be traversed and only ten gained in direction.

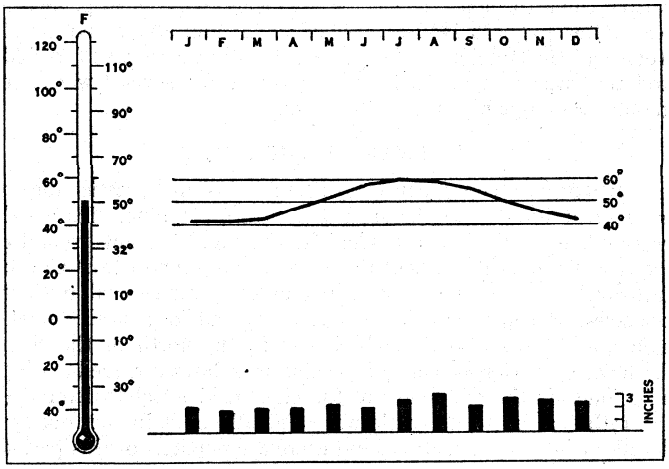
Dublin is among the counties generally considered to have been formed by King John, and comprised the chief portion of country within the English pale. The limits of the county, however, were uncertain. and underwent many changes before they were fixed. As late as the 17th century the mountainous country south of Dublin offered a retreat to the lawless, and it was not until 1606 that the boundaries of the county received definition in this direction, along with the formation of county Wicklow. Although so near the seat of government much land was forfeited in the Rebellion of 1641 and in the Revolution of 1688. In 1867 the most formidable of the Fenian risings took place near the village of Tallaght, about 7 m. from the city. Raths or encampments are frequent, and there are also dolmens and round towers.

The extension of Dublin city and its suburbs has no doubt had its influence on the decrease of acreage under both tillage and pasture. Oats and potatoes are the principal crops, but live stock, especially cattle, receives greater attention. A large proportion of the land holdings are smaller than one acre. The manufactures of the county are mainly confined to the city and suburbs, but there is manufacture of cotton hosiery at Balbriggan. Fisheries, both deep-sea and coastal, are important, and Kingstown is the headquarters of the fishery district. The salmon fishery district of Dublin also affords considerable employment. The communications of the county are good, several important railways and two canals converging upon the city of Dublin, under the head of which they are considered. Co. Dublin returns five members to Dáil Eireann.

DUBLIN, county borough and seaport, and the metropolis of Eire. It lies at the head of a bay of the Irish Sea, to which it gives name, about midway on the eastern coast of the island, and 70 mi. W. of Holyhead. The Gaelic name, Baile Atha Cliath, "Town of the Ford of the Hurdles," is now used by the Post Office. Pop. (1936) 468,103. (For map, *see* IRELAND.)

History.—The name of Dublin signifies the "Black pool." It is recorded that the inhabitants of Leinster were defeated by the people of Dublin in the year 291. Christianity was introduced by St. Patrick about 450. In the 9th century the Danes took Dublin. The first Norse king was Thorkel I. (832), though the Danes had appeared in the country as early as the close of the previous century. Thorkel established himself strongly at Armagh. In 1014 Brian Boroihme, king of Munster, fought the battle of Clontarf against the Danes, and he and his son and 11,000 of his followers fell. The Irish, however, won the battle, but the Danes reoccupied the city. Constant struggles with the Irish resulted in intermissions of the Danish supremacy from 1052 to 1072, at various intervals between 1075 and 1118 and from 1124 to 1136. The Danes were finally ousted by the Anglo-Normans in 1171. In 1172 Henry II. came to Dublin and held his court there. Previous to his departure for England, Henry bestowed the government on Hugh de Lacy, having granted by charter "to his subjects of Bristol his city of Dublin to inhabit, and to hold of him and his heirs for ever, with all the liberties and free customs which his subjects of Bristol then enjoyed at Bristol and through all England." In 1176 Strongbow, earl of Pembroke, died in Dublin and was buried in Christ Church cathedral. A fresh charter was granted in 1207 by King John to the inhabitants of Dublin, who were at constant feud with the native Irish. In 1216 Magna Carta was granted to the Irish by Henry III. In 1217 the fee farm of the city was granted to the citizens at a rent of 200 marks per annum; and about this period many monastic buildings were founded. In 1227 the same monarch confirmed the charter of John fixing the city boundaries and the jurisdiction of its magistrates.

During the invasion of Ireland by Edward Bruce in 1315 some of the suburbs of Dublin were burnt to prevent their falling into



GRAPH OF THE AVERAGE TEMPERATURE IN DUBLIN THROUGH THE YEAR
The mercury in the thermometer stands at the normal annual mean temperature. The curve shows the normal monthly mean temperature through the year. The columns below indicate the normal precipitation for each month

his hands. The inroad of Bruce had been countenanced by native Irish ecclesiastics, whose sentiments were recorded in a statement to Pope John XXII.

Richard II. erected Dublin into a marquisate in favour of Robert de Vere, whom he also created duke of Ireland. The same monarch entered Dublin in 1394, and after holding a parliament and making much courtly display before the native chieftains, returned to England. Five years later Richard returned to Ireland and visited Dublin, where he remained a fortnight.

In 1534 Lord Thomas Fitzgerald, son of the Lord Deputy Kildare, organized a rebellion against the English Government and attacked the city of Dublin itself, but raised the siege on certain conditions. After many vicissitudes, Lord Thomas and others were executed at Tyburn in 1536.

At the outbreak of civil war in 1641, a conspiracy to seize Dublin Castle was disclosed, and the city was thus preserved for the king's party; but the Irish outside began an indiscriminate extermination of the Protestant population. In 1646 Dublin was besieged unsuccessfully by the Irish. The city had been put in an efficient state of defence by the marquess of Ormonde, then lord-lieutenant; but in the following year, to prevent its falling into the hands of the Irish, he surrendered it on conditions to Colonel Jones, commander of the Parliamentary forces. In 1649 Ormonde was totally defeated at the battle of Baggotrath, near Old Rathmines, in an attempt to recover possession. The same year Cromwell landed in Dublin, as commander-in-chief under the parliament.

When James II. landed in Ireland in 1689 to assert his right to the British throne, he held a parliament in Dublin, which passed acts of attainder against upwards of 3,000 Protestants. The governor of the city, Colonel Luttrell, at the same time issued a proclamation ordering all Protestants not housekeepers, excepting those following some trade, to depart from the city within 24 hours, under pain of death or imprisonment, and in various ways restricting those who were allowed to remain. In the hope of relieving his financial difficulties, the king depreciated the coinage. After his defeat at the battle of the Boyne, James returned to Dublin for a few hours. William III. on the following day proceeded in state to St. Patrick's cathedral to return thanks for his victory.

In 1783 a convention of delegates from all the volunteer corps in Ireland assembled in Dublin for the purpose of procuring a

reform in parliament; but the House of Commons refused to entertain the proposition. In May 1798 a conspiracy planned by the United Irishmen to seize the city was frustrated. In 1803 an insurrection broke out, but was immediately quelled, with the loss of some lives in the tumult, and the death of its leaders on the scaffold. In 1848 the lower classes in Dublin were greatly agitated, but the city was saved from much bloodshed. In 1867 the most serious of modern conspiracies, that known as the Fenian organization, came to light. The Habeas Corpus Act was suspended at one sitting by both Houses of Parliament and about 960 arrests were made in Dublin in a few hours. Dublin Castle was fortified; and the citizens lived in a state of terror for several weeks together. For later history, see IRELAND.

GROWTH OF THE CITY

Buildings.— The expansion of Dublin from a castle nucleus is of great interest to the student of town-planning. The castle was built on a ridge overlooking the river and the low ground to the east. Within the limits of the old walls are found Christ Church cathedral, the city hall, municipal offices, and several business premises. Speed's map of 1610 gives a good idea of this settlement and shows also some buildings to the north of the river. With the exception of some of the churches, however, the buildings now found in the old centre of the city are themselves later than the 17th century. The castle was originally built in the first two decades of the 13th century, and there are portions of this period, but nearly the whole is of the 16th century and later.

The cathedral of Christ Church, or Holy Trinity, was founded by Sigtryg, a Christianized king of the Danes of Dublin, in 1038, but dates its elevation to a deanery and chapter from 1541. It was restored in 1870–77 by G. E. Street, who rebuilt the choir and south side of the nave, but the model of the ancient building was followed with great care. The crypt embodies remains of the founder's work; the rest is Transitional Norman and Early English in style. Among the monuments is that of Strongbow, the invader of Ireland, to whom the earlier part of the superstructure (1170) is due. Here the tenants of the church lands were accustomed to pay their rents. Synods were occasionally held in this church, and parliaments also, before the Commons' Hall was destroyed in 1566. Here also the pretender Lambert Simnel was crowned.

The portions of the city immediately around the castle nucleus represent the development up to the first half of the 19th century. There was considerable growth to the north of the river where Sackville (O'Connell) street is one of the principal thoroughfares, although it was badly damaged in 1922. In it is the Nelson pillar, 134 ft. in height with a statue of the admiral on the top. Farther to the east are the docks. The customs house was destroyed in 1922 but was rebuilt. The most interesting buildings, however, are to the south of the river.

A short distance south from Christ Church, through the squalid quarter of Nicholas and Patrick streets, stands the cathedral dedicated to St. Patrick, the foundation of which was an attempt to supersede the older foundation of Christ Church, owing to jealousies, both ecclesiastical and political, arising out of the Anglo-Norman invasion. It was founded about 1190 by John Comyn. archbishop of Dublin; but there was a church dedicated to the same saint before. It was burnt about 200 years later, but was rebuilt. At the Reformation it was deprived of its status as a cathedral, and the building was used for some of the purposes of the courts of justice. Edward VI. contemplated its change into a university, but the project was defeated. In the succeeding reign of Mary, St. Patrick's was restored to its original purpose. The installations of the knights of St. Patrick were originally held here. This cathedral contains the monument of Dean Swift. Attached to the cathedral is Marsh's library, incorporated in 1707, by a request of Primate Marsh, archbishop of Armagh.

Westmoreland street is a continuation to the south of Sackville street and, where it meets Dame street, which leads up to the castle, are situated the Bank of Ireland and Trinity college. The Bank of Ireland was formerly the House of Parliament. There are three fronts; the principal, towards College Green, is a colonnade of the Ionic order, with facade and two projecting wings; it connects with the western portico by a colonnade of the same order, forming the quadrant of a circle. The eastern front, which was the entrance of the House of Lords, is of the Corinthian order. The House of Lords contains tapestry dating from 1733, and remains in its original condition, but the octagonal House of Commons was demolished by the bank directors. The building was begun in 1729, but the fronts date from the end of the century; the remodelling took place in 1803.

Trinity College.— Trinity college, or the University of Dublin, founded in 1591, has a Palladian façade (1759), with two statues by Foley, of Goldsmith and Burke. Above the gateway is a hall called the Regent House. The first quadrangle, Parliament square, contains the chapel (1798), with a Corinthian portico, the public theatre or examination hall (1787), containing portraits of Queen Elizabeth, Molyneux, Burke, Bishop Berkeley and other celebrities, and the wainscoted dining-hall, also containing portraits. A beautiful campanile (1853) occupies the centre of the square. The library is one of those scheduled in the Copyright Act as entitled to receive a copy of every volume published in the United Kingdom. There is a notable collection of early Irish manuscripts, including the ornamented Book of Kells, containing the gospels. The building was begun in 1712. In this square are the oldest buildings of the foundation, dating in part from the close of the 17th century, and the modern Graduates' Memorial buildings (1904). These contain a theatre, library and reading-room, the rooms of the college societies and others. The schools form a fine modern pile (1856), and other buildings are the provost's house (1760), printing house (1760), museum (1857) and the medical school buildings, in three blocks, one of the best schools in the kingdom. Other buildings of the 20th century include chemical laboratories. The college (recreation) park and fellows' garden are of considerable beauty. The college observatory is at Dunsink, about 5 m. N.W. of Dublin. It was erected in 1785, and in 1791 was placed by statute under the management of the royal astronomer of Ireland, whose official residence is here. The magnetic observatory of Dublin was erected in the years 1837–38 in the gardens attached to Trinity college, at the expense of the university. A normal climatological station was established in the fellows' garden in 1904. The botanic garden is at Ball's Bridge, 1 m. S.E. of the college.

The outer portions of the city extending as far as the circular road which skirts the periphery date from the second half of the 19th century, whilst beyond this boundary has been some more recent development. The congestion in the tenements of the older quarter has to some extent been relieved, although much remains to be done. Near St. Stephen's Green is University college, which occupies the site of the International Exhibition of 1865. University college is one of the constituent colleges, with Cork and Galway, of the National University of Ireland.

COMMERCE AND TRANSPORTATION

Trade.— Dublin was for long stigmatized as lacking, for so large a city, in the proper signs of commercial enterprise. About the time of the Revolution, the woollen trade flourished in Dublin, and the produce attained great celebrity. The cheapness of labour attracted capitalists, who started extensive factories in that quarter of the town known even now as the Liberties. This quarter was inhabited altogether by workers in wool. About 1700 the English legislature prevailed on William III. to assent to laws which directly crushed the Irish trade. All exportation except to England was forbidden, and the woollen manufacture soon decayed. But at the close of the 18th century there were 5,000 persons at work in the looms of the Liberties. About 1715 parliament favoured the manufacture of linen, and the Linen Hall was built. The cotton trade was soon afterwards introduced; and silk manufacture was begun by the Huguenots, who had settled in Dublin in considerable numbers after the revocation of the edict of Nantes. Acts favourable to these enterprises were passed, and they flourished apace. But the old jealousy arose in the reign of George I., and in the reign of George III. an Act was passed which tended directly to the ruin of the manufacture. The linen shared the same fate. Dublin poplins, however, keep their reputa-

tion. However adverse influences may have been combated, Dublin yet produces little for export save whisky and porter; but a considerable export trade, principally in agricultural produce, passes through Dublin from the country. To the manufacturing industries of the city there should be added mineral water works, biscuit-making, glass-making, cigarette-making, foundries and shipbuilding.

By continual dredging a great depth of water is kept available in the harbour. The Dublin Port and Docks Board, which was created in 1898, undertook considerable works of improvement at the beginning of the 20th century. These improvements, *inter alia*, enabled vessels drawing up to 23 ft. to lie alongside the extensive quays which border the Liffey, at low tide. The extensive Alexandra tidal basin, on the north side of the Liffey, admits vessels of similar capacity. The Custom House Works on the north side have about 17 ft. of water. With docks named after them are connected the Royal and Grand canals, passing respectively to north and south of the city, the one penetrating the great central plain of Ireland on the north, the other following the course of the Liffey, doing the same on the south, and both joining the river Shannon. The docks attached to the canals, and certain other smaller docks, are owned by companies. Vessels entering these pay tolls, but not those entering docks under the Board.

The direct route to Dublin from London and other parts of England is by the Holyhead route, controlled by the L.M.S.R. with steamers to the port of Dublin itself, while the company also works in conjunction with the mail steamers of the City of Dublin Steam Packet Company to the outlying port of Kingstown, 7 mi. S.E. Passenger steamers, however, also serve Liverpool, Heysham, Bristol, the south coast ports of England and London; Edinburgh and Glasgow, and other ports of Great Britain. The railways leaving Dublin are the following: the Great Northern, with suburban lines and a main line running north to Drogheda, Dundalk and Belfast, with ramifications through the northern counties; the Great Southern to Kilkenny, Athlone and Cork; the Midland Great Western to Cavan, Sligo and Galway; and there is the North Wall station of the L.M.S.R., with the line known as the North Wall extension, connecting with the other main lines. The internal communications of the city are excellent, electric tramways which connect all the principal suburbs. The county borough of Dublin is divided into four constituencies—Dublin North-East returning three members, Dublin North-West returning five, Dublin South returning seven, and Dublin Townships three to Dáil Eireann. Dublin is governed by an elected council and a manager. The council's powers are restricted to imposing rates, raising loans and making by-laws. Other functions are performed by the manager, a paid official who has power over all municipal officers and whose own removal is subject to central authority.

See W. Harris, *History and Antiquities of the City of Dublin* (1766); Sir J. T. Gilbert, *History of the City of Dublin* (1859); L. J. Vogt, *Dublin som Norsk By* (Christiania, *1896*); *The Dublin Civic Survey*, vol. ii. of the publications of the Civics Institute of Ireland (1925).

DUBLIN, a city of Georgia, U.S.A., on the Oconee river, 125m. S.E. of Atlanta; the county seat of Laurens county. It is on Federal highway 80, and is served by the Central of Georgia, the Macon, Dublin and Savannah and the Wrightsville and Tennille railways. The population was 6,681 in 1930 (46% Negroes) and it was 7,814 in 1940 by the federal census. It is a shipping point for various agricultural products, lumber and naval stores, and has cotton compresses, cottonseed-oil mills, fertilizer plants and wood-working industries. The city was incorporated in 1812.

DUBNER, JOHANN FRIEDRICH (1802–1867), German classical scholar (naturalized a Frenchman), was born in Horselgau, near Gotha. In 1832 he was invited by the brothers Didot to Paris, to co-operate in a new edition of H. Etienne's Greek *Thesaurus*, and edited many volumes in Didot's *Bibliotheca Graeca*. He received the Legion of Honour for his edition of Caesar, undertaken by command of Napoleon III. His editions did much to raise the standard of classical scholarship in France. He violently attacked Burnouf's method of teaching Greek, but without result. Dübner may have gone too far in his zeal for reform, but time has shown him to be right. The old text-books have been discarded, and a great improvement in classical teaching has taken place.

See F. Godefroy, *Notice sur J. J. Dübner* (1867); Sainte-Beuve, *Discours à la mtmoire de Dubner* (1868); article in *Allgemeine Deutsche Biographie.*

DUBOC, JULIUS (1829–1903), German author and philosopher, was born on Oct. 10, 1829, at Hamburg, and died on June 11, 1903, at Dresden. He studied at both Leipzig and Berlin and became a disciple of Feuerbach. Evolutionary monism, atheism, and the doctrine that pleasure is the end of all human activity find expression in his works, which include *Soziale Briefe* (3rd ed. 1873); *Die Psychologie der Liebe* (1874); *Das Leben ohne Gott* (1875); *Hundert Jahre Zeitgeist in Deutschland* (1889); and *Die Lust als sozialethisches Entwicklungsprinzip* (1900).

DUBOIS, FRANÇOIS CLEMENT THEODORE (1837–1924), French musical composer, was born at Rosney (Marne) on Aug. 24, 1837. He studied at the Conservatoire under Ambroise Thomas, and won the Grand Prix de Rome in 1861 with his cantata *Atala*. On his return to Paris he was appointed "maitre de Chapelle" at the church of Ste. Clotilde. where César Franck was organist. Here he produced *Les Sept Paroles du Christ* (1867), a work which has become well known in France. In 1868 he became "maitre de Chapelle" at the Madeleine, and nine years later succeeded Camille Saint-Saens there as organist. He became professor of harmony at the Conservatoire in 1871, and was appointed professor of composition in succession to Leo Delibes in 1891. At the death of Ambroise Thomas in 1896 he became director of the Conservatoire; he retired in 1905. Dubois was an extremely prolific composer and wrote in a variety of forms. His sacred works include four masses, a requiem, a large number of motets and pieces for organ. For the theatre he composed a light opera, *La Guzla de l'Émir*, (Athenée, April *30*, 1873); a one-act piece, *Le Pain bis* (Opéra Comique, Feb. 26, 1879); a ballet, *La Farandole* (Grand Opera, Dec. 14, 1883); *Aben-Hamet*, a four-act opera (Théâtre Italien, Dec. 16, 1884); *Xavidre*, a dramatic idyll in three acts (Opéra Comique, Nov. 26, 1895). His orchestral works include two concert overtures, the overture to *Fritio* (1880), several suites, *Marche héroïque de Jeanne d'Arc* (1888), etc. He was also the author of various sacred works and in addition he composed much for the piano and voice, Dubois died in Paris on June 11, 1924.

DUBOIS, GUILLAUME (1656–1723), French cardinal and statesman, was born at Brive, Corrèze, on Sept. 6, 1656. He received the tonsure at the age of 13, was educated at the college of St. Michel at Paris, and became tutor to the young duke of Chartres, afterwards duke of Orleans. When his pupil became regent (1715) Dubois, who had for some years acted as his secretary, was made councillor of state and the chief power passed into his hands.

His policy was steadily directed towards maintaining the peace of Utrecht. To counteract Alberoni's intrigues for the aggrandizement of Spain, he suggested an alliance with England, and succeeded in negotiating the Triple Alliance (1717). In 1719 he sent an army into Spain, and forced Philip V. to dismiss Alberoni. Otherwise his policy remained that of peace. Dubois's success strengthened him against the bitter opposition of a large section of the court. In spite of his dissolute life he asked the regent to give him the archbishopric of Cambray. His demand was supported by George I., and the regent yielded. In one day all the usual orders were conferred on him, and even Massillon consented to take part in the ceremonies. After long and most profitable negotiations on the part of Pope Clement XI., the red hat was given to him by Innocent XIII. (1721), whose election was largely due to the bribes of Dubois. This cardinalate cost France about 8,000,000 francs. In the following year he was named first minister of France (August).

When Louis XV. attained his majority in 1723 Dubois remained chief minister. He had accumulated an immense private fortune, possessing in addition to his see the revenues of seven abbeys. He died at Versailles on Aug. 10, 1723. His portrait was thus

drawn by the duc de St. Simon: — "He was a little, pitiful, wizened, herring-gutted man, in a flaxen wig, with a weasel's face, brightened by some intellect. All the vices — perfidy, avarice, debauchery, ambition, flattery — fought within him for the mastery. He was so consummate a liar that, when taken in the fact, he could brazenly deny it." This famous picture is certainly biased. Dubois, in spite of his vices, gave France peace after the disastrous wars of Louis XIV.

In 1789 appeared *Vie privée du Cardinal Dubois*, attributed to one of his secretaries, Mongez, and in 1815 his *Mémoires secrets et correspondance ine'dite*, edited by *L.* de Sevelinges. *See* also *A.* Cheruel, *Saint-Simon et E'abbk Dubois; L.* Wiesener, *Le Re'gent, L'abbk Dubois et les Anglais* (1891); and memoirs of the time.

DUBOIS, JEAN ANTOINE (1765–1848), French Cathplic missionary in India, was ordained in the diocese of Viviers in 1792, and sailed for India in the same year under the *Missions Etrangbres.* He at first worked in the southern districts of the present Madras presidency. On the fall of Seringapatam in 1799 he went to Mysore to reorganize the Christian community shattered by Tipu Sultan. He benefited his impoverished flock by founding agricultural colonies and introducing vaccination as a preventive of smallpox. By his fervent desire to understand Hindu life, he gained an extraordinary welcome amongst all castes, and is still spoken of in many parts of south India with affection and esteem as "the prince's son, the noblest of Europeans." His great work, *Hindu Manners, Customs and Ceremonies* (3rd ed., Oxford, 1906) gives a shrewd, clear-sighted, candid account of the manners and customs of the Hindus. Dubois left India in Jan. 1823, and on reaching Paris was appointed director of the *Missions Etrangbres,* of which he afterwards became superior (1836–39). He translated into French the famous book of Hindu fables called *Panchatantra,* and also a work called *The Exploits of the Guru Paramarta.* He died on Feb. 17, 1848.

DUBOIS, LOUIS ERNEST (1856–1929), French ecclesiastic, was born at Saint Calais, France, Sept. 1, 1856. In 1901 he became bishop of Verdun, in 1909 Archbishop of Bourges, and in 1916 of Rouen. He was made cardinal of Santa Maria in Aquino, Rome, by Pope Benedict XV. in Dec. 1916. On the death of Cardinal Amette in 1920, Cardinal Dubois was made Cardinal Archbishop of Paris. He died at Paris on Sept. 23, 1929.

See his *Memoirs* published in 1929.

DUBOIS, PAUL (1829–1905), French sculptor and painter, was born at Nogent-sur-Seine on July 18, 1829, and died on March 22, 1905. After studying at the Ecole des Beaux-Arts, Dubois went to Rome. His first contributions to the Paris Salon (1860) were busts of "The Countess de B." and "A Child." "A Florentine Singer of the Fifteenth Century" was shown in 1865; "The Virgin and Child" appeared in the Paris Universal Exhibition in 1867; from 1873 onwards date the busts of Henner, Dr. Parrot, Paul Baudry, Pasteur, Gounod and Bonnat, remarkable alike for vivacity, likeness, refinement and subtle handling. The chief work of Paul Dubois was "The Tomb of General Lamoricière" in the cathedral of Nantes, a brilliant masterpiece conceived in the Renaissance spirit, with allegorical figures and groups representing Warlike Courage, Charity, Faith and Meditation, with basreliefs and enrichments. The statue of the "Constable Anne de Montmorency" was executed for Chantilly, and that of "Joan of Arc" (1889) for the town of Reims. In 1873 Dubois was appointed keeper of the Luxemburg museum. He succeeded Guillaume as director of the École des Beaux-Arts, 1878, and Perraud as member of the Académie des Beaux-Arts.

DUBOIS, PIERRE (*c.* 1250–*c.* 1312), French publicist in the reign of Philip the Fair, was educated at the university of Paris. In 1300, he wrote his anonymous *Summaria, brevis et compendiosa doctrina felicis expedicionis et abbreviationis guerrarum et litium regni Francorum,* which is extant in a unique ms., but is analysed by N. de Wailly in the *Bibliothbque de l'École des Chartes* (2nd series, vol. iii.). In the contest between Philip the Fair and Boniface VIII. Dubois identified himself with the secularizing policy of Philip. His *Supplication du pueble de France au roy contre le pape Boniface le VIII^e^,* printed in 1614 in *Acta infer Bonifacium VIII. et Philippum Pulchrum,* dates from 1304, and is a heated indictment of the temporal power. He represented Coutances in the states-general of 1302, but in 1306 he was serving Edward I. as an advocate in Guienne, without apparently abandoning his Norman practice by which he had become a rich man. His treatise *De recuperatione terrae sanctae,* outlining the conditions for a successful crusade, was written in 1306, and dedicated in its extant form to Edward I., though it is certainly addressed to Philip. Dubois's ideas on education, on the celibacy of the clergy, and his schemes for the codification of French law, were far in advance of his time. He was an early and violent "Gallican," and the first of the great French lawyers who occupied themselves with high politics. In 1308 he attended the states-general at Tours. He is generally credited with *Quaedam proposita papae a rege super facto Templariorum,* a draft epistle supposed to be addressed to Clement by Philip.

See an article by E. Renan in *Hist. litt. de la France,* vol. xxvi. pp. 471–536; P. Dupuy, *Hist. de la condamnation . . . des Templiers* (Brussels, 1713), and *Hist. du différend entre le pape Boniface VIII. et Philippe le Bel* (Paris, 1655); and *Notices et extraits de manuscrits,* vol. xx. *E.* Zeck, *Pierre Dubois,* etc. (1911).

DUBOIS, a city of Clearfield county, Pa., U.S.A., on Sandy Lick creek, 85 mi. N.E. of Pittsburgh. It is on federal highways 119, 219 and 322, and is served by the Baltimore and Ohio and the Pennsylvania railways. The population in 1920 was 13,681; in 1930 it was 11,595; in 1940, 12,080 by federal census. The city is built on a small plateau surrounded by hills, on the western slope of the Allegheny mountains, nearly 1,400 ft. above sea level It is an important coal and lumber centre, and has various manufacturing industries, including large coal-car shops, foundry and machine shops, flour and lumber mills, wood-working plants, tanneries and others, with an aggregate output in 1937 valued at $1,938,514. The city was founded in 1872 by John DuBois, and was incorporated in 1881.

DUBOIS-CRANCE, EDMOND LOUIS ALEXIS (1747–1814), French revolutionary, born at Charleville, was elected deputy to the states-general in 1789 by the third estate of Vitry-le-Franqois. At the Constituent assembly, of which he was named secretary in Nov. 1789, he worked for the replacement of the old military system, with its caste distinctions and its mercenaries, by national guards open to all citizens. In his report on Dec. 12, 1789, he adumbrated the idea of *conscription.* He secured the Assembly's vote that any slave who touched French soil should become free. Elected to the Convention by the department of the Ardennes, he sat among the *Montagnards.* In the trial of Louis XVI. he voted for death without delay or appeal. On Feb. 21, 1793, he was named president of the Convention. He composed a remarkable report on the army, recommending the rapid advancement of the lower officers, and the fusion of the volunteers with the veteran troops. In Aug. 1793 Dubois-Crancé was designated "representative on mission" to the army of the Alps, to direct the siege of Lyons. Accused of lack of energy, he was replaced by G. Couthon (*q.v.*). On his return he was excluded from the Jacobin club at the instance of Robespierre. He took part in the revolution of 9th Thermidor of the year II., directed against Robespierre. He was one of the committee of five which had to oppose the Royalist insurrection of Vendémiaire (*see* FRENCH REVOLUTION), and was named a member of the committee of public safety, then much reduced in importance. After the Convention, under the Directory, Dubois-Crancé was a member of the council of the Five Hundred, and was appointed inspector general of infantry; then, in 1799, minister of war. Opposed to the *coup d'état* of the 18th Brumaire, he lived in retirement during the consulate and the empire. He died at Rethel on June 29, 1814.

Among the numerous writings of Dubois-Crancé may be noticed his *Observations sur la constitution militaire, ou bases du travail proposé au comitk militaire. See H. F. T.* Jung, *Dubois de Crancé. L'armke et la Révolution, 1789–1794* (2 vols. 1884).

DU BOIS-REYMOND, EMIL (1818–1896), German physiologist, was born in Berlin on Nov. 7, 1818. His father belonged to Neuchâtel, his mother was of Huguenot descent, and he spoke of himself as "being of pure Celtic blood." He studied geology at Bonn, then anatomy and physiology at Berlin under Johannes Müller. Du Bois-Reymond's graduation thesis on "Electric Fishes," was the beginning of a long series of investigations

on animal electricity. The results of these inquiries were published in his *Untersuchungen über tierische Elektrizität* (2 vols. 1848–84).

This great work may be regarded under two aspects On the one hand, it is a record of the exact determination and approximative analysis of the electric phenomena presented by living beings. On the other hand it contains an exposition of a theory. Du Bois-Reymond developed the view that a living tissue, such as muscle, might be regarded as composed of a number of electric molecules, of molecules having certain electric properties, and that the electric behaviour of the muscle as a whole in varying circumstances was the outcome of the behaviour of these native electric molecules. This theory has perhaps not stood the test of time so well as have Du Bois-Reymond's more simple deductions from observed facts It was early attacked by Ludimar Hermann, who maintained that a living untouched tissue is not the subject of electric currents so long as it is at rest, is isoelectric in substance, and therefore need not be supposed to be made up of electric molecules, all the electric phenomena which it manifests being due to internal molecular changes associated with activity or injury Although most subsequent observers ranged themselves on Hermann's side, Du Bois-Reymond's theory was of great value if only as a working hypothesis, and as such it greatly helped in the advance of science.

For many years, Du Bois-Reymond exerted a great influence as a teacher. In 1858, upon the death of Johannes Müller, he was given the new chair of physiology at Berlin. In 1851 he was elected to the Academy of Sciences of Berlin, and in 1867 became its perpetual secretary. From 1857 to 1877, he was co-editor of the *Archiv fur Anatomie* His principal work, other than the one on electricity, is *Gesammelte Abhandlungen zur allgemeinen Muskelund Nervenphysik* (2 vols., 1875–77) He died Nov. 26, 1896.

See J. Burdon Sanderson in *Nature* (vol. iv, 1897).

DUBROVNIK (Ital *Ragusa*), a port of Dalmatia, Yugoslavia. Pop. 18,767 Dubrovnik was known as Ragusa from before the 10th century, but upon its incorporation in the newly-formed state of Yugoslavia in 1918, its name was officially changed to Dubrovnik. The name is commonly thought to be derived from the Slavonic *dubrava,* "woody," though this derivation has been questioned.

It is by far the most picturesque city on the Dalmatian coast, occupying a promontory jutting out into the sea under the bare limestone mass of Mt. Sergio. The seaward fortifications rise directly from the water's edge, while a massive round tower dominates the city on the landward side. Beyond the walls, mostly a double line, which have always been the pride of Dubrovnik, are many villas, surrounded by gardens. The Stradone, or main street, runs along a narrow valley, which until the 13th century was a marshy channel, dividing the Latin island of Ragusa from the forest settlement of Dubrovnik.

Dubrovnik first became prominent during the 7th century In 639 and 6j6 the flourishing Latin communities of Salona and Epidaurus were destroyed by the Avars, and the island rock of Ragusa was colonized by the survivors. A colony of Slavs soon joined the Latin settlers at Ragusa, and thus, from an early date, the city formed a link between two great civilizations *(see* VLACHS). During the 9th, 10th, 11th and 12th centuries, Ragusa defended itself against attacks by foreign powers, but from 1205 to 1358 it acknowledged Venetian suzerainty. Ragusan policy during this period was usually peaceful. To refugees of all nations the city afforded asylum; and by means of treaty and tribute it worked its way to a position of great mercantile power. It was conveniently situated at the seaward end of a great trade route, which bifurcated at Plevlje to Byzantium and the Danube. Ragusan trade flourished, both by land throughout the Balkans; and by sea in the Mediterranean region, in northern Europe, and in the 16th century, even as far as America and India From 1358 to 1526, Ragusa was a vassal state of Hungary, but the downfall of Hungary in 1526 left the city free. About this time a great development of art and literature, begun in the 1 jth century and continued into the 17th, earned for the city its title of the "South Slavonic Athens." After this period, however, the importance of Ragusa declined. The conquest of the Balkans by the Turks and the misrule of Hungary in Dalmatia ruined its commerce, and the discovery of America reduced the importance of the Mediterranean ports. In 1667 an earthquake destroyed a considerable portion of the city and about one-fifth of the inhabitants. Only during the Napoleonic wars did the republic regain its prosperity. From 1800 to 1805 it was the sole Mediterranean state remaining neutral, and thus it secured a large share of the carrying trade. In 1805, however, it was seized by the French. Napoleon deprived it of independence and in 1814 it was annexed to Austria In 1918 it became a part of Yugoslavia and in 1941 it was seized by Italy.

Despite the havoc wrought by the earthquake in 1667, the city is rich in antiquarian interest One church, of the Byzantine period, is mentioned in 13th century documents as being, even then, of great age. Two 14th century convents stand at the ends of the city; for the Franciscans were set to guard the western gate against the hostile Slavs, while the Dominicans kept the eastern one The Rector's palace is one of the masterpieces of Dalmatian architecture. It has a fine façade of six arches. and the capitals of the supporting pillars are curiously carved. One of them bears the figure of Aesculapius, whose traditional birthplace was nearby Epidaurus, whence the Latins migrated in the 7th century to found Ragusa.

The harbour being too small for modern needs and also difficult of approach, Gravosa (Gruz), a village to the N with a good natural harbour became the steamship station and was connected by rail with Dubrovnik. Dubrovnik's industries include the manufacture of liqueurs, cheeses, silk, leather, drawn thread work, metalwork and soap, oil-refining and slate mining. Dates. figs, olives, etc. are cultivated. Malmsey, formerly its most famous wine, was not produced after the vine disease of 1852. There is a secondary school and a naval college. The Grotto of Aesculapius is famous for its stalactites.

LACROMA (Serbo-Croatian Lokrum), an island ½ mi. to the S. is remarkable for the beauty of its vegetation. It was a favourite resort of the Austrian crown prince Rudolph (1857–89), and of the archduke Maximilian, afterwards emperor of Mexico (1832–67), who restored the chateau and park, in which are the ruins of an 11th century Benedictine monastery and a church, locally ascribed to Richard I (1188–99).

See *Lacroma,* by the crown princess Stephanie, afterwards Countess Lonyay (Vienna, 1892).

DUBS, JAKOB (1822–1879), Swiss statesman, was born on July 26, 1822, at Affoltern,and studied law at Heidelberg, Berne and Zürich. After holding various offices in his native canton, he was elected a member and, in 1857, president of the federal court He was president of the Swiss confederation in 1864 and in 1868. He died at Lausanne on Jan. 13, 1879. He published *Die Schweizer Demokratie* (1866) and *Das öffentliche Recht der schweizerischen Eidgenossenschaft* (1877).

DUBUQUE, a city of Iowa, U.S.A., on the Mississippi river, opposite the boundary line between Wisconsin and Illinois; a port of entry and the county seat of Dubuque county. It is served by the Burlington, the Chicago Great Western, the Chicago, Milwaukee, St. Paul and Pacific and the Illinois Central railaays, and by river steamers and barges. Pop. 1930, 41,679; 1940, 43,892.

The business section of the city lies on the lowlands along the river, but most of the residential sections are on the slopes and tops of bluffs, which command extensive and picturesque views. Dubuque has a large traffic by rail and by water, and is winter quarters for the boats operating on the upper Mississippi. It is the centre of the state's lead and zinc mines, which were, however, abandoned because of water in 1918. There is a variety of manufacturing industries (107 plants, producing 371 commodities), with an output valued at $21,980,038 in 1937. A city-manager government was put into operation in 1920. Dubuque is the see of a Roman Catholic archbishop, and is the seat of Loras college for men, formerly Columbia college (established in 1873) and Clarke college for women, formerly Mt. St. Joseph college (established as an academy in 1843), both Roman Catholic institutions, the University of Dubuque (Presbyterian), the outgrowth

of a school started in 1852 by a Presbyterian minister, known especially as a German theological seminary from 1864 to 1905, and organized as a university in 1920, and Wartburg seminary (Lutheran). Twelve miles southwest of the city is a monastery of Trappist monks. Dubuque is the oldest town of Iowa, and until after the Civil War was the largest. In 1788 Julien Dubuque (1765–1810) settled there, attracted by the lead deposits, which were crudely worked by the Sac and Fox Indians, and which he mined until his death. In June 1829, miners from Galena, Ill., attempted to make a settlement, in direct violation of treaties with the Indians, but were driven away by U.S. troops, under orders from Col. Zachary Taylor. White settlers began to come in immediately after the Black Hawk War. A town was laid out under authority of an act of congress (approved July 2, 1836) and in 1841 it was incorporated.

DU CAMP, MAXIME (1822–1894), French writer, was born in Paris. Between 1844 and 1845, and again, in company with Gustave Flaubert, between 1849 and 1851, he travelled in Europe and the East, and made excellent use of his experiences in books published after his return. In 1851 he was one of the founders of the *Revue de Paris* (suppressed in 1858), and he was a frequent contributor to the *Revue des deux mondes*. He served as a volunteer with Garibaldi in 1860, and gave a vivid account of his experiences in his *Expédition des deux Siciles* (1861). Du Camp's *Souvenirs littéraires* (2 vols., 1882–83) contain much information about contemporary writers, especially Gustave Flaubert, of whom he was an early and intimate friend. Du Camp was one of the earliest amateur photographers, and his many books of travel were among the first photographically illustrated.

DU CANGE, CHARLES DU FRESNE, SIEUR (1610–1688), one of the lay members of the great 17th century group of French critics and scholars who laid the foundations of modern historical criticism, was born at Amiens on Dec. 18, 1610. He was educated at the Jesuits' college at Amiens, studied law at Orleans, and afterwards went to Paris, where in 1631 he was received as an advocate before the *parlement*. He had no success at the bar, and soon returned to his native city, where he married and settled. In 1647 he purchased the office of treasurer from his father-in-law. Forced to leave Amiens in 1668 in consequence of a plague, he settled in Paris, where he died Oct. 23, 1688. Of his numerous works the most important are the *Glossarium ad scriptores mediae et infimae latinitatis* (Paris, 1678), and the *Glossarium ad scriptores mediae et infimae graecitatis* (Lyons, 1688), which are indispensable aids to the student of the history and literature of the middle ages.

Du Cange studied the history of the later Roman empire, and wrote *Historia Byzantina duplici commentario illustrata* (Paris 1680), and an introduction to his edition and translation into modern French of Geoffrey de Villehardouin's *Histoire de l'empire de Constantinople sous les empereurs français* (1657). He also brought out editions (1670 and 1686) of the Byzantine historians, John Cinnamus and John Zonaras. His autograph manuscripts in addition to his large and valuable library passed through the hands of many persons before the French Government secured the greater portion of the manuscripts, which were preserved in the imperial library in Paris. Some of these were subsequently published, and the manuscripts are now found in various libraries.

To the three original volumes of the Latin *Glossarium*, three supplementary volumes were added by the Benedictines of St. Maur (Paris, 1733–36), and a further addition of four volumes (1766) by a Benedictine, Pierre Carpentier (1697–1767). There were other editions, and an abridgment with some corrections was brought out by J. C. Adelung (Halle, 1772–84). The edition in seven volumes edited by G. A. L. Henschel (Paris, 1840-50) includes these supplements and also further additions by the editor, and this has been improved and published in ten volumes by Léopold Favre (Niort, 1883–87). An edition of the Greek *Glossarium* was published at Breslau in 1889.

See H. Hardouin, *Essai sur la vie et sur les ouvrages de Ducange* (Amiens, 1849); and L. J. Feugère, in the *Journal de l'instruction publique* (1852).

DUCANGE, VICTOR HENRI JOSEPH BRAHAIN (1783–1833), French novelist and dramatist, was born on Nov. 24, 1783, at The Hague, where his father was secretary to the French embassy. Dismissed from the civil service at the Restoration, Victor Ducange became one of the favourite authors of the Liberal party, and owed some part of his popularity to the fact that he was fined and imprisoned more than once for his outspokenness. He was twice imprisoned for seditious articles in his journal *Le Diable rose, ou le petit courrier de Lucifer* (1822); after the publication of *Hélène ou l'amour et la guerre* (1823), he took refuge in Belgium. Ducange wrote numerous plays and melodramas, including *Marco Loricot, ou le petit Chouan de 1830* (1836), and *Trente ans, ou la vie d'un joueur* (1827). Many of his books were prohibited, ostensibly for their coarseness, but perhaps rather for their political tendencies. He died in Paris on Oct. 15, 1833.

DUCAS, DUKAS or **DOUKAS,** the name of a Byzantine family which supplied several rulers to the Eastern empire. The family first came into prominence during the 9th century, but was ruined when Constantine Ducas, a son of the general Andronicus Ducas, lost his life in his effort to obtain the imperial crown in 913. Towards the end of the 10th century there appeared another family of Ducas, which was perhaps connected with the earlier family through the female line. A member of this family became emperor as Constantine X. in 1059, and Constantine's son Michael VII. ruled, nominally in conjunction with his younger brothers, Andronicus and Constantine, from 1071 to 1078. Michael left a son, Constantine, who married into the family, which was also allied by marriage with other great Byzantine houses, and its members continued to take an active part in public affairs. In 1204 Alexius Ducas, called Mourzoufle, deposed the emperor Isaac Angelus and his son Alexius, and vainly tried to defend Constantinople against the attacks of the Latin crusaders. Nearly a century and a half later one Michael Ducas took a leading part in the civil war between the emperors John V. Palaeologus and John VI. Cantacuzenus, and Michael's grandson was the historian Ducas (*see* below). Many of the petty sovereigns who arose after the destruction of the Eastern empire sought to gain prestige by adding the famous name of Ducas to their own.

DUCAS (15th cent.), Byzantine historian, flourished under Constantine XIII. (XI.) Dragases, the last emperor of the East, about 1450. The dates of his birth and death are unknown. He was the grandson of Michael Ducas (*see* above). After the fall of Constantinople, he was employed in various diplomatic missions by Dorino and Domenico Gateluzzi, princes of Lesbos, where he had taken refuge. He survived the annexation of Lesbos in 1462, but no more is known of him. He was the author of a history of the period 1341–1462. Although barbarous in style, it is both judicious and trustworthy, and it is the most valuable source for the closing years of the Greek empire and the capture of Constantinople. Ducas was a strong supporter of the union of the Greek and Latin churches, and is very bitter against those who rejected even the idea of appealing to the West for assistance against the Turks.

The history, preserved (without a title) in a single Paris MS., was first edited by I. Bullialdus (Bulliaud) (Paris, 1649); later editions are in the Bonn *Corpus scriptorum Hist. Byz.*, by I. Bekker (1834) and Migne, *Patrologia Graeca*, clvii. The Bonn edition contains a 15th century Italian translation by an unknown author, found by L. Ranke in one of the libraries of Venice, and sent by him to Bekker.

DUCASSE, PIERRE EMMANUEL ALBERT, BARON (1813–1893), French historian, was born at Bourges on Nov. 16, 1813. In 1849 he became aide-de-camp to Prince Jerome Bonaparte, ex-king of Westphalia, then governor of the Invalides. He was attaché to Jerome's son, Prince Napoleon, during the Crimean War. He was employed by Prince Napoleon on the *Correspondance* of Napoleon I., and afterwards published certain letters, purposely omitted there, in the *Revue historique*. These documents, subsequently collected in *Les Rois frères de Napoléon* (1883), as well as the *Journal de la reine Catherine de Westphalie* (1893), were edited with little care and are not entirely trustworthy, but their publication threw much light on Napoleon I. and his entourage. Ducasse was also employed by Jerome Bonaparte and his son in the cornpilation of historical accounts of the affairs in which they were concerned.

DUCAT (dŭk'ạt), **a** coin, generally of gold, and of varying value, formerly in use in many European countries. It was first struck by Roger II. of Sicily as duke of Apulia, and bore an

inscription *"Sit tibi, Christe, datus, quem tu regis, iste ducatus"* (Lord, thou rulest this duchy, to thee be it dedicated); hence, it is said, the name. Between **1280** and **1284** Venice also struck a gold coin, known first as the ducat, afterwards as the zecchino or sequin, the ducat becoming merely a money of account. The ducat was also current in Holland, Austria, the Netherlands, Spain and Denmark *(see* NUMISMATICS). A gold coin termed a ducat was current in Hanover during the reigns of George I. and George III. A pattern gold coin was also struck by the English mint in **1887** for a proposed decimal coinage. On the reverse was the inscription "one ducat" within an oak wreath; above "one hundred pence," and below the date between two small roses.

DUCCIO DI BUONINSEGNA *(c.* 1255–1319), Italian painter of the Sienese School. His father's name was Buoninsegna. We learn some facts regarding Duccio's work from the records of the exchequer of the city of Siena *(Libri d'entrata e uscita* of the Biccherna). In **1278** he was employed as a painter by the commune to decorate *cassoni* in which public documents were kept. From **128j** to **1295** he received five commissions to decorate book-covers of the Biccherna. He seems therefore to have been a craftsman at the beginning of his career, and his work on book covers may have brought him in touch with Byzantine illuminations.

According to a document in the state archives at Florence (Milanesi, *Documenti* etc., vol. i. pp. 158–160) he was asked in 1285 to paint a large Madonna for the church of Sta. Maria Novella at Florence. This picture has been identified with the celebrated Ruccellai Madonna, long regarded as the work of Cimabue. In **1295** Duccio was consulted as to the site of the Fonte Nova, a Gothic fountain outside the Porta Ovile of Siena, showing that his knowledge was not confined to painting. In 1302 he was paid for a "Madonna enthroned" in the Palazzo Pubblico of Siena, a picture now lost. In **1308** he began work on the great altarpiece for the Siena cathedral, which he undertook to carry out with his own hand. When the work was completed on June **9,** 1311, a public holiday was proclaimed, and amid the rejoicing crowds the picture was carried in procession to the cathedral, accompanied by the principal men of the city, and placed over the high altar underneath the cupola. This was the climax of Duccio's career. He died eight years later, on Aug. **3,** 1319. His great masterpiece is now preserved in the Opera del Duomo (Cathedral Museum). It adorned a double altar and was painted on both sides. The front represents the "Majestas," the Virgin Enthroned surrounded by angels and saints. The back is made up of small panels representing the life of Christ. Below was a predella, also made up of small panels. Several of these small pictures have found their way to England. Three are in the National Gallery, London. The four of the Benson Collection were acquired by Duveen; and one of these is now in the Frick Collection, New York. The altarpiece is the one fully authenticated work of the master extant, and represents his later style. The following works are attributed to Duccio for stylistic reasons. To his early period belong, besides the Ruccellai Madonna mentioned above, three smaller pictures: the little Madonna with three Franciscans in the Siena Gallery, the Madonna from Count Stroganoff's Collection, and the triptych in the National Gallery representing the Madonna and two saints. These paintings adhere closely to the Byzantine type. In the National Gallery triptych, however, a new influence makes itself felt. Here the gesture of childlike love contrasting with the sad expression in the mother's face is an innovation in Byzantine as well as in Italian art, and marks the direction in which Duccio was to develop. A triptych representing "the Crucifixion" in Buckingham Palace is ascribed to the master's second period. A very fine example of the artist's later period is the Crucifixion in Lord Crawford's collection; this work is contemporary with the altarpiece in the Opera del Duomo. When comparing his later with his early work, we find a marked advance in the expression of emotion. The figures are inspired with virile energy. Moreover, Gothic features are introduced in the architecture and in the rendering of drapery, trees and animals. Nevertheless the Byzantine formulae are closely adhered to as regards the composition of figures. The harmoniously coloured shapes are arranged in an expressive two-dimensioned design, contrasting with the plastic conception of form in the work of Giotto, his younger contemporary. We do not know where Duccio learned his art. Both Vasari and Ghiberti agree that he painted in the "Maniera greca," and it is thought that he may have derived his training directly from Byzantine sources. He may have aimed at a revival of Byzantine painting at a time when the art of Central Italy was hopelessly degenerated. Though his influence was felt in the general development of Sienese art, he had but one or two direct followers: Segna di Buonaventura and Ugolino da Siena. Meanwhile Giotto carried the whole of Italy with him. Duccio may therefore be called the last and greatest representative of the Byzantine tradition.

See A. Lisini, "Notizie di Duccio Pittore" in the *Bullettino Senese di Storia Patria* (Sienna, 1898); J. P. Richter, *Lectures on the National Gallery* (1858); Langton Douglas, *History of Siena* (1902); J. A. Crowe and G. B. Cavalcaselle, *History of Painting in Italy*, ed. L. Douglas (2nd ed., 1903–14); C. H. Weigelt, *Duccio di Buoninsegna* (1911). *(I. A.* R.)

DU CHAILLU, PAUL BELLONI (1835–1903), traveller and anthropologist, was born, probably in Paris, on July **31,** 1835. In his youth he accompanied his father, who was in the African trade, to the west coast of Africa. In **18jj** he settled in America, and was commissioned by the Academy of Natural Sciences at Philadelphia to explore the delta of the Ogowé river and the estuary of the Gabun. During his travels he saw numbers of the anthropoid apes, then known to scientists only by a few skeletons. A subsequent expedition, from **1863** to **186j,** enabled him to confirm the accounts given by the ancients of a pygmy people inhabiting the African forests. His *Explorations and Adventures in Equatorial Africa* **(1861)** and *A Journey to Ashangoland* **(1867)** excited much controversy. Du Chaillu's later works are concerned with travel in Sweden and Lapland. He died on April 29, 1903, at St. Petersburg (Leningrad)

DUCHCOV or Dux, a town of Bohemia, situated in the fertile Eger valley near the centre of the Briix-Teplitz lignite field. It has flourishing glass and ceramic industries using local raw materials. Pop. (1930) **12,877,** 50% German.

DUCHENNE, GUILLAUME BENJAMIN AMAND (1806–1875), French physician, was born on Sept. **17, 1806,** at Boulogne, the son of a sea-captain. He was educated at Douai, and then studied medicine in Paris until **1831,** when he returned to his native town to practise his profession. Two years later he first tried the effect of electro-puncture of the muscles on a patient under his care, and from this time on devoted himself to electro-physiology and neurology, thereby laying the foundation of the modern science of electro-therapeutics. In **1842** he removed to Paris where he worked until his death. His greatest work. *L'Électrisation localiske* (1855), passed through three editions during his lifetime, though by many his *Physiologie des mouvements* **(1867)** is considered his masterpiece. He published over **50** volumes containing his researches on muscular and nervous diseases, and on the applications of electricity both for diagnostic purposes and for treatment. His name is especially connected with the first description of locomotor ataxy, progressive muscular atrophy, pseudo-hypertrophic paralysis, glosso-labio laryngeal paralysis, and other nervous troubles. He died in Paris on Sept. **17,** 1875.

For a detailed life see *Archives générales de médicine* (Dec. 1875), and for a list of his works the 3rd ed. of *L'Électrisation localisée* (1872).

DUCHESNE (Latinized DUCHENIUS, *QUERNEUS,* or QUERCETANUS), **ANDRÉ** (1 584–1640), French geographer and historian, generally styled the father of French history. Through the influence of Richelieu, he was appointed historiographer and geographer to the king. He died in Paris on May **30, 1640.** Duchesne left behind him more than 100 folio volumes of manuscript extracts now preserved in the Bibliothèque Nationale (L. Delisle, *Le Cabinet des manuscrits de la bibliothkque impkriale,* t. L, 333–334). Several of his larger works were continued by his only son François du Chesne (1616–93), who succeeded him in the office of historiographer to the king. The principal works of André Duchesne are *Historiae Normannorum scriptores antiqui* **(1619,** now the only source for some of the texts), and his *Historiae Francorum*

scriptores (5 vols. 1636–49). This last was intended to comprise 24 volumes, and to contain all the narrative sources for French history in the middle ages; only two volumes were published by the author, his son François published three more, and the work remained unfinished. Duchesne's other works include *Les antiquite's . . . des rois de France* (1639); *Les antiquités . . . de toute la France* (1609); *Histoires des Papes jusqu'à Paul V.* (1619).

DUCWESNE, LOUIS MARIE OLIVIER (1843–1922), French scholar and ecclesiastic, was born at St. Servan, Brittany, on Sept. 13, 1843. He was educated at the seminary of St. Brieuc and at Rome and was ordained priest in 1867. In 1874 he went on a scientific expedition to Mt. Athos and in 1876 to Asia Minor; but his interest in the history of the Western Church appeared in 1877 when he received the degree of *docteur ès lettres* with two remarkable theses, a dissertation *De Macario magnete,* and an *Étude sur le Liber pontificalis,* an acute critical study of the origin and editions of that celebrated chronicle. Immediately afterwards he was appointed professor at the Catholic Institute in Paris, and for eight years presented the example, then rare in France, of a priest teaching church history according to the rules of scientific criticism. His course, bold even to the point of rashness in the eyes of the traditionalists, was at length suspended. In Nov. 1885 he was appointed lecturer at the École Pratique des Hautes Btudes. In 1886 he published vol. i. of his learned edition of the *Liber pontificalis* (completed in 1892 by vol. ii.). In 1888 he was elected member of the Académie des Inscriptions et Belles-Lettres, and was afterwards appointed director of the French school of archaeology at Rome. Much light is thrown upon the Christian origins, especially those of France, by his *Origines du culte chre'tien, étude sur la liturgie latine avant Charlemagne* (1889; Eng. trans. by M. L. McClure, *Christian Worship: its Origin and Evolution,* London, 5th ed. 1919); *Mémoire sur l'origine des diocbses épiscopaux dans l'ancienne Gaule* (1890), the preliminary sketch of a more detailed work, *Fastes e'piscopaux dans l'ancienne Gaule* (1894–99); and *Catalogues épiscopaux de la province de Tours* (1898). His *Autonomies ecclésiastiques; églises séparées* (1897; Eng. trans. by H. H. Mathew, 1907), in which he speaks of the origin of the Anglican Church, but treats especially of the origin of the Greek Churches of the East, was received with scant favour in certain narrow circles of the pontifical court. In the *Histoire ancienne de l'église,* 4th ed. (1908; Eng. trans. by C. Jenkins, 1909–24). Duchesne touches cleverly upon the most delicate problems, and, without any elaborate display of erudition, presents notable conclusions. *L'Église at4 VI^e siècle* was published posthumously in 1925. His incisive style, his fearless and often ruthless criticism, and his wide and penetrating erudition, make him a redoubtable adversary in the field of polemic. The *Bulletin critique,* a review of history, philology and theology, founded by him in 1880, has contributed powerfully to spread the principles of the historical method among the French clergy.

Duchesne received an honorary Litt.D. from Cambridge and D.Litt. from Oxford, and in 1910 was elected to the French Academy. He died on April 21, 1922.

See C. D. 'Habloville, *Grandes Figures de l'Église contemporaine— Mgr. Duchesne* (1925).

DUCIS, JEAN FRANÇOIS (1733–1816), French dramatist and adapter of Shakespeare, succeeded to the fauteuil of Voltaire at the Academy in 1779. His father, originally from Savoy, was a linen-draper at Versailles. In 1768 he produced his first tragedy, *Amélise.* The failure of this first attempt was compensated by the success of his Shakespearian adaptations: *Hamlet* (1769), *Roméo et Juliette* (1772), *Le Roi Lear* (1783), *Macbeth* (1783) and *Othello* (1792), which last, supported by the acting of Talma, obtained immense applause, Though actuated by honest admiration of the great English dramatist, Ducis is not Shakespearian. His ignorance of the English language left him at the mercy of the translations of Pierre Letourneur (1736–88) and of Pierre de la Place (1707–93); and even this modified Shakespeare had still to undergo a process of purification and correction before he could be presented to the fastidious criticism of French taste. He did not pretend to reproduce, but to excerpt and refashion; and consequently the French play sometimes differs from its English namesake in everything almost but the name. The plot is different, the characters are different, the *motif* different, and the scenic arrangement different. To *Othello,* for instance, he wrote two endings. In one of them Othello was enlightened in time and Desdemona escaped her tragic fate. Of his original works the best were *Oedipe chez Admète* (1778), and *Abufar* (1795).

An edition of his works in three volumes appeared in 1813; *Oeuvres posthumes* were edited by Campenon in 1826; and *Hamlet, Oedipe chez Admète, Macbeth* and *Abufar* are reprinted in vol. ii. of Didot's *Chefs-d'oeuvrs tragiques. See* Onésime Leroy, *Etude sur la personne et les écrits de Ducis* (1832), based on Ducis' own memoirs preserved in the library at Versailles; Sainte-Beuve, *Causeries du lundi,* t. vi., and *Nouveaux lundis,* t. iv.; Villemain, *Tableau de la litt. au XVIII^e siècle.*

DUCK, the English name for birds forming five of the eleven sub-families of the family *Anatidae.* Technically, duck is restricted to the female, the male being called "drake," and, in one species, "mallard."

Ducks comprise: (1) the *Anatinae* or fresh-water ducks; (2) the *Fuligulinae* or sea-ducks *(see* EIDER; POCHARD; SCAUP; SCOTER); (3) the *Erismaturinae* or spiny-tailed ducks; (4) the *Merganettinae* or torrent ducks; (5) the *Merginae* or mergansers (q.v.).

The *Anatinae* are the typical group and the only ones here considered. The mallard (*Anas platyrhynchos*) is the most plentiful and best-known species, and is the origin of the domestic breeds of Europe and U.S.A. It inhabits the Northern Hemisphere, reaching Panama, Egypt and N.W. India in winter, and the Arctic Circle in summer. The nest may be on the ground or in a hole in a tree; g to 11 pale green eggs are laid on a lining of down which the mother pulls from her breast. As soon as the young hatch out, the mother takes them to the nearest piece of water. The male may guard the nest before hatching, but takes no interest in the brood and, indeed, is incapable of rendering active assistance by reason of an additional moult that deprives him of power of flight until the autumn. In hard weather, the ducks resort to tidal waters. For the domestic breeds of duck, *see* POULTRY AND POULTRY FARMING. It is an interesting point that, whereas the male wild duck is monogamous, the domesticated drake is polygamous.

Numerous allied species occur in various parts of the world, in some of which, e.g., *A. obscura* of America, there is little difference in plumage between the sexes. Among other genera are the groups represented by the shoveller (q.v.), garganey (q.v.), gadwall (q.v.), teal (q.v.), pintail, and widgeon (q.v.). The genus *Aix* includes the beautiful American wood-duck *(A. sponsa)* and the mandarin duck *(A. galericulata)* from East Asia. The sheldrakes (q.v.), the musk-duck *(Cairina)* of South America, and the tropical tree-ducks (*Dendrocygna*) are other groups.

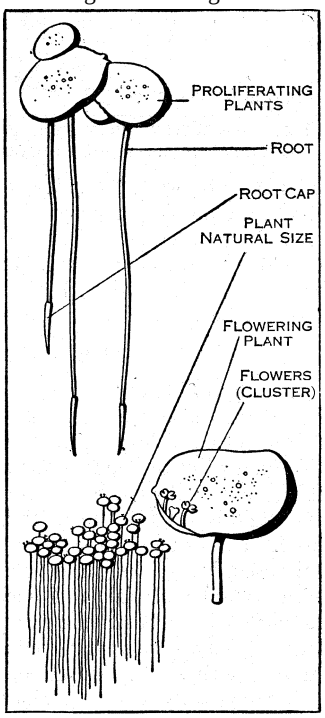
DUCK, a plain fabric, made originally from tow yarns. The cloth is lighter than canvas or sailcloth, and differs from these in that it is almost invariably single in both warp and weft. The term is also used to indicate the colour obtained'at a certain stage in the bleaching of flax yarns; it is a colour between half-white and cream. Most of the flax ducks (tow yarns) appear in this colour, although quantities are bleached or dyed. Some of the ducks are made from long flax, dyed black, and used for kit-bags, while the dyed tow ducks may be used for inferior purposes. The fabric, in its various qualities and colours, is used for an enormous variety of purposes, including tents, wagon and motor hoods, light sails, clothing, workmen's overalls, bicycle tubes, mail and other bags and pocketings. *Russian duck* is a fine white linen canvas. The term is probably derived from the Dutch *doeck,* a coarse linen material.

DUCKING and **CUCKING STOOLS,** chairs used for the punishment of scolds, witches and prostitutes in bygone days. The two have been confused, but are distinct. The earlier, the cucking-stool or stool of repentance, is of very ancient date, and was used by the Saxons, who, called it the *Scealding* or *Scolding Stool.* Seated on this stool the woman, her head and feet bare, was publicly exposed at her door or paraded through the streets amidst the. jeers of the crowd. The cucking-stool was used for

both sexes, and was specially the punishment for dishonest brewers and bakers. The earliest record of the use of the ducking-stool is towards the beginning of the 17th century. It was a strongly made wooden armchair in which the culprit was seated, an iron band being placed around her so that she should not fall out during her immersion. The chair was fastened to a long wooden beam fixed as a seesaw on the edge of a pond or river. Sometimes, however, the ducking-stool was not a fixture, but was mounted on a pair of wooden wheels so that it could be wheeled through the streets. In sentencing a woman the magistrates ordered the number of duckings she should have. Yet another type of ducking-stool was a chair on two wheels with two long shafts fixed to the axles. This was pushed into the pond and the shafts released, thus tipping the chair up backwards. Ducking-stools were used in England as late as the beginning of the 19th century.

See W. Andrews, *Old Time Punishments* (Hull, 1890); *A.* M. Earle, *Curious Punishments of Bygone Days* (Chicago, 1896); W. C. Hazlitt, *Faithr and Folklore* (London, 1905); Llewellynn Jewitt in *The Reliquary,* vols. i. and ii. (1860–62); *Gentleman's Magazine* for 1732.

DUCKWEED, the common botanical name for species of lemna (family *Lemnaceae)* which form a green coating on fresh-water ponds and ditches. The plants are of extremely simple structure and are the smallest and least differentiated of flowering plants. They consist of a so-called "frond"—a flattened green more or less oval structure which emits branches similar to itself from lateral pockets at or near the base. From the under surface a root with a well-developed sheath grows downwards into the water. The flowers, which are rarely found in Britain, are developed in one of the lateral pockets. The inflorescence is very simple, consisting of one or two male flowers each comprising a single stamen, and a female flower comprising a flask-shaped pistil. The family to which they belong is regarded as representing a very reduced type perhaps allied to the Aroids.



DUCKWEED (LEMNA MINOR), OR DUCK MEAT, SHOWING THE FLAT BLADE-LIKE FROND AND FLOWER, WHICH FLOAT ON THE WATER, ALLOWING THE ROOTS TO HANG LOOSELY

Besides *Lemna,* other genera kepresentative of the family are *Spirodela,* with several roots, and *Wolfia* and *Wolffiella,* with no roots. In Great Britain three species of *Lemna* occur; the lesser duckweed (*L. minor*), the gibbous duckweed (L. *gibba),* and the ivy-leaved duckweed (L. *trisulca*); the greater duckweed (*Spirodela polyrrhiza*) is also found. All the foregoing are distributed widely throughout the world. In Great Britain the family is further represented by *Wolffia arrhiza,* in which the rootless fronds are only $\frac{1}{20}$ in. long; it is the smallest of British flowering plants. In North America eight duckweeds occur, including all those found in Great Britain; there are also three species each of *Wolfia* and *Wolffiella. Wolfia punctata,* with fronds only $\frac{1}{50}$ in. to $\frac{1}{35}$ in. long, is one of the most minute of all flowering plants.

DUCKWORTH, SIR JOHN THOMAS (1748–1817), British admiral, was born at Leatherhead, Surrey, on Feb. 28, 1748, and entered the navy in 1759. He shared in the three days' naval engagement in which the Brest fleet was defeated (June 1, 1794), and received a gold medal and the thanks of parliament. In March 1801 he was the naval commander of the combined force which reduced the islands of St. Bartholomew and St. Martin, a service for which he was rewarded with the Order of the Bath and a pension of £1,000 a year. Promoted to be vice-admiral of the blue, he was appointed in 1804 to the Jamaica station. Two years later, while cruising off Cadiz with Lord Collingwood, he was detached with his squadron to pursue a French fleet that had been sent to the relief of Santo Domingo. He came up with the enemy on Feb. 6, 1806, and, after two hours' fighting, inflicted a signal defeat, capturing three of their five vessels and stranding the other two. In 1807 he was again sent to the Mediterranean to watch the movements of the Turks. In command of the "Royal George" he forced the passage of the Dardanelles, but sustained considerable loss on his return. In 1815 he was appointed to the chief command at Plymouth, which he held until his death on April 14, 1817.

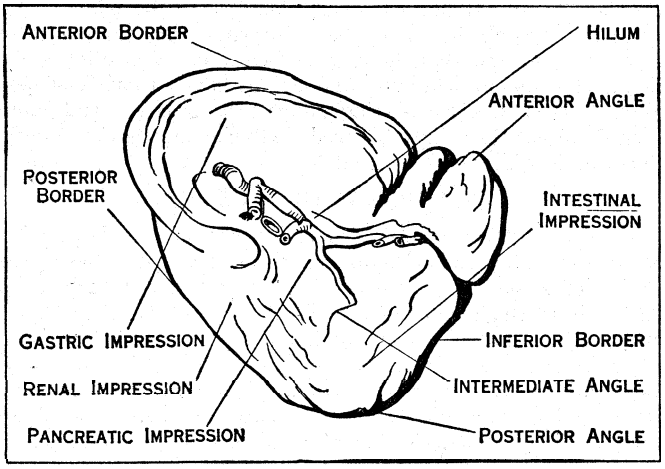
See *Naval Chronicle,* xviii.; Ralfe's *Naval Biography,* ii.

DUCLAUX, AGNES MARY FRANCES (1857–), English poet and critic (*née* Robinson), was born at Leamington on Feb. 27, 1857. In 1888 she married James Darmesteter (*q.v.*), and in 1901, after his death, Émile Duclaux, director of the Pasteur institute. She published several volumes of poetry, including *A Handful of Honeysuckle* (1878); *The New Arcadia and other Poems* (1884); *An Italian Garden* (1886); *Collected Poems, Lyrical and Narrative* (1902), and *The Return to Nature, Songs and Symbols* (1904).

Madame Duclaux's best known prose works are a monograph on *Emily Brontë* (1883); the *Life of Ernest Renan* (1897); *The End of the Middle Ages* (1888); "Froissart" (1894) in the *Grands écrivains français; Vie d'Émile Duclaux* (1907); *Madame de Sévigné* (1914); *La Pensée de Robert Browning* (1922) and *A Portrait of Pascal* (1927).

DUCOS, PIERRE ROGER (1747–1816), French politician, was born at Dax. Despite his lack of ability, he ascended the highest rungs of the political ladder from the day when he became member of the council of the Five Hundred, serving successively as a director, consul and vice-president of the Senate. He abandoned Napoleon in 1814, but was himself exiled in 1816. He died at Ulm in March 1816.

DUCTLESS GLANDS, in anatomy, glands in the body having no *ducts* or canals for conveying away their products, which, known as internal secretions, pass directly into the veins or lymphatics. Among these structures are the *spleen, adrenals, thyroid gland, parathyroids, thymus* and the *carotid* and *coccygeal* bodies. In addition lymphatic glands are described under lymphatic system (*q.v.*), and pineal and pituitary bodies under brain (*q.v.*).



FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY" BY PERMISSION OF OXFORD MEDICAL PUBLICATIONS

FIG. 1.—THE SPLEEN, VISCERAL ASPECT

THE SPLEEN

The human *spleen* is an oval, flattened gland, of a dull purple colour, and about 5in. long by three broad, situated in the upper and back part of the left side of the abdominal cavity. The external surface is convex to adapt it to the concavity of the diaphragm, against the posterior part of which it lies; external to the diaphragm is the pleural cavity, and more externally still, the ninth, tenth and eleventh ribs. The internal surface is divided by

a prominent ridge into a gastric or anterior and a renal or posterior surface. Probably, the shape of the spleen varies somewhat from time to time. The gastric surface is concave to fit the fundus of the stomach, while just in front of the ridge separating the gastric and renal surface is the hilum, where the vessels enter and leave the organ. The renal surface is moulded on to the upper part of the outer border of the left kidney and just reaches the left adrenal body. The borders of the spleen usually show two or more notches. The whole spleen is surrounded by peritoneum, which is reflected off on to the stomach and the kidney. Small accessory spleens are fairly often found in the neighbourhood, though, possibly, some of these may be haemo-lymph glands (see LYMPHATIC SYSTEM).

Microscopically the spleen has a fibro-elastic coat in which involuntary muscle is found (fig. 2). This coat sends fine trabeculae into the organ, subdividing it into minute compartments, in which the red, highly vascular, spleen pulp is contained. This pulp contains small spherical masses of adenoid tissue (Malpighian corpuscles), situated on the terminal branches of the splenic blood-vessels, numerous red blood corpuscles, lymphocytes and endothelial cells, the last often containing pigment granules or fat. The arteries in large part open into spaces, which give origin to the veins.

Embryology.— The spleen is developed in the dorsal mesogastrium (see COELOM AND SEROUS MEMBRANES) from the mesenchyme, or that portion of the mesoderm, the cells of which lie scattered in a matrix. Large lymphoid cells are early seen among those of the mesenchyme, probably being derived from the coelomic epithelium. The network of the spleen seems certainly to be derived from cells of the mesenchyme which lose their nuclei.

Comparative Anatomy.— The spleen is regarded as the remains of a mass of lymphoid tissue which, in a generalized type of vertebrate, stretched all along the alimentary canal. It is absent as a distinct gland in the Acrania and Cyclostomata. In the fishes it is closely applied to the U-shaped stomach, and in some of the Elasmobranchs, *e.g.,* the basking and porbeagle sharks, it is divided into small lobules. In Protopterus (Dipnoi) it is enclosed within the walls of the stomach. In frogs and toads (Amphibia) it is a spherical mass close to the rectum, and is derived from a different part of the original mass, already mentioned, to that which persists in other vertebrates. In the Iguana (Reptilia) the organ has many notches, each corresponding to the point of entrance of a vessel. In mammals the notches, when present, also frequently correspond to the points of entrance of arteries at the hilum. The Monotremata and Marsupialia have curious Y-shaped spleens. As a rule flesh-eating animals have larger and more notched spleens than vegetable feeders, though among the Cetacea the spleen is relatively very small.

ADRENAL GLANDS

The adrenal glands or suprarenal capsules are two conical bodies, flattened from before backward, resting on the upper poles of the kidneys close to the sides of the vertebral column; each has a concave base which is in contact with the kidney. On the anterior surface is a transverse sulcus or hilum from which a large vein emerges. The arteries are less constant in their points of entry. The glands are entirely retro-peritoneal. In a vertical transverse section each gland is seen to consist of two parts, cortical (yellow) and medullary (red). The cortical substance is composed of columns of cells, separated by a stroma. The medullary part consists of small islets of cells, which resemble columnar epithelium lying among venous sinuses; these cells are in close connection with the sympathetic nerve filaments from the great solar plexus.

Embryology.— The generally accepted view is that the cortical substance is derived fom the coelomic epithelium covering the mesoderm of the upper (cephalic) portion of the Wolffian body, and corresponds to the nephrostomes of mesonephridial tubules (see URINARY SYSTEM), while the medullary part grows out from the sympathetic ganglia and so is probably ectodermal in origin. In the early human embryo the adrenals are larger than the kidneys, and at birth they are proportionately much larger than in the adult.

Comparative Anatomy.— Adrenals are unknown in Amphioxus and the Dipnoi. In the Cyclostomata (hags and lampreys) they are said by some to arise in connection with the cephalic part of the pronephros, though other writers deny their presence altogether. In the Elasmobranchs and Holocephali the medullary and cortical parts are apparently distinct, the former being represented by a series of organs situated close to the intercostal arteries, while the latter may be either median or paired, and, being placed between the kidneys, are often spoken of as interrenals. In the Amphibia the glands are sunk into the surface of the kidney. In reptiles and birds they are long lobulated bodies lying close to the testis or ovary. In the lower mammals they are not as closely connected with the kidneys as they are in man, and their shape is usually oval or spherical.

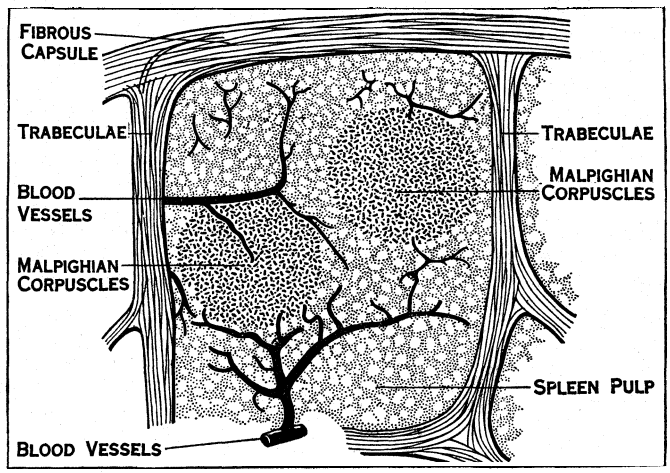


FIG. 2.— SECTION OF SPLEEN. UNDER LOW MAGNIFICATION. SHOWING FIBRO-ELASTIC COVERING. BLOOD VESSELS AND VARIOUS CORPUSCLES

THE THYROID GLAND

The thyroid body or gland is a deep red glandular mass consisting of two lobes which lie one on each side of the upper part of the trachea and lower part of the larynx; these are joined across the middle line by the isthmus which lies in front of the second and third rings of the trachea. The gland is relatively larger in women and children than in men. It is enclosed in a capsule of cervical fascia and is supplied by the superior and inferior thyroid arteries. Microscopically, the gland consists of closed tubular alveoli filled with colloid material, and lined by cuboidal epithelial cells, unsupported by a basement membrane. The lymphatic vessels are large and numerous, and contain the same colloid as the alveoli. Accessory thyroids, close to the main gland, are often found.

Embryology.— The median part of the gland is developed from the thyro-glossal duct which grows down in the middle line from the junction of the buccal and pharyngeal parts of the tongue (*q.v.*), between the first and second branchial arches. The development of the hyoid bone obliterates the middle part of the duct, leaving its upper part as the foramen caecum of the tongue, while its lower part bifurcates. The lateral parts of the gland are developed from the entoderm of the fourth visceral clefts, and, joining the median part, lose their pharyngeal connection.

Comparative Anatomy.— The endostyle or hypobranchial groove of Tunicata and Acrania is regarded as the first appearance of the median thyroid; this is a median entodermal groove in the floor of the pharynx, secreting a glairy fluid in which food particles become entangled and so pass into the intestine. In the larval lamprey the connection with the pharynx is present, but in the adult as in all adult vertebrates, this connection is lost. In Elasmobranchs, the single median thyroid lies close to the mandibular symphysis, but in Teleostei it is paired. In Dipnoi there is also an indication of a division into two lobes. In Amphibia the thyroid forms numerous vesicles close to the anterior end of the pericardium. In Reptilia it lies close to the trachea, and in Chelonia and Crocodilia is paired. In birds it is also paired and lies near the origin of the carotid arteries. In Mammalia the lateral

lobes make their first appearance. In the lower orders of this class the isthmus is often absent.

PARATHYROID GLANDS

These little oval bodies are two on each side. The upper pair is embedded in the thyroid at the level of the lower border of the cricoid cartilage, while the lower pair may be embedded in the lateral lobes of the thyroid or lie below in relation to the inferior thyroid veins. They are often very difficult to find in the adult. Microscopically they consist of solid masses of epithelioid cells with numerous blood-vessels, while, embedded in their periphery, are often masses of thymic tissue including the concentric corpuscles of Hassall. They are developed from the entoderm of the third and fourth branchial grooves.

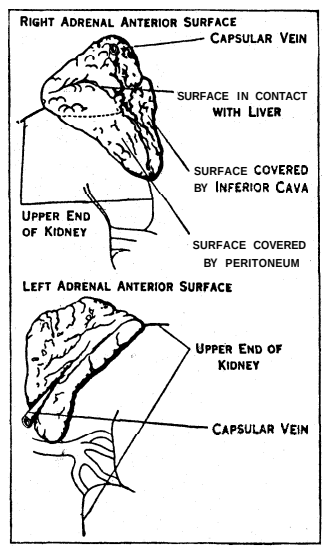
Parathyroids have been found in the orders of Primates, Cheiroptera, Carnivora, Ungulata and Rodentia among the Mammalia, and also in birds. In the other classes of vertebrates little is known of them.

THE THYMUS GLAND

The thymus is a light pink gland, consisting of two unequal lobes, which lies in front of the pericardium and great vessels; it also extends up into the root of the neck to within a short distance of the thyroid gland. It continues to grow until the second year of life, after which it remains stationary until puberty, when it usually atrophies and is represented by a mass of fat. Each lobe is divided up by areolar tissue, and, microscopically, the lobules consist of a cortical and medullary part. The cortex resembles in structure a lymphatic gland (see LYMPHATIC SYSTEM). In the medulla the lymphoid cells are fewer, and nests of epithelial cells are found (concentric corpuscles of Hassall). The vascular supply is derived from all the vessels in the neighbourhood, the lymphatics are very large and numerous, but the nerves, which come from the sympathetic and vagus, are few and small.

Embryology. — The thymus is formed from a diverticulum, on each side, from the entoderm lining the third branchial groove, but the connection with the pharynx is soon lost. The lymphoid cells and concentric corpuscles are probably derived from the original cells lining the diverticulum.

Comparative Anatomy.— The thymus is always a paired gland. In most fishes it rises from the dorsal part of all five branchial clefts; in Lepidosiren (Dipnoi), from all except the first; in Urodela from third, fourth and fifth, and in Anura from the second only. In all fishes, including the Dipnoi, it is placed dorsally to the gill arches on each side. In Amphibia it is close to the articulation of the mandible. In Reptilia it lies along the carotid artery; but in young crocodiles it is lobulated and extends all along the neck, as it does in birds, lying close to the side of the oesophagus. In mammals the Marsupials are remarkable for having a well-developed cervical as well as thoracic thymus. In some of the lower mammals the gland does not disappear as early as it does in man.



FROM CUNNINGHAM, "TEXTBOOK OF ANATOMY" (OXFORD UNIVERSITY PRESS)

FIG. 3.—RIGHT AND LEFT SUPRARENAL BODIES SHOWING THE ANTERIOR SURFACES

CAROTID BODIES

These are two small bodies situated between the origins of the external and internal carotid arteries. Microscopically they are divided into nodules or cell balls by connective tissue, and these closely resemble the structure of the parathyroids, but are without any thymic tissue. The blood-vessels in their interior are large and numerous. It is believed that they are part of the sympathetic system.

COCCYGEAL BODY

This is a median body. the size of a oea. situated in front of the apex of the coccyx and between the insertions of the levatores ani muscles. It resembles the carotid body in its microscopical structure, but is not so vascular. Concentric corpuscles, like those of the thymus, have been recorded in it. Of its embryology and comparative anatomy little is known. Probably it is sympathetic in origin. (For further information see ENDOCRINOLOGY.)

BIBLIOGRAPHY.—Quain's ***Anatomy***, vol. 1 (1908); McMurrich's ***Development*** of ***the Human Body*** (1906); Wiedersheim's ***Vergleich. Anat. der Wirbeltiere*** (Jena, **1898**).

DUDDELL, WILLIAM DU BOIS (1872–1917), British electrical engineer, was born in 1872. Because of his delicate health Duddell was educated at Cannes, and as a child he showed signs of great mechanical ingenuity. He served his apprenticeship as an engineer at Colchester. In 1893 he went to the City and Guilds Institute, where he stayed for some years because of the facilities for experimental work. Later he had an office of his own in Victoria street, London. Duddell showed an extraordinary gift for designing and constructing apparatus. His first, and probably his most notable instrument was the Duddell galvanometer or oscillograph. (See INSTRUMENTS, ELECTRICAL.) While carrying out observations on the resistance of the electric arc, the results of which were published in the *Proceedings of* the Royal Society (1901), he discovered the "singing arc," which led eventually to the development of the Poulsen arc. In connection with this work he designed and constructed a mechanical high frequency alternator giving 120,000 cycles per sec. Duddell also designed a thermo-ammeter (see INSTRUMENTS, ELECTRICAL), which he used in his work on radio-telegraphy. He was F.R.S. and held office in several learned societies. Duddell died on Nov. 4, 1917.

DUDERSTADT, town, Prussian province of Hanover, Germany, situated in a beautiful and fertile valley (formerly called Goldene Mark) watered by the Hahle, and on the railway Wulften-Leinefelde. Population 6,950. Duderstadt was founded by Henry I. (the Fowler) in 929, passed later to the monastery of Quedlinburg, and then to Brunswick. It was a member of the Hanseatic League, and during the Thirty Years' War became a stronghold of the Imperialists. It was taken by Duke William of Weimar in 1632; in 1761 its walls were dismantled, and it passed finally in 1866 with Hanover to Prussia. It is an interesting mediaeval town with many ancient buildings. There are two beautiful Gothic churches of the 14th century. It makes gloves, hats, paper, cigars and bricks; it has also a trade in singing-birds.

DUDEVANT, A. L. A.: see SAND, GEORGE.

DUDLEY, BARONS AND EARLS OF. The holders of these English titles are descended from John de Sutton (c. 1310–59) of Dudley Castle, Staffordshire, who was summoned to parliament as a baron in 1342. Sutton was the son of another John de Sutton, who had inherited Dudley Castle through his marriage with Margaret, sister and heiress of John de Somery (d. 1321); he was called Lord Dudley, or Lord Sutton of Dudley, the latter being doubtless the correct form. However, his descendants, the Suttons, were often called by the name of Dudley; and from John Dudley of Atherington, Sussex, a younger son of John Sutton, the 5th baron, the earls of Warwick and the earl of Leicester of the Dudley family are descended.

John Sutton or Dudley (*c.* 1400–87), the 5th baron, was first summoned to parliament in 1440, having been viceroy of Ireland from 1428 to 1430. He died on Sept. 30. 1487. He was succeeded as 6th baron by his grandson Edward (c. 1459–1532), and one of his sons, William Dudley, was bishop of Durham from 1476 until his death in 1483. His descendant Edward Sutton or Dudley, the 9th baron (1567–1643), had several illegitimate sons. Among them was Dud Dudley (1599–1684), who in 1665 published *Metallum Martis,* describing a process of making iron with "pit-coale, sea-coale, etc.," which was put in operation at his father's ironworks at Pensnet, Worcestershire, of which he was manager. During the Civil War he was a colonel in the army of Charles I.

Dying without lawful male issue in June 1643, the 9th baron was succeeded in the barony by his grand-daughter, Frances

(1611–97); she married Humble Ward (*c.* 1614–70), the son of a London goldsmith, who was created Baron Ward of Birmingham in 1644. Their son Edward (1631–1701) succeeded both to the barony of Dudley and to that of Ward, but these were separated when his grandson William died unmarried in May 1740. The barony of Dudley passed to a nephew, Ferdinando Dudley Lea, falling into abeyance on his death in Oct. 1757; that of Ward passed to the heir male, John Ward (d. 1774), a descendant of Humble Ward. In 1763 Ward was created Viscount Dudley, and in April 1823 his grandson, John William Ward (1781–1833), foreign minister in 1827–28, became the 4th viscount. He was created Viscount Ednam and earl of Dudley in 1827, and when he died unmarried on March 6, 1833, these titles became extinct. His barony of Ward, however, passed to William Humble Ward (1781–1833), whose son, William (1817–85) was created Viscount Ednam and earl of Dudley in 1860. The 2nd earl of Dudley in this creation was the latter's son William Humble (b. 1866), who was lord-lieutenant of Ireland from 1902 to 1906, and governor-general of Australia from 1908 to 1911. He died in 1932.

See H. S. Grazebrook in the *Herald and Genealogist*, vols. ii., v. and vi.; in *Notes and Queries*, 2nd series, vol. xi.; and in vol. ix. of the publications of the William Salt Society (1888).

DUDLEY, EDMUND (c. 1462–1510), minister of Henry VII. of England, was a son of John Dudley of Atherington, Sussex, and a member of the great baronial family of Sutton or Dudley. After studying at Oxford and at Gray's Inn, Dudley came under the notice of Henry VII. He and his colleague Sir Richard Empson (*q.v.*) are called *fiscales iudices* by Polydore Vergil, and their extortions made them bitterly hated. Dudley, who was speaker of the House of Commons in 1504, amassed a great amount of wealth for himself, and possessed large estates in Sussex, Dorset and Lincolnshire. When Henry VII. died in April 1509, he was thrown into prison by order of Henry VIII. and charged with the crime of constructive treason, being found guilty and attainted. He was executed on Aug. 17 or 18, 1510. Dudley's nominal crime was that during the last illness of Henry VII. he had ordered his friends to assemble in arms in case the king died, but the real reason for his death was the unpopularity caused by his avarice. During his imprisonment he sought to gain the favour of Henry VIII. by writing a treatise in support of absolute monarchy called The Tree of *Commonwealth* (printed privately, in Manchester 1859).

See Francis Bacon, *History of Henry VII.* edit. *J. R.* Lumby (1881); and J. S. Brewer, *The Reign of Henry VIII.*, edit. *J.* Gairdner (1884).

DUDLEY, SIR ROBERT (1573–1649), titular duke of Northumberland and earl of Warwick, English explorer, engineer and author, was the son of Robert Dudley, earl of Leicester (*q.v.*), the favourite of Queen Elizabeth. His mother was Lady Douglas Sheffield, daughter of Thomas, first Baron Howard of Effingham. Leicester, who deserted Lady Douglas Sheffield for Lettice Knollys, widow of the first earl of Essex, denied that they were married. Her son Robert was born in May 1573, was recognized by Leicester, and sent to Christ Church, Oxford, in 1587. He inherited all Leicester's property under the earl's will at his death in 1588, and in the following year the property of Ambrose Dudley, earl of Warwick. In 1594 he made a voyage to the West Indies, and in 1596 he took part in the expedition to Cadiz and was knighted. After the death of Elizabeth he endeavoured to secure recognition of his legitimacy, and of his right to inherit the titles of his father and uncle. The proceedings were quashed by the Star Chamber. In 1605 he obtained leave to travel abroad, and went to Italy accompanied by the beautiful Miss Elizabeth Southwell, daughter of Sir Robert Southwell of Woodrising, in the dress of a page. When ordered to return home and to provide for his deserted wife and family, he refused, was outlawed, and his property was confiscated. On the continent he avowed himself a Roman Catholic, married Elizabeth Southwell at Lyons, and entered the service of Cosimo II., grand duke of Tuscany. He was employed in draining the marshes behind Leghorn, and in the construction of the port. In Italy Dudley was known as Duca di Nortombria and Conte di Warwick. He died near Florence on Sept. 6, 1649. His deserted wife, Alicia, was created duchess of Dudley by Charles I. in 1644, and died in 1670, when the title became extinct. Dudley's chief claim to remembrance is the magnificent *Arcano del mare* (Florence, 3 vols. 1645–1646, reprinted 2 vols. 1661), a collection of all the naval knowledge of the age, remarkable for a scheme for t e construction of a navy in five rates which Dudley designed and described.

See G. L. Craik, *Romance of the Peerage* (London, 1848–1850), vol. iii.; Sir N. H. Nicolas, *Report of Proceedings on the Claim to the Barony of L'Isle* (London, 1829); and *The Italian Biography of Sir R. Dudley*, by Doctor Vaughan Thomas.

DUDLEY, THOMAS (1576–1653), British colonial governor of Massachusetts, was born in Northampton, England, in 1576, possibly a member of the elder branch of the family to which Robert Dudley, earl of Leicester, belonged. He was the son of a country gentleman of some means and high standing, was captain of an English company in the French expedition of 1597, serving under Henry of Navarre, and eventually became the steward of the earl of Lincoln's estates, which he managed with great success for many years. Having been converted to Puritanism, he became an advocate of its strictest tenets. About 1627 he associated himself with other Lincolnshire gentlemen who in 1629 entered into an agreement to settle in New England provided they were allowed to take the charter with them. This proposal the general court of the Plymouth Company agreed to, and in April 1630 Dudley sailed to America in the same ship with John Winthrop, the newly appointed governor, Dudley himself at the last moment being chosen deputy-governor in place of John Humphrey (or Humfrey), the earl of Lincoln's son-in-law, whose departure was delayed. Dudley was for many years the most influential man in the Massachusetts Bay Colony, save Winthrop, with whose policy he was more often opposed than in agreement. He was deputy-governor in 1629–34, in 1637–40, in 1646–50 and in 1651–53, and was governor four times, in 1634, 1640, 1645 and 1650. Soon after his arrival in the colony he settled at Newton (Cambridge), of which he was one of the founders; he was also one of the earliest promoters of the plan for the establishment of Harvard college. Winthrop's decision to make Boston the capital instead of Newton precipitated the first of the many quarrels between the two, Dudley's sterner and harsher Puritanism, being in strong contrast to Winthrop's more tolerant and liberal views. He was an earnest and persistent heresy-hunter — not only the Antinomians, but even such a good Puritan as John Cotton, against whom he brought charges, feeling the weight of his stern and remorseless hand. His position he himself best expressed in the following brief verse found among his papers: —

> Let men of God in courts and churches watch
> O'er such as do a Toleration hatch,
> Lest that ill egg bring forth a Cockatrice
> To poison all with heresy and vice.

He died at Roxbury, Mass., on July 31, 1653.

See Augustine Jones, *Life and Work of Thomas Dudley, the Second Governor of Massachusetts* (1899); and the *Life of Mr. Thomas Dudley, several times Governor of the Colony of Massachusetts, written as is supposed by Cotton Mather*, edited by Charles Deane (1870). Dudley's interesting and valuable "Letter to the Countess of Lincoln," is reprinted in Alexander Young's *Chronicles of the Planters of the Colony of Massachusetts Bay* (1846), and in the New Hampshire Historical Society *Collections*, vol. iv. (1834); G. K. Koues, *Thomas Dudley, Governor of Massachusetts* (Boston, 1914).

His son JOSEPH DUDLEY (1647–1720), colonial governor of Massachusetts, was born in Roxbury, Mass., on Sept. 23, 1647. He graduated at Harvard college in 1665, became a member of the general court, and in 1682 was sent by Massachusetts to London to prevent the threatened revocation of her charter by Charles II. There, with an eye to his personal advancement, he secretly advised the king to annul the charter; this was done, and Dudley, by royal appointment, became president of the provisional council. With the advent of the new governor, Sir Edmund Andros, Dudley became a judge of the superior court and censor of the press. Upon the deposition of Andros, Dudley was imprisoned and sent with him to England, but was soon set free. In 1691–92 he was chief-justice of New York, presiding

over the court that condemned Leisler and Milburn. Returning to England in 1693, he was lieutenant-governor of the Isle of Wight and a member of parliament, and in 1702, after a long intrigue, secured from Queen Anne a commission as governor of Massachusetts, serving until 1715. His administration was marked, particularly in the earlier years, by ceaseless conflict with the general court, from which he demanded a regular fixed salary instead of an annual grant. He was active in raising volunteers for the so-called Queen Anne's War. He was accused by the Boston merchants, who petitioned for his removal, of being in league with smugglers and illicit traders, and in 1708 a bitter attack on his administration was published in London, entitled The Deplorable State of New England by reason of a Covetous and Treacherous Governor and Pusillanimous *Counsellors*. His character may be best summed up in the words of one of his successors, Thomas Hutchinson, that "he had as many virtues as can consist with so great a thirst for honour and power." He died at Roxbury on April 2, 1720.

See Everett Kimball, *The Public Life of Joseph Dudley* (1911); J. G. Palfrey, *History of New England*, vol. iv. (1875); and the *Massachusetts Historical Society, Collections*, series 5, vol. vi. (1879).

Joseph Dudley's son, PAUL DUDLEY (1675–1751), graduated at Harvard in 1690, studied law at the Temple in London, and became attorney-general of Massachusetts (1702–18). He was associate justice of the superior court of that province from 1718 to 1745, and chief justice from 1745 until his death. He was a member of the Royal Society (London), to whose Transactions he contributed several valuable papers on the natural history of New England, and was the founder of the Dudleian lectures on religion at Harvard.

DUDLEY, market town, county and parliamentary borough, Worcestershire, England, in a portion of that county enclaved in Staffordshire, 8 mi. N.W. of Birmingham and 121 mi. N.W. of London by the L.M.S. Ry., also served by the G.W. Ry. and on the Birmingham and Stourbridge canals. Pop. (1938) 61,600. Area 6 sq.mi. Dudley stands on a ridge in the Black Country, in which are ironworks and coal mines. The "ten-yard" coal, in the neighbourhood, is the thickest seam worked in England. Limestone, for burning, and dolerite, for road metal, are extensively quarried; while iron and brass foundries and engineering and brickworks are the chief industries. The principal buildings are the churches of the six parishes of the town, the council house (1935), the town hall (1928), county court, free libraries, grammar school, girls' school, technical school, teachers' training college, the Guest hospital (founded by Joseph Guest, 1868) and a dispensary. The town is noted for the excellent Silurian fossils obtained from the limestone quarries of Dudley Castle and Wren's Nest. To the north of the town, on Dudley Castle hill, are extensive remains of an ancient castle, surrounded by beautiful grounds open to the public. The view from the castle is remarkable. The whole district is seen to be set with chimneys, pit-buildings and factories; and at night the glare of furnaces reveals the tireless activity of the Black Country. Dudley and its environs are connected by a bus system.

Brierley Hill, urban district and market town, 2½ mi. S.W. of Dudley, on the G.W. Ry., in Kingswinford parliamentary division, Staffordshire, and on the river Stour and the Stourbridge and Birmingham canals, is an important industrial centre, producing coal, fire clay and glass. Pop. (1938) 46,360. Between here and Dudley are the ironworks of Roundoak and Netherton, a suburb of Dudley. Three miles west of Dudley is Kingswinford (in Brierley Hill urban district), a mining township, with large brickworks, giving name to a parliamentary division of Staffordshire. The parliamentary borough of Dudley returns one member.

In mediaeval times, Dudley (Dudelei) depended on the castle, which is mentioned in the Domesday Survey. Before the Conquest Earl Eadwine held the manor, which in 1086 belonged to William FitzAnsculf, from whom it passed to Fulk Paynel, afterwards to the Somerys, Suttons and Wards, and their descendants, the present earls of Dudley. The first mention of Dudley as a borough occurs in an inquisition taken after the death of Roger de Somery in 1272. In 1865 Dudley was incorporated. Before that time it was governed by a high and low bailiff, appointed every year at the court leet of the manor. Roger de Somery evidently held a market by prescription in Dudley before 1261, in which year he came to terms with the dean of Wolverhampton, who had set up a market in Wolverhampton. According to the terms of the agreement the dean might continue his market on condition that Roger and his tenants should be free from toll there. Two fairs, on Sept. 21 and April 21, were granted in 1684 to Edward Lord Ward, lord of the manor. Dudley was represented in the parliament of 1295, but not again until the Reform Act of 1832. Mines of sea-coal in Dudley are mentioned as early as the reign of Edward I., and by the beginning of the 17th century mining had become an important industry.

DUDO or **DUDON** (*fl. c.* 1000), Norman historian, was dean of St. Quentin, where he was born about 965. Sent in 986 by Albert I. count of Vermandois, on an errand to Richard I., duke of Normandy, he spent some years in that country. During a second stay in Normandy Dudo wrote his history of the Normans, a task which Duke Richard I. had urged him to undertake. Very little else is known about his life, except that he died before 1043. Written between 1015 and 1030, his *Historia Normannorum*, or Libri *III.* de moribus et *actis primorum Normanniae ducum*, was dedicated to Adalberon, bishop of Laon. Dudo appears to have obtained his information from oral tradition, much of it being supplied by Raoul, count of Ivry, a half-brother of Duke Richard I. Consequently the *Historia* partakes of the nature of a romance; nevertheless, J. Lair and J. Steenstrup, while admitting the existence of a legendary element, regard the book as of considerable value for the history of the Normans. The Historia, which is written alternately in prose and in verse of several metres, is divided into four parts, and deals with the history of the Normans from 852 to the death of Duke Richard I. in 996. It was largely used by William of Jumièges, Wace, Robert of Torigni, William of Poitiers and Hugh of Fleury in compiling their chronicles, and was first published by A. Duchesne in his Historiae Normannorum scriptores *antiqui*, at Paris in 1619. Another edition is in the Patrologia Latina, tome cxli. of J. P. Migne (Paris, 1844), but the best is perhaps the one edited by J. Lair (Caen, 1865).

See E. Dummler, "Zur Kritik Dudos von St. Quentin" in the *Forschungen zur deutschen Geschichte*, Bande vi. and ix. (Gottingen, 1866); G. Waitz, "Über die Quellen zur Geschichte der Begrundung der normannischen Nerrschaft in Frankreich," in the *Gottinger gel. Anzeigen* (Gottingen, 1866); J. C. H. R. Steenstrup, *Normannerne*, Band i. (Copenhagen, 1876); J. Lair, *Étude critique et historique* sur *Dudon* (Caen, 1865); G. Kortung, *Über die Quellen des Roman de Rou* (Leipzig, 1867); W. Wattenbach, *Deutschlands Geschichtsquellen*, Band i. (Berlin, 1904); and *A.* Molinier, *Les Sources de l'histoire de France*, tome ii. (Paris, 1902).

DUDWEILER, a town of the Saar district of Germany, on the Sulzbach, 4 mi. by rail N.E. from Saarbriicken. It has extensive coal mines and ironworks and produces fireproof bricks. Pop. (1939) 25,061.

DUEL. A prearranged encounter between two persons, with deadly weapons, in accordance with conventional rules, with the object of voiding a personal quarrel or of deciding a point of honour. The first recorded instance of the word occurs in Coryate's Crudities (1611), but Shakespeare has *duello* in this sense, and uses "duellist" of Tybalt in Romeo and Juliet. In its earlier meaning of a judicial combat we find the word latinized in the Statute of Wales (Edw. I., Act 12), "Placita de terris in *partibus istis non habent* terntinari per *duellum*." The word duel is from Ital. *duello*, Lat. duellum—old form of bellum—from duo, two.

Duels in the modern sense were unknown to the ancient world, and their origin must be sought in the feudal age of Europe. The single combats recorded in Greek and Roman history and legend, of Hector and Achilles, Aeneas and Turnus, the Horatii and Curiatii, were incidents in national wars and have nothing in common with the modern duel. It is, however, noteworthy that in Tacitus (*Germania*, cap. x.) we find the rudiments of the judicial duel (*see* WAGER, for the wager of battle). Domestic differences, he tells us, were settled by a legalized form of combat

between the disputants, and when a war was impending a captive from the hostile tribe was armed and pitted against a national champion, and the issue of the duel was accepted as an omen. The judicial combat was a Teutonic institution, and it was in fact an appeal from human justice to the God of battles, partly a sanction of the current creed that might is right, that the brave not only will win but deserve to win. It was on these grounds that Gundobald justified against the complaints of a bishop, the famous edict passed at Lyons (A.D. 501) which established the wager of battle as a recognized form of trial. It is God, he argued, who directs the issue of national wars, and in private quarrels we may trust His providence to favour the juster cause. Thus, as Gibbon comments, the absurd and cruel practice of judicial duels, which had been peculiar to some tribes of Germany, was propagated and established in all the monarchies of Europe from Sicily to the Baltic. Yet in its defence it may be urged that it abolished a worse evil, the cornpurgation by oath which put a premium on perjury, and the ordeal, or judgment of God, when the cause was decided by blind chance, or more often by priest-craft.

The Judicial Combat. — Those who are curious to observe the formalities and legal rules of a judicial combat will find them described at length in the 28th book of Montesquieu's *Esprit des lois*. On these regulations he well remarks that, as there are an infinity of wise things conducted in a very foolish manner, so there are some foolish things conducted in a very wise manner. For our present purpose it is sufficient to observe the development of the idea of personal honour from which the modern duel directly sprang. In the ancient laws of the Swedes we find that if any man shall say to another, "You are not a man equal to other men," or "You have not the heart of a man," and the other shall reply, "I am a man as good as you," they shall meet on the highway, and then follow the regulations for the combat. What is this but the modern challenge? By the law of the Lombards if one man call another *arga*, the insulted party might defy the other to mortal combat. What is *arga* but the *dummer Junger* of the German student? Beaumanoir thus describes a legal process under Louis le Debonnaire: The appellant begins by a declaration before the judge that the appellee is guilty of a certain crime; if the appellee answers that his accuser lies, the judge then ordains the duel.

From Germany the judicial combat rapidly spread to France, where it flourished greatly from the 10th to the 12th century, the period of customary law. By French kings it was welcomed as a limitation of the judicial powers of their half independent vassals. It was a form of trial open to all freemen and in certain cases, as under Louis VI., the privilege was extended to serfs. Even the Church resorted to it not unfrequently to settle disputes concerning church property. Abbots and priors as territorial lords and high justiciaries had their share in the confiscated goods of the defeated combatant, and Pope Nicholas when applied to in 858 pronounced it "a just and legitimate combat." Yet only three years before the council of Valence had condemned the practice, imposing the severest penance on the victor and refusing the last rites of the church to the vanquished as to a suicide.

Under Louis XII. and Francis I. we find the beginnings of tribunals of honour. The last instance of a duel authorized by the magistrates, and conducted according to the forms of law, was the famous one between Franqois de Vivonne de la Châtaignerie and Guy Chabot de Jarnac. The duel was fought on July 10, 1547, in the courtyard of the château of St. Germain-en-Laye, in the presence of the king and a large assembly of courtiers. It was memorable in two ways. It enriched the French language with a new phrase; a sly and unforeseen blow, such as that by which de Jarnac worsted La Châtaignerie, has since been called a *coup de Jarnac*. And Henry, grieved at the death of his favourite, swore a solemn oath that he would never again permit a duel to be fought. This led to the first of the many royal edicts against duelling. By a decree of the council of Trent (cap. xix.) a ban was laid on "the detestable use of duels, an invention of the devil to compass the destruction of souls together with a bloody death of the body."

Trial by Battle in England. — In England, it is now generally agreed, the wager of battle did not exist before the time of the Norman Conquest. Some previous examples have been adduced, but on examination they will be seen to belong rather to the class of single combats between the champions of two opposing armies. By the laws of William the Conqueror the trial by battle was only compulsory when the opposite parties were both Normans, in other cases it was optional. As the two nations were gradually merged into one, this form of trial spread, and until the reign of Henry II. it was the only mode for determining a suit for the recovery of land. The method of procedure is admirably described by Shakespeare in the opening scene in *Richard II.*, where Henry of Bolingbroke, duke of Hereford, challenges Thomas, duke of Norfolk; in the mock-heroic battle between Horner the Armourer and his man Peter in *Henry VI.;* and by Sir W. Scott in the *Fair Maid of Perth*, where Henry Gow appears before the king as the champion of Magdalen Proudfute.

The judicial duel never took root in England as it did in France. In civil suits it was superseded by the grand assize of Henry II., and in the cases of felony by indictment at the prosecution of the crown. One of the latest instances occurred in the reign of Elizabeth, 1571, when the lists were actually prepared and the justices of the common pleas appeared at Tothill Fields as umpires of the combat. Fortunately the petitioner failed to put in an appearance, and was consequently non-suited (*see* Spelman, *Glossary, s.v.* "Campus"). As late as 1817 Lord Ellenborough, in the case of *Thornton* v. *Ashford,* pronounced that "the general law of the land is that there shall be a trial by battle in cases of appeal unless the party brings himself within some of the exceptions." Thornton was accused of murdering Mary Ashford, and claimed his right to challenge the appellant, the brother of the murdered girl, to wager of battle. His suit was allowed, and, the challenge being refused, the accused escaped. Next year the law was abolished (59 Geo. III., c. 46).

The Duel of Honour. — We are justified, then, in dating the commencement of duelling from the abolition bf the wager of battle. The causes which made it indigenous to France are sufficiently explained by the condition of society and the national character. As Buckle has pointed out, duelling is a special development of chivalry, and chivalry is one of the phases of the protective spirit which was predominant in France up to the time of the Revolution. The third chapter of d'Audiguier's *Ancien usage des duels* is headed, "Pourquoi les seuls Franqais se battent en duel." English literature abounds with allusions to this characteristic of the French nation. Lord Herbert of Cherbury, who was ambassador at the court of Louis XIII., says, "There is scarce a Frenchman worth looking on who has not killed his man in a duel."

Duels were not common before the 16th century. Hallam attributes their prevalence to the barbarous custom of wearing swords as a part of domestic dress, a fashion which was not introduced till the later part of the 15th century. In 1560 the states-general at Orleans supplicated Charles IX. to put a stop to duelling. Hence the famous ordinance of 1566, drawn up by the chancellor de l'Hôpital, which served as the basis of the successive ordinances of the following kings. Under the frivolous and sanguinary reign of Henry III., "who was as eager for excitement as a woman," the rage for duels spread till it became almost an epidemic. In 1602 the combined remonstrances of the church and the magistrates extorted from the king an edict condemning to death whoever should give or accept a challenge or act as second. But public opinion was revolted by such rigour, and the statute was a dead letter. Fontenay-Mareuil says, in his *Mémoires,* that in the eight years between 1601 and 1609, 2,000 men of noble birth fell in duels. In 1609 a more effective measure was taken at the instance of Sully by the establishment of a court of honour. The edict decrees that all aggrieved persons shall address themselves to the king, either directly or through the medium of the constables, marshals, etc.; that the king shall decide, whether, if an accommodation could not be effected, permission to fight should be given; and that anyone who kills

his adversary in an unauthorized duel shall suffer death without burial. Henri Martin has declared this "the wisest decree of the old monarchy on a matter which involves so many delicate and profound questions of morals, politics, and religion touching civil rights" (*Histoire* de *France*, x. 466).

"Who is to Fight To-day?" — In the succeeding reign the mania for duels revived. Rostand's *Cyrano* is a life-like modern portraiture of French bloods in the first half of the 17th century. De Houssaye tells us that in Paris when friends met, the first question was, "Who fought yesterday? who is to fight today?" They fought by night and day, by moonlight and by torch-light, in the public streets and squares. A hasty word, a misconceived gesture, a question about the colour of a riband or an embroidered letter, such were the commonest pretexts for a duel. The slighter and more frivolous the dispute, the less were they inclined to scbmit them to the king for adjudication. Often, like gladiators or prize-fighters, they fought for the pure love of fighting. A misunderstanding is cleared up on the ground. "N'importe," cry the principals, "puisque nous sommes ici, battons-nous." Seconds, as Montaigne tells us, are no longer witnesses, but must take part themselves unless they would be thought wanting in affection or courage; and he goes on to complain that men are no longer contented with a single second, "c'était anciennement des duels, ce sont à cette heure rencontres et batailles." There is no more striking instance of Richelieu's firmness and power as a statesman than his conduct in the matter of duelling. In his *Testament politique* he has assigned his reasons for disapproving it as a statesman and ecclesiastic. But this disapproval was turned to active detestation by a private cause. His elder brother, the head of the house, had fallen in a duel stabbed to the heart by an enemy of the cardinal. Already four edicts had been published under Louis XIII. with little or no effect, when in 1626 there was published a new edict condemning to death any one who had killed his adversary in a duel, or had been found guilty of sending a challenge a second time. Banishment and partial confiscation of goods were awarded for lesser offences. But this edict differed from preceding ones not so much in its severity as in the fact that it was the first which was actually enforced. The cardinal began by imposing the penalties of banishment and fines, but, these proving ineffectual to stay the evil, he determined to make a terrible example. To quote his own words to the king, "Il s'agit de couper la gorge aux duels ou aux édits de votre Majesté." The count de Boutteville, a renommist who had already been engaged in 21 affairs of honour, determined out of pure bravado to fight a 22nd time. The duel took place at midday on the Place Royale. Boutteville was arrested with his second, the count de Chapelles; they were tried by the parlement of Paris, condemned and, in spite of all the influence of the powerful house of Montmorenci, of which de Boutteville was a branch, they were both beheaded on June 21, 1627. For a short time the ardour of duellists was cooled.

Duels Under Louis XIV.—Under the long reign of Louis XIV. many celebrated duels took place, of which the most remarkable were that between the duke of Guise and Count Coligny, the last fought on the Place Royale, and that between the dukes of Beaufort and Nemours, each attended by four friends. Of the ten combatants, Nemours and two others were killed on the spot, and none escaped without some wound. No less than 11 edicts against duelling were issued under le Grand Monarque. That of 1643 established a supreme court of honour composed of the marshals of France; but the most famous was that of 1679, which confirmed the enactments of his predecessors, Henry IV. and Louis XII.

The subsequent history of duelling in France may be more shortly treated. In the preamble to the edict of 1704 Louis XIV. records his satisfaction at seeing under his reign an almost entire cessation of those fatal combats which by the inveterate force of custom had so long prevailed. Addison *(Spectator*, 99) notes it as one of the most glorious exploits of his reign to have banished the false point of honour. Under the regency of Louis XV. there was a brief revival. The last legislative act for the suppression of duels was passed on April 12. 1723. Then came the Revolution, which in abolishing the *ancien régime* fondly trusted that with it would go the duel, one of the privileges and abuses of an aristocratic society. Dupleix, in his ***Military Law*** *concerning the* ***Duel*** (1611), premises that these have no application to lawyers, merchants, financiers or justices. This explains why in the legislation of the National Assembly there is no mention of duels. Camille Desmoulins when challenged shrugged his shoulders and replied to the charge of cowardice that he would prove his courage on other fields than the Bois de Boulogne. The two great Frenchmen whose writings preluded the French Revolution both set their faces against it. Voltaire had indeed, as a young man, in obedience to the dictates of society, once sought satisfaction from a nobleman for a brutal insult, and had reflected on his temerity in the solitude of the Bastille. The story runs that Voltaire met the chevalier Rohan-Chabot at the house of the marquis of Sully. The chevalier, offended by Voltaire's free speech, insolently asked the marquis, "Who is that young man?" "One," replied Voltaire, "who if he does not parade a great name, honours that he bears." The chevalier said nathing at the time, but, seizing his opportunity, inveigled Voltaire into his coach, and had him beaten by six of his footmen. Voltaire set to work to learn fencing, and then sought the chevalier in the theatre, and publicly challenged him. A *bon-mot* at the chevalier's expense was the only satisfaction that the philosopher could obtain. "Monsieur, si quelque affaire d'intérêt ne vous a point fait oublier l'outrage dont j'ai à me plaindre, j'espère que vous m'en rendrez raison." The chevalier was said to employ his capital in petty usury. After this incident and its consequences, Voltaire inveighed against duelling, not only for its absurdity, but also for its aristocratic exclusiveness. Rousseau had said of duelling, "It is not an institution of honour, but a horrible and barbarous custom, which a courageous man despises and a good man abhors." Napoleon was a sworn foe to it. "Bon duelliste mauvais soldat" is one of his best known sayings; and, when the king of Sweden sent him a challenge, he replied that he would order a fencing-master to attend him as plenipotentiary. After the battle of Waterloo duels such as Lever loves to depict were frequent between disbanded French officers and those of the allies in occupation. The restoration of the Bourbons brought with it a fresh crop of duels. Since then duels have been frequent in France — more frequent, however, in novels than in real life — fought mainly between politicians and journalists, and with rare exceptions bloodless affairs. If fought with pistols, the distance and the weapons chosen render a hit improbable; and, if fought with rapiers, honour is generally satisfied with the first blood drawn. Among Frenchmen famous in politics or letters who have "gone out" may be mentioned Armand Carrel, who fell in an encounter with Emile Girardin; Thiers, who thus atoned for a youthful indiscretion; the elder Dumas; Lamartine; Ste. Beuve, who to show at once his sangfroid and his sense of humour, fought under an umbrella; Ledru Rollin; Edmond About; Clément Thomas; Veuillot, the representative of the church militant; Rochefort; and Boulanger, the Bonapartist *fanfaron,* whose discomfiture in a duel with Floquet resulted in a notable loss of popular respect.

Duels in England. — Duelling did not begin in England till some 100 years after it had arisen in France. There is no instance of a private duel fought in England before the 16th century, and they are rare before the reign of James I. A very fair notion of the comparative popularity of duelling, and of the feeling with which it was regarded at various periods, might be gathered by examining the part it plays in the novels and lighter literature of the times. The earliest duels we remember in fiction are that in the *Monastery* between Sir Piercie Shafton and Halbert Glendinning. and that in *Kenilworth* between Tressilian and Varney. (That in *Anne of Geierstein* either is an anachronism or must reckon as a wager of battle.) Under James I. we have the encounter between Nigel and Lord Dalgarno. The greater evil of war, as we observed in French history, expels the lesser, and the literature of the Commonwealth is in this respect a blank. With the Restoration there came a reaction against Puritan morality, and a return to the gallantry and loose manners of French society, which is best represented by the theatre of the day. The drama

of the Restoration abounds in duels. Passing on to the reign of Queen Anne, we find the subject frequently discussed in the *Tatler* and the *Spectator*, and Addison points in his happiest way the moral to a contemporary duel between Thornhill and Sir Cholmeley Dering. "I come not," says Spinomont to King Pharamond, "I come not to implore your pardon, I come to relate my sorrow, a sorrow too great for human life to support. Know that this morning I have killed in a duel the man whom of all men living I love best." No reader of *Esmond* can forget Thackeray's description of the doubly fatal duel between the duke of Hamilton and Lord Mohun, which is historical, or the no less life-like though fictitious duel between Lord Mohun and Lord Castlewood. The duel between the two brothers in Stevenson's *Master of Ballantrae* is one of the best conceived in fiction. Throughout the reigns of the Georges they are frequent. Richardson expresses his opinion on the subject in six voluminous letters to the *Literary Repositor*. Sheridan, like Farquhar in a previous generation, not only dramatized a duel, but fought two himself. Byron thus commemorates the bloodless duel between Tom Moore and Lord Jeffrey:—

> Can none remember that eventful day,
> That ever glorious almost fatal fray,
> When Little's leadless pistols met the eye,
> And Bow Street myrmidons stood laughing by?

There are no duels in Miss Austen's novels, but in those of Miss Edgeworth, her contemporary, there are three or four. As we approach the 19th century they become rarer in fiction. Thackeray's novels, indeed, abound in duels. "His royal highness the late lamented commander-in-chief" had the greatest respect for Maj. Macmurdo, as a man who had conducted scores of affairs for his acquaintance with the greatest prudence and skill; and Rawdon Crawley's duelling pistols, "the same which I shot Captain Marker," have become a household word. Dickens, on the other hand, who depicts contemporary English life, and mostly in the middle classes, in all his numerous works has only three; and George Eliot never once refers to a duel. Tennyson, using a poet's privilege, laid the scene of a duel in the year of the Crimean War, but he echoes the spirit of the times when he stigmatizes "the Christless code that must have life for a blow." Browning, who delights in cases of conscience, has given admirably the double moral aspect of the duel in his two lyrics entitled "Before" and "After."

To pass from fiction to fact we will select the most memorable English duels of the last century and a half. Lord Byron killed Chaworth in 1765; Charles James Fox and Adams fought in 1779; duke of York and Colonel Lennox, 1789; William Pitt and George Tierney, 1796; George Canning and Lord Castlereagh, 1809; Christie killed John Scott, editor of the *London Magazine*, 1821; duke of Wellington and earl of Winchelsea, 1829; Roebuck and Black, editor of *Morning Chronicle*, 1831; Lord Alvanley and a son of Daniel O'Connell in the same year; Earl Cardigan wounded Captain Tuckett, was tried by his peers, and acquitted on a legal quibble, 1840.

The Killing of Captain Boyd.—The year 1808 is memorable in the annals of duelling in England. Major Campbell was sentenced to death and executed for killing Capt. Boyd in a duel. In this case it is true that there was a suspicion of foul play; but in the case of Lieut. Blundell, who was killed in a duel in 1813, though all had been conducted with perfect fairness, the surviving principal and the seconds were all convicted of murder and sentenced to death, and, although the royal pardon was obtained, they were all cashiered. The next important date is the year 1843, when public attention was painfully called to the subject by a duel in which Col. Fawcett was shot by his brother-in-law, Lieut. Monro. The survivor, whose career was thereby blasted, had, it was well known, gone out most reluctantly, in obedience to the then prevailing military code. A full account of the steps taken by the prince consort, and of the correspondence which passed between him and the duke of Wellington, will be found in the *Life of the Prince* by Sir T. Martin. Meanwhile there had been formed in London the association against duelling. It included leading members of both houses of parliament and distinguished officers of both services. The first report, issued in 1844, gives a memorial of the association presented to Queen Victoria through Sir James Graham, and in a debate in the House of Commons (March 11, 1844) Sir H. Hardinge, the secretary of war, announced to the House that her majesty had expressed herself desirous of devising some expedient by which the barbarous practice of duelling should be as much as possible discouraged. In the same debate Turner reckoned the number of duels fought during the reign of George III. at 172, of which 91 had been attended with fatal results; yet in only two of these cases had the punishment of death been inflicted. But though the proposal of the prince consort to establish courts of honour met with no favour, yet it led to an important amendment of the articles of war (April, 1844). The 98th article ordains that "every person who shall fight or promote a duel, or take any steps thereto, or who shall not do his best to prevent duel, shall, if an officer, be cashiered, or suffer such other penalty as a general court-martial may award." These articles, with a few verbal changes, were incorporated in the consolidated Army Act of 1879 (section 38), which is still in force.

Duels in Germany.—Under the late imperial régime, German army duels were authorized by the military code as a last resort in grave cases. A German officer who was involved in a difficulty with another was bound to notify the circumstance to a council of honour at the latest as soon as he had either given or received a challenge. A council of honour consisted of three officers of different ranks and was instructed, if possible, to bring about a reconciliation. If unsuccessful it had to see that the conditions of the duel were not out of proportion to the gravity of the quarrel. Public opinion was greatly aroused by a tragic duel fought by two officers of the reserve in 1896; and the German emperor in a cabinet order of 1897, confirmed in 1901, enforced the regulation of the military court of honour, and gave warning that any infringement would be visited with full penalties of the law. It continued to be the fact that a German officer who was not prepared to accept a challenge and to fight, if the opinion of his regiment demanded it, was compelled to leave the service.

Under the republic, the question is governed (1928) by articles 201 to 210 inclusive of the existing criminal code. It should be noted that the German cabinet have pledged themselves to revise this code. The existing provisions which refer to duelling may be summarized as follows:—

(1) (Article 201.) Any person challenging a second person to a duel or accepting such a challenge is liable to punishment by a term of imprisonment not exceeding six months.

(2) (Article 205.) Persons taking part in a duel are liable to sentences ranging from three months to five years.

(3) (Article 206.) Should anyone kill his opponent in a duel, he will be sentenced to imprisonment for not less than two years. Should it be shown, however, that the duel was entered into with mortal intent, the period of imprisonment shall not be less than three years.

(4) (Article 210.) Should any person intentionally encourage another person to fight a duel, he will, in the event of the duel taking place, be punished by imprisonment for not less than three months.

The German Student Duels.—The celebrated *Mensuren*, or German students' duels, have survived the War changes, and although forbidden by the German criminal code it is probable that the new code will make it plain that they are to be regarded as a sport and therefore legalized. They still form a regular element in German student life. In Berlin alone, there are in 1928 some 12 fighting corps which meet once a week in secret. These meetings continue from 8 o'clock in the morning onwards, and some 20 fights take place on each occasion. The police, as well as the university authorities, naturally know all about them; but are only too willing to close their eyes. These fighting corps or *Verbindungen* exist to-day in every German university.

The entry of a student into one of these clubs is held to be a considerable honour, and is only possible where a student has shown the necessary qualifications to permit of his admission. It moreover carries with it a number of advantages to the ex-

student in after life, and very often helps him to obtain a good position in a profession or industry. The primary qualification would seem to be having fought three "parties" or matches "successfully."

To fight a students' duel, it would seem that a considerable amount of previous practice is necessary. In each fighting *Verbindung*, a *Fechtsaal* forms part of the equipment of the club-house, and daily practice is provided for fighting students under the supervision of the training instructor, who is one of the senior students of the *Verbindung* and named the *Zweiter Chargierter*. There are two categories of fighting students. First, the *Fuchs* or novice; secondly, the *Bursch* (fellow or accepted member); besides these, the "inactive," which means a student who has finished his time in the *Verbindung*, but still retains his membership of the university.

The training practice consists of a number of short bouts fought under rather similar conditions to the actual duel. The student, however, is provided with a steel mask to accustom him to the art of fencing without the possibility of damage. The body and arms are also protected. The sword, moreover, is not sharpened. It is of interest in this connection to note that Roman Catholic members of the German universities are forbidden by their Church to enter fighting *Verbindungen* on penalty of expulsion.

Apparently the only point that is decided for or against a particular fighter is his bearing during the fight. No points are given for skill in attack or defence, and each fighter is judged by the witnessing *Korpsbrüder* of his own fighting *Verbindung* only.

Modern Views of the Duel.—Any formal discussion of the morality of duelling is, in England at least, happily superfluous. No fashionable vice has been so unanimously condemned both by moralists and divines. Some, however, of the problems, moral and social, which it suggests may be noticed briefly. That duelling flourished so long in England the law is, perhaps, as much to blame as society. It was doubtless from the fact that duels were at first a form of legal procedure that English law has refused to take cognizance of private duels. A duel in the eye of the law differs nothing from an ordinary murder. The greatest English legal authorities, from the time of Elizabeth downwards, such as Coke, Bacon and Hale, have all distinctly affirmed this interpretation of the law. But here as elsewhere the severity of the penalty defeated its own object. The public conscience revolted against a Draconian code which made no distinction between wilful murder and a deadly combat wherein each party consented to his own death or submitted to the risk of it. No jury could be found to convict when conviction involved in the same penalty a Fox or a Pitt and a Turpin or a Brownrigg. Such, however, was the conservatism of English publicists that Bentham was the first to point out clearly this defect of the law, and propose a remedy. In his *Introduction to the Principles of Morals and Legislation*, published in 1789, Bentham discusses the subject with his usual boldness and logical precision. In his exposition of the absurdity of duelling considered as a branch of penal justice, and its inefficiency as a punishment, he only restates in a clearer form the arguments of Paley. So far there is nothing novel in his treatment of the subject. But he soon parts company with the Christian moralist, and proceeds to show that duelling does, however rudely and imperfectly, correct and repress a real social evil. "It entirely effaces a blot which an insult imprints upon the honour. Vulgar moralists, by condemning public opinion upon this point, only confirm the fact." He then points out the true remedy for the evil. It is to extend the same legal protection to offences against honour as to offences against the person. The legal satisfactions which he suggests are some of them extremely grotesque. Thus for an insult to a woman, the man is to be dressed in woman's clothes, and the retort to be inflicted by the hand of a woman. But the principle indicated is a sound one, that in offences against honour the punishment must be analogous to the injury. Doubtless, if Bentham were now alive, he would allow that the necessity for such a scheme of legislation had in a great measure passed away. That duels have since become extinct is no doubt principally owing to social changes, but it may be in part ascribed to improvements in legal remedies in the sense which Bentham indicated. A notable instance is Lord Campbell's Act of 1843, by which, in the case of a newspaper libel, a public apology coupled with a pecuniary payment is allowed to bar a plea. In the Indian code there are special enactments concerning duelling, which is punishable not as murder but as homicide.

The duel, which in a barbarous age may be excused as "a sort of wild justice," was condemned by Bacon as "a direct affront of law and tending to the dissolution of magistracy." It survived in more civilized times as a class distinction and as an ultimate court of appeal to punish violations of the social code. In a democratic age and under a settled government it is doomed to extinction. The military duels of the European continent, and the so-called American duel, where the lot decides which of the two parties shall end his life, are singular survivals. For real offences against reputation law will provide a sufficient remedy. The learned professions will have each its own tribunal to which its members are amenable. Social stigma is at once a surer and juster defence against conduct unworthy of a gentleman.

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(F. S.; X.)

DUENNA, specifically the chief lady-in-waiting upon the queen of Spain (Span. *dueña*, a married lady or mistress, Lat. *domina*). The word is more widely applied, however, to an elderly lady in Spanish and Portuguese households (holding a position midway between a governess and companion) appointed to take charge of the young girls of the family; and "duenna" is thus used in English as a synonym for chaperon (*q.v.*).

DUEPPEL, a village of Germany, in the Prussian province of Schleswig-Holstein, opposite the town of Sonderburg (on the island of Alsen). (Pop. 600.) The position of Diippel, forming as it does a bridge-head for the defenders of the island of Alsen, played a conspicuous part in the wars between Denmark and the Germans. On May 28, 1848, the German federal troops were there defeated by the Danes under Gen. Hedemann, and a second battle was fought on June 6, 1848. On April 13, 1849, an indecisive battle was fought between the federal troops under Prittwitz and the Danes under Bülow. The most important event in the military history of Diippel was, however, the siege by the Prussians of the Danish positions in 1864. The flanks of the defenders' line rested upon the Alsen sund and the sea, and a second line of trenches was constructed behind the front attacked, and a small réduit opposite Sonderburg to cover the bridges between Alsen and the mainland. The Prussian siege corps was commanded by Prince Frederick Charles and after three weeks' skirmishing a regular siege was begun, the batteries being opened on March 15. The siege was pushed rapidly from the first parallel, completed March 30, and the assault delivered on April 18. The whole line was carried after a brief but severe conflict, and the Prussians had penetrated to and captured the réduit opposite Sonderburg by 2 P.M. The loss of the Danes, half of whose forces were not engaged, included 1,800 killed and wounded and 3,400 prisoners. This operation was followed by the daring passage of the Alsen sund, effected by the Prussians in boats almost under the guns of the Danish warships, and resulting in the capture of the whole island of Alsen (June 29, 1864).

See R. Neumann, *Über den Angriff der Düppeler Schanzen in der Zeit vom 15. März bis 18 April 1864* (1865); and *Der deutschdänische Krieg 1864*, published by the Prussian General Staff (1887).

DUET, a term in music for a composition for two performers, either vocal or instrumental, in which the two parts are of more or less equal importance. Thus a piece for a violin and piano in which the latter provides merely an accompaniment is not properly called a duet. Duo is a term having the same meaning though usually applied to instrumental duets only.

DUFAURE, JULES ARMAND STANISLAS (1798–1881), French statesman, was born at Saujon (Charente-Inférieure) on Dec. 4, 1798. He became an advocate at Bordeaux, and in 1834 was elected deputy. As minister of public works (1839) in the Soult ministry, he freed railway construction in France from the obstacles which till then had hampered it. In 1840 Dufaure became one of the leaders of the Opposition, and on the outbreak of the revolution of 1848 he frankly accepted the Republic. On Oct. 13 he became minister of the interior under G. Cavaignac but retired on the latter's defeat in the presidential election. During the Second Empire Dufaure practised at the Paris bar and was elected *bâtonnier* in 1862. In 1863 he succeeded to Pasquier's seat in the French Academy. In 1871 he became a member of the Assembly, and it was on his motion that Thiers was elected President of the Republic. Dufaure was minister of justice under Thiers and under L. J. Buffet, whom he succeeded (March 9, 1876) as president of the council. He resigned office on Dec. 12 but returned to power on Dec. 24, 1877. Early in 1879 Dufaure took part in compelling the resignation of Marshal MacMahon, but immediately afterwards (Feb. 1), worn out by opposition, he himself retired. He died in Paris on June 28, 1881.

See G. Picot, *M. Dufaure, sa vie et ses discours (1883).*

DUFF, ALEXANDER (1806–1878), Scottish missionary in India, was born at Auchnahyle, Moulin, Perthshire. At St. Andrews university he came under the influence of Dr. Chalmers, and was sent out by the foreign mission committee of the general assembly as their first missionary to India. He was ordained in Aug. 1829, and started at once for India, but was twice shipwrecked before he reached Calcutta in May 1830, and lost all his books and other property. Up to this time Protestant missions in India had been successful only in reaching low-caste and outcaste peoples, particularly in Tinevelly and south Travancore. The Hindu and Mohammedan communities had been practically untouched. Duff therefore devised the policy of an educational mission. He first opened an English school in which the Bible was the centre of the school work, and along with it all kinds of secular knowledge were taught from the rudiments upwards to a university standard. The school soon began to expand into a missionary college, and a Government minute was adopted on March 7, 1835, to the effect that in higher education the object of the British Government should be the promotion of European science and literature among the natives of India.

After six years' furlough in England, Duff returned in 1840 to India. In 1839 the earl of Auckland, governor-general, had yielded to the "Orientalists" who opposed Duff, and adopted a policy which was a compromise between the two. At the Disruption of 1843 Duff sided with the Free Church, gave up the college buildings, with all their effects, and with unabated courage set to work to provide a new institution. He had the support of Sir James Outram and Sir Henry Lawrence, and the encouragement of seeing a new band of converts, including several young men of high caste. In 1844 Viscount Hardinge opened Government appointments to all who had studied in institutions similar to Duff's foundation. In the same year Duff took part in founding the *Calcutta Review*, of which from 1845 to 1849 he was editor. In 1849 he returned home. He was moderator of the Free Church assembly in 1851.

In 1856 Duff returned to India. He gave much thought and time to the University of Calcutta, which owes its examination system and the prominence given to physical sciences to his influence. In 1863 Sir Charles Trevelyan offered him the post of vice-chancellor of the university, but his health compelled him to leave India. He continued his work for foreign missions in different parts of the world, and was the first occupant of the chair of foreign missions at New college, Edinburgh; and at his death, on Feb. 12, 1878, left his personal property to found a lectureship on foreign missions on the model of the Bampton lectures.

See his *Life*, by George Smith (2 vols.).

DUFF, SIR EVELYN MOUNTSTUART GRANT (1863–1926), British diplomatist, second son of the Sir Mountstuart Grant Duff, the administrator and diarist, was born on Oct. 9, 1863. From 1888 he was on Foreign Office service in Rome, Tehrān, St. Petersburg (Leningrad), Stockholm and elsewhere. In 1913 he was made minister at Berne, a post which acquired great importance with the outbreak of war in 1914. Grant Duff had the responsibility of furthering friendly relations between the British and Swiss Governments, and of mitigating the difficulties arising out of the blockade. He was the object of a violent newspaper campaign instigated by the Germans, and was accused of taking observations of Friedrichshaven from the neutral Romanshorn. This propaganda was officially contradicted by the Swiss Government. In 1900 he married Edith Florence, daughter of Sir George Bonham. Lady Grant Duff gave invaluable assistance in organizing the *Bureau de Secours aux prisonniers de Guerre (British Section)*. Sir Evelyn resigned in August 1916. He died at Bath on Sept. 19, 1926.

DUFF, SIR MOUNTSTUART ELPHINSTONE GRANT (1829–1906), British politician and writer, was born at Eden, Scotland. He was educated at Edinburgh and Oxford, and in 1854 was called to the bar. He sat in parliament as the Liberal member for the Elgin Burghs from 1857 to 1881, being undersecretary of state for India from 1868 to 1874 and for the colonies during 1880–81. He was governor of Madras from 1881 to 1886. His writings include *Miscellanies, Political and Literary* (1878); *Studies in European Politics* (1886); *Memoirs of Henry Maine* (1892); *Renan* (1893), and *Notes from a Diary for the years 1851–1901* (14 vols., 1897–1905).

DUFFERIN AND AVA, FREDERICK TEMPLE HAMILTON-TEMPLE-BLACKWOOD, 1ST MARQUESS OF (1826–1902), British diplomatist, son of Price Blackwood, 4th Baron Dufferin, was born at Florence, Italy, on June 21, 1826. The Irish Blackwoods were of old Scottish stock, tracing their descent back to the 14th century. Frederick went to Eton (1839–43) and Christ Church, Oxford (1845–47), where he took a pass school and was president of the Union. His father died in 1841, and the influence of his mother, Helena Selina Sheridan—one of three unusually accomplished sisters, the other two being the duchess of Somerset and Mrs. Norton (*q.v.*)—was very marked on his mental development; she lived till 1867 and is commemorated by the "Helen's Tower" erected by her son in her honour at Clandeboye (the Irish seat of the Blackwoods) in 1861, and adorned with epigraphical verses written by Tennyson, Browning and others. Her son edited her *Poems and Verses* (1894). In 1846–48 Lord Dufferin was active in relieving the distress in Ireland due to the famine. He was a good landlord; in 1855 he already advocated compensation for disturbance and for improvements; but while supporting reasonable reform, he demanded justice for the landowners. When Gladstone adopted Home Rule, Lord Dufferin regarded the new policy as fatal both to Ireland and to the United Kingdom, though, being then an ambassador, he took no public part in opposing it. In 1849 Dufferin was made a lord-in-waiting. In 1855 Lord John Russell took him as attaché on his special mission to the Vienna Conference, and in 1860 sent him as British representative on a joint commission of the powers appointed to inquire into the affairs of the Lebanon (Syria), where the massacres of Christian Maronites by the Mussulman Druses had resulted in the landing of a French force and the possibility of a French occupation. Lord Dufferin was associated with French, Russian, Prussian and Turkish colleagues, and the diplomatic position was delicate. At last it was agreed to place a Christian governor, subordinate to the Porte, over the Lebanon district, and to set up local administrative councils. In May 1861 the French forces departed, and Lord Dufferin was thanked for his services by the government. In 1862 he married Hariot, daughter of Cap-

tain A. Rowan Hamilton, of Killyleagh Castle, Down. He held successively the posts of under-secretary for India (1864–66) and under-secretary for war (1866) in Lord Palmerston's and earl Russell's ministries; and he was chancellor of the duchy of Lancaster, outside the cabinet, under Gladstone (1868–72). In 1871 he was created earl of Dufferin.

In 1872 he was appointed governor-general of Canada. He had already become known as a powerful and graceful orator, and a man of culture and political distinction; and his abilities were brilliantly displayed in dealing with the problems of the newly united provinces of the Canadian Dominion. He admittedly strengthened and consolidated the imperial connection. Lord Dufferin left Canada in 1878, and in 1879 he was appointed by Lord Beaconsfield ambassador to Russia. In 1881 he was transferred to Constantinople, where he was concerned in the negotiations connected with the situation in Egypt caused by Arabi's revolt and the intervention of Great Britain. He was considerably helped by Turkish ineptitude, and by the accomplished fact of British military successes in Egypt, but his own diplomacy contributed to secure freedom of action for Great Britain. From Oct. 1882 to May 1883 he was in Egypt as British commissioner to report on a scheme of reorganization. In 1884 he was appointed viceroy of India, succeeding Lord Ripon. Lord Dufferin though agreeing in the main with Lord Ripon's native policy, gained the confidence of the Anglo-Indian community without producing any undesirable reaction. He initiated stable relations with Afghanistan, and settled the crisis with Russia arising out of the Panjdeh incident (1885), which led to the delimitation of the north-west frontier (1887). The annexation of Burma during his viceroyalty procured for him, on his resignation, the title of marquess of Dufferin and Ava (1888). His viceroyalty was also memorable for Lady Dufferin's work in providing better medical treatment for native women. In 1888 he was made ambassador at Rome, and in 1892 ambassador in Paris. He retired in 1896.

His last years, spent mainly at his Irish home, were clouded by the death of his eldest son, the earl of Ava, at Ladysmith in the Boer War (1900), and by business troubles due to his having accepted the chairmanship of the London and Globe Finance Corporation, of which Whitaker Wright was managing director. He died on Feb. 12, 1902, and was succeeded in the title by his second son Terence (1866–1918). His fourth son Frederick (b. 1875) succeeded in 1918 and was Speaker of the Senate, Northern Ireland, in 1921. Killed in an air smash, July 21, 1930, he was succeeded by his son Basil. Lord Ava (b. 1909).

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DUFF-GORDON, LUCIE (1821–1869), English woman of letters, daughter of John and Sarah Austin (*q.v.*), was born on June 24, 1821, and died in Egypt on July 14, 1869. Her chief playfellows as a child were her cousin, Henry Reeve, and John Stuart Mill, who lived next door in Queen Square, London. In 1834 the Austins went to Boulogne, and at table d'hôte Lucie found herself next to Heinrich Heine. The poet and the little girl became fast friends, and years afterwards she contributed to Lord Houghton's *Monographs Personal and Social* a touching account of a renewal of their friendship when Heine lay dying in Paris. Her parents went to Malta in 1836, and Lucie Austin was left in England at school. She married in 1840 Sir Alexander Duff-Gordon (1811–72). With her mother's beauty she had inherited her social gifts, and she gathered round her a brilliant circle of friends. George Meredith has analysed and described her extraordinary success as a hostess. and the process by which she reduced too ardent admirers to "happy crust-munching devotees" "In England, in her day," he says, "while health was with her, there was one house where men and women conversed. When that house perforce was closed, a light had gone out in our country." She went in 1860 to the Cape of Good Hope, and later to Egypt, where she died. She had translated among other works *Ancient Grecian Mythology* (1839) from the German of Niebuhr; *Mary Schweidler; The Amber Witch* (1844) from the German of Wilhelm Meinhold; and *Stella and Vanessa* (1850) from the French of A. F. L. de Wailly. Her *Letters from the Cape* (1862–63) appeared in 1865, and were reprinted in 1927; and in 1865 her *Letters from Egypt*, edited by her mother, attracted much attention. *Last Letters from Egypt* (1875) contained a memoir by her daughter, Janet Ross (*q.v.*), Lady Duff-Gordon won the hearts of her Arab dependents and neighbours. She doctored their sick and taught their children.

The *Letters from Egypt* were not originally published in a complete form. A fuller edition with an introduction by George Meredith, was edited in 1902 by Mrs. Janet Ross. *See* also Mrs. Ross's *Three Generations of Englishwomen* (1886).

DUFFTOWN, police burgh, Banffshire, Scotland, on the Fiddich, 64 m. W.N.W. of Aberdeen by the L.N.E.R. Pop. (1931) 1,454. It dates from 1817 and bears the name of its founder, James Duff, 4th earl of Fife. Although planned in the shape of a cross, with a square and tower in the middle, the arms of the cross are not straight, the constructor holding that, in order to prevent little towns from being taken in at a glance, their streets should be crooked. The leading factories are lime-works and distilleries, the water being good for whisky making. The town is a health resort. Dufftown is in the parish of Mortlach. The Stone of Mortlach is traditionally believed to have been erected to commemorate the success of Malcolm II. over the Danes in 1010. There are also three large stones known as "The King's Grave," a hill-fort and cairns. A portion of old Balvenie castle, a ruin, is considered to be of Pictish origin, but most of it is of the Scots Baronial period. Two miles south-east of Dufftown is the ruined castle of Auchindown, on a limestone crag, 200 ft. high, of which three sides are washed by the Fiddich and the fourth was protected by a moat. It dates from the 11th century, and once belonged to the Ogilvies, from whom it passed in 1535 to the Cordons. The Gothic hall with rows of fluted pillars is in fair preservation. About 4 m. to the NW. is Craigellachie, on the confines of Elginshire. It is a growing place, with a large hotel, situated on the Spey amidst fine scenery. The slogan of the Grants is "Stand fast Craigellachie!"

DUFFY, SIR CHARLES GAVAN (1816–1903), Irish and colonial politician, was born in Monaghan, Ireland, on April 12, 1816. He was one of the founders (1842) of the *Nation*, a Dublin weekly remarkable for the fire and spirit of its political poetry. In 1844 Duffy was included in the same indictment with O'Connell, and shared his conviction in Dublin and his acquittal by the House of Lords upon a point of law. His ideas, nevertheless, were too revolutionary for O'Connell; a schism took place in 1846, and Duffy united himself to the "Young Ireland" party. He was tried for treason-felony in 1848, but the jury were unable to agree. Duffy continued to agitate in the press and in parliament, to which he was elected in 1852, but his failure to bring about an alliance between Catholics and Protestants upon the land question determined him in 1856 to emigrate to Victoria. There he became in 1857 minister of public works, and after an active political career, in the course of which he was prime minister from 1871 to 1873, when he was knighted, he was elected speaker of the House of Assembly in 1877, being made K.C.M.G. in the same year. In 1880 he resigned and returned to Europe, residing mostly in the south of France. He published *The Ballad Poetry of Ireland* (1845), several works on Irish history, *Conversations with Carlyle* (1892), *Memoirs* (1898), etc. In 1891 he became first president of the Irish Literary Society. He died on Feb. 9, 1903.

DUFOUR, WILHELM HEINRICH (GUILLAUME HENRI) (1787–1875), Swiss general, was born at Constance, of Genevese parents temporarily in exile, on Sept. 15, 1787. He studied at the Bcole Polytechnique in Paris, served in the French army, and returned to Switzerland after 1815 He became chief instructor at the military school at Thun, where he had Louis Napoleon (Napoleon III.) among his pupils. He carried out the trigonometrical survey of Switzerland, which was thirty-two years in the

making. In *1847* Dufour was made general of the Federal Army, which was employed in reducing the revolted Catholic cantons, a task in which he showed conspicuous skill and moderation. In politics he belonged to the moderate conservative party, and he consequently lost a good deal of his popularity in *1848*. In *1856*, in the conflict with Frederick-William IV. of Prussia over the possession of Neuchâtel, Dufour was put at the head of the republican army and was sent to Paris to obtain the mediation of Napoleon III.; and again in *1859* at the time of the French annexation of Savoy, he was in charge of the negotiations at Paris concerning the neutrality of northern Savoy. *(See* SWITZERLAND: *History.)* In *1864* he presided over the international conference which framed the Geneva Convention as to the treatment of the wounded in time of war, etc. He died on July *14, 1875*.

His works include: *De la fortification permanente* (1850); *Mémoire sur l'artillerie des anciens et sur celle du moyen âge (1840)*; *Manuel de tactique pour les officiers de toutes armes* (1842), and various other works in military science. His memoir, *La Campagne du Sonderbund* (Paris, 1876), is prefaced by a biographical notice.

See Senn-Bardiene, *Das Buch des Generals Dufour* (6th ed., 1897).

DUGDALE, SIR WILLIAM *(1605–1686)*, English antiquary, was born at Shustoke, near Coleshill, Warwickshire, on Sept. *12*, 160*5*. He married at *17*, and lived with his wife's family until his father's death in *1624*, when he went to live at Fillongley, near Shustoke, an estate formerly acquired for him by his father. In *1625* he purchased the manor of Blythe, Shustoke, and removed thither in 1626. In 1635 he met Sir Symon Archer (1581–1662), himself a learned antiquary, who was then employed in collecting materials for a history of Warwickshire, and accompanied him to London. In *1638* Dugdale was created a pursuivant of arms extraordinary by the name of Blanch Lyon, and in *1639* rouge croix pursuivant in ordinary. He now had a lodging in the Heralds' Office, and spent much of his time in London examining the records in the Tower and the Cottonian and other collections of mss. In *1641* Sir Christopher Hatton, foreseeing the war and dreading the ruin and spoliation of the church, commissioned him to make exact drafts of all the monuments in Westminster Abbey and the principal churches in England. In June, *1642*, he was summoned to attend the king at York. When war broke out Charles deputed him to summon to surrender the castles of Banbury and Warwick, and other strongholds which were being rapidly filled with ammunition and rebels. He went with Charles to Oxford, remaining there till its surrender in *1646*. He witnessed the battle of Edgehill, where he made afterwards an exact survey of the field, noting how the armies were drawn up, and where and in what direction the various movements took place, and marking the graves of the slain. In *1646* Dugdale returned to London and compounded for his estates, which had been sequestrated, by a payment of *£168*. He collaborated with Roger Dodsworth (*q.v.*) in his *Monasticon Anglicanum*, which was published successively in single volumes in 1655, *1664* and *1673*. At the Restoration he obtained the office of Norroy king-at-arms, and in *1677* was created garter principal king-at-arms, and was knighted. He died at Blythe Hall on Feb. 10, *1686*.

Dugdale's most important works are *Antiquities of Warwickshire* (1656, 1786); *Monasticon Anglicanum* (1655–73, 1846); *History of St. Paul's Cathedral* (1658), and *Baronage of England* (1675–76). His *Life*, written by himself up to 1678, with his diary and correspondence, and an index to his manuscript collections, was edited by William Hamper, and published in 1827.

DUGGAR, BENJAMIN MINGE *(1872–*), American botanist, was born at Gallion, Ala., on Sept. *1, 1872*. He graduated at Harvard in *1895*, received in *1898* the degree of doctor of philosophy from Cornell university and later studied in various universities in Germany and France, and in Naples. He was cryptogamic botanist in the agricultural experiment station and instructor and assistant professor in plant physiology at Cornell university in 1896–1901. He was physiologist in the bureau of plant industry, U.S. Department of Agriculture. in 1901–02, following which he was professor of botany in the University of Missouri until 1907 and professor of plant physiology in Cornell university until 1913. He then became research professor of plant physiology in the Missouri botanical garden and Washington university, serving until 1927 when he was appointed professor of physiological and economic botany in the University of Wisconsin. He made extensive researches in plant physiology, and was editor for plant physiology of *Botanical Abstracts* from 1917 to *1926* when he became editor of *Biological Abstracts*. Among his published works are *Fungous Diseases of Plants* (1909), *Plant Physiology* (1911), *Mushroom Growing* (1915), and numerous research articles in scientific journals.

DUGONG, one of the two existing genera of the Sirenia, or herbivorous aquatic mammals. Dugongs *(Halicore)* are distinguished from manatee by the presence in the upper jaw of the male of a pair of large tusks. There are never more than five molar teeth on each side of the jaw, and these are flat on the grinding surface. The paddles are unprovided with nails, and the tail is broad and crescent-shaped; the bones are hard and firm. Dugongs frequent the shallow waters of tropical seas where they may be seen basking on the surface of the water, or browsing on submarine pastures of seaweed, for which the thick lips and truncated snout pre-eminently fit them; they are gregarious. The female produces a single young one at a birth, and is remarkable for its great maternal affection. Three species—the Indian dugong (H. *dugong)*, the Red Sea dugong *(H. tabernaculi)* and the Australian dugong *(H. australis)* are recognized. The first abounds in the Indian Ocean, and is captured by the Malays, who esteem its flesh a great delicacy; it is generally taken by spearing. It seldom attains a length of more than 10ft. The Australian dugong is larger, attaining a length of 15ft.; it occurs along the Australian coast from Moreton bay to Cape York, and is highly valued by the natives. Of late years the oil obtained from the blubber of this species has been used in Australia as a substitute for cod-liver oil, A full-grown dugong yields from ten to 12 gallons.

FROM VOGT & SPECHT, "NATURAL HISTORY OF ANIMALS"

DUGONG (HALICORE DUGONG)

DUG-OUT, an underground chamber or passage dug out of a slope or bank or in a trench. The simplest form of dug-out is the small shelter for two or three men, protecting them rather against the elements than against the effects of enemy fire; larger and more elaborate dug-outs will secure their occupants against bullets and splinters of shell; while the deep mined works, constructed by all belligerents on the Western front during the World War, were capable of housing whole units in complete immunity from even the heaviest bombardment, and were in many cases equipped with lighting, sleeping and living facilities. As against this security from shell fire, however, it was found that these large dug-outs often proved traps for the garrisons sheltering in them, who were unable to emerge in time to repel a hostile infantry attack, and during the later years of the war their construction was largely discontinued. The word also designates the Western plain dwellings of North American pioneers. *(See* also CANOE.)

DUGUAY-TROUIN, RENÉ (1673–1736), French sea captain, was born at St. Malo on June 10, *1673*. On the outbreak of the war with England and Holland in *1689* he went to sea in a privateer owned by his family. As a volunteer in a vessel of *28* guns he was present in 1690 at a bloody combat with an English fleet of five merchant vessels. His family then gave him a corsair of 14 guns; and having been cast by a storm on the coast of Ireland, he burned two English ships in the River Limerick. In *1694* his vessel of *40* guns was captured by the English and he was confined in the castle of Plymouth. He escaped and obtained command of a vessel of 48 guns and captured some English vessels on the Irish coast. In *1696* he made a brilliant capture of Dutch vessels and was made *capitaine de frégate* (commander) in the royal navy. In 1704–5 he persistently raided the coasts of England. In 1706 he was raised to the rank of captain of a vessel of the line. In 1707 he captured off the Lizard the greater part of an English convoy of troops and munitions bound for Portugal. His most glorious action was the capture in 1711 of Rio Janeiro, on

which he imposed a heavy contribution. In 1711 he was made *chef d'escadre*, and in 1728 *lieutenant général des armées navales*. He died in Paris on Sept. 27, 1736.

See his own *Mémoires* (1740); and J. Poulain, *Duguay-Trouin* (1882).

DU GUESCLIN, BERTRAND (*c.* 1320–1380), constable of France, the most famous French warrior of his age, was born of an ancient family at the castle of La Motte-Broons (Dinan). The name is spelt in various ways in contemporary records, *e.g.* Claquin, Klesquin, Guescquin, Glayaquin, etc. In his boyhood Bertrand was a dull learner and could never read or write. At the tournament held at Rennes in 1338 to celebrate the marriage of Charles of Blois with Jeanne de Penthièvre he unseated the most famous competitors. In the war which followed between Charles of Blois and John de Montfort for the possession of the duchy of Brittany, he put himself at the head of a band of adventurers, and fought on the side of Charles and of France. He fought a brilliant action at the siege of Vannes in 1342; and after that he disappears from history for some years.

In 1354 he was sent to England with the lords of Brittany to treat for the ransom of Charles of Blois, who had been defeated and captured by the English in 1347. When Rennes and Dinan were attacked by the duke of Lancaster in 1356, Du Guesclin fought continuously against the English, and at this time he engaged in a celebrated duel with Sir Thomas Canterbury. He finally forced his way with provisions and reinforcements into Rennes, which he defended till June 1357, when the siege was raised in pursuance of the truce of Bordeaux. Shortly afterwards he passed into the service of France. In 1359, 1360, 1361 and 1362 he was continually in the field though he was twice a prisoner of the English. In May 1364 he defeated the Navarrese at Cocherel, and took the famous Captal de Buch prisoner. He had previously been made lord of Pontorson (1357), of La Roche-Tesson (1361) and chamberlain (1364); he was now made count of Longueville and lieutenant of Normandy. Shortly afterwards Du Guesclin was taken prisoner by Sir John Chandos at the battle of Auray, in which Charles of Blois was killed. Du Guesclin was ransomed for 100,000 crowns, and was charged to lead the bands of discharged mercenaries, the famous *compagnies*, out of France. He marched with them into Spain, supported Henry of Trastamara against Pedro the Cruel, set the former upon the throne of Castile (1366), and was made constable of Castile and count of Trastamara. In the following year he was defeated and captured by the Black Prince, ally of Pedro, at Navarete, but was soon released for a heavy ransom. Once more he fought for Henry, won the battle of Montiel (1369), reinstated him on the throne, and was created duke of Molinas.

In May 1370, at the command of Charles V., who named him constable of France, he returned to France. For nearly ten years he was engaged in fighting against the English in the south and the west of France, recovering from them the provinces of Poitou, Guienne and Auvergne. In 1373, when the duke of Brittany sought English aid against a threatened invasion by Charles V., Du Guesclin seized the duchy; two years later he frustrated the attempt of the duke with an English army to recover it. In 1380 he was sent into Languedoc to suppress disturbances and brigandage, provoked by the harsh government of the duke of Anjou. His first act was to lay siege to the fortress of Châteauneuf-Randon, but on the eve of its surrender the constable died on July 13, 1380.

See biography by *D.* F. Jamison (Charleston, 1863), which was translated into French (1866) by order of Marshal Count Randon, minister of war; also S. Luce, *Histoire de* B. *du Guesclin* (1876, 3rd ed., 1896).

DUHAMEL, GEORGES (b. 1884–), French poet, novelist and playwright, born in Paris on June 30, 1884. His early life was one of struggle and hardship. He studied medicine, and in the Quartier Latin made the acquaintance of Romains, Vildrac and Arcos, with whom he founded the group of the *Abbaye* (*q.v.*) at Créteil. He obtained his medical degree in 1909, and until the World War he divided his activity between scientific research and literary work. He made his name with a series of volumes of verse: *Selon ma Loi* (1910), and *Compagnons* (1912). Several plays of his were produced about the same time: *La Lumidre* (1911), *Dans l'Ombre des Statues* (1912) and *Le Combat* (1913). It was, however, his two war books, *Vie des Martyrs* (1916) and *Civilisation* (1917) which brought him before the public. Their evidence is at once poignant and unimpeachable. Since the war Duhamel has published a number of essays mainly directed to the creation of a new religious thought independent of any denomination, and to the promotion of a new era of mutual understanding between the peoples of different nationalities. He has also written a series of novels, the three most important of which form a trilogy: *Confession de Minuit* (1920), *Deux Hommes* (1924), *Journal de Salavin* (1927) and *Le Club des Lyonnais* (1929), in which the Russian influence is combined with typically French restraint and interest in everyday things of life.

DUHAMEL DU MONCEAU, HENRI LOUIS (1700–1782), French botanist and engineer, was born in Paris. His discovery of the fungus destroying the saffron plant in Gâtinais gained him admission to the Academy of Sciences in 1728. From then he devoted himself to vegetable physiology, and experimented on the growth and strength of wood, the growth of the mistletoe, on layer planting, on smut in corn, etc. He was probably the first, in 1736, to distinguish clearly between the alkalis, potash and soda. For many years he was inspector-general of marine. He died in Paris on Aug. 13, 1782.

His principal works are: *Traité des arbres et arbustes qui se cultivent en France* (1755); *La Physique des arbres* (1758); *Des Semis et plantations des arbres et de leur culture* (1760); *Éléments d'agriculture* (1762); *De l'exploitation des bois* (1764); *Traité des arbres fruitiers* (1768); *Éléments de l'architecture navale* (1785).

DÜHRING, EUGEN KARL (1833–1921), German philosopher and political economist, was born on Jan. 12, 1833, at Berlin, and died on Sept. 21, 1921. After a legal education he practised at Berlin as a lawyer till 1859. A weakness of the eyes, ending in total blindness, occasioned his taking up the studies with which his name is now connected. In 1864 he became *docent* of the university of Berlin, but, in consequence of a quarrel with the professoriate, was deprived of his licence to teach in 1874. Among his works are *Kapital und Arbeit* (1865); *Der Wert des Lebens* (1865); *Natürliche Dialektik* (1865); *Kritische Geschichte der Philosophie* (1869); *Kritische Geschichte der allgemeinen Principien der Mechanik* (1872)—one of his most successful works; *Kursus d@ National- und Sozialökonomie* (1873); *Der Ersatz der Religion durch Volkommeneres* (1883). He published his autobiography in 1882 under the title *Sache, Leben und Feinde*. Dühring's philosophy claims to be emphatically the philosophy of reality. He is passionate in his denunciation of everything which, like mysticism, tries to veil reality. He is almost Lucretian in his anger against religion which would withdraw the secret of the universe from our direct gaze. His "substitute for religion" is a doctrine in many points akin to Comte and Feuerbach, the former of whom he resembles in his sentimentalism. Dühring's opinions changed considerably after his first appearance as a writer. His earlier work, *Natürliche Dialektik*, in form and matter not the worst of his writings, is entirely in the spirit of the Critical Philosophy. Later, in his movement towards Positivism, he strongly repudiates Kant's separation of phenomenon from noumenon, and affirms that our intellect is capable of grasping the whole reality. In political philosophy Dühring teaches an ethical communism and attacks the Darwinian principle of struggle for existence. In economics he is best known by his vindication of the American writer H. C. Carey, who attracts him both by his theory of value, which suggests an ultimate harmony of the interests of capitalist and labourer, and also by his doctrine of "national" political economy, which advocates protection on the ground that the morals and culture of a people are promoted by having its whole system of industry completed within its own borders. His patriotism is fervent, but narrow and exclusive. He idolized Frederick the Great and denounced Jews, Greeks, and the cosmopolitan Goethe.

See H. Druskowitz, *Eugen Dühring* (Heidelberg, 1888); E. Döll, *Eugen Dühring* (Leipzig, 1892); F. Engels, Eugen *D.'s Umwälzung* der *Wissenschaft* (Eng. trans. by E. Aveling, 1892, reprinted 1925); H. Vaihinger, *Hartmann, Dühring* und *Lange* (1876).

DUIKER or **DUIKERBOK,** a small south African antelope, *Cephalophus grimmi;* the popular name alluding to its habit of diving into and threading its way through thick bush. The genus *Cephalophus,* together with two other African genera, Guaveia and *Sylvicapra,* constitutes the sub-family *Cephalophinae.* Duikers are animals of small or medium size, frequenting thick forest. The horns, usually present in both sexes, are small and straight, situated far back on the forehead; and between them rises a crest-like tuft of hair. The common duiker (C. *grimmi*) is found in bush-country from the Cape to the Zambezi, Nyasaland and Angola. The banded duiker (C. doriae) from West Africa is golden brown with black transverse bands on back and loins. C. *sylvicultor,* of West Africa, is the largest species, and approaches a donkey in size. (See ANTELOPE.)

DUILIUS (or DUELLIUS), **GAIUS,** Roman general during the first Carthaginian War. In 260 B.C., when consul in command of the land forces in Sicily, he was appointed to supersede his colleague Cn. Cornelius Scipio Asina, as commander of the fleet. Recognizing that for the unskilled Romans the only chance of victory lay in fighting under conditions as similar as possible to those of a land engagement, he invented grappling irons (corvi) and boarding bridges, and gained a brilliant victory over the Carthaginian fleet off Mylae on the north coast of Sicily. A memorial column (*columna* rostrata), adorned with the beaks of the captured ships, was set up in honour of his victory.

See Corpus *Inscriptionum Latinarum,* i. No. 195; Polybius i. 22; Diod. Sic. xvii. 44; Frontinus, *Strat.* ii. 3; Florus ii. 2; Cicero, De senectute 13; Silius Italicus vi. 667; and PUNIC WARS.

DUISBURG, a town in the Prussian Government district (*Regierungsbezirk*) of Diisseldorf, Germany. It is situated at the junction of the Rhine and the Ruhr, 15 mi. N. (by rail) of Düsseldorf. Pop. (1885) 47,519; (1939) 431,256. Duisburg was known to the Romans as Castrum Deutonis and under the Frankish kings as Dispargum. In the 12th century it attained the rank of an imperial free town; but in the 17th century it was acquired by Brandenburg. Of the many churches in the town, the fine Gothic Salvatorkirche (15th century) is the most interesting. The town is well provided with educational facilities; of the technical schools, the school of machinery is important. In 1655, the elector Frederick William of Brandenburg founded a Protestant university, which flourished until 1802. The great development of industry on the Rhine made Duisburg into a large industrial town. Its chief industries are connected with metallurgical manufactures; in addition it has important chemical, textile, tobacco, sugar, soap, margarine and plate-glass works, as an entrepôt for the industries of the Ruhr area it exports large quantities of coal. The port—one of the largest inland ports of Europe—covers an area of 632 hectares. The Rhine-Herne canal connects Duisburg with Dortmund and by way of the Dortmund-Ems canal, with German North Sea ports. It is also an important railway centre. It was occupied by the Belgians from 1921 to 1925 as a sanction under the treaty of Versailles and was heavily bombed by the British in World War II.

DUJARDIN, FELIX (1801–1860), French biologist, was born at Tours on April 5, 1801, and died at Rennes on April 8, 1860. He forsook his early training in art and engineering for natural science, from 1843 concentrating on microscopic work in zoology. In 1840 he became dean of Rennes university, but two years later resigned to become a professor. In 1835 he distinguished protoplasm from other viscid substances, designating it "sarcode" and assigning to it all the qualities of life. He made detailed studies of rhizopods which he had discovered in 1834, and of oceanic foraminifera. Besides a manual of microscopic observation, he wrote Natural History of *Infusoria* (1841).

DUKAS, PAUL (1865–1935), French composer, born in Paris Oct. 1, 1865, studied under Matthias, Dubois arid Guiraud. His cantata *Velléda* gained for him a second Grand Prix de Rome. The symphonic poem, *L'Apprenti* Sorcier, produced at the Société Nationale de Musique in 1897, was an immediate success. His next important work was the music which he wrote for Maeterlinck's *Ariane* et *Barbe Bleue,* a lyrical story in 3 acts. This was played at the Opéra Comique in 1907 and subsequently at many of the principal opera-houses in Europe. A "poème dansé," The *Peri,* in which the orchestration is extraordinarily rich, was produced in Paris in 1912 with the Russian dancer Mademoiselle Trouhanova. Dukas is a master of instrumentation, equally effective in bold colour effects and in the delicate passages which he touches in with so sure a hand. His works for piano include a sonata in E flat minor and "Variations, Interlude and Final on a theme of Rameau," while his appreciation of the great harpsichord composers led him to edit a number of the works of Rameau. Couperin and Scarlatti. He was also a critic and a writer on music. held the position of inspector of music at the Beaux-Arts, was on the Conseil Supérieur of the Conservatoire and was an officer of the Légion d'Honneur.

See O. Seré, *Musiciens français d'aujourd'hui* (1911–12); G. Samazeuilh, *Un* musicien *français, Paul Dukas* (1913); V. d'Indy, *Emmanuel* Chabrier *et* Paul Dukas (1920); **A.** Coeuroy, La *musique française moderne* (1922).

DUK-DUK, a secret society of the New Britain Archipelago north-east of New Guinea, in the South Pacific. The society has religious and political as well as social objects.

See "Duk-Duk and other Customs or Forms of Expression of the Melanesian's Intellectual Life," by Graf von Pfeil (*Journ. of Anthrop. Instit.* vol. 27, p. 181); E. **A.** Weber, The *Duk-Duks* (1929).

DUKE, the title of one of the higher orders of the European nobility, and of some minor sovereign princes. The word "duke," which is derived from the Lat. *dux,* a leader, or general, originally signified a leader, and more especially a military chief. In this general sense the word survived in English literature until the 17th century, but is now obsolete.

The origin of modern dukes is twofold. The *dux* first appears in the Roman empire under the emperor Hadrian, and by the time of the Gordians has already a place in the official hierarchy. He was the general appointed to command an expedition and his functions were purely military. In the 4th century, after the separation of the civil and military administrations, there was a duke in command of the troops in each of the frontier provinces of the empire, *e.g.,* the *dux Britanniarum.* The number of dukes increased, and in the 6th and 7th centuries there were *duces* at Rome, Naples, Rimini, Venice and Perugia. They became charged with civil as well as military functions, and even exercised considerable authority in ecclesiastical administration. Under the Byzantine emperors they were the representatives in all causes of the central power. The Roman title of duke was less dignified than that of count (comes, companion) which implied an honourable personal relation to the emperor (see COUNT). Both titles were borrowed by the Merovingian kings for the administrative machinery of the Frank empire, and under them the functions of the duke remained substantially unaltered. He was a great civil and military official, charged to watch, in the interests of the crown, over groups of several *comitatus,* or countships, especially in the border provinces. The sphere of the dukes was never rigidly fixed, and their commission was sometimes permanent, sometimes temporary. Under the Carolingians the functions of the dukes remained substantially the same; but with the decay of the royal power in the 10th century both dukes and counts gained in local authority; the number of dukes became for the time fixed, and finally title and office were made hereditary, the relation to the crown being reduced to that of more or less shadowy vassalage. (See FEUDALISM.)

Side by side with these purely official dukedoms, however, there had continued to exist, or had sprung up, either independently or in more or less of subjection to the Frank rulers, national dukedoms, such as those of the Alemanni, the Aquitanians, and, later, of the Bavarians and Thuringians. These were developed from the early Teutonic custom by which the *herizog* (military chief) was elected by the nation as leader for a particular campaign, as in the case of the *heretogas* who had led the first Saxon invaders into Eritain. Tacitus says of the ancient Germans reges ex *nobilitate,*

duces *ex virtute sumunt, i.e.,* they elected their dukes for their warlike prowess only, and as purely military chiefs, whereas their kings were chosen from a royal family of divine descent. Sometimes the dukes so chosen succeeded in making their power permanent without taking the style of king. To this national category belong, besides the great German dukedoms, the dukes of Normandy, and the Lombard dukes of Spoleto and Benevento, who traced their origin, not to an administrative office, but to the leadership of Teutonic war bands. With the development of the feudal system the distinction between the official and the national dukedoms was more and more obliterated. By the 13th and 14th centuries the title had become purely territorial, and implied no necessary over-lordship over counts and other nobles, who existed side by side with the dukes as tenants-in-chief of the crown. From this time the significance of the ducal title varies widely in different countries.

The abolition of the Holy Roman Empire in 1806 removed the shadow of vassalage from the German reigning dukes, who retained their sovereign status under the new empire. Only one, however, the grand duke of Luxembourg, remained both sovereign and independent. Besides those who were sovereign dukes in Germany there are certain "mediatized" ducal houses, *e.g.,* that of Ratibor, which share with the dispossessed families of the Italian sovereign duchies certain royal privileges, notably that of equality of blood (*Ebenbürtigkeit*). In Italy, where titles of nobility give no precedence at court, that of duke (*duca*) has lost nearly all even of its social significance owing to lavish creations by the popes and minor sovereigns, and to the fact that the title often passes by purchase with a particular estate. Political significance it has none. Some great Italian nobles are dukes, notably the heads of the great Roman ducal families, but not all Italian dukes are great nobles.

In France the title duke at one time implied vast territorial power, as with the dukes of Burgundy, Normandy, Aquitaine and Brittany, who asserted a practical independence against the crown, though it was not till the 12th century that the title duke was definitely regarded as superior to others. At first (in the 10th and 11th centuries) it had no defined significance, and even a baron of the higher nobility called himself in charters duke, count or even marquess, indifferently. In any case the strengthening of the royal power sapped the significance of the title, until on the eve of the Kevolution it implied no more than high rank and probably territorial wealth.

There were, under the *ancien régime,* three classes of dukes in France: (1) dukes who were peers (see PEERAGE) and had a seat in the parlement of Paris; (2) hereditary dukes who were not peers; (3) "brevet" dukes, created for life only. The French duke ranks in Spain with the "grandee" (*q.v.*), and vice versa. In republican France the already existing titles are officially recognized, but they are now no more than the badges of distinguished ancestry. Besides the descendants of the feudal aristocracy there are in France certain ducal families dating from Napoleon I.'s creation of 1806 (*e.g.,* ducs d'Albufera, de Montebello, de Feltre), from Louis Philippe (duc d'Isly, and duc d'Audiffret-Pasquier), and from Napoleon III. (htalakoff, Magenta, Morny).

In England the title of duke was unknown till the 14th century, though in Saxon times the title ealdorman, afterwards exchanged for "earl," was sometimes rendered in Latin as dux, and the English kings till John's time styled themselves dukes of Normandy, and dukes of Aquitaine even later. In 1337 King Edward III. erected the county of Cornwall into a duchy for his son Edward the Black Prince, the first English duke. The second was Henry, earl of Lancaster, Derby, Lincoln and Leicester, created duke of Lancaster in 1351. In Scotland the title of duke was first bestowed in 1398 by Robert III. on his eldest son David, who was made duke of Rothesay, and on his brother, who became duke of Albany.

British dukes rank next to princes and princesses of the blood royal, the two archbishops of Canterbury and York, the lord chancellor, etc., but beyond this precedence they have no privileges which are not shared by peers of lower rank (see PEERAGE). Though their full style as proclaimed by the herald is "most high, potent and noble prince," and they were included in the *Almanach* de *Gotha,* they were not recognized as the equals in blood of the crowned or mediatized dukes of the Continent, and the daughter of a British duke marrying a foreign royal prince could only take his title by courtesy, or where, under the "house. laws" of certain families, a family council sanctioned the match. The eldest son of a British duke takes as a rule by courtesy the second title of his father, and ranks, with or without the title, as a marquess. The other sons and daughters bear the titles "Lord" and "Lady" before their Christian names, also by courtesy. A duke in the British peerage, if not royal, is addressed as "Your Grace" and is styled "the Most Noble." (See ARCHDUKE, GRAND DUKE, and, for the ducal coronet, CROWN AND CORONET.)

(W. A. P.)

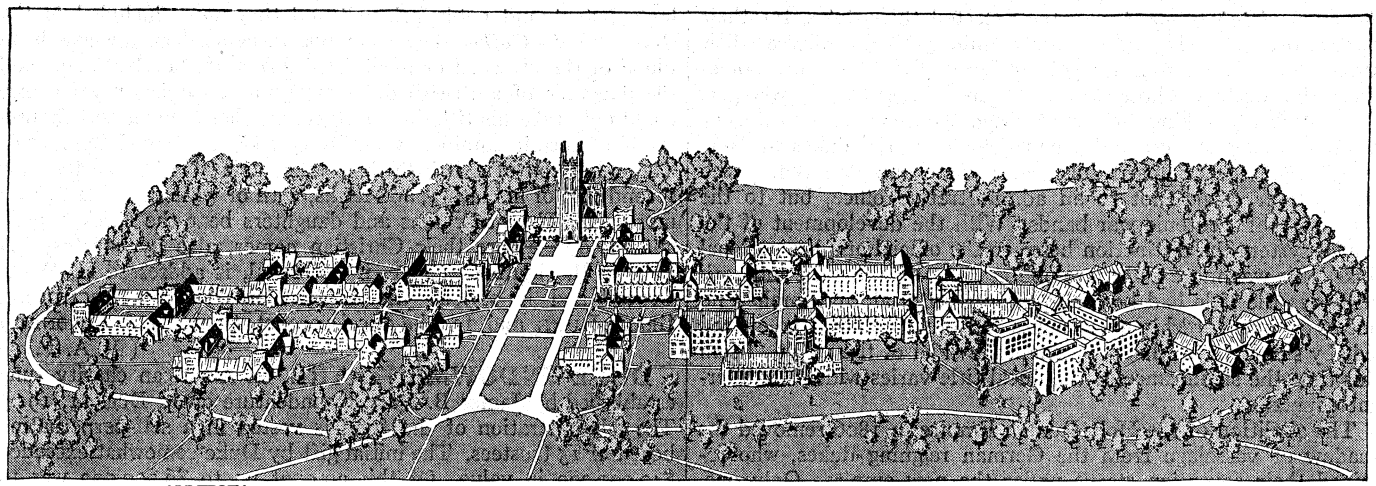
DUKE ENDOWMENT, THE, an American charity fund established by James B. Duke by indenture dated Dec. 11, 1924. The administration of the fund is vested in a self-perpetuating board of 15 trustees. The initial gift by Duke somewhat exceeded $40,000,000 in value. Of this amount up to $6,000,000 was to be used in connection with building and equipping Duke university. Twenty per cent of the net income is to be reinvested until such reinvestments aggregate $40,000,000. The remaining income is distributable as follows: Duke cniversity, 32%; hospitals not operated for private gain in North and South Carolina, 32%; Davidson college, 5%; Furman university, 5%; Johnson C. Smith university, 4%; orphanages in North and South Carolina, 10%; superannuated preachers having served in a North Carolina conference of the Methodist Episcopal Church, South, 2%; building and operating rural churches of the Methodist Episcopal Church, South, in North Carolina, 6% and 4% respectively. By his will Duke added to the fund $10,000,000 together with two-thirds of his residuary estate. Of the $10,000,000, $4,000,000 may be used for providing hospital, medical school and nurses' home facilities at Duke university, the income from the balance of $10,000,000 going to Duke university. He further provided that $7,000,000 out of two-thirds of the residuary estate are to be used for purposes of building and equipping Duke university, 10% of the income going to Duke university and 90% for the benefit of hospitals not operated for private gain in North and South Carolina.

DUKE OF EXETER'S DAUGHTER, a 15th-century instrument of torture resembling the rack. (See TORTURE.)

DUKERIES, THE, a district in the north-west of Nottinghamshire, England, forming part of Sherwood forest (*q.v.*). The name was taken from the existence of several adjacent demesnes of noblemen, and the character of the forest is to some extent preserved here. On the north is the Lincoln, Retford, Worksop, Sheffield branch and on the south, the Lincoln, Ollerton, Chesterfield branch of the L.N.E. railway. The following demesnes are in the district. Worksop Manor formerly belonged to the dukes of Norfolk. Welbeck Abbey, the seat of the dukes of Portland, to whom it came from the Cavendish family (dukes of Newcastle), is mainly classic in style, dating from the early 17th century, but with many subsequent additions; the fifth duke of Portland (d. 1879) built the curious series of subterranean corridors and chambers beneath the grounds. Clumber House, the seat of the dukes of Newcastle, was demolished in 1938. Thoresby Park is the seat of the Pierrepont family (earls Manvers). Part of this demesne is a splendid tract of wild woodland.

DUKES, LEOPOLD (1810–1891), Hungarian critic of Jewish literature. He spent about twenty years in England, and from his researches in the Bodleian library and the British Museum (which contain two of the most valuable Hebrew libraries in the world) Dukes was able to complete the work of Zunz (*q.v.*). The most popular work of Dukes was his Rabbinische Blumenlese (1844), in which he collected the rabbinic proverbs and illustrated them from the gnomic literatures of other peoples. Dukes made many contributions to philology, but his best work was connected with mediaeval Hebrew poets, especially Ibn Gabirol.

DUKE UNIVERSITY at Durham, North Carolina, U.S.A., owes its existence to a trust established by James B. Duke Dec. 11, 1924 (see DUKE ENDOWMENT). The university is



BY COURTESY OF DUKE UNIVERSITY

THE MAIN UNIT OF DUKE UNIVERSITY. WHICH WILL CONSIST OF SOME 40 BUILDINGS ON A 4.000-ACRE WOODLAND CAMPUS. THE MEMORIAL CHAPEL. IN CENTRE, WILL HAVE A SPIRE TOWERING TO 265 FEET. DORMITORY BUILDINGS ARE PLANNED FOR 3,000 STUDENTS

being built around Trinity college, founded 1838. From 1910 to 1925 the college grew in endowment and value of property from $1,221,382 to $6,145,087; in faculty from 32 to 113; and in students from 315 to 1,164.

After spending two years in college, including summer reading. the ablest students may enter the professional schools or continue in the advanced college or university courses.

The woman's college provides for women educational opportunities equal to those provided for men in Trinity college. The graduate school of arts and sciences with the purpose of differentiating more sharply between the college and the graduate school, gives to the work of the latter a more distinctively university character than has heretofore been the rule in the United States. This school aims at developing those especially fitted for teaching, but special emphasis is laid on research, mathematics, chemistry, physics, biology (in close co-operation with the medical school) and on the social sciences including law. The school of medicine runs through four quarters, so that a four-year medical course may be completed in three calendar years. The school of law provides liberal training in law as one of the social sciences closely allied with government, economics and business administration. A university press is maintained, and issues the *South Atlantic Quarterly,* the *Hispanic American Historical Review* and *Studies in American Literature.* In 1928 there were 1,608 students, exclusive of the summer school, and a teaching staff of 170.

See E. W. Knight, *Public School Education in North Carolina* (1916); W. K. Boyd, *The Story of Durham* (1925); W. P. Few, *Twenty-five Years of Trinity College* (Trinity College *President's Reports 1917,* and *Trinity Alumni Register,* vol. iii. p. 140–167); E. C. Brooks, *Trinity Alumni Register,* vol. i. p. 4–18, 89–103, 247–257; vol. ii. p. 248–258, 309–321; vol. iii. p. 1–12, 169–185; vol. iv. p. 1–10; W. T. Laprade, *Trinity Alumni Register,* vol. viii. p. 4–18

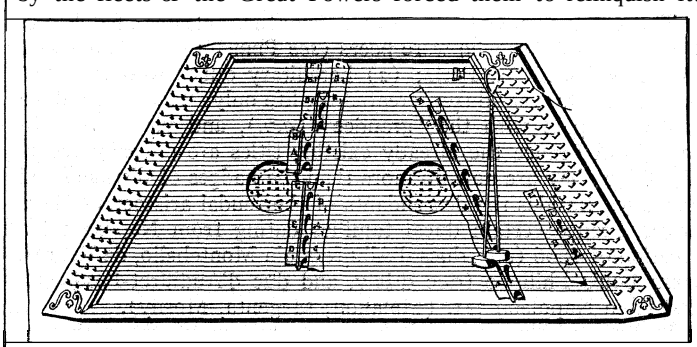
(W. P. F.)

DUKINFIELD, municipal borough, parliamentary division of Stalybridge and Hyde, Cheshire, England, 6 m. east of Manchester. Pop. (1938), 18,700. It lies in a densely populated district and is served by the L.M.S. and L.N.E. railways. The chief industries include coal-mining, cotton manufactures, calico-printing, hat-making, iron-founding, engineering and the manufacture of firebricks and tiles. A portion remains of the old timbered Dukinfield Hall, in the chapel of which Samuel Eaton (d. 1665) taught the first Congregational church in the north of England. The chapel is still used. The borough was incorporated in 1899. Area, 2.69 sq.mi.

DULAC, EDMUND (1882–), illustrator, born at Toulouse in 1882. After having studied in Paris under Jean Paul Laurens he settled in London. His exhibition of watercolours illustrating "Arabian Nights" at the Leicester gallery in 1907 was very much liked and his work was reproduced with a text by Lawrence Housman. Dulac also illustrated Shakespeare's "Tempest," Andersen's *Fairy Tales,* Edgar Allan Poe's *The Bells and other Poems,* and Arthur Quiller-Couch's *Old French Tales.*

DULCIGNO, a seaport of Montenegro, Yugoslavia, on the Adriatic sea. Population 3,748, chiefly Albanians and Turks. Shut in by hills and forests, Dulcigno is the prettiest of Montenegrin towns. The old quarter, built on a promontory, is walled and has a mediaeval castle. There is a Roman Catholic cathedral and an ancient Latin church. Steamers call, and some shipbuilding and fishing are carried on, but the harbour lacks shelter, and is liable to silting. Like the rest of Montenegro, the port in 1941 came under Italian control.

To the Romans, who captured the town in 167 B.C. Dulcigno was known as Ulcinium or Olcinium; in the middle ages it was a noted haunt of pirates; in 1571 it was captured by the Turks from the Venetians. In 1718 it was the scene of a great Venetian defeat; in 1877 the Montenegrins took it from the Turks and in 1878 it was ceded to them by the Treaty of Berlin. The Turks however held it till 1880 when the "Dulcigno demonstration" by the fleets of the Great Powers forced them to relinquish it.



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART, N.Y.

18TH CENTURY FRENCH DULCIMER AND HAMMERS WITH WHICH IT IS PLAYED

The direct ancestor of the piano, the dulcimer came originally from the East, *being introduced* to Europe probably during the Crusades. It was popular throughout the Middle Ages. In the days of Louis XIV. of France elaborate models were constructed

DULCIMER, the prototype of the pianoforte (*q.v.*), an instrument of great antiquity derived originally from the East, consisting of a horizontal sound-chest over which are stretched a varying number of wire strings set in vibration by strokes of little sticks or hammers. The dulcimer differed from the psalterium or psaltery chiefly in the manner of playing, the latter having the strings plucked by means of fingers or plectrum, a distinction the importance of which was fully recognized when the invention of the pianoforte had become a matter of history. It was then perceived that the psalterium in which the strings

were plucked, and the dulcimer in which they were struck, when provided with keyboards, gave rise to two distinct families of instruments, differing essentially in tone quality, in technique and in capabilities. The evolution of the psalterium stopped at the harpsichord, that of the dulcimer gave us the pianoforte. The dulcimer was very popular all over Europe throughout the middle ages.

The pantaleon, a double dulcimer, named after the inventor, Pantaleon Hebenstreit of Eisleben, a violinist, had two soundboards, 185 strings. one scale of overspun catgut and one of wire. Hebenstreit travelled to Paris with his monster dulcimer in 1705 and played before Louis XIV, who baptized it *Pantaléon.* Quantz and Quirin of Blankenburg both gave descriptions of the instrument.

DÜLKEN, town, Prussian Rhine province, Germany, 11 mi. by rail S.W. from Crefeld. Pop. (1939) 15,952. It has a Gothic parish church. There are manufactures of linen, cotton, silk and velvet, etc., ironworks and foundries.

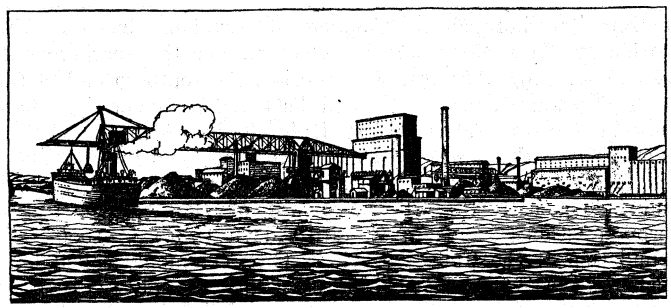
DULONG, PIERRE LOUIS (1785–1838), French chemist and physicist, was born at Rouen on Feb. 12 (or 13), 1785. After acting as assistant to Berthollet, he became successively professor of chemistry at the faculty of sciences and the normal and veterinary schools at Alfort, and then (1820) professor of physics at the École Polytechnique, of which he was appointed director in 1830. He died in Paris on July 18 (or 19), 1838.

His earliest work was chemical in character. In 1811 he discovered nitrogen trichloride; during his experiments serious explosions occurred twice, and he lost an eye, besides sustaining severe injuries to his hand. He also investigated the oxygen compounds of phosphorus and nitrogen, and was one of the first to hold the hydrogen theory of acids.

Dulong's important research work in physics was on heat and was carried out in conjunction with Alexis Thérèse Petit (1791–1820), the professor of physics at the École Polytechnique. In 1815 they made the first accurate comparisons between the mercury and the air thermometer. The first published research (1816) dealt with the dilatation of solids, liquids and gases and with the exact measurement of temperature, and it was followed by one in 1817 in which they showed that Newton's law of cooling was only true for small differences in temperature, and one in 1818 on the measurement of temperature and the transference of heat, which was crowned by the French academy. In another, "On some important points in the theory of heat" (1819), they stated the "law of Dulong and Petit" dealing with atomic heats. Subsequent papers by Dulong were concerned with "New determinations of the proportions of water and the density of certain elastic fluids" (1820, with Berzelius); the property possessed by certain metals of facilitating the combination of gases (1823 with Thénard); the refracting powers of gases (1826); and the specific heats of gases (1829). In 1830 he published a research, undertaken with Arago for the Academy of Sciences, on the elasticity of steam at high temperatures. In his last paper, published posthumously in 1838, Dulong gave an account of experiments made to determine the heat developed in a chemical reaction, together with a description of the calorimeter he employed. He was so badly supplied with apparatus that he spent practically all his wealth in providing what was necessary for his researches.

DULSE, in botany, *Rhodymenia palmata,* one of the red seaweeds, consisting of flat solitary or tufted purplish-red fronds, fan-shaped in general outline and divided into numerous segments, which are often again and again divided in a forked manner. It varies much in size and degree of branching, ranging from 5 to 12 or more inches long. It grows on rocks, shellfish or larger seaweeds, and is used by the poor in Scotland and Ireland as a relish with their food. It is commonly dried and eaten raw, the flavour being brought out by long chewing. In the Mediterranean it is used cooked in ragouts and made dishes.

DULUTH, a city of Minnesota, U.S.A., on the western tip of Lake Superior, at the mouth of the St. Louis river, opposite Superior, Wis.; the county seat of St. Louis county. It is on federal highways 2, 53 and 61; and is served by the Chicago, St. Paul, Minneapolis and Omaha, the Duluth, Missabe and Iron Range, the Duluth, South Shore and Atlantic, the Great Northern, the Northern Pacific. the Soo Line, the Chicago, Milwaukee, St. Paul and Pacific and the Duluth, Winnipeg & Pacific railways, and by an air line and many lake steamers. The population was 101,463 in 1930, of whom 24,929 were foreign-born white and was 101,065 in 1940 by the federal census. The city has a beautiful site (62.3 sq.mi. land area) on slopes rising to 600 ft. above the



BY COURTESY OF THE OFFICE OF THE CHIEF OF ENGINEERS, DULUTH

A VIEW OF DULUTH HARBOUR BASIN SHOWING COAL DOCKS AND ELEVATORS

level of the lake, commanding fine views of harbour, lake, river and surrounding country. A 25-mi. boulevard runs along the top of the bluff back of the city, and there are 3,216 ac. in public parks. The Duluth-Superior harbour, with 49 mi. of water frontage, formed by long narrow strips of land projecting from either shore (Minnesota point and Wisconsin point), is one of the finest in the world, and it ranks second only to New York, among American ports, in the commercial tonnage handled. It is well equipped with modern machinery for transferring cargoes, and had (1941) 21 coal docks, 7 iron ore docks, 46 wharves for general freight, 25 grain elevators and a cement storage elevator with a capacity of 114,000 barrels. Its commerce in 1940 was 54,147,695 tons (valued at $407,484,967), consisting largely of iron ore from the Vermilion, Cuyuna and Mesabi ranges, wheat and other grains from the Red river valley and the plains of Canada, butter and eggs from adjacent territory, automobiles and coal from Lake Erie ports. Among the manufacturing industries, which are increasing in importance, the largest are the great mills of the American Steel and Wire company. established there in 1909. The aggregate factory output in 1937 was valued at $46,020,607. The assessed valuation of property in 1940 was $48,791,248, and bank clearings amounted to $170,548,380. Since 1912 a commission form of government has been in effect. A zoning ordinance was adopted in 1925, and the city's development is under the supervision of a planning commission. The recreation system includes provision for flying, skiing, curling and iceboating, as well as for the more usual sports. The charitable agencies are financed through a joint community chest. There are three daily papers, including one in Finnish. In the city are 43 public and 15 parochial schools, a junior college and the College of St. Scholastica, an extension department of the University of Minnesota and a state teachers' college (established in 1902). The federal government maintains a coast guard station on Minnesota point, a fish hatchery at Lester river and a weather bureau station in the city.

The first visitor on record to the site of Duluth was Daniel Greysolon, Sieur du Lhut (d. 1709), a French trader and explorer, who about 1679 built a stockaded trading post at the mouth of Pigeon river on the north shore of the lake. About 1752 a second trading post, which later became a depot of Astor's American Fur company, was established in the vicinity. Permanent settlement on the site of the city began in 1853. In 1870, when the city was incorporated and the first railway reached it, the population was 3,131, and in 1880 it was only 3,483. Between 1880 and 1890, with the development of railways, of commerce on Lake Superior and of the iron mines of northern Minnesota, the population increased nearly tenfold, to 33,115. The traffic of the port increased from 2,848,672 tons in 1890 to 46,875,416 tons in 1913, fluctuated considerably during the World War and the years immediately following, and reached its maximum (to 1940) in 1929, when the commerce was 60,385,767 tons.

Because of its cool climate and scenic and recreational advantages, Duluth is a popular vacation playground. According to U.S. weather bureau records it is coolest summer city in the U.S., with an average spring and summer temperature of 62 5°. Its freedom from noxious pollen attracts many hay-fever sufferers. Duluth is the gateway to the Superior national forest (largest in the U.S., with more than 3,000,000 ac. within its boundaries).

DULWICH, a county and parliamentary division in the metropolitan borough of Camberwell, London, England, with stations at East, North and West Dulwich on the Southern railway. Pop. (1931) 60,643. It comprises the southern end of the borough from Denmark Hill and Peckham to upper Sydenham and the Crystal Palace. West Dulwich, in which the College is situated, with its wooded lanes descending from the Sydenham hill, still retains much of its rural character. The manor, which had belonged to the Cluniac monks of Bermondsey, passed through various hands to Edward Alleyn (*q.v.*) in 1606. His foundation of the College of God's Gift, commonly called Dulwich College, was opened with great state on Sept. 13, 1619, in the presence of Lord Chancellor Bacon, Inigo Jones and other distinguished men. According to the letters patent the almspeople and scholars were to be chosen from the parishes of St. Giles, St. Botolph without Bishopsgate, and St. Saviour's (Southwark). By a series of statutes signed in 1626, Alleyn ordained that his school should consist of three distinct classes:—(1) twelve poor scholars; (2) children of inhabitants of Dulwich, who were to be taught freely; and (3) "towne or foreign schollers." The almspeople consisted of six "poor brethren" and six "poor sisters," and the head of the teaching and governing staff was to consist of a master and a warden, who were always to be of the founder's surname.

The founder's intention to establish a great public school, with provision for university training, is shown by the statutes; but for more than two centuries the educational benefits were restricted to the twelve poor scholars. In 1857 and 1882, however, the foundation was entirely reconstituted. It now comprises two schools, called respectively Dulwich College and Alleyn's school. The former is one of the important English public schools; the buildings (1866–70) by Charles Barry contain a fine hall. The college possesses one of the leading private picture galleries in the country, the bequest mainly of Sir P. F. Bourgeois, R.A., in 1811, with later additions and a separate endowment. The Dutch and Flemish schools in particular are well represented, together with some fine examples of the Spanish, French and British. Dulwich park (72 ac.) was presented to the public in 1890.

DUMA, an old Russian word meaning thought; in connection with the adjective *Gosudarstvennaya* (of Empire) was the name of the first Russian House of Representatives, granted by Nicholas II. (Oct. 30, 1905), and after the amendment of the electoral law (Dec. 24, 1905), formally sanctioned on March 5, 1906. Electors were distributed in six "curias": large landed proprietors, small landed proprietors, peasants, capitalists, middle class, working men. Direct voting was admitted only in six large cities. The remaining population elected electors who in their turn elected the electors to upper local units, from which the electors were finally sent to provincial assemblies to elect members of the Duma. Thus peasants elected in four stages (village, township, district, province); small landowners in three (preparatory, district, province) as well as working men (factory, district, province); big land-owners, rich citizens and middle class citizens in two (district, province). The number of electors given to various constituencies varied in opposite proportion to the number of population, thus giving enormous preponderance to the upper classes. Landed gentry (about 200,000) had the right to choose 2,594 electors; wealthy citizens (500,000) 788, middle class (8,000,000) 590, working men (12,000,000) 112, peasants (70,000,000) 1,168. The Duma had the power to legislate, to vote the Budget and to control the administration. But its rights were extremely curtailed by the tsar's prerogative, through indiscriminate use of Orders in Council, to thwart regular legislation, by withdrawing from its competence a great part of Budget expenses, by the lack of responsibility of ministers and, last, not least, by an extremely conservative Upper House (the Council of Empire) composed half of old dignitaries nominated by the tsar and half of elected members from gentry, church, commerce, and learned bodies.

The first two Dumas were dissolved after 73 and 103 days of existence. The third Duma, elected after a change of electoral law, lasted for the full five years of its mandate (1907–12), and the fourth (1912–17) was nearing its end when the March revolution hcgan.

See also RUSSIA; *History* and P. *N.* Milyoukov's article on "The Representative System in Russia" in *"Russian Realities and Problenzs,"* ed. *J.* D. Duff (1917). (P. M.)

DUMAGUETE, a municipality (with administrative centre and 23 *barrios* or districts) and capital of the province of Negros Oriental, of the island of Negros, Philippine islands, on Tañon strait, 424 mi. from Manila. Pop. (1939), 22,236, of whom 67 were whites. It is the centre of a fertile agricultural region which supports a flourishing trade. Silliman Institute, a Presbyterian school, founded early in the century, has done excellent work in educating the natives. Of those aged 6 to 19, inclusive, 42.2% were reported in 1939 as attending school and of. those ten years old and over 53·7% were reported as literate. The vernacular is a dialect of Bisayan. There is also a meteorological station. The number of parcels of land declared for taxation in 1938 was 8,172 and the number of owners 6,117.

DUMANJUG, a municipality (with administrative centre and 32 *barrios* or districts), of the province and island of Cebu, Philippine islands, on the west coast, at the mouth of the Dumanjug river, about 40 mi. S.W. of Cebu, the provincial capital. Pop. (1939), 20,973, of whom two were white. Communication with Sibonga, a municipality situated on the opposite shore of the island is accomplished through one of the few passes of the mountains in the interior. Corn and sugar are grown in the neighbouring region and there is an important coastwise trade. There is little industry, aside from agriculture. Cebuano is the vernacular.

DUMAS, ALEXANDRE (ALEXANDRE DAVY DE LA PAILLETERIE) (1802–1870), French novelist and dramatist, was born at Villers-Cotterets (Aisne) on July 24, 1802. His father, General Dumas (Alexandre Davy de la Pailleterie) was born in San Domingo, the natural son of Antoine Alexandre Davy, marquis de la Pailleterie. by a negress, Marie Cessette Dumas, who died in 1772. In 1780 he accompanied the marquis to France, and there the father made a mésalliance which drove the son into enlisting in a dragoon regiment The young Alexandre Dumas was still a private at the outbreak of the revolution, but he rose rapidly and became general of division in 1793. He was general-in-chief of the army of the western Pyrenees, and was transferred later to commands in the Alps and in La Vendée. Among his many exploits was the defeat of the Austrians at the bridge of Clausen on April 22, 1797, where he commanded Joubert's cavalry. He lost Napoleon's favour by plain speaking in the Egyptian campaign, and later returned to France to spend the rest of his days in retirement at Villers-Cotterets, where he had married in 1792 Marie Elisabeth Labouret.

The novelist, who was the offspring of this union, was not four years old when General Dumas died (1806), leaving his family with no further resource than 30 acres of land. Mme. Dumas tried to obtain help from Napoleon, but in vain, and lived with her parents in narrow circumstances. Alexandre received the rudiments of education from a priest, and entered the office of a local solicitor. His chief friend was Adolphe de Leuven, the son of an exiled Swedish nobleman implicated in the assassination of Gustavus III. of Sweden, and the two collaborated in various vaudevilles and other pieces which never saw the footlights. Leuven returned to Paris, and Dumas was sent to the office of a solicitor at Crépy. In 1823 Dumas visited his friend in Paris, and was received by Talma. He then determined to seek his fortune in Paris. An introduction to General Foy procured for him a place as clerk in the service of the duke of Orleans, and he began to collaborate with Leuven in the production of vaudevilles and melodramas. Madame Dumas presently joined her son in Paris, where she died in 1838. Soon after his arrival in Paris Dumas

had entered on a liaison with a dressmaker; Marie Catherine Labay, and their son, the famous Alexandre Dumas *fils (see* below). was born in 1824. Dumas acknowledged his son in 1831, and obtained the custody of him after a lawsuit with the mother.

AS DRAMATIST AND NOVELIST

His Plays.—The first piece by Dumas and Leuven to see the footlights was *La Chasse et l'amour* (Ambigu-Comique, Sept 22, 1825), and in this they had help from other writers. Dumas had a share in another vaudeville, *La Noce et l'enterrement* (Porte Saint-Martin, Nov. 21, 1826). It was under the influence of the Shakespeare plays produced in Paris by Charles Kemble, Harriet Smithson (afterwards Mme. Berlioz) and an English company that the romantic drama of *Christine* was written. The subject was suggested by a bas-relief of the murder of Monaldeschi exhibited at the Salon of 1827. The piece was accepted by the Comédie Française, but its production was deferred Meanwhile Dumas had written, in prose, *Henri III. et sa cour,* which was immediately accepted by the Comédie Française and produced on Feb. 11, 1829. It was the first great triumph of the romantic drama. The brilliant stagecraft of the piece and its admirable historical setting delighted an audience accustomed to the decadent classical tragedy, and brought him the friendship of Hugo and Vigny. His patron, the duke of Orleans, now gave him the librarianship of the Palais Royal. *Christine* was recast as a romantic trilogy in verse in five acts with a prologue and epilogue, with the sub-title of *Stockholm, Fontainebleau, Rome,* and was produced by Harel at the Odéon in March 1830.

The revolution of 1830 temporarily diverted Dumas from letters. The account of his exploits should be read in his *Mémoires,* where the incidents lose nothing in the telling. He finally alienated himself from the Orleans Government by being implicated in the disturbances which attended the funeral of General Lamarque in June 1832, and he received a hint that his absence from France was desirable. A tour in Switzerland undertaken on this account furnished material for the first of a long series of amusing books of travel. Dumas remained, however, on friendly and even affectionate terms with the young duke of Orleans until his death in 1842. Meanwhile he had produced *Napoléon Bonaparte* (Odéon, Jan. 10, 1831), his unwillingness to make a hero of the man who had slighted his father having been overcome by Harel, who put him under lock and key until the piece was finished His next play, *Antony,* hsd a real importance in the history of the romantic theatre It was put in rehearsal by Mlle. Mars, but so unsatisfactorily that Dumas transferred it to Bocage and Mme Dorval, who played it magnificently at the Porte Saint-Martin theatre on May 3, 1831. The Byronic hero Antony was a portrait of himself in his relations with Mélanie Waldor, except of course in the extravagantly melodramatic *dénouement,* when Antony, to save his mistress's honour, kills her and exclaims, "Elle me résistait, je l'ai assassinée." He produced more than 20 more plays alone or in collaboration before 1845, exclusive of dramatizations from his novels. *Richard Darlington* (Porte Saint-Martin, Dec. 10, 1831), the first idea of which was drawn from Sir Walter Scott's *Chronicles of the Canongate,* owed part of its great success to the admirable acting of Frédérick Lemaître. *La Tour de Nesle* (Porte Saint-Martin, May 29, 1832), announced as by MM. × × × and Gaillardet, was the occasion of a duel and a law-suit with the original author, Frédéric Gaillardet, whose ms. had been revised, first by Jules Janin and then by Dumas In rapidity of movement, and in the terror it inspired, the piece surpassed *Henri III.* and *Antony* A lighter drama, *Mademoiselle de Belle-Isle* (Théâtre Français, April 2, 1839), long held the stage.

In 1840 Dumas married Ida Ferrier, an actress whom he had imposed on the theatres that took his pieces. The amiable relations which had subsisted between them for eight years were disturbed by the marriage, which is said to have been undertaken in consequence of a strong hint from the duke of Orleans, and Mme. Dumas lived in Italy separated from her husband

His Novels.—As a novelist Dumas began by writing short stories, but his happy collaboration with Auguste Maquet, which began in 1839, led to the admirable series of historical novels in which he proposed to reconstruct the whole course of French history. In 1844 he produced, with Maquet's help, that most famous of "cloak and sword" romances, *Les Trois Mousquetaires* (8 vols.), the material for which was discovered in the *Me'nzoires de M. d'Artagnan* (Cologne, 1701–02) of Courtils de Sandras. The adventures of d'Artagnan and the three musketeers, the gigantic Porthos, the clever Aramis, and the melancholy Athos, who unite to defend the honour of Anne of Austria against Richelieu and the machinations of "Milady," are brought down to the murder of Buckingham in 1628. Their admirers were gratified by two sequels, *Vingt ans après* (10 vols., 1845) and *Dix ans plus tard, ou le vicomte de Bragelonne* (26 pts., 1848–50), which opens in 1660, showing us a mature d'Artagnan, a respectable captain of musketeers, and contains the magnificent account of the heroic death of Porthos. The three musketeers are as famous in England as in France. Thackeray could read about Athos from sunrise to sunset with the utmost contentment of mind, and R. L. Stevenson and Andrew Lang have paid tribute to the band in *Memories and Portraits* and *Letters to Dead Authors.* Before 1844 was out Dumas had completed a second great romance in 12 volumes, *Le Comte de Monte-Cristo,* in which he had help from Fiorentino as well as from Maquet. The idea of the intrigue was suggested by Peuchet's *Police de'voile'e,* and the stress laid on the earlier incidents, Dantès, Danglars and the Château d'If, is said to have been an afterthought. Almost as famous as these two romances is the set of Valois novels of which Henri IV. is the central figure, beginning with *La Reine Margot* (6 vols., 1845), which contains the history of the struggle between Catherine of Medicis and Henry of Navarre; the history of the reign of Henry III. is told in *La Dame de Monsoreau* (8 vols., 1846), generally known in English as *Chicot the Jester,* from its principal character; and in *Les Quarante-cinq* (10 vols., 1847–@), in which Diane de Monsoreau avenges herself on the duke of Anjou for the death of her former lover, Bussy d'Amboise.

Much has been written about the exact share which Dumas had in the novels which bear his name. The Dumas-Maquet series is undoubtedly the best, but Maquet alone never accomplished anything to approach them in value. The mss. of the novels still exist in Dumas's handwriting, and the best of them bear the unmistakable stamp of his unrivalled skill as a narrator. The chief key to his enormous output is to be found in his untiring industry and amazing fertility of invention, not in the system of wholesale collaboration which was exposed with much exaggeration by Quérard in his *Supercheries littéraires* and by "Eugène de Mirecourt" (C. B. J. Jacquot) in his misleading *Fabrique de romans, maison Alexandre Dumas et c^ie* (1845). His assistants, in fact, supplied him with outlines of romances on plans drawn up by himself, and he then rewrote the whole thing. That this method was never abused it would be impossible to say; *Les Deux Diane,* for instance, a prelude to the Valois novels, is said to have been written entirely by Paul Meurice, although Dumas's name appears on the title-page.

LATER YEARS

The latter part of Dumas's life is a record of excessive toil to meet prodigal expenditure and accumulated debts. His disasters began with the building of a house in the Renaissance style, with a Gothic pavilion and an "English" park, at Saint Germain-en-Laye. This place, called Monte-Cristo, was governed by a crowd of hangers-on of both sexes, who absorbed Dumas's large earnings and left him penniless. Dumas also founded the Théâtre Historique chiefly for the performance of his own works. The enterprise was under the patronage of the duc de Montpensier, and was under the management of Hippolyte Hostein, who had been the secretary of the Comédie Française. The theatre was opened in Feb. 1847 with a dramatic version of *La Reine Margot.* Meanwhile Dumas had been the guest of the duc de Montpensier at Madrid, and made a quasi-official tour to Algeria and Tunis in a Government vessel, which caused much comment in the press. Dumas had never changed his republican opinions. He greeted the revolution of 1848 with delight, and was even a candi-

date for electoral honours in the department of the Yonne. But the change was fatal to his theatrical enterprise, for the failure of which in 1850 he was made financially responsible. His son, Alexandre Dumas, was at that time living with his mother Mlle. Labay, who was eventually reconciled with the elder Dumas. Father and son, though always on affectionate terms when they met, were too different in their ideas to see much of one another. After the *coup d'état* of 1851 Dumas crossed the frontier to Brussels, and two years of rapid production, and the economy of his secretary, Noel Parfait, restored something like order to his affairs. On his return to Paris in the end of *1853* he established a daily paper, *Le Mousquetaire,* for the criticism of art and letters. It was chiefly written by Dumas, whose *Mémoires* first appeared in it, and survived until *1857,* when it was succeeded by a weekly paper, the *Monte-Cristo (1857–60).* In *1858* Dumas travelled through Russia to the Caucasus, and in *1860* he joined Garibaldi in Sicily. After an expedition to Marseilles in search of arms for the insurgents, he returned to Naples, where Caribaldi nominated him keeper of the museums. After four years' residence in Naples he returned to Paris, and after the war of *'66* he visited the battlefields and produced his story of *La Terreur prussienne.* But his powers were beginning to fail, and in spite of the 1,200 volumes which he told Napoleon he had written, he was at the mercy of his creditors, and of the succession of theatrical ladies who tyrannized over him and feared nothing except the occasional visits of Dumas fils. He was finally rescued from these by his daughter, Mme. Petel, who came to live with him in *1868;* and two years later, on Dec. 5, *1870,* he died in his son's house at Puys, near Dieppe.

Auguste Maquet was Dumas's chief collaborator. Others were Paul Lacroix (the bibliophile "P. L. Jacob"), Paul Bocage, J. P. Mallefille and P. A. Fiorentino. The novels of Dumas may be conveniently arranged in a historical sequence. The Valois novels and the musqueteers series brought French history down to *1672.* Contributions to later history are:—La *Dame de volupte' (2* vols., 1864), being the memoirs of Mme. de Luynes, and its sequel *Les Deux Reines (2* vols., *1864);* *La Tulipe noire (3* vols., 1850), giving the history of the brothers de Witt; *Le Chevalier d'Harmental (4* vols., 1853), and *Une Fille du régent (4* vols., 1845), the story of two plots against the regent, the duke of Orleans; two books on Mme. du Deffand, *Mémoires d'une aveugle (8* vols., 1856–57) and *Les Confessions de la marquise (8* vols., 1857), both of doubtful authorship; *Olympe de Clkves* (9 vols., 1852), the story of an actress and a young Jesuit novice in the reign of Louis XV., one of his most popular novels; five books on the beginning of the Revolution down to the execution of Marie Antoinette: the *Me'moires d'un médecin,* including *Joseph Balsamo* (19 pts., 1846–48), in which J. J. Rousseau, Mme. du Barry and the dauphiness Marie Antoinette figure, with its sequels; *Le Collier de la reine* (9 vols., 1849–50), in which Balsamo appears under the alias of Cagliostro; *Ange Pitou (8* vols., 1852), known in English as "The Taking of the Bastille"; *La Comtesse de Charny* (19 vols., 1853–55), describing the attempts to save the monarchy and the flight to Varennes; and *Le Chevalier de maison rouge (6* vols., 1846), which opens in 1793 with the hero's attempt to save the queen. Among the numerous novels dealing with the later revolutionary period are:—*Les Blancs et les bleus (3* vols., *1868)* and *Les Compagnons de Jéhu* (7 vols., *1857). Les Louves de Machecoul* (10 vols., 1859) deals with the rising in *1832* in La Vendée. Other famous stories are:—Les *Frères corses (2* vols., *1845);* *La Femme au collier de velours (2* vols., 1851); *Les Mohicans de Paris* (19 vols., 1854–55), detective stories with which may be classed the series of *Crimes célèbres* (8 vols., 1839–41), which are, however, of doubtful authorship; *La San Félice* (9 vols., 1864–65), in which Lady Hamilton played a prominent part, with its sequels *Emma Lyonna* and *Souvenirs d'une favorite.* Of his numerous historical works other than fiction the most important is his *Louis* XIV. *et son siècle (4* vols., 1845). *Mes Me'moires* (20 vols., 1852–54; Eng. trans. of selections by A. F. Davidson, *2* vols., 1891) is an account of his father and of his own life down to *1832.* There are collective editions of his plays (6 vols., 1834–36, and 15 vols, 1863–74), but of the 91 pieces for which he was wholly or partially responsible, *24* do not appear in these collections.

The complete works of Dumas were issued by Michel Lévy *frères* in 277 vols. (1860–84). The more important novels have been frequently translated into English. There is a long list of writings on his life and his works both in English and French. The more important French authorities are: his own memoirs, already cited; C. Glinel, *Alexandre Dumas et son oeuvre* (Reims, *1884);* H. Parigot, *Dumas père* (Grands écrivains français series, 1902), and *Le Drame d'Alexandre Dumas (1899);* *H.* Blaze de Bury, *Alexandre Dumas* (1885); Philibert Andebrand, *Alexandre Dumas à la maison d'or (1888);* G. Ferry, *Dernières Années d'Alexandre Dumas (1883);* and L. H. Lecomte, *Alexandre Dumas* (1904). Of the English lives of Dumas perhaps the best is that by Arthur F. Davidson, *Alexandre Dumas Père his Life and Works* (1902, bibl.). *See* the lives by P. Fitzgerald (1873) and H. *A.* Spurr (1902), and essays by Andrew Lang *(Letters to Dead Authors)* and *R. L.* Stevenson *(Memories and Portraits). See* also Herbert Gorman, *The Incredible Marquis, Alexandre Dumas (1929).*

DUMAS, ALEXANDRE ("DUMAS **FILS**") (1824–1895), French dramatist and novelist, was born in Paris on July *27,* 1824, the natural son of Alexandre Dumas *(see* above) and the dressmaker Marie Labay. "Happily," writes the son, "my mother was a good woman, and worked hard to bring me up"; while of his father he says, "by a most lucky chance he happened to be well-natured," and "as soon as his first successes as a dramatist" enabled him to do so, "recognized me and gave me his name." Nevertheless, the lad's earlier school-life was made bitter by his illegitimacy. The cruel taunts and malevolence of his companions rankled through life *(see* preface to *La Femme de Claude* and *L'Affaire Clémenceau*), and left indelible marks on his character and thoughts. Nor was his paternity, however distinguished, without peril. Alexandre the younger and elder saw life together very thoroughly, and Paris can have had few mysteries for them. Suddenly the son, who had been led to regard his prodigal father's resources as inexhaustible, was rudely undeceived. Coffers were empty, and he had accumulated debts to the amount of £2,000.

Thereupon he pulled himself together. To a son of Dumas the use of the pen came naturally. Like most clever young writers—and report speaks of him as specially brilliant at that time—he opened with a book of verse, *Péchés de jeunesse (1847).* It was succeeded in *1848* by a novel, *La Dame aux camélias,* a sort of reflection of the world in which he had been living. The book was followed, in fairly quick succession, by *Le Roman d'une femme (1848)* and *Diane de Lys (1851).* All this, however, did not deliver him from the load of debt, which, as he tells us, remained odious. In 1849 he dramatized *La Dame aux came'lias,* but the rigour of the censorship and other circumstances delayed its production until Feb. *2,* 1852, when Napoleon's all-powerful minister, Morny, intervened. The play succeeded then, and has held the stage ever since, less perhaps from inherent superiority to other plays which have foundered than to the great opportunities it affords to any actress of genius.

Thenceforward Dumas's career was that of a brilliant and prosperous dramatist. *Diane de Lys* (1853), *Le Demi-Monde* (1855), *La Question d'argent* (1857), *Le Fils naturel* (1858), *Le Pbre prodigue* (1859) followed rapidly. Debts became a thing of the past, and Dumas a wealthy man. The didactic habit was always strong upon him. "Alexandre loves preaching overmuch," wrote his father; and in most of his plays he assumes the attitude of a rigid and uncompromising moralist commissioned to impart to a heedless world lessons of deep import. The lessons themselves are mostly concerned with the "eternal feminine," by which Dumas was haunted, and differ in ethical value. Thus in *Les Idées de Madame Aubray (1867)* he inculcates the duty of the seducer to marry the woman he has seduced; but in *La Femme de Claude (1873)* he argues the right of the husband to take the law into his own hand and kill the wife who is unfaithful and worthless—a thesis again defended in his novel, *L'Affaire Cle'menceau,* and in his pamphlet, *L'Homme-femme;* while in *Diane de Lys* he had taught that the betrayed husband was entitled to kill—not in a duel, but summarily—the man who had taken his honour; and in *L'Etrangère (1876)* the bad husband is the victim. Nor did he preach only in his plays. He preached in voluminous introductions, and pamphlets not a few And when, in 1870 and *1872,*

France was going through bitter hours of humiliation, he called her to repentance and amendments in a *Nouvelle Lettre de Junius* and two *Lettres sur les choses du jour*.

As a moralist Dumas *fils* took himself very seriously indeed. As a dramatist, didacticism apart, he had great gifts. He knew his business thoroughly, possessed the art of situation, interest, crisis—could create characters that were real and alive. His dialogue also is admirable, the repartee rapier-like, the wit most keen. He was singularly happy, too, in his dramatic interpreters. The cast of *L'Etrangère,* for instance, comprised Sarah Bernhardt, Sophie Croizette, Madeleine Brohan, in the female characters; and Coquelin, Got, Mounet-Sully and Fbbvre in the male characters; and Aimée Desclée, whom he discovered, gave her genius to the creation of the parts of the heroine in *Une Visite* de *noces,* the *Princesse Georges* and *La Femme de Claude*. He possessed wit in abundance, of a singularly trenchant kind. It shows itself less in his novels, which, however do not contain his best work; but in his introductions, whether to his own books or those of his friends, and what may be called his "occasional" writings, there is an admirable brightness. His style is that of the best French traditions. Towards his father Dumas acted a kind of brother's part, and while keeping free from his literary influence, both loved and admired him. The father never belonged to the French Academy. The son was elected on Jan. 30, 1874. He died on Nov. 27, 1895.

See J. Claretie, *A. Dumas fils* (1883); P. Bourget, *Nouveaux Essais de psychologie contemporaine* (1885); "La Comédie de moeurs," by René Doumic, in L. Petit de Julleville's *Histoire de la langue et de la littérature française,* viii. pp. 82 *et seq.;* R. Doumic, *Portraits d'écrivains* (1892), Emile Zola, *Documents littéraires, ttudes et portraits* (1881). (F. T. M.)

DUMAS, GUILLAUME MATHIEU, COUNT (1753–1837), French general, was born at Montpellier on Nov. 23, 1753, and entered the army in 1773. He served in America and elsewhere almost continuously up to the outbreak of the Revolution. During the Revolution he acted with the moderate party, and, though he was president of the Legislative Assembly in 1791, spent most of his time abroad until the consulate. Under Napoleon he served at Austerlitz, and then with Joseph Bonaparte in Naples and Spain. He was made a count of the empire in 1810. In 1812 he was intendant-general of the Grande Armée in Russia, but was taken prisoner after the capitulation of Dresden in 1813. At the first restoration he assisted in army administration, but joined Napoleon during the Hundred Days, when he organized the National Guard. He employed his enforced retirement after the second restoration in writing his *Précis des évènements militaires* (19 vols,, 1817–26), the first part of which had appeared anonymously at Hamburg in 1800. The *Précis* embraces the history of the war from 1798 to the peace of 1807. A growing weakness of sight, ending in blindness, prevented him from carrying the work further, but he translated Napier's *Peninsular War* as a sort of continuation to it. In 1818 Dumas was admitted a member of the council of state, from which, however, he was excluded in 1822. After the revolution of 1830, in which he took an active part, Dumas was created a peer of France, and re-entered the council of state. He died in Paris on Oct. 16, 1837.

Besides the *Prtcis des évènements militaires,* which forms a valuable source for the history of the period, Dumas wrote *Souvenirs du lieut.-général Comte Mathieu Dumas* (published posthumously by his son, 1839).

DUMAS, JEAN BAPTISTE ANDRE (1800–1884), French chemist, was born at Alais (Gard) on July 15, 1800. He was apprenticed to an apothecary in his native town. In 1816 he moved to Geneva. There he attended the lectures of Pictet, de la Rive and A. P. de Candolle, and before he was 21 he was engaged with Dr. J. L. Prévost in original work on problems of physiological chemistry, and even of embryology. In 1823 A. von Humboldt induced him to go to Paris, which he made his home for the rest of his life. He became a member of the National Legislative Assembly in 1849; he acted as minister of agriculture and commerce for a few months in 1850–51, and subsequently became a senator, president of the municipal council of Paris and master of the French mint; but his official career came to a sudden end with the fall of the Second Empire. He died at Cannes on April 11, 1884.

Dumas is one of the greatest figures in the chemical history of the middle part of the 19th century. He was one of the first to criticize the electro-chemical doctrines of J. J. Berzelius, which at the time his work began were widely accepted as the true theory of the constitution of compound bodies, and opposed a unitary view to the dualistic conception of the Swedish chemist. In a paper on the atomic theory (1826) he anticipated ideas which are frequently supposed to belong to a later period; and the continuation of these studies led him to the ideas about substitution ("metalepsis") which were developed about 1839 into the theory ("Older Type Theory") that in organic chemistry there are certain types which remain unchanged even when their hydrogen is replaced by an equivalent quantity of a haloid element. Many of his researches were carried out in support of these views, one of the most important being that on the action of chlorine on acetic acid to form trichloracetic acid—a derivative of essentially the same character as the acetic acid itself. 'In the 1836 paper he described his method for ascertaining vapour densities, and the redeterminations which he undertook by its aid of the atomic weights of carbon and oxygen proved the forerunners of a long series which included some 30 of the elements, the results being mostly published in 1858–60. He devised a method of great value in the quantitative analysis of organic substances for the estimation of nitrogen, while the classification of organic compounds into homologous series was advanced as one consequence of his researches into the acids generated by the oxidation of the alcohols.

Dumas was a prolific writer, and his numerous books, essays, memorial addresses, etc., are written in a clear and graceful style. His earliest large work was a treatise (8 vols., 1828–48) on applied chemistry. In the *Essai de statique chimique des êtres organisés* (1841), written jointly with J. B. J. D. Boussingault (1802–87), he treated the chemistry of life, both plant and animal; this book brought him into conflict with Liebig, who conceived that some of his prior work had been appropriated without due acknowledgment. In 1824, in conjunction with J. V. Audouin and A. T. Brongniart, he founded the *Annales des sciences naturelles,* and from 1840 he was one of the editors of the *Annales de chimie et de physique.* As a teacher Dumas was the first French chemist to adopt the practical laboratory teaching instituted at Giessen by Liebig. We used this method at the École Polytechnique and afterwards in his own laboratory. A member of the Académie des Sciences from 1832, he became its perpetual secretary in 1868, and was elected to the French Academy in 1875 to the chair left vacant by the death of Guizot.

DU MAURIER, GEORGE LOUIS PALMELLA BUSSON (1834–1896), British artist and writer, was born in Paris. His father, a naturalized British subject, was the son of *émigrés* who had left France during the Reign of Terror and settled in London. In *Peter Ibbetson,* the first of the three books which won George Du Maurier late in life a reputation as novelist almost as great as he had enjoyed as artist and humorist for more than a generation, the author tells in the form of fiction the story of his singularly happy childhood which was mostly spent at Passy. After some years at a Paris school, he left (in 1851) to study chemistry at University College, London, actually setting up as an analytical chemist afterwards in Bucklersbury. But this was clearly not to be his *métier,* and the year 1856 found him once more in Paris, in the Quartier Latin this time, in the core of that art-world of which in *Trilby,* 40 years later, he was to produce with pen and pencil so idealistic and fascinating a picture. Then (like Barty Josselin in *The Martian,* his third novel) he spent some years in Belgium and the Netherlands, experiencing at Antwerp in 1857, when he was working in the studio of van Lerius, the one great misfortune of his life—the gradual loss of sight in his left eye, accompanied by alarming symptoms in his right. It was a period of tragic anxiety, but the cloud was soon to show its silver lining, for, about Christmas-time 1858, there came to the forlorn invalid a copy of *Punch's Almanac,* and with it the dawn of a new era in his career.

There can be little doubt that the study of this *Almanac,* and especially of Leech's drawings in it, fired him with the ambition

of making his name as a graphic humorist; and it was not long after his return to London in 1860 that he sent in his first contribution (very much in Leech's manner) to *Punch*. Mark Lemon, then editor, appreciated his talent, and on Leech's death in 186j appointed him his successor, counselling him with wise discrimination not to try to be "too funny," but "to undertake the light and graceful business" and be the "romantic tenor" in Mr. Punch's little company, while Keene, as Du Maurier puts it, "with his magnificent highly-trained basso, sang the comic songs." These respective rôles the two artists continued to play until the end, and Du Maurier himself in his book on Social Pictorial Satire has set forth their points both of resemblance and of difference. Besides working for *Punch* he illustrated several books, including his own novels, and from time to time he sent pretty and graceful pictures to the exhibitions of the Royal Society of Painters in Water-Colour, to which he was elected in 1881. In 1885 the first exhibition of his works at the Fine Art Society took place. He died on October 8, 1896, and was buried in the Hampstead parish churchyard. He left a family of two sons—the elder, Major Guy Du Maurier (1865–1915), a soldier who became more widely known in 1909 as author of the military play An Englishman's *Home*, and the second, Gerald (later, Sir), a well-known actor—and three daughters.

See *Thomas Armstrong, C.B.; a Memoir* (1912), and *T.* Martin Wood, *George Du Maurier* (1913). Other volumes containing information about Du Maurier's life and work are: M. H. Spielmann, *The History of Punch;* Felix Moscheles, *In Bohemia with Du Maurier;* *Century Magazine* (1883); *Harper's Magazine* (Sept. 1897, June 1899). *See* also Ruskin, *Art of England*, Lecture 5, Pennell, *Pen Drawing and Pen-Draughtsmen*, and Muther, *Modern Painting.* (F. W. W.)

DUMBARTON, royal, municipal and police burgh, seaport, and county town, Dumbartonshire, Scotland, on the river Leven, near its confluence with the Clyde, 15½ m. W. by N. of Glasgow by the L.N.E.R. and L.M.S.R. Pop. (1931) 21,546. The Alcluith ("hill of the Clyde") of the Britons, and Dumbreatan ("fort of the Britons") of the Celts, it was the capital of the district of Strathclyde. Here the Romans had a naval station called Theodosia. The history of the town, however, practically centres in that of the successive fortresses on the Rock of Dumbarton, a twin-peaked hill, 240 ft. high and a mile in circumference at the base. The Picts seized it in 736, the Northmen in 870, and Thomas Crawford of Jordanhill on March 31, 1571, in the interests of James VI. The castle has been held by Queen Mary's adherents, and gave them free communication with France. William Wallace was in 1305 imprisoned in the castle before he was removed to London. The higher of the two peaks is known as Wallace's seat, a tower being named after him. On the portcullis gateway are rudely carved heads of Wallace and his betrayer. Queen Mary, when a child, resided in the castle for a short time. The rock is basalt, with a tendency to columnar formation.

Dumbarton was of old the capital of the earldom of Lennox, but was given up by Earl Maldwyn to Alexander II., by whom it was made a royal burgh in 1221 and declared to be free from all imposts and burgh taxes. Later sovereigns gave it other privileges, and all were finally confirmed by a charter of James VI. It had the right to levy customs and dues on all vessels on the Clyde between Loch Long and the Kelvin. "Offers dues" on foreign ships entering the Clyde were also exacted. In 1700 these rights were transferred to Glasgow by contract, but were afterwards vested in a special trust created by acts of parliament.

Most of the town lies on the left bank of the Leven, but there is communication with the suburb of Bridgend on the right bank by a five-arched stone bridge. Dumbarton is controlled by provost and council. It unites with Clydebank in returning one member to parliament. The principal industry is shipbuilding. The old staple trade of the making of crown glass, begun in 1777, lapsed some 70 years afterwards when the glass duty was abolished. There are several great engineering works, besides iron foundries, breweries, and rope-yards. There are quays, docks and a harbour at the mouth of the Leven, and a pier for river steamers runs out from the Castle rock, but is now disused. The first steam navigation company was established in Dumbarton in 1815, when the "Duke of Wellington" (built in the town) plied between Dumbarton and Glasgow. But it was not till 1844, consequent on the use of iron for vessels, that shipbuilding became the leading industry.

DUMBARTONSHIRE, western county, Scotland, bounded north by Perthshire, east by Stirlingshire, south-east by Lanarkshire, south by the Clyde and its estuary, and west by Loch Long and Argyllshire. The detached parish of Kirkintilloch and part of that of Cumbernauld are enclosed between the shires of Stirling and Lanark. This formerly formed part of Stirlingshire, but was annexed in the 14th century when the earl of Wigtown, to whom it belonged, became heritable sheriff of Dumbartonshire. Dumbartonshire has an area (excluding water) of 156,927 acres. The north-west and west are mountainous, the highest point exceeding 3,200 feet. This is a district composed of rocks belonging to the metamorphic series of the Highlands, into which, in the north of the county, there is a large plutonic intrusion. In the south of the county are the Kilpatrick Hills (1,300 ft.), a system of lavas, tuffs and agglomerates intercalated in the Calciferous Sandstone series. Sandstones of various ages occupy most of the rest of the county, but the Carboniferous limestone follows them in some parts, and, notably in the detached portion of the county, includes important coal-measures. The boulder clay of the Carboniferous lowland is full of schistose boulders brought by glacial action from areas far to the north-west. The Clyde, the Kelvin and the Leven are the only rivers of importance. The Leven flows out of Loch Lomond at Balloch and joins the Clyde at Dumbarton after a serpentine course of about 7 miles. Most of the other streams are among the mountains, whence they find their way to Loch Lomond, and nearly all afford good fishing. Of the inland lakes by far the largest is Loch Lomond (*q.v.*). The boundary between the shires of Dumbarton and Stirling runs through the lake from the mouth of Endrick Water to a point opposite the Isle of Vow, giving about two-thirds of the loch to the former county. Loch Sloy on the side of Ben Vorlich is a long, narrow lake, 812 ft. above the sea amid wild scenery. From its name the Macfarlanes took their slogan or war-cry. The shores of the Gareloch, a salt-water inlet 6½ m. long and 1 m. wide, are studded with houses of those whose business lies in Glasgow. Garelochhead, and Cove and Kilcreggan at the entrance to Loch Long, are favourite summer resorts. The more important salt-water inlet, Loch Long, is 17 m. in length and varies in width from 2 m. at its mouth to about ½ m. in its upper reach. It is a dumping-place for the dredgers which are constantly at work preserving the tide-way of the Clyde from Dumbarton to Broomielaw. The scenery on both shores is very beautiful. Only a mile separates Garelochhead from Loch Long, and at Arrochar the distance from Tarbet on Loch Lomond is barely 1¾ miles. Nearly all the glens are situated in the Highland part of the shire, the principal being Glen Sloy, Glen Douglas, Glen Luss and Glen Fruin. The last is memorable as the scene of the conflict in 1603 between the Macgregors and the Colquhouns, in which the latter were almost exterminated. It was this encounter that led to the proscription of the Macgregors, including Rob Roy.

History.—Prehistoric peoples have left rude forts and tumuli, and there are several remains of the wall of Antoninus, built from Forth to Clyde, and running along the north of the detached portion of the shire and through the south-eastern corner of the county to Kilpatrick. Other Roman relics have been found at Duntocher, Cumbernauld and elsewhere. The shire forms part of the old Scottish territory of Lennox (*Levenachs*, "fields of the Leven"), which embraced the Vale of the Leven and the basin of Loch Lomond, or all modern Dumbartonshire, most of Stirling and parts of the shires of Renfrew and Perth. It gave the title of the earldom created in 1174 by William the Lion and of the dukedom conferred by Charles II. on his natural son, Charles, duke of Richmond and Lennox. Robert Bruce is said to have mustered his forces at Dullatur prior to the battle of Bannockburn, and died at Cardross Castle in 1329. The Covenanters in their flight from the field of Kilsyth, where in 1645 Montrose had defeated them, made their way through the southern districts. The clans of Macgregor and Macfarlane made their home in the Highland fastness and raided their Lowland neighbours.

Agriculture, Industries and Communications.—The arable

lands extend chiefly along the Clyde and the Leven, and are composed of rich black loam, gravelly soil and clay. The farmers have markets on the Clyde for all kinds of stock and produce, and high farming and dairying prosper. Black-faced sheep and Highland cattle are pastured on the hilly lands and Cheviots and Ayrshires on the low grounds. Oats are the principal cereal, but wheat. potatoes and turnips are also grown.

Turkey-red dyeing has long been a distinctive industry. The water of the Leven being singularly soft and pure, dyers and bleachers have constructed works at many places. Bleaching has been carried on since the early part of the 18th century, and cotton-printing at Levenfield dates from 1768. There are large establishments at Alexandria, Bonhill, Jamestown, Renton and other towns for bleaching, dyeing and printing of cottons, calicoes and other cloths, besides yarns. The engineering works and shipbuilding yards at Clydebank are famous, and at Dumbarton there are others. The Vale of Leven and the riverside towns east of Dumbarton make a busy industrial district. Coal and fireclay are worked, and sandstone and igneous rocks are quarried in the detached portion at Kirkintilloch and Cumbernauld. There is some fishing at Helensburgh and along the Gareloch.

The populous districts of the county are served by the L.N.E.R. From Helensburgh to Inverarnan the West Highland line runs through beautiful scenery. The L.M S.R. has access to Balloch from Glasgow, and traverses the detached portion. Portions of the Forth and Clyde Canal, connecting with the Clyde at Bowling, and opened for traffic in 1775, pass through the shire. There is regular steamer communication between Glasgow and the towns and villages on the coast.

Population and Government. — The population of Dumbartonshire in 1921 was 150,868, and in 1931, 147,751, of whom 1,866 spoke both Gaelic and English. The principal towns, with populations in 1931, are—Bonhill (15,565), Clydebank (46,963), Dumbarton (21,546), Helensburgh (8,893), Kirkintilloch (11,-817), Milngavie (5,056). The county returns one member to parliament, and Dumbarton, the county town and the only royal burgh, one member with Clydebank. Dumbartonshire forms a sheriffdom with the counties of Stirling and Clackmannan, and there is a resident sheriff-substitute at Helensburgh, who sits also at Dumbarton and Kirkintilloch.

DUMB WAITER, originally a small oblong or circular table to hold reserve plates, knives and forks, and other necessaries for a meal. It came into use in England towards the end of the 18th century, and some exceedingly elegant examples were designed by Sheraton and his school. They were usually circular, with three 'diminishing tiers, sometimes surrounded by a continuous or interrupted pierced gallery in wood or brass. The smaller varieties are now much used in England for the display of small silver objects in drawing-rooms.

The term has more recently been extended to mean the small elevator used to convey household commodities from one floor to another in modern apartments. It is a box-like structure, about 2 feet square, built within the walls, and run with a rope and pulley.

DUM-DUM, a town and cantonment in British India, in the district of the Twenty-four Parganas, 4-j m. N.E. of Calcutta. The name is derived from *dam dama,* meaning a raised mound, a battery. Dum-Dum was the headquarters of the Bengal artillery from 1783 to 1853. when they were transferred to Meerut. It contains an army rifle and ammunition factory. The town is divided between two municipalities, North Dum-Dum (pop. 9,885) and South Dum-Dum (pop. **18,471).** It was at Dum-Dum that Siraj-ud-daula signed the treaty of 1757 with Clive.

At the Dum-Dum foundry the hollow-nosed "Dum-Dum" (Mark IV.) bullets were manufactured, the supposed use of which by the British during the Boer War caused considerable comment in 1899. Their peculiarity consisted in their expanding on impact and thus creating an ugly wound, and they had been adopted in Indian frontier fighting owing to the failure of the usual type of bullets to stop the rushes of fanatical tribesmen. They were not, in fact, used during the Boer War. Other and improvised forms of expanding bullet were used in India and the Sudan, the commonest methods of securing expansion being to file down the point until the lead core was exposed and to make longitudinal slits in the nickel envelope. All these forms of bullet have come to be described colloquially, and even in diplomatic correspondence as "dum-dum bullets," and their alleged use by Russian troops in the Russo-Japanese War of 1904–1905 formed the subject of a protest on the part of the Japanese government. An International declaration was made at the second Hague Conference, July 29, 1899, forbidding the use of these bullets. The United States did not participate in this declaration. During the World War actual charges were made by the belligerents of the use of illegal bullets, but there was no evidence forthcoming that such use (if any) was authorized by any power.

DUMESNIL, MARIE FRANÇOISE (1713–1803), French actress, whose real name was Marchand, was born in Paris on Jan. 2, 1713, made her *début* in 1737 at the Comkdie Française as Clytemnestre in *Iphigénie en Tauride.* She played Cléopâtre, Phèdre, Athalie and Hermione with great effect, and when she created Mérope (1743) Voltaire says that she kept the audience in tears for three successive acts. She retired in 1776 and died on Feb. 20, 1803. She authorized the publication of a *Mémoire de Marie Françoise Dumesnil,* in reply to an attack by her rival, Clairon (1800)

DUMFRIES, royal burgh, parish and county town, Dumfriesshire, Scotland (Gaelic, "the fort in the copse"). It lies on the left bank of the Nith, about 8 m. from the Solway Firth and 82 m. S.E. of Glasgow by the L.M.S.R., and is a junction for several lines. Pop. (1931) 22,795. Dumfries is a fine town, beautifully situated. St. Michael's (1746) was the church which Robert Burns attended, and in its churchyard he was buried, his remains being transferred in 1815 to the magnificent mausoleum erected in the south-east corner. The schools include an important academy. In the middle of the market-place stands the old town hall, with red tower and cupola, known from its situation as the Mid Steeple. It was built by Tobias Bachup of Alloa (1708), and is now occupied by shops. The Theatre Royal, reconstructed in 1876, dates from 1787. Burns composed several prologues and epilogues for some of its actors and actresses. The Nith is crossed by three bridges and the railway viaduct. The bridge used for vehicular traffic dates from 1790–1794. Devorguilla's bridge below it, built of stone in 1280, originally consisted of nine arches (now reduced to three), and is reserved in spite of its massive appearance for foot passengers only, as is also the suspension bridge opened in 1875.

Maxwelltown, on the opposite side of the river, is practically part of Dumfries, but is a separate burgh in Kirkcudbrightshire.

The leading industries comprise manufactures of tweeds, hosiery, clogs, aerated water, gloves and various foodstuffs, besides the timber trade, nursery gardening, electrical and motor engineering, and the making of implements. Dumfries markets for horses, cattle and sheep have always ranked with the best, and there is also a market for pork during the five months beginning with November. The Nith is navigable at Dumfries for vessels drawing 8 ft., but the sea-borne trade is small.

Although Dumfries was the site of a camp of the Selgovian Britons, nothing is known of its early history. William the Lion (d. 1214) made it a royal burgh, but the oldest existing charter was granted by Robert II in 1395. The town became embroiled in the struggles that ended in the independence of Scotland. It favoured the claims to the throne, first of John Baliol—whose mother Devorguilla, daughter of Alan, lord of Galloway, had done much to promote its prosperity by building the stone bridge over the Nith—and then of the Red Comyn, as against those of Robert Bruce, who drew his support from Annandale. Until nearly the close of the 16th century the burgh was exposed to frequent raids, both from freebooters on the English side and from partisans of the Douglases, Maxwells and Johnstones. James VI. was royally entertained on Aug 3, 1617, and afterwards presented the seven incorporated trades with a silver gun to encourage craftsmen in the practice of musketry. A competition for this gun, which is now kept in the old town hall, took place annually—with a great festival every seven years—until 1831. John Mayne (1759–1836), a native of Dumfries, commemorated

the gathering in a humorous poem, "The Siller Gun." The Union with England was so unpopular that not only did the provost vote against the measure in the Scottish parliament, but the articles were burned (Nov. 20, 1706) at the Market Cross by a body of Cameronians. In both 1715 and 1745 Dumfries remained apathetic. Burns, the poet, resided here from December 1791 till his death on the 21st of July 1796. The house in which he died is still standing.

The picturesque ruins of Carlaverock Castle, which is claimed to be the "Ellangowan" of Guy *Mannering,* are 8 m. to the south. Part of the present structure is believed to date from 1220 and once sheltered William Wallace. It withstood Edward I.'s siege in 1300 for two days, although garrisoned by only sixty men. Subsequently it often changed hands. In 1570 it fell into disrepair, but was restored, and in 1641 was besieged for the last time by the Covenanters. A mile and a half to the north-west of Dumfries lies Lincluden Abbey, "an old ruin," says Burns, "in a sweet situation at the confluence of the Cluden and the Nith." Originally the abbey was a convent, founded in the 12th century, but converted two centuries later into a collegiate church by Archibald, earl of Douglas. The remains of the choir and south transept disclose rich Decorated work.

DUMFRIESSHIRE, border county, Scotland, bounded south by Solway Firth, south-east by Cumberland, east by Roxburghshire, north by the shires of Lanark, Peebles and Selkirk, and west by Ayrshire and Kirkcudbrightshire. Area (excluding water) 686,302 acres. The county slopes gradually from uplands of 2,700 ft. in the north down to the sea, lofty hills alternating in places with stretches of tableland or rich fertile holms. The greater part belongs to the tableland of Silurian rock in southern Scotland, which is bordered in the north-west and south of the county by old red sandstones, and broken at many points by intensive igneous rocks. Strata of Carboniferous age (among others) occur in hollows of the tableland. and at Sanquhar and Rowanburn include coal-measures, which have been worked but are no longer rich. At various points within a few miles of the Solway are tracts of moss land, like Craigs Moss, Lochar Moss and Longbridge Moor in the west, and Nutberry Moss in the east, all once under water, but now largely reclaimed. The county is cleft from north to south by Nithsdale, Annandale and Eskdale. The Nith (65 m.) enters the shire 16 m. from its source and flows south-east to the Solway. The Annan rises near the Devil's Beef Tub, a remarkable chasm in the far north, and flows south for about 40 m. to the Solway. From the confluence of the White Esk (rising near Ettrick Pen) and the Black Esk (rising near Jock's Shoulder, 1,754 ft.) the Esk flows south-east to the border, and south-west in Cumberland to the Solway. For 1 m. of its course the Esk, and for 7 m. of its course the Sark, form the boundaries between Dumfriesshire and Cumberland. Loch Skene in the north (1,750 ft. above sea), the group of lochs around Lochmaben, and Loch Urr in the west, are the principal lakes. The wild and beautiful passes of Dalveen, Enterkin and Menock, lead up from Nithsdale to the Lowther and other hills. For part of the way Enterkin pass runs between mountains rising sheer from the burn to a height of nearly 2,000 feet. Loch Skene finds an outlet in Tail burn, the water of which at a short distance from the lake leaps from a height of 200 ft. in a fine waterfall, known as the Grey Mare's Tail. A much smaller but picturesque fall of the same name, also known as Crichope linn, occurs on the Crichope, near Thornhill. Mineral waters are found at Moffat, Hartfell Spa, some three miles farther north, and Closeburn on the Solway.

History. — The early populations have left hill forts in the north, stone circles (as in Dunscore and Eskdalemuir), camps (Dryfesdale), tumuli and cairns (Closeburn), and sculptured stones (Dornock). The country around Moffat especially is rich in remains. At Holywood, near Dumfries, there stands the relic of the grove of sacred oaks from which the place derived its name, and a stone circle known locally as the Twelve Apostles. The British inhabitants were called Selgovae by the Romans. In the parish church of Ruthwell (prov. Rivvel: the "rood, or cross, well") is preserved an ancient cross which tells in Runic characters the story of the Crucifixion. There are traces of Roman roads which ran by Dalveen pass into Clydesdale and up the Annan to Tweeddale, and at Birrens is a well preserved Roman camp. Roman altars, pottery and coins have been found in many places. Upon the withdrawal of the Romans, the Selgovae were conquered by Scots from Ireland. The Saxon conquest of Dumfriesshire does not seem to have been thorough, the people of Nithsdale and elsewhere maintaining their Celtic institutions up to the time of David I.

Edward I. besieged Carlaverock castle, and the factions of Bruce (who was lord of Annandale), John Comyn and John Baliol were at constant feud. The Border clans were always at strife until the 18th century. The hill country afforded retreat to persecuted Covenanters, who, at Sanquhar, published in 1680, their declaration against the king, anticipating the principles of the "glorious Revolution" by several years. The Jacobite sentiment made little appeal to the people.

Robert Burns farmed at Ellisland on the Nith for three years, and spent the last five years of his life at Dumfries. Thomas Carlyle was born at Ecclefechan, in a house still standing, and was buried beside his parents in the kirkyard.

Agriculture, Industries and Communications. — Towards the middle of the 18th century farmers began to raise stock for the south, and 100 years later 20,000 head of heavy cattle, formerly Galloways, later mostly shorthorns and Ayrshires, were sent annually to the English markets. Sheep breeding, of later origin, has attained to large dimensions, the walks in the higher hilly country being given over to Cheviots, and the richer pasture of the low-lying farms being reserved for half-bred lambs, a cross of Cheviots and Leicesters or other long-woolled rams. Horse-breeding is pursued on a considerable scale, Oats are the principal crop. Sheep, cattle, pigs, grain, wool, hides and skins are exported. Some lead ore is mined, and limestone and sandstone are quarried. In general, the manufactures are only of local importance, the chief being the woollen and hosiery industries of Dumfries and Langholm. There are distilleries at Langholm and Annan; dyeing and tanning works at Langholm. Nursery gardening and some shipping are carried on at Annan and Dumfries; and the salmon fisheries of the Nith and Annan and the Solway Firth are of value.

Of the two main lines of the L.M.S.R. between Glasgow and Carlisle, one (the former Glasgow and South Western), runs through Nithsdale, practically following the course of the river, and lower Annandale to the Border. The other (the former Caledonian railway) runs through Annandale, throwing off at Beattock a branch to Moffat, at Lockerbie a cross-country line to Dumfries, and at Kirtlebridge a line to Annan. From Dumfries westwards there is communication with Castle Douglas, Kirkcudbright. Newton Stewart, Stranraer and Portpatrick. The L.N.E.R. sends a short line to Langholm from Riddings Junction in Cumberland, giving access to Carlisle and, by the Waverley route, to Edinburgh.

Population and Government. — The population in 1931 was 81.060. The chief towns are Annan (pop. in 1931, 3,959), Dumfries (22,795), Langholm (2,448), Lockerbie (2,574) and Moffat (2,006). The county returns one member to parliament. Dumfries, the county town, Annan, Lochmaben and Sanquhar are royal burghs; Dumfries forms a sheriffdom with the shires of Kirkcudbright and Wigtown, and there is a resident sheriff-substitute at Dumfries. Secondary education has been notably directed by public authorities toward carrying on science and technical classes, embracing agriculture and dairying (at Kilmarnock dairy school). There are academies at Dumfries, Annan, Moffat and other centres.

DÜMICHEN, JOHANNES (1833–1894), German Egyptologist, was born near Grossglogau. He studied philology and theology in Berlin and Breslau, and in 1872 became professor of Egyptology at Strasbourg. In 1875–76 he directed the excavation of the temple at Dendera.

Among his works are *Bauurkunde des Tempels von Dendera* (1865); *Geographische Inschriften altagyptischer Denkmäler* (4 vols., 1865–1885); *Altägyptische Kalenderinschriften* (1866); *Altägypt. Tempelinschriften* (2 vols., 1867); *Historische Inschriften altagypt.,*

Denkmäler (6 vols., 1867–1869); *Baugeschichte und Beschreibung des Denderatempels* (Strassburg, 1877); *Die Oasen der libyschen Wüste* (1878); *Die kalendarischen Opferfestlisten von Medinet-Habu* (1881); *Gesch. des alten Aegypten* (1878–1883); *Der Grabpalast des Patuamenap in der thebanischen Nekropolis* (1884–1894).

DUMKA (pl. Dumky), a Little Russian term signifying a lament and employed frequently by Dvořák in his chamber works to designate movements of a melancholy, mournful character. The English word "dump," signifying a melancholy mood, and also a doleful ditty, is possibly akin. *Cf.* also Ger. *dumpf*, meaning dull, flat, dead.

DÜMMLER, ERNST LUDWIG (1830–1902), German historian, the son of Ferdinand Diimmler (1777–1846), a Berlin bookseller, was born in Berlin, on Jan. 2, 1830. He studied at Bonn under J. W. Löbell (1786–1863), under L. von Ranke and W. Wattenbach. He entered the faculty at Halle in 1855, became professor extraordinary (1858), and full professor (1866). In 1875 he became a member of the revised committee directing the *Monumenta Germaniae historica*, himself undertaking the direction of the section *Antiquitates*, and in 1888 became president of the central board in Berlin. His great work was the *Gesclzichte des ostfränkischen Reiches* (1862–65, in 2 vols.; 2nd ed. 1887–88, in 3 vols.). In conjunction with Wattenbach he completed the *Monumenta Alcuiniana* (1873), which had been begun by Philipp Jaffé, and with R. Köpke he wrote *Kaiser Otto der Grosse* (Leipzig, 1876). He edited the first and second volumes of the *Poetae latini aevi Carolini* for the *Monumenta Germaniae historica* (1881–84). Diimmler died in Berlin on Sept. 11, 1902.

DUMMY, in advertising and printing, a material representation or full-sized complete physical model showing the general appearance of a proposed folder, pamphlet, or other piece of printing. It is used as a guide both in sketching in the details of the various pages and in assisting the printer to follow instructions as to how the work is to appear when finished.

DUMONT, the name of a family of prominent French artists. François Dumont (1688–1726), a sculptor, best known for his figures in the church of Saint Sulpice, Paris, was the brother of the painter Jacques Dumont, known as "le Romain" (1701–1781), whose chief success was gained with a great allegorical composition for the Paris *Hôtel de Ville* in 1761. François' son Edme (1720–1775), the latter's son Jacques Edme (1761–1844), and the son of the last named, Augustin Alexander (1801–1884), were also famous sculptors. A contemporary, Jean Joseph Dumons (1687–1779), sometimes called Dumont, is best known for his designs for the Aubusson tapestries.

See G. Vattier, *Une Famille d'artistes* (1890).

DUMONT, ANDRE HUBERT (1809–1857), Belgian geologist, was born at LiCge on Feb. 1j, 1809. He was professor of mineralogy and geology and afterwards rector in the university of LiCge. He spent 20 years on the preparation of a geological map of Belgium (1849), and then collected materials for a geological map of Europe. The Geological Society of London awarded him the Wollaston medal in 1840, and he died at LiCge on Feb. 28, 1857.

See Memoir by Major-General J. E. Portlock in *Address* to *Geol. Soc.* (1858).

DUMONT, FRANÇOIS (1751–1831), French miniature painter, was born at Lunéville (Meurthe), studied for a time under Jean Girardet, and in 1788 was accepted as an academician and granted an apartment in the Louvre. He married the daughter of Antoine Vestier, the miniature painter, and had two sons, Aristide and Bias, both of whom became painters. He was one of the three greatest miniature painters of France, painting portraits of Louis XVI. and Marie Antoinette, Louis XVIII. and Charles X., and of almost all the important persons of his day. His own portrait was engraved both by Audouin and by Tardieu. He spent the greater part of his life in Paris, and there he died. A younger brother, known as Tony Dumont, was also a miniature painter, a pupil of his brother, a frequent exhibitor and the recipient of a medal from the Academy in 1810. Each artist signed with the surname only, and there is some controversy concerning the attribution to each of his own canvases. Many of Dumont's finest paintings came into the collection of J. Pierpont Morgan, but others are in the Louvre, presented by the heir of Bias Dumont.

See G. C. Williamson, *The History of Portrait Miniatures* (1904); also the privately printed *Catalogue of the Collection of Miniatures of Mr. J. Pierpont Morgan*, vol. iv.

DUMONT, JEAN (d. 1726), French publicist, became historiographer to the emperor, who conferred on him the title of baron de Carlscroon. He died at Vienna in 1726, at an advanced age.

Among his publications are:—*Mémoires politiques pour servir à la parfaite intelligence de l'histoire de la Paix de Ryswick (The* Hague, 1699, 4 vols. 12mo.); *Recherches modcstes des causes de la présente guerre, en ce qui concerne les Provinces Unies* (1713, 12mo); *Recueil de traite's . . . depuis la Paix de Munster* (Amsterdam, 1710, 2 vols. 12mo); *Corps universe1 diplomatique du droit des gens, contenant un recueil des traite's de paix, d'alliance*, etc., *faits en Europe, depuis Charlemagne jusqu'à présent* (Amsterdam, 1626, and following years, 8 vols. fol., continued after Dumont's death by J. Rousset), and *Batailles gagnées par le Prince Eugène de Savoie* (The Hague, 1723). Dumont was also the author of *Lettres historiques conteaant ce qui se passe de plus important en Europe* (12mo). This periodical, which was commenced in 1692, two volumes appearing annually, Dumont conducted till 1710, from which time it was continued by Basnage and others until 1728. The earlier volumes are much prized.

DUMONT, PIERRE ÉTIENNE LOUIS (1759–1829), French political writer, was born at Geneva where his family had been citizens of good repute from the days of Calvin. He was educated for the ministry at the college of Geneva, and in 1781 was chosen one of the pastors of the city. The triumph of the aristocratic party in 1782, however, through the interference of the courts of France and Sardinia, made residence in his native town impossible, though he was not among the number of the proscribed. He therefore went to join his mother and sisters at St. Petersburg (Leningrad). In 1785 Lord Shelburne took him to London as tutor to his sons. There he met Fox, Sheridan, Lord Holland and Sir S. Romilly.

In 1788 Dumont visited Paris with Romilly. During a stay of two months in that city he met Mirabeau with whom he became intimate. On his return from Paris Dumont made the acquaintance of Jeremy Bentham, and set himself to recast and edit the writings of the great English jurist in a form suitable for the ordinary reading public. This literary relationship was, according to Dumont's own account, one of a somewhat peculiar character. All the fundamental ideas and most of the illustrative material were supplied in the manuscripts of Bentham; Dumont's task was chiefly to abridge by striking out repeated matter, to supply *lacunae*, to secure uniformity of style, and to improve the French. The following works of Bentham were published under his editorship: *Traité de législation civile et pénale* (1802), *Théorie des peines et des récompenses* (1811), *Tactique des assemblées législatives* (1815), *Traitd des preuves judiciaires* (1823), and *De l'organization judiciaire et de la codification* (1828).

In the summer of 1789 Dumont went to Paris. He contributed to Mirabeau's journal, the *Courier de Provence*, supplying it with reports as well as original articles, and also furnishing Mirabeau with speeches to be delivered or rather read in the assembly, as related in his posthumous work entitled *Souvenirs sur Mirabeau* (1832).

In 1814 the restoration of Geneva to independence induced Dumont to return to his native place, and he soon became the leader of the supreme council. Many improvements in the judicial and penal systems of his native state are due to him.

See A. P. de Candolle, *Notice sur* la *vie et les kcrits de M. Dumont* (1829).

DUMONT D'URVILLE, JULES SEBASTIEN CÉSAR (1790–1842), French navigator, was born at Condé-sur-Noireau, in Normandy. He went to sea in 1807 as a *novice* on board the "Aquilon." During the next 12 years he gradually rose in the service, and added a knowledge of botany, entomology, English, German, Spanish, Italian and even Hebrew and Greek to the professional branches of his studies. In 1820, while engaged in a hydrographic survey of the Mediterranean, he was fortunate enough to recognize the Venus of Milo (hfelos) in a Greek statue recently unearthed, and to secure its preservation by the report he

presented to the French ambassador at Constantinople. In 1822 he served in the circumnavigating expedition of the "Coquille" under the command of his friend Duperrey; and on its return in 1825 he was promoted *capitaine de frégate,* and given the command of a similar enterprise, with the purpose of discovering traces of the lost explorer, La Pérouse, in which he was successful. The "Astrolabe," as he renamed the "Coquille," left Toulon on April 25, 1826, and returned to Marseille on March 25, 1829, having traversed the south Atlantic, coasted the Australian continent from King George's sound to Port Jackson, charted various parts of New Zealand, and visited the Fiji islands, the Loyalty islands, New Caledonia, New Guinea, Amboyna, Van Diemen's Land, the Caroline islands, Celebes and Mauritius. Promotion to the rank of *capitaine de vaisseau* was bestowed on the commander in Aug. 1829; and in August of the following year he conveyed the exiled king Charles X. to England. On Sept. 7, 1837, he set sail from Toulon with the "Astrolabe" and its convoy "La Zélée" on a voyage of exploration in the South Polar regions. On Jan 1j, 1838, they sighted the Antarctic ice, and soon after their progress southward was blocked by a continuous bank, which they vainly coasted for 300m. to the east. Returning westward they visited the South Orkney islands and part of the New Shetlands, and discovered Joinville island and Louis Philippe Land, but were compelled by scurvy to seek succour at Talcahuano in Chile. Thence they proceeded across the Pacific and through the Asiatic archipelago, visiting among others the Fiji and the Pelew islands, coasting New Guinea, and circumnavigating Borneo. In 1840, leaving their sick at Hobart Town, Tasmania, they returned to the Antarctic region, and subsequently discovered Adélie Land, which D'Urville named after his wife, in 140° E. Nov. 6 found them at Toulon. On May 8, 1842, D'Urville was killed, with his wife and son, in a railway accident near Meudon. An island (also called Kairu) off the north coast of New Guinea and a cape on the same coast bear his name.

His principal works *are:—Enzcnreratio plantarum quas in insulis Archipelagi aut littoribus Ponti Euxini,* etc. **(1822);** *Voyage de la corvette "l'Astrolabe," 1826–1829* (1830–35), and *Voyage au pôle sud et dans l'Océanie, 1837–1840* (1842–54), in each of which his scientific colleagues had a share; *Voyages autour du monde; résumé général des voyages de Magellan,* etc. **(1833** and **1844).**

DUMORTIERITE, a mineral first recorded from pegmatite in gneiss at Chaponost, near Lyons, France, and named after E. Dumortier, a French palaeontologist. It is essentially a basic aluminium borosilicate, most reliable analyses conforming to the formula $8Al_2O_3{\cdot}6SiO_2{\cdot}B_2O_3{\cdot}H_2O$. Crystallizing in the rhombic system, it occurs usually in fibrous or columnar aggregates of blue, lavender or almost black colour. These commonly observed colours are due to the oxides of iron and titanium always present in small amounts. The mineral is strongly pleochroic in blue and violet tints. On heating to 800° C the colour rapidly disappears. At higher temperatures B_2O_3 is volatilized and decomposition occurs with formation of mullite ($3Al_2O_3{\cdot}2SiO_2$), liquid appearing first at a temperature of 1,550°C.

On account of its high alumina content dumortierite possesses considerable advantages as a basis for refractory bodies. Dumortierite occurs as a rare constituent of pegmatites and gneisses. The best known locality is at Clip, Ariz., where it is found as dense fibres embedded in quartz. Among European localities its presence in pegmatite at Ellon (Scotland), in cordierite-gneiss at Tvedestrand (Norway), with corundum in pegmatite at Wolfshan (Silesia) may be mentioned. In company with lazulite and kyanite it occurs in quartzites at Chari (French Central Africa) and Svarina (Madagascar). (C. E. T.)

DUMOULIN, CHARLES (Molinaeus) (1500–1566), French jurist, was born in Paris in 1500. He began practice as an advocate before the parlement of Paris. Dumoulin turned Calvinist, and when the persecution of the Protestants began he went to Germany, where for a long time he taught law at Strasbourg, Besançon and elsewhere. He returned to France in 1557. Dumoulin had, in 1552, written *Commentaire sur l'édit du roi Henri II. sur les petites dates,* which was condemned by the Sorbonne, but his *Conseil sur le fait du concile de Trente* created *a* still greater stir, and aroused against him both the Catholics and the Calvinists. He was imprisoned by order of the parlement until 1564. Dumoulin was regarded by his contemporaries as the "prince of jurisconsults." He had a considerable effect on the subsequent development of French law. He was a bitter enemy of feudalism, which he attacked in his *De feudis* (Paris, 1539). Other important works were his coininentaries on the customs of Paris (Paris, 1539, 1554; Frankfort, 1575; Lausanne, 1576). valuable as the only commentary on those in force in 1510, and the *Extricatio labyrinthi dividui et individui,* a treatise on the law of surety.

A collected edition of Dumoulin's works was published in Paris in 1681, with *a* life by Brodeau. *See* also H. de Pansey, *Eloge de* **C.** *Dumoulin* **(1769);** Hello, *Essai sur la vie et les Ouvrages de C. Dumoulin* **(1839).**

DUMOURIEZ, CHARLES FRANÇOIS DU PÉRIER (1739–1823), French general, born at Cambrai on Jan. 25, 1739, saw his first service as a volunteer in the campaign of Rossbach. He was retired at the peace of 1763, but was subsequently employed in Corsica. Under Choiseul he was in the secret service, and on his patron's fall was imprisoned, being only released on the accession of Louis XVI. in 1774. Dumouriez was commandant of Cherbourg for ten years, and in 1788 became *maréchal de camp.* At the outbreak of the Revolution he went to Paris, where he joined the Jacobin Club. The death of Mirabeau, to whose fortunes he had attached himself, was a great blow to him; but, promoted to the rank of lieut.-general and commandant of Nantes, his opportunity came after the flight to Varennes, when he offered to march to the assistance of the Assembly. He now joined the Girondist party, and on March 15, 1792, was appointed minister of foreign affairs. He was mainly responsible for the declaration of war against Austria (April 20), and the invasion of the Low Countries was planned by him. On the dismissal of Roland, Clavière and Servan (June 13), he took the latter's post of minister of war, but resigned it two days later on account of the king's refusal to come to terms with the Assembly, and went to join the army of Marshal Liickner. After the *émeute* of August 10 and Lafayette's flight he was appointed to the command of the "Army of the Centre," and at the same moment the Coalition assumed the offensive. Dumouriez acted promptly. His subordinate Kellermann repulsed the Prussians at Valmy (Sept. 20, 1792), and he himself severely defeated the Austrians at Jemappes (Nov. 6).

Defeated at Neerwinden in Mar. 1793, he ventured all on a desperate stroke. Arresting the commissaries of the Convention sent to inquire into his conduct, he handed them over to the enemy, and then attempted to persuade his troops to march on Paris and overthrow the revolutionary government. The attempt failed, and Dumouriez with the duc de Chartres (afterwards King Louis Philippe) and his brother the duc de Montpensier, fled into the Austrian camp.

In 1804 he settled in England, where the government conferred on him a pension of £1200 a year. He became a valuable adviser to the War Office in connection with the struggle with Napoleon, though the extent to which this went was only known to the public many years later. He died at Turville Park, near Henley-on-Thames, on March 14, 1823. His memoirs were published at Hamburg in 1794. An enlarged edition, *La Vie et les mémoires du Général Dumouriez,* appeared at Paris in 1823.

See A. von Boguslawski, *Das Leben des Generals Dumouriez* (1878–**79);** *Revue des deux mondes* (July 15, Aug. 1 and 15, **1884);** **H.** Welschinger, *Le Roman de Dumouriez* (1890); A. Chuquet, *La Première Invasion, Valmy, La Retraite de Brunrwick, Jemappes, La Trahison de Dumouriez* (1886–91); A. Sorel, *L'Europe et la Révolution française* (1885–92); *J.* Holland Rose and A. M. Broadley, *Dumouriez and the Defence of England* (1908); *E.* Daudet, *La Conjuration de Pichegru et les complots royalistes du midi et du l'est, 1795–1797* **(1901);** Pouget de Saint-André, in his *Le Général Dumouriez* (1914) contends that Dumouriez has been misjudged.

DUMP. (1) (Of obscure origin), a state of wonder, perplexity or melancholy. The word thus occurs particularly in the plural, in such phrases as "doleful dumps." It was also formerly used for a tune, especially one of a mournful kind. (2) (Connected with "dumpy," but appearing later than that word, and also of obscure origin), something short and thick, and hence used of nrany objects such as a lead counter or medal, of a coin formerly used in

Australia, formed by punching a circular piece out of a Spanish dollar, and of a short, thick bolt used in shipbuilding. (3) (Probably of Norse origin, cf. Nor. *dumpa*, meaning "to fall" suddenly, with a bump), to throw down in a heap, and hence particularly applied to the depositing of any large quantity of material, to the shooting of rubbish, or tilting a load from a cart. It is thus used of the method of disposal of the masses of gravel, etc., disintegrated by water in the hydraulic method of gold mining. A "dump" or "dumping-ground" is thus the place where such waste material is deposited.

Dump was used for an ammunition depot in the World War.

DUMPING, term commonly used to describe the sale of goods for export at prices lower than those charged at the same time and under like circumstances to buyers in the country of manufacture. Anti-dumping legislation exists in the United States, Canada, Australia, New Zealand, the Union of South Africa, and Great Britain. In the United States, Australia and the Union of South Africa dumping is held to exist when the importation of the dumped goods is likely to result in injury to an industry within the territory concerned.

In Great Britain the anti-dumping duty is chargeable subject to the following conditions:

(a) That goods are being imported at a price below the cost of production. Cost of production within the meaning of the act is 95% of the wholesale price charged at the works for consumption in the country of manufacture, subject to the deduction of any excise or similar taxes;

(b) That similar goods can be profitably manufactured in the United Kingdom (not merely in Great Britain);

(c) That by importation under (a) employment in any industry in the United Kingdom is being or is likely to be seriously affected;

(d) That the affected home industry is being carried on with reasonable efficiency and economy;

(e) That the finishing industry which uses the goods in question as material is not too hard hit by a dumping duty (the Act provides that a committee shall make a special report on the subject, to be referred for "consideration" by the board of trade);

(f) That no dumping duty shall be levied which is at variance with any treaty with a foreign State.

According to a memorandum prepared by Prof. Jacob Viner for the economic and financial section of the League of Nations, "Dumping is likely to prevail as a systematic practice only if:

"(a) The exporting industry is trustified or syndicated; or

"(b) The industry, though not organized into a single unit for production or export, is dominated by one or two large concerns, each of which controls a sufficient proportion of the total output to warrant its assumption of a disproportionate part of the burden of accepting export orders at less than the prevailing domestic rates; or

"(c) The product is not standardized as between different producers, so that each producer can individualize his product by trade-mark, brand, pattern, type of container or otherwise, and so escape the full pressure of price competition; or

"(d) An export bounty is granted by some agency external to the industry, such as the State, or another industry supplying the materials which the industry under consideration works up into a more finished product."

Prof. Viner also holds that protective import duties in the exporting country facilitate dumping.

According to the final report of the Committee on Commercial and Industrial Policy After the War (cd. 9035) 1918, the recommendations of which led to the act of 1921, "the view is strongly held that the frequent dumping of any particular class of foreign goods produces a feeling of insecurity in the corresponding industry of this country which diminishes the incentive to development, and that in certain cases the dumping by foreign combinations has been the expression of a persistent policy aiming at the depression of some British industries and the prevention of the establishment of others It is, of course, impossible in every case to prove the truth of this latter suggestion; but we see no reason to doubt that there is at least a *prima facie* ground in support of it." The value of dumping to the dumping industry is held to lie in the fact that it enables it to maintain a high level of output, thus keeping works at or near full production and reducing the incidence of overhead charges. (C. TE.)

DUNAJEC-SAN, BATTLES OF THE. The Dunajec and San rivers, which, rising in the Carpathians, flow northwards across Galicia to join the Vistula on the Polish border, mark the first two stages of the great Austro-German offensive of 1915. The Russian pronunciation of the first of these rivers is Dunaietz.

Austro-German Plans.—By the end of March 191 j the Austrian armies in the Carpathians were on the verge of collapse under pressure of the persistent Russian attacks (see CARPATHIANS, BATTLES IN THE); and it became obvious to Falkenhayn, who directed German strategy, that the available reserves of Germany must be used in the East to bolster up her principal ally—using these reserves to deal Russia a blow which would paralyse her offensive power for a time at least. Reviewing the ineffective Franco-British attacks, he decided that troops could safely be withdrawn for the Russian front. He had also arrived at a just appreciation of the seriousness of Russia's shortage of reinforcements and of munitions. Russia's situation invited attack.

For such an offensive, the choice lay between enveloping operations from the flanks or a break-through attack. The poor railway communications to the Carpathians and the disorganization existing in that region as a consequence of the long winter battle excluded an operation from that flank. An enveloping movement from the northern flank—Ludendorff's favourite projcct—would be too distant to influence immediately the critical situation in the Carpathians. Accepting Conrad von Hotzendorf's suggestion, Falkenhayn determined on a break-through attack east of Cracow between the Carpathians and the upper Vistula. This point of attack appears well chosen. No great obstacle would be met till the line of the San was reached; the Vistula would afford some protection to the left flank of the advance; and a success would immediately influence the Carpathian situation. Moreover, the enemy's line on the selected front of attack was weakly held.

Disposition of Forces.—The Russian III. Army, which in January held from the Vistula-Dunajec junction to about Gorlice in the Carpathian foothills only, had extended its front during the Carpathians battle. It now reached to about Mezo Laborcz, southeast of the Dukla pass, a total front of over 100 miles. It comprised a fighting wing and a defensive wing. The left wing, which had been engaged in the last great offensive of the Carpathians battle, consisted of four corps, all somewhat exhausted. The right, the defensive wing, on which the blow was to fall, had been weakened by the withdrawal of one corps to the Bukowina and by the transfer of another corps to the left, the fighting wing; it now contained two corps only, holding a front of 50 to 60 miles. The right corps, the IX., held the lower Dunajec, from its junction with the Vistula to south of Tarnów; the other, the X., extended between Tuchów and Gorlice. These two corps had been sitting inactive opposite the Austrian IV. Army all winter; and the dispositions they had made were calculated for defence against Austrians, not Germans. Consequently there were neither sufficient rear lines nor alternative gun emplacements. The Army had only a single corps in reserve, the III. Caucasian. The Russian army commander was Radko-Dimitriev. He had some ability and was a gallant fighter, but seems to have distinguished himself more as a corps commander than as an army commander. The German XI. Army, the spear point of the offensive, consisted of eight German divisions from the western Front, two Austrian divisions" and a cavalry division. It was assembled with great secrecy behind the right of the Austrian IV. Army, opposite the Russian X. Corps. Its commander was Mackensen, who had led the Lódz offensive at the end of 1914 (see LÓDZ-CRACOW) and was to win further fame by his victories in Serbia and Rumania. The Austrian IV. Army was placed under him in addition to his own Army. He himself was subordinate to the Austrian High Command.

Mackensen's Attack.—The preliminary bombardment began on May 1 and was continued during the forenoon of the 2nd It was carried out by 1,500 guns of all calibres, and left the Russians

powerless. Mackensen's army swept over the shattered trenches of the X. Corps. meeting with little resistance, and pressed forward in the direction of Rzeszów and Jaroslaw. The Austrian IV. Army forced the Russian IX. Corps from its line on the lower Dunajec. The Austrian II. and III. Armies in the Carpathians also began a forward move. There followed five days of hard fighting, but the Russians were unable to stem the tide. Radko-Dimitriev's reserve corps attacked gallantly but fruitlessly; his left wing had to yield the Dukla pass and the hard-won gains of the April offensive. An attempt to stand on the line of the Wistok river and the Lupków pass failed before renewed Austro-German attacks on May 8. Brusilov's VIII. Army was now also involved in the retreat; and a few days later the left wing of the Russian IV. Army north of the Vistula retired from the line of the Nida.

The Russians now decided to check their foes on the strong line of the river San, with the fortress of PrzemySl to support their left centre, and the Dniester marshes to protect their left flank. Mackensenis army, however, reached Jaroslaw on May 14, stormed the bridge-head next day and established itself east of the San. It extended its gains to Sieniawa on the following days and threatened to jeopardize the whole Russian position on the San. But the impetus of the attack had spent itself for the moment and the Russians were given a breathing space. Strong reinforcements were being hurried up to them, but their losses had been enormous, over 170,000 in prisoners alone.

Further Austro-German Attacks.—The second stage of the fighting began with an attack by Mackensen's forces on May 24, which forced the line of the San at and about Radymno and thrust southeast towards the Przemyśl-Lemberg railway. The Austrians simultaneously attacked Przemyśl from the south, but made little progress. The Russians now made a counter-stroke on Sieniawa, north of Jaroslaw, with the III. Caucasian Corps. This gallant corps stormed the Austrian positions and caused a temporary set-back to Mackensen's plans. At the same time heavy attacks were made on the Austrian IV. Army further north.

But the odds against the Russians were too heavy; they had little or no ammunition for their guns and practically no heavy artillery at all. Before combined attacks of the German XI. and Austrian II. and III. Armies, PrzemySl fell on June 3; and the line here had to be withdrawn to about Gródek. The line of the lower San, north of Sieniawa, was held till June 11, when Mackensen, who had received reinforcements, attacked again and forced the whole of the San line, the Russians retiring to the last line of defence west of Lemberg. *(See* LEMBERG, BATTLES *OF.)*

By the middle of June the Russian losses in Galicia since the beginning of Mackensen's offensive included nearly 400,000 prisoners, over 300 guns and much other material. Their losses in killed and wounded had also been exceedingly heavy, for they had counter-attacked repeatedly with little artillery support. The Russians were in fact paying in flesh and blood for their lack of modern equipment. The dominance of his heavy artillery was the chief factor in Mackensen's success; the Russians had none with which to oppose it. (See WORLD WAR.)

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DUNASH, the name of two Jewish scholars of the 10th century.

1. DUNASH BEN LABRAT, grammarian and poet, belonged to the brilliant circle attracted to Cordova by Hasdai, and took a large share in promoting the Jewish "Golden Age" under the Moors in Andalusia. Dunash not only helped in the foundation of a school of scientific philology, but adapted Arabian metres to Hebrew verse, and thereby gave an impulse to the neo-Hebraic poetry, which reached its highest level in Spain.

2. DUNASH IBN TAMIM was, like the preceding, a leader in the critical study of language among Arabic-speaking Jews. Professor Bacher says of him: "In the history of Hebrew philology Ibn Tamim ranks as one of the first representatives of the systematic comparison of Hebrew and Arabic."

DUNBAR, GEORGE (1774–1851), English classical scholar and lexicographer, was born at Coldingham, in Berwickshire. When about 30 years of age, he settled in Edinburgh, where he became tutor in the family of Lord Provost Fettes. In 1807 he succeeded Andrew Dalzel as professor of Greek in the university, and held the post till his death. His Greek-English and English-Greek lexicon (1840), on the compilation of which he spent eight years, was the best work of its kind that had appeared in England.

The little that is known of Dunbar's life will be found in the *Caledonian Mercury* (Dec. 8, 1851).

DUNBAR, PAUL LAURENCE (1872–1906), American author, of negro descent, was born in Dayton (O.), June 27, 1872. In high school he wrote the class poem and was editor-in-chief of the school paper. While earning his living as an elevator boy, assistant in the library of Congress, etc., he continued to write, recite, and publish his work; and after 1898, the year of his marriage, he gave his full time to writing. He died of consumption at his home in Dayton, Feb. 8, 1906. His poetry was brought to the attention of American readers by William Dean Howells, who reviewed *Majors and Minors* (1896) in *Harper's Weekly* and wrote an appreciative introduction to his *Lyrics of Lowly Life* (1896), which was subsequently used in his *Complete Poems* (1913). Dunbar published numerous volumes of verse, novels and short stories. Some of his short stories and sketches, especially those dealing with the American negro, are charming; they are far superior to his novels, which deal with scenes in which the author is not so much at home. His most enduring work, however, is his poetry. Some of this is in literary English, but the best is in the dialect of his people.

See L. K. Wiggins, *Life and Works of Paul Laurence Dunbar* (Naperville (Ill.), 1907). Tributes to him by his wife, Alice Moore Dunbar, also a writer, and by others, were reprinted from the A.M.E. *Church Review* under the title *Paul Laurence Dunbar, Poet Laureate of the Negro Race.*

DUNBAR, WILLIAM (*c.* 1460–*c.* 1520), Scottish poet. He became M.A. at St. Andrews in 1479 and afterwards joined the Order of Observantine Franciscans, at St. Andrews or Edinburgh, proceeding to France as a wandering friar. He spent a few years in Picardy, and was still abroad when, in 1491, Bothwell's mission to secure a bride for the young James IV. reached the French court. About 1500 he returned to Scotland, and became a priest at court, and a royal pensioner. His literary life begins with his attachment to James' household. He is spoken of as the rhymer of Scotland in the accounts of the English Privy Council dealing with the visit of the mission for the hand of Margaret Tudor, rather because he wrote a poem in praise of London than because, as has been stated, he held the post of laureate at the Scottish court. In 1511 he accompanied the queen to Aberdeen and commemorated her visit in verse. Other pieces, such as the *Orisoun* ("Quhen the Gouernour past in France"), apropos of the setting out of the regent Albany, are of historical interest, but they tell us little more than that Dunbar was alive.

One hundred and one poems have been ascribed to Dunbar. Of these at least 90 are generally accepted as his: of the 11 attributed to him it would be hard to say that they should not be considered authentic. Most doubt has clung to his verse tale *The Freiris of Berwik.*

Dunbar's chief allegorical poems are *The Goldyn Targe* and *The Thrissil and the Rois.* The motif of the former is the poet's futile endeavour, in a dream, to ward off the arrows of Dame Beautee by Reason's "scheld of gold." When wounded and made prisoner, he discovers the true beauty of the lady: when she leaves him, he is handed over to Heaviness. The noise of the ship's guns, as the company sails off, wakes the poet to the real pleasures of a May morning. Dunbar works on the same theme in a shorter poem, known as *Beauty and the Prisoner. The Thrissil and the Rois* is a prothalamium in honour of James IV. and Margaret Tudor, in which the heraldic allegory is based on the familiar beast-parliament.

The greater part of Dunbar's work is occasional—personal and

social satire, complaints (in the style familiar in the minor verse of Chaucer's English successors), orisons, and pieces of a humorous character. The last type shows Dunbar at his best, and points the difference between him and Chaucer. The best specimen of this work, of which the outstanding characteristics are sheer whimsicality and topsy-turvy humour, is *The Ballad of Kynd Kittok*. This strain runs throughout many of the occasional poems, and is not wanting in odd passages in Dunbar's contemporaries; and it has the additional interest of showing a direct historical relationship with the work of later Scottish poets, and chiefly with that of Robert Burns. Dunbar's satire is never the gentle funning of Chaucer: more often it becomes invective. Examples of this type are *The Satire on Edinburgh, The General Satire,* the *Epitaph on Donald Owre,* and the powerful vision of *The Dance of the Sevin Deidlie Synnis.* In the *Flyting of Dunbar and Kennedie,* an outstanding specimen of a favourite northern form, analogous to the continental *estrif,* or *tenzone,* he and his rival reach a height of scurrility which is certainly without parallel in English literature. This poem has the additional interest of showing the racial antipathy between the "Inglis"-speaking inhabitants of the Lothians and the "Scots" or Gaelic-speaking folk of the west country.

There is little in Dunbar which may be called lyrical, and little of the dramatic. His *Interlud of the Droichis (Dwarf's) part of the Play,* one of the pieces attributed to him, is supposed to be a fragment of a dramatic composition. It is more interesting as evidence of his turn for whimsicality, already referred to, and may for that reason be safely ascribed to his pen. If further selection be made from the large body of miscellaneous poems, the comic poem on the physician, Andro Kennedy, may stand out as one of the best contributions to mediaeval Goliardic literature; *The Two Mariit Wemen and the Wedo,* as one of the richest and most effective *pastiches* in the older alliterative style, then used by the Scottish Chaucerians for burlesque purposes; *Done is a battell on the Dragon Blak,* for religious feeling expressed in melodious verse; and the well-known *Lament for the Makaris.* The main value of the last is historical, but it, too, shows Dunbar's mastery of form, even when dealing with lists of poetic predecessors.

BIBLIOGRAPHY.—The chief authorities for the text of Dunbar's poems are:—(*a*) the Asloan MS (c. 1515); (*b*) the Chepman and Myllar prints (1508), preserved in the Advocates' library, Edinburgh; (*c*) Bannatyne ms. (1568) in the same; (*d*) the Maitland Folio ms. (*c.* 1570–90) in the Pepysian library, Magdalene college, Cambridge. Some of the poems appear in the Makculloch ms. (before 1500) in the library of the University of Edinburgh; in ms. Cotton Vitellius A. xvi., appendix to royal mss. No. 58, and Arundel 285, in the British Museum; in the Reidpath ms. in the university library of Cambridge; and in the Aberdeen register of Sasines. The first complete edition was published by David Laing (1834) with a supplement (186;). This has been superseded by the Scottish Text Society's edition (ed. John Small, Aeneas J. G. Mackay and Walter Gregor, 1893), and by Dr. Schipper's edition (Kais. Akad. der Wissenschaften, 1894). The editions bv James Paterson (1860) and H. B. Baildon (1907), are of minor value. Selections have been frequently reprinted since Ramsay's *Ever-Green* (1724) and Hailes's *Ancient Scottish Poems* (1817). For critical accounts see Irving's *History of Scottish Poetry,* Henderson's *Vernacular Poetry of Scotland,* Gregorv Smith's *Transition Period,* J. H. Millar's *Literary History of Scotland,* and the *Cambridge History of English Literature,* vol. ii. (1908). Prof. Schipper's *William Dunbar, sein Leben und seine Gedichte* (with German trans. of several of the poems), appeared in 1884.

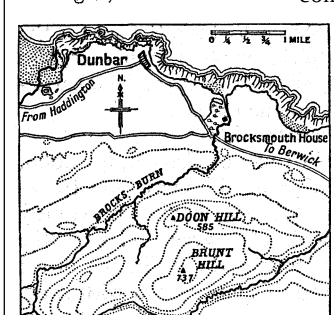
DUNBAR, royal parish and police burgh (Gaelic, "the fort on the point"), and seaport, East Lothian, Scotland. Pop. (1931) 3,751. It is on the southern shore of the entrance to the Firth of Forth, 29¼ m. E. by N. of Edinburgh by the L.N.E.R. Dunbar is said to have the smallest rainfall in Scotland and is a favourite summer resort, with good golf and bathing. The ruins of the castle, and the remains of the Grey Friars' monastery, founded in 1218, at the west end of the town, and Dunbar House in High Street, formerly a mansion of the Lauderdales, but now used as barracks, are of historic interest.

There are two harbours, difficult of access owing to the number of reefs and sunken rocks. On the advent of steam the shipping declined, and even the herring fishery, which fostered a large curing trade, has lost much of its prosperity. Crabs and lobsters are caught. There are few industries, but corn, fish and potatoes are exported.

A castle was built on the cliffs at least as early as 856. In 1070 Malcolm Canmore gave it to Cospatric, earl of Northumberland, ancestor of the earls of Dunbar and March. The fortress was an important bulwark against English invasion, and the town—which was created a royal burgh by David 11.—grew up under its protection. The castle was taken by Edward I., and it afforded shelter to Edward II. after Bannockburn. In 1336 it was besieged by the English under William, Lord Montacute, afterwards 1st earl of Salisbury, but was successfully defended by Black Agnes of Dunbar, countess of March, a member of the Murray family. Joanna Beaufort, widow of James I., chose it for her residence, and in 1479, after his escape from Edinburgh Castle, the duke of Albany concealed himself here before sailing for France, and Mary sheltered here in two crises. The regent Moray dismantled it in 1568, but its ruins are still a picturesque object on the hill above the harbour.

Battle of Dunbar.—This battle was fought on the 3rd (13th) of September 1650 between the English army under Oliver Cromwell and the Scots under David Leslie, afterwards Lord Newark. It took place about 3m S.E. of the centre of the town, where between the hills and the sea coast there is a plain about 1m. wide, through the middle of which the main road from Dunbar to Berwick runs. The plain and the road are crossed at right angles by the course of the Brocks Burn, or Spott Burn, which at first separated the hostile armies. Rising from the right bank of the Brock is Doon Hill (650ft.), which overlooks the lower course of the stream and indeed the whole field. For the events preceding the battle *see* GREAT REBELLION.

Cromwell, after a war of manoeuvre near Edinburgh, had been compelled by want of supplies to withdraw to Dunbar; Leslie pursued and took up a position on Doon Hill, commanding the English line of retreat on Berwick. The situation was more than difficult for Cromwell. Some officers were for withdrawing by sea, but the general chose to hold his ground, though his army was enfeebled by sickness and would have to fight on unfavourable terrain against odds of two to one. Leslie, however, who was himself in difficulties on his post among the bare hills, and was perhaps subjected to pressure from civil authorities, descended from the heights on Sept. 2 and began to edge towards his right, in order first to confront, and afterwards to surround, his opponent. The cavalry of his left wing stood fast, west of Doon Hill, as a pivot of manoeuvre, the northern face of Doon (where the ground rises from the burn at an average slope of fifteen degrees and is even steeper near the summit) he left unoccupied. The centre of infantry stood on the forward slope of the long spur which runs east from Doon, and beyond them, practically on the plain, was the bulk of the Scottish cavalry. But if Leslie had placed himself on Cromwell's line of retreat, he had thereby placed Cromwell on his—to the latter's moral advantage. In the evening Cromwell drew up his army, under 11,000 effective men, along the ravine, and issued orders to attack the Scots at dawn of the 3rd (13th). The left of the Scots was ineffective, as was a part of their centre of foot on the upper part of the hillside, and the English commander proposed to deal with the remainder, Before dawn the English advanced troops crossed the ravine, attacked Doon, and pinned Leslie's left; under cover of this the whole army began its manoeuvre The artillery was posted on the Dunbar side of the burn, directly opposite and north of Doon, the infantry and cavalry crossed where they could, and



BATTLE OF DUNBAR, SEPT. 3, 1650
Oliver Cromwell, with a force of 11,000 men, defeated the Scots under David Leslie in one of the most complete victories of the Great Rebellion. The Scottish commander had been drawn into leaving his stand on Doon Hill for a position on the plains where Brocks Burn divided his army. Cromwell instantly seized this opportunity for a surprise stroke

formed up gradually in a line south of and roughly parallel to the Berwick road, the extreme left of horse and foot, acting as a reserve, crossed at Brocksmouth House on the outer flank. The Scots were surprised in their bivouacs, but quickly formed up, and at first repulsed both the horse and the foot. But ere long Cromwell himself arrived with his reserve, and the whole English line advanced again. The fresh impulse enabled it to break the Scottish cavalry and repulse the foot, and Leslie's line of battle was gradually rolled up from right to left. In the words of an English officer, "The sun appearing upon the sea, I heard Nol say, 'Now let God arise, and let His enemies be scattered,' and following us as we slowly marched I heard him say, 'I profess they run.'" Driven into the broken ground, and penned between Doon Hill and the ravine, the Scots were indeed helpless. "They routed one another after we had done their work on their right wing," says the same officer. Ten thousand men, including almost the whole of the Scottish foot, surrendered, and their killed numbered three thousand. Few of the English were killed. "I do not believe," wrote Cromwell, "that we have lost twenty men."

The account of the battle of Dunbar here followed is that of C. H. Firth, for which *see* his *Cromwell, pp.* 281 ff. and references there given. For other accounts *see* Carlyle, *Cromwell's Letters and Speeches,* letter cxl.; Hoenig, *Cromwell;* Baldock. *Cromwell as a Soldier;* and Gardiner, *Hist. of the Commonwealth and Protectorate,* vol. i.

DUNBLANE, police burgh and parish, Perthshire, Scotland, on the left bank of Allan water, a tributary of the Forth, 3 m. N. by W. of Stirling by the L.M.S.R. Pop. (1931) 2,692. It is a place of great antiquity, with narrow streets and old-fashioned houses. Industry is limited, but a considerable amount of worsted-spinning is carried on; the town is in repute as a watering-place. The cathedral, by the side of the river, was one of the few ecclesiastical edifices that escaped injury at the hands of the Reformers. The first church is alleged to have been erected by Blane, a saint of the 7th century, but the cathedral was founded by David I. in 1141, and almost entirely rebuilt about 1240 by Bishop Clemens. The tower is Early Norman, the rest is Early Pointed style. After the decline of episcopacy the building was neglected for a long period, but the choir, which contains some carved oak stalls of the 16th century, and nave have been restored. From the time of the Reformation the choir only had been used as the parish church, but since its restoration the whole cathedral has been devoted to this purpose. An ancient Celtic cross, 6½ ft. high, stands in the north-western corner of the nave. Of the bishop's palace only a few ruins remain. The Queen Victoria School for the sons of Scottish soldiers and sailors, to the north of Dunblane, was opened in 1908, and the chapel in the grounds in 1910. The battlefield of Sheriffmuir is about 2¾ m. E. of the town.

DUNCAN, the name of two Scottish kings.

DUNCAN I. (d. 1040) was a son of Crinan or Cronan, lay abbot of Dunkeld, and became king of the Scots in succession to his maternal grandfather, Malcolm II., in 1034, having previously as *rex Cumbrorum* ruled in Strathclyde. His accession was "the first example of inheritance of the Scottish throne in the direct line." Duncan is chiefly known through his connection with Macbeth, which has been immortalized by Shakespeare. The only fact which can be ascertained with any certainty about the feud between the two princes is that Duncan was slain by Macbeth in 1040. Two of Duncan's sons, Malcolm III Canmore and Donald V. Bane, were afterwards kings of the Scots.

DUNCAN II. (d. 1094) was a son of Malcolm III. and therefore a grandson of Duncan I. For a time he lived as a hostage in England and became king of the Scots after driving out his uncle. Donald Bane, in 1093, an enterprise in which he was helped by some English and Normans. He was killed in the following year.

See W. F. Skene, *Celtic Scotland* (1876–80), and *A.* Lang, *History of Scotland,* vol. i. (1900).

DUNCAN, ADAM DUNCAN, 1ST VISCOUNT (1731–1804), British naval commander, was born on July 1, 1731, at Lundie, in Forfarshire, Scotland. Entering the navy in 1746, he saw much active service in European and American waters, and in Feb. 1795 he hoisted his flag as commander-in-chief of the North Sea fleet, appointed to harass the Batavian navy. Towards the end of May 1797, though, in consequence of the mutiny in the British fleet, he had been left with only the "Adamant" (50), besides his own ship the "Venerable" (74), Admiral Duncan proceeded to his station off the Texel, where lay at anchor the Dutch squadron of 15 sail of the line, under the command of Vice-admiral de Winter. From time to time he caused signals to be made, as if to the main body of a fleet in the offing, a stratagem which probably secured his freedom from molestation until, in the middle of June, reinforcements arrived. On Oct. 3 the admiral put into Yarmouth roads to refit, but receiving information early on the 9th that the enemy was at sea, he gave chase. On the morning of the 11th de Winter's fleet was sighted lying about 9m. from shore, between the villages of Egmont and Camperdown. The British fleet was slightly superior in force to that of the Dutch. Shortly after mid-day the British ships, without waiting to form in order, broke through the Dutch line, and an engagement commenced which, after heavy loss on both sides, resulted in the taking by the British of 11 of the enemy's vessels. In recognition of this victory, Admiral Duncan was, on Oct. 21, created Viscount Duncan of Camperdown and baron of Lundie, with an annual pension of £3,000 to himself and the two next heirs to his title. The earldom of Camperdown was created for his son Robert (1785–1859) in 1831, and is still in the possession of his descendants. Lord Duncan retired in 1800, and died on Aug. 4, 1804.

See Charnock, *Biog. Nav.* (1794–96); Collins, *Peerage of England,* p. 378 (1812); W. James, *Naval History of Great Britain* (1822); Yonge, *History of the British Navy,* vol. i. (1863); Earl of Camperdown, *Admiral Duncan* (1898), vol. xvi. of the Navy Record Soc. publications, contains the logs of the ships engaged at Camperdown.

DUNCAN, ISADORA (1878–1927), American dancer, was born at San Francisco (Calif.), on May 27, 1878. She began her career as a girl of 17 at Daly's theatre, New York, where she danced the part of a fairy in *A Midsummer Night's Dream.* Her early years were full of poverty and difficulty. With only the sum of $150, the Duncans went to England in a cattle boat; and in London and Paris, before recognition was won, they nearly starved.

Isadora had already conceived the thought of interpretative dancing to awaken the world to the grace and meaning of nature dancing, spiritual expression flowing into the channels of the body. She spent hours studying the Greek vases in the Louvre. Then she danced in Paris, Budapest, Florence and Berlin. Later, amid the ruins of the Theatre of Dionysus in Athens, she meditated on the dances of Hellas. In that atmosphere she further worked out her ideas of the dance evolved directly from nature, through the rhythmic movement of wind and wave and the winged flight of bird and bee. Her ideas were so old that, to an over-civilized world accustomed to the artificiality of the ballet and much-dressed dramatic dancing, they were startlingly new. Even the Russian ballet through Michel Fokine at home and Sergei Diaghilev's Ballets *Russes* abroad was influenced by Isadora Duncan's ideas and technique after she visited St. Petersburg in 1905. In 1904 she established a school for classical dancing near Berlin, where she taught her art to girls who later became known as the Duncan dancers; another in Paris in 1914; and another in Moscow in 1921, which was closed in the spring of 1928. Isadora Duncan and her sister had a school near Tarrytown.

When she returned to her native country in 1908 the United States was puzzled and divided itself into enthusiasts and critics. But later the stage of the Metropolitan opera house itself was hers for her performances. In April 1915, with the dancers from her Paris school she danced for a month at the Century theatre, trying to interest Americans in a project for a school in her own land. One was conducted for a short time near Tarrytown, N.Y., by her sister, Elizabeth, who had much to do with the display of Isadora's genius. Conventionally minded people were estranged, however, by her erratic actions, which became more marked after an automobile tragedy in Paris, 1913, when her two children, Deidre and Patrick, with their nurse were drowned.

She became an ardent advocate of the Soviet revolution in Russia and accepted Lenin's invitation (1921) to open the Moscow school of dancing in the palace of a former nobleman, which was given to her. Her marriage with a Russian, Sergei Essenin, ten years younger than herself, the difficulties at Ellis Island in 1922 on re-entering the United States with him, the episode of the red

scarf waved during a performance on the stage of the Symphony Hall, Boston (Oct. 22, 1922), brought on her such trials that she left America vowing never to return.

The last years of her life were pitiably tragic—in debt and difficulty in Germany and France. Her many friends rallied to establish the Duncan memorial dance school at Neuilly, raising in all 400,000 francs. She was killed in an automobile accident at Nice on Sept. 14, 1927. Her work to a certain extent was carried on by her adopted daughters, Anna and Irma who danced, and by Elizabeth Duncan who had a school near Salzburg.

See her autobiography *My Life* (1927); Shaemas O'Sheel's "Isadora," *New Republic* (Oct. 26, 1927); Jose Clara's "Isadora Duncan," *L'Art decoratif* (1913); *Le Ballet Contemporain, ouvrage edité avec la collaboration de L. Bakst. Traduction francaise de M. D Calvocoressi V. Svetlow,* pseud. of Valerian Yakovlevich Ivchenko; and Charles H. Caffin's "Henry Matisse and Isadora Duncan," *Camera Work* (1909).

DUNCAN, JOHN (1796–1870), Scottish theologian and Hebraist, was born at Aberdeen and studied at Marischall college. In 1836 he was ordained in the Established Church and given charge of Milton church, Glasgow. After three years as a missionary to the Jews in Budapest he was appointed, in 1843, to the chair of Oriental languages in the new Free Church college, Edinburgh. Apart from his 1838 edition of Robinson's Lexicon of the Greek New Testament, Duncan's writings consist largely of sermons and addresses, some of which were edited by J. Steven Sinclaire (1925). He died on Feb. 26, 1870.

See Knight: *Colloquia Peripatetica* (1870) and Brown: *The Late Rev. J. Duncan* (1874).

DUNCAN, ROBERT KENNEDY (1868–1914), American chemist, was born near Brantford, Ont., Canada on Nov. 1, 1868. He graduated at the University of Toronto in 1892; studied at Clark university and later at Columbia university (1897–98). He taught physics and chemistry in New York and Pennsylvania high schools. From 1901 to 1906 he was professor of chemistry at Washington and Jefferson college. During parts of 1903, 1904 and 1907, he made special studies in Europe. In 1906, while attending the International Congress of Applied Chemistry in Rome, he conceived the idea of the industrial fellowship system. His plan was to assist American manufacturers in making their products in a scientific manner and to base their plans for efficient production upon scientific research. In 1907 he became professor of industrial chemistry at the University of Kansas, and the same year arranged for the establishment of the first industrial fellowship. In 1910, his work at Kansas attracted attention in Pittsburgh, and he was made professor of chemistry at the University of Pittsburgh and director of industrial research, which position he held until his death on Feb. 18, 1914. In March 1913, the Mellon Institute of Industrial Research of the University of Pittsburgh was founded by Andrew W. Mellon and Richard B. Mellon of Pittsburgh as a memoriai to their father, Thomas Mellon, and also to Duncan. This placed the industrial fellowship system upon a permanent basis.

Duncan's works are noted for their high scientific accuracy. Among his more important books are: The New *Knowledge* (1905); *The* Chemistry of Commerce (1907), and *Some* Chemical Problems of To-day (1911).

DUNCAN, THOMAS (1807–1845), Scottish portrait and historical painter, was born at Kinclaven, Perthshire, on May 24, 1807, and died at Edinburgh, May 25, 1845. He was a pupil of Sir William Allan. His most famous pictures are: "Prince Charles Edward and the Highlanders entering Edinburgh after the battle of Prestonpans" (1843) and "Charles Edward asleep after Culloden, protected by Flora MacDonald" (1843), which has often been engraved.

DUNCAN, a city of southern Oklahoma, U.S.A.. on Federal highway 81 and the Rock Island railroad; the county seat of Stephens county. The population was 8,363 in 1930 (97% native white), and was 9,207 in 1940 by the federal census. There is a diversified income from agriculture, dairying, produce, livestock and oil production.

Within a few miles of the city of Duncan, there are oil and gas wells, and the city has refineries and casinghead plants and wholesale houses dealing in oil-well supplies, as well as numerous jobbers in other lines. Duncan mas settled about 1890 and incorporated in 1899. It has a well equipped airport.

DUNCE, a stupid person, incapable of learning. "Duns" or "dunsman" was a name applied by their opponents to the Scotists or followers of Duns Scotus, the great schoolman. When, in the 16th century, the Scotists obstinately opposed the "new learning," the term "duns" or "dunce" became, in the mouths of the humanists and reformers, a term of abuse, a synonym for one incapable of scholarship.

DUNCKER, MAXIMILIAN WOLFGANG (1811–1886), German historian and politician, eldest son of the publisher Karl Duncker, was born at Berlin on Oct. 15, 1811. He studied at the universities of Bonn and Berlin till 1834, when he was condemned to six years' imprisonment, afterwards reduced to six months, for belonging to students' societies. In 1842 he became a lecturer at Halle university. Elected to the National Assembly at Frankfort in 1848, he joined the Right Centre party, and was chosen reporter of the projected constitution. He sat in the Erfurt assembly in 1850, and in the second Prussian chamber from 1849 to 1852. In 1859 he was assistant in the ministry of State in the Auerswald cabinet, and in 1867 he became director of the Prussian archives, with which it was his task to incorporate those of Hanover, Hesse and Nassau. He retired on Jan. 1, 1875, and died at Ansbach on July 21, 1886. Duncker's fame rests mainly on his Geschichte des *Alterthums* (1st ed., 1852–57; 5th ed. in 9 vols., 1878–86; Eng. trans. by Evelyn Abbott, 1877–82).

His works include: *Zur Geschichte der deutschen Reichsversammlung in Frankfurt* (1849); the anonymous *Vier Monate auswärtiger Politik* (1851); *Origines Germanicae* (1840); *Die Krisis der Reformation* (1845) and *Feudalitat und Aristokratie* (1858). *See* his *Politischer Briefwechsel* (ed. *W*. Schulze, 1923); and Haym, *Das Leben Max Dunckers* (1891).

DUNCOMBE, SIR CHARLES (c. 1648–1711), English politician, was a London apprentice, who became a goldsmith and a banker, and an alderman of the City of London in 1683. Duncombe was elected M.P. for Hedon in 1685 and afterwards sat for Yarmouth in the Isle of Wight and Downton in Wiltshire. He was made receiver of the customs, and for a short time receiver of the excise, and in this capacity he profited slightly by a transaction over some exchequer bills which had been falsely endorsed. Tried before the court of the king's bench in 1699 he was found "not guilty." He represented Downton a second time from 1702 until his death. In 1709 he served as lord mayor of London. He died at Teddington on April g, 1711.

DUNDALK, a seaport of Co. Louth, Eire, near the mouth of the Castletown river, in Dundalk bay. Pop. of urban district (1936) 14,684. It is an important junction on the G.N. railway, by which it is 54 mi. N. from Dublin. Dundalk was a borough by prescription, and received charters from Edward III. and successive kings. It was stormed in 1315 by Edward Bruce, who here proclaimed himself king. He was defeated and killed by the English in 1318 in the neighbourhood, and was buried at Faughart, near Dundalk. Ruins of a Franciscan priory with a lofty tower may still be seen. There are distilleries, breweries, flax and jute spinning mills, salt works, etc. The town is in large part dependent for its prosperity upon the activity of the Great Northern railway, which maintains large railway shops. There are also shoe factories. Trade is in agricultural produce and livestock. The town is also the centre of sea and salmon fisheries.

DUNDEE, JOHN GRAHAM OF CLAVERHOUSE, VISCOUNT (*c.* 1649–1689), Scottish soldier, was the elder son of Sir William Graham and Lady Madeline Carnegie. Educated at St. Andrews university, he served as a volunteer in France and Holland, returning to England in 1677. In 1678 he became a lieutenant, and soon afterwards captain of a troop, in the regiment commanded by his relative, the marquis of Montrose, and was employed in suppressing the rebellion of the Covenanters.

After the murder of Archbishop Sharp (1679), there were reports of rebels gathering near Glasgow, and Graham went in pursuit. On June 1, the Covenanters being in a well-protected position upon the marshy ground of Drumclog, Graham advanced to the attack. Hindered by the ground, he had to wait till the

impatience of his adversaries induced them to commence an impetuous attack. The charge of the Covenanters routed the royal cavalry, who turned and fled, Graham himself having a narrow escape. This was the only regular engagement he had with the Covenanters. The enthusiasm raised by this victory was the beginning of a serious and open rebellion.

On June 22 Graham was present at the battle of Bothwell Bridge, at the head of his own troop. He was then commissioned to search the south-western shires for the rebels. The wide powers given to him by his commission were most sparingly used, and the gravest accusation made against him in reference to this period is that he was a robber.

His own systematic and calculated terrorism, directed principally against the ringleaders, proved far more efficacious than the irregular and haphazard brutalities of other commanders. During these months he was despatched to London, along with Lord Linlithgow, to influence Charles II. against the indulgent method adopted by Monmouth with the extreme Covenanting party. In April 1680 it appears that his roving commission had been withdrawn; he was not, therefore, responsible for the severe measures which followed the Sanquhar Declaration of June 22, 1680.

In the disorders following the Test Act of 1681 Graham was again commissioned to act in the disaffected districts. At the end of January he was appointed to the sheriffships of Wigtown, Dumfries, Kirkcudbright and Annandale. He retained his commission in the army, and appears to have had powers in life and death in virtue of a commission of justiciary granted to him about the same time. He quartered on the rebels, rifled their houses, and, to use his own words, "endeavoured to destroy them by eating up their provisions." His severities were rewarded with many honours, and with a grant of part of the Maitland lands.

Claverhouse was present at the sittings of the circuit court of justiciary in Stirling, Glasgow, Dumfries and Jedburgh, instituted for the imposition of the test and the punishment of rebels. As a member of the privy council of Scotland he declared—to his honour—against the proposal to let loose the Highland marauders upon the south of Scotland. In June 1684 he was again at his old employment—the inspection of the southern shires; in May 1685 he was ordered with his cavalry to guard the borders, and to scour the south-west in search of rebels. In 1686 he was promoted to the rank of major-general, and had added to his position of constable the dignity of provost of Dundee. In 1688 he was second in command to Gen. Douglas in the army which had been ordered to England to aid the falling dynasty of the Stuarts; he was created Viscount Dundee on Nov. 12, 1688.

After the flight of James II. Dundee returned to Scotland for the meeting of the convention, and sought to confirm the waning resolution of the duke of Gordon with regard to holding Edinburgh Castle for the king. The convention proving hostile he left Edinburgh (March 18) at the head of a company of 50 faithful dragoons. He was not long gone ere the news was brought to the alarmed convention that he had been seen clambering up the castle rock and holding conference with the duke of Gordon. On March 30 he was publicly denoupced as a traitor, and attempts were made to secure him. But the secrecy and speed of his movements outwitted his pursuers, and he retreated to the north.

Gen. Hugh Mackay was now in the field against him, and a Highland chase began. Dundee considered himself at the head of the Stuart interest in Scotland, and to the day of his death expected help to arrive from the exiled king. It mattered little to him that on July 24 a price of £20,000 had been placed upon his head. The clans had begun to reassemble; he was now in command of a considerable force, and in July both sides took the field again. A contest for the castle of Blair forced on the decision. Mackay, in his march towards that place, entered the pass of Killiecrankie, the battle-ground selected by Dundee and his officers. Here, on July 17–27, 1689, was fought the battle of Killiecrankie (*q.v.*) The Highlanders were completely victorious, but their leader was shot beneath the breastplate, and fell dying from his horse. Dundee was conveyed to the castle of Blair, where he died on the night of the battle. His death in battle formed the subject of numerous legends, the best known of which is the long prevalent tradition that he was invulnerable to all bullets and was killed by a silver button from his own coat.

See Mark Napier, *Memorials and Letters of Graham of Claverhouse* (1859–62); Bannatyne Club, *Letters of the Viscount Dundee* (1826); C. S. Terry, *John Graham of Claverhouse, Viscount Dundee;* and authorities quoted in *Dict. Nat. Biogr., s.v.* "Graham of Claverhouse."

DUNDEE, royal, municipal and police burgh, county of a city and seaport of Forfarshire, Scotland. Pop. (1931) 175,583. Broughty Ferry (pop. 11,058) was added to the burgh in 1913, making its acreage 6,548. It lies on the north shore of the Firth of Tay, 59¼ m. N. by E. of Edinburgh by the L.N.E.R. via the Forth and Tay bridges. The L.M.S.R. finds access to the city by way of Perth. The town has a frontage on the water of over 4 m., and rises gradually from the river to Dundee Law and Balgay Hill. The estuary to the E. of Tay bridge is 1½ m. wide, and the docks—accessible from it at all stages of the tide—are within 12 m. of the sea.

The town-hall, built in 1734 from the designs of Robert Adam, stands in High Street. It is surmounted by a steeple 140 ft. high, carrying a good peal of bells, and beneath it is a piazza. A city hall, with a fine classic portico, has been built behind it, largely from a bequest of Sir James Caird (d. 1916). The old Town Cross, a shaft 15 ft. high, bearing a unicorn with the date of 1586, once stood in High Street also, but was re-erected within the enclosure on the south-west of Town Churches (*see* below). The halls used for great public meetings are the Volunteer Drill Hall in Parker Square, and Kinnaird Hall in Bank Street. A central library and sculpture galleries in Ward Street were finished in 1915 and the Albert Institute contains the art-gallery, museum, etc. In Dock Street stands the Royal Arch, erected to commemorate the visit of Queen Victoria in 1844. Dudhope Castle, once the seat of the Scrymgeours, hereditary constables of the burgh—one of whom (Sir Alexander) was a companion-in-arms of Wallace,—was granted by James II. to John Graham of Claverhouse. On his death it reverted to the Crown, and is now used as a technical school. Though Dundee was once a walled town, the only relic of its walls is the East Port, preserved because it was said that George Wishart preached from the top of it during the plague of 1544.

Of the many churches and chapels the most interesting is Town Churches—St. Mary's, St. Paul's and St. Clement's, the three under one roof—surmounted by the noble square tower, 156 ft. high, called the Old Steeple, which was once the belfry of the church erected on this spot by David, earl of Huntingdon, as a thank-offering for his escape from shipwreck on the shoals at the mouth of the Tay (1193). The church perished, but the bell-tower remained and was restored in 1871–1873 by Sir Gilbert Scott. Bishop Forbes (1817–1875) transferred the Anglican see of Brechin to Dundee.

Parks include Dundee Law (18 ac.) on the north, Baxter Park (37 ac.) on the east, Balgay Hill (36 ac.) on the west and, near it, Lochee Park (2½ ac.); in the extreme north is the park of Fair Muir (12 ac.), and, nearer to the heart of the town, Dudhope Park. Near the north end of the Tay bridge is Magdalen Green, an old common of 17 ac., and along the shore of the estuary there runs for a distance of 2¾ m. from Magdalen Point to beyond Craig Pier a promenade called the Esplanade. To the north is Caird Park, opened in 1923 on part of the estate given by Sir James Caird in 1911; it contains the ruins of Claverhouse Castle.

Education.—University college in Nethergate, founded in 1880 by Miss Baxter of Balgavies (d. 1884) and Dr. John Boyd Baxter, was opened in 1883, and finally united to the University of St. Andrews in 1897. The curriculum is especially concerned with medicine and natural and applied science. A technical college and school of art was opened in Bell street in 1910. In connection with the high school, a building in the Doric style, dating from 1833, there is a museum, endowed in 1880 by Mr. William Harris. Morgan hospital, in Scots Baronial style, immediately north of Baxter Park, was founded in 1868 by John Morgan, a native of Dundee, for poor boys, but was acquired by the school board and transformed into a secondary school. A training school for teachers was opened in Park Place is 1920. The Royal Infirmary

is a large institution. The Baldovan asylum for imbeciles, founded in 1854 by Sir John Ogilvy, is said to be the earliest of its kind in Scotland.

Trade and Shipping.— Dundee is noted first for the jute industries. Enormous quantities of the raw material are imported from India. Fabrics in jute range from the roughest sacking to beautiful carpets. Another staple industry is the linen manufacture, which is also one of the oldest, although it was not till the introduction of steam power that headway was made. The chief textile products are canvas (for which the British navy is the largest customer), ropes, sheetings, sackings, carpets, etc. Dundee is also celebrated for its confectionery and preserves, especially marmalade. Other industries are bleaching and dyeing, engineering, shipbuilding, tanning, sawmills, the making of boots and shoes, foundries, breweries, corn and flour mills and the construction of motor-cars. On the front wharves and harbour works extend for 2 m., and the docks cover an area of 3j3 ac., made up thus—Earl Grey Dock, 5¼ ac.; King William IV. Dock, 6¼ ac.; Tidal Harbour, 4¾ ac.; Victoria Dock, 10¾ ac.; Camperdown Dock, 8½ ac. There are, besides, graving docks, the ferry harbour and timber ponds. There is regular communication by steamer with London, Hull, Newcastle, Liverpool, Manchester, Belfast and Leith, besides Rotterdam, Hamburg and other continental ports. Of local excursions the two hours' run to Perth is a favourite summer trip.

Dundee returns two members to parliament. The city council consists of the lord provost, bailies and councillors. The corporation owns the gas, electricity and water supplies (the latter drawn from an artificial loch at Moni Rie to the N.E., and the loch of Lintrathen, 18 m. to the N.W.).

History.— The name of the city is derived most probably from the Gaelic *Dun Taw*, "the fort of the Tay," of which the Latin *Taodunum* is a transliteration— the derivation pointing to the fact of a Pictish settlement on the site. Its earliest authentic mention is in a deed of gift by David, earl of Huntingdon, younger brother of William the Lion, dated about 1200, in which it is designated as "Dunde." Shortly afterwards it was erected into a royal burgh by William the Lion. Edward I. is said to have removed its charter. Robert Bruce and successive kings confirmed its privileges and rights, and Charles I. finally granted it its great charter. Here Wallace finished his education, and here he slew young Selby, son of the English constable, in 1291. In that year the town fell into the hands of the English, and it was whilst engaged in besieging the castle in 1297 that Wallace withdrew to fight the battle of Stirling Bridge. In their incursion into Scotland under John of Gaunt the English captured and partially destroyed the town in 1385, but retreated to meet a counter-invasion of their own country. The English seized it again for a brief space during one of the first earl of Hertford's devastating raids in the reign of Edward VI. Dundee bore such a prominent part in propagating the Reformed doctrines that it was styled "the Scottish Geneva." The marquess of Montrose sacked it in 1645, and then burnt a considerable portion of it. Charles II. spent a few days in the castle after his crowning at Scone (Jan. 1, 1651). In the same year General Monk captured it after an obstinate resistance and put more than one-sixth of the inhabitants and garrison, including its governor Lumsden, to the sword. Sixty vessels were seized and filled with plunder; but the ships, says Gumble in his *Life* of Monk, "were cast away within sight of the town and that great wealth perished." In 1684 John Graham, of Claverhouse— to the north of the town, became constable, and in 1688 provost. In the same year James II. created him Viscount Dundee.

With modern changes, some picturesque but insanitary buildings, narrow winding streets and unsavoury closes disappeared, along with a few structures of more or less historic interest, like the castle, the mint and numerous convents. But the large factory population, together with the number of high tenement buildings, has given rise to slum conditions with which the municipality has endeavoured to cope by means of housing schemes. The wholesale clearances have improved both the public health and the appearance of the city. Queen Victoria granted a charter to Dundee, dated Jan. 25, 1889, raising it to the status of a city, and since 1892 its chief magistrate has been styled lord provost.

Among men more or less eminent who were born or lived in Dundee may be named Hector Boece (1465–1536), Viscount Dundee (1643–89), James Halyburton, the reformer (1518–89), many of the Scrymgeours and Wedderburns, and James Chalmers, the post-office reformer. George Constable of Wallace Craigie, the prototype of Jonathan Oldbuck in Sir Walter Scott's Antiquary, had a residence in the east end of Seagate; and William Thom (1798–1848), the writer of The *Rhymes* of *a Handloom Weaver*, was buried in the Western Cemetery.

Suburbs.—Broughty Ferry lies on the Firth of Tay, 3½ m. E. of Dundee. The name is a corruption of Brugh or Burgh Tay, in allusion to the fortress standing on the rock that juts into the Firth. It is believed that a stronghold has occupied this site since Pictish times. The later castle, built in 1498, fell into the hands of the English in 1547 and was held by them for three years. Gradually growing more or less ruinous it was acquired by the Government in 185j, repaired, strengthened and converted into a Tay defence, mounting several heavy guns. Owing to its healthy and convenient situation, Broughty Ferry has become a favourite residence of Dundee merchants. To the north-west lies Benvie; Camperdown House is in the parish. Fowlis, 5 m. N.W., is remarkable for its 15th century church, with carved ambry and rood-screen (curious representation of the Crucifixion), decorated font, crocketed door canopy and several pictures. The ruined castle adjoining the church ultimately became a dwelling for labourers. Lundie, 3 m. farther out in the same direction, contains several lakelets, and its kirkyard is the burial-place of the earls of Camperdown. Tealing, 4 m. N. of Dundee, was the scene of the ministry of John Glas before he was deposed for heresy. Newport and Wormit, on the opposite bank of the Tay, are connected with Dundee by steam ferry.

DUNDERLANDSDAL, a valley of northern Norway, draining south-westward from the neighbouring glaciers to the Ranenfjord (lat. 66° zo' N.). Valuable deposits of iron ore (magnetite and pyrites), first worked in 1902, occur here. At the mouth of the river is Mo, a considerable trading village. The valley is remarkable for caverns in the limestone, some of the tributary streams flowing for considerable distances underground.

DUNDONALD, THOMAS COCHRANE, 10TH EARL OF (1775–1860), British admiral, was born at Annsfield, Lanarkshire, on Dec. 14, 1775. He was the son of Archibald Cochrane, 9th earl (1749–1831), a most ingenious, but also most unfortunate, scientific speculator and inventor, who was before his time in suggesting and attempting new processes of alkali manufacture, and various other uses of applied science. The family was greatly impoverished owing to his losses over these schemes. Thomas went to sea in his uncle's, Captain Cochrane's ship, the "Hind," in 1793. His promotion was rapid.

In 1800 he was appointed to the command of the "Speedy" brig. His capture of the Spanish frigate "El Gamo" (32) on May 6, 1801, brought him promotion to post rank. He sat in parliament as member for Honiton in 1806 and for Westminster in 1807. In the House of Commons he made his mark as a radical and a denouncer of naval abuses. In April 1809 he was engaged in the attack on the French squadron in the Basque Roads, which was very ill conducted by Lord Gambier. Cochrane's conduct was brilliant, but he made accusations against the admiral which necessitated a court-martial on Gambier. The admiral was acquitted, and Cochrane fell into disfavour with the admiralty. He was not employed again till 1813.

In the interval he speculated on the Stock Exchange. At this moment a notorious fraud was perpetrated on the Stock Exchange by an uncle of his and by other persons with whom he habitually acted. Lord Cochrane was brought to trial with the others before Lord Ellenborough on June 8, 1814, and all were condemned. He was expelled from parliament and deprived of the order of the Bath.

In 1817 he accepted the invitation of the Chileans, who were then in revolt against Spain, to take command of their naval forces, and remained in their service until 1822. His capture of

the Spanish frigate "Esmeralda" (40) in the harbour of Callao, on Nov. j, 1820, was a signal achievement. In 1823 he transferred his services to Brazil, where he helped the emperor Dom Pedro I. to shake off the yoke of Portugal; but by the end of 182 j he had fallen out with the Brazilians, and he returned to Europe. He then entered the Greek service, but he found no opportunity for distinguishing himself, and in 1828 returned home. He succeeded in 1832 in securing reinstatement in the British navy. In 1848 he was appointed to the command of the North American and West India station, which he retained till 1851. At various periods of his life he occupied himself with scientific invention. He took out patents for lamps to burn oil of tar, for the propulsion of ships at sea, for facilitating excavation, mining and sinking, for rotary steam-engines and for other purposes; and in 1843 was an advocate of the employment of steam and the screw propeller in warships. Lord Dundonald died in London on Oct. 30, 1860. and was buried in Westminster Abbey. He was succeeded in the title by his son Thomas as 11th earl (d. 1885), and the latter by his son Douglas as 12th earl (*q.v.*).

See the 10th earl's *Autobiography of a Seaman* (2 vols., 1860–61), which was the main source for his *Life* (1869, *by* his son and heir); his *Notes on the Mineralogy, Government and Condition of the British West India Islands* (1851), and a *Narrative of Services in the Liberation of Chili, Peru and Brazil* (1858); and J. B. Atlay, *The Trial of Lord Cochrane before Lord Ellenborough* (1897).

DUNDONALD, DOUGLAS MACKINNON BAILLIE HAMILTON COCHRANE, 12TH EARL OF (1852–1935), son of the 11th earl of Dundonald and Louisa Mackinnon, was born on Oct. 29, 1852, and succeeded to the earldom in 188 j. On leaving Eton he entered the 2nd Life Guards, in 1870, and served in the Nile expedition of 1884–85, and in the desert march to the relief of Khartoum. In 1899–1900 he commanded the Mounted Brigade in South Natal, and led the 2nd Cavalry Brigade into Ladysmith in 1900. In the same year he was promoted major-general; in 1907 he was made K.C.V.O., and in 1913 K.C.B.

DUNEDIN, a city of New Zealand, capital of the provincial district of Otago, and the seat of a bishop, in Taieri county. Pop. (census of 1926) 85,197. It lies 1 j m. from the open sea, at the head of Otago harbour, a narrow inlet on the south-eastern coast of South island.

The colony of Otago (from a native word meaning ochre, which was found here and highly prized by the Maoris) was founded as the chief town of the Otago settlement by settlers sent out under the auspices of the Free Church of Scotland in 1848. The discovery of large quantities of gold in Otago in 1861 and the following years brought prosperity, a great "rush" of diggers setting in from Australia.

The situation was chosen on the consideration of this harbour alone, for the actual site offered many difficulties, steep forest-clad hills rising close to the sea, and rendering reclamation necessary. The hills give the town a beautiful appearance, as the forest was allowed to remain closely embracing it, being preserved in the public ground named the Town Belt. The principal thoroughfare is comprised in Prince's street and George street, running etraight from south-west to north-east and passing through the Octagon, which is surrounded by several of the principal buildings. From these streets others strike at right angles down to the harbour, while others lead obliquely up towards the Belt, beyond which are extensive suburbs. The town hall, Athenaeum and museum are noteworthy buildings, the last having a fine biological collection. The Otago university at Dunedin is a constituent college of the University of New Zealand with 51 professors and lecturers. The college was founded in 1869. The white Oamaru stone is commonly used in the buildings. Besides the Belt there are several parks and reserves.

Dunedin is connected by rail with Christchurch northward and Invercargill southward, with numerous branches. The depth of the channel to Port Chalmers (9 m. N.E. of Dunedin by rail) is 30 feet, at Dunedin itself the harbour has a depth from 18 to 24 feet and can accommodate vessels up to 22½ ft. draught. The exports include gold (procured by dredging), wool, dairy produce, frozen meat: the imports are coal, timber and manufactured goods.

DUNES or **DUNKIRK DUNES, BATTLE OF,** was fought near Dunkirk on May 24 (June 3), 1658, between the French and English army under the command of Marshal Turenne and the Spanish army under Don Juan of Austria and the prince of Condé. The severest part of the fighting was borne by the English contingents on either side. Six thousand English infantry under Gen. Lockhart were sent by Cromwell to join the army of Turenne, and several Royalist corps under the command of the duke of York (afterwards James II.) served in the Spanish forces. The object of the Spaniards was to relieve Dunkirk, which Turenne was besieging. Don Juan had a strong superiority in cavalry, but left behind his artillery in order not to delay his advance. He took up a position on the dunes with his right on the sea and his left on the Bruges canal, and here Turenne at once attacked him. Condé's cavalry on the left wing charged with great resolution and despite heavy loss gained the upper hand. But their success was nullified by the failure of the Spanish right wing and centre under Turenne's pressure, to which Cromwell's veterans largely contributed. But when all the rest of the Spanish army was in rapid retreat, the one small corps of English Royalists, some 300 strong only, held out stubbornly and only laid down their arms on terms that they were allowed to rejoin their king, Charles II. at Ypres. From this corps, the Royal Regiment of Guards, are descended the present Grenadier Guards. With Turenne's victory, the surrender of Dunkirk speedily followed, and the fortress passed into English hands until sold back by Charles 11.—an ironical last word on this singular footnote to English history.

DUNES, mounds or hills and ridges of sand heaped by wind. They are numerous in (1) deserts, particularly in low-lying areas; (2) on sandy coasts with onshore winds; and (3) near rivers of which the volume varies, leaving sandy beds exposed during the dry season. The areg of the Sahara and Arabian deserts are characterized by vast expanses of dunes, as are the *koums* of the deserts of Persia and Turkistan and the plateaux of Gobi and other Mongolian deserts. Few such desert dunes are found in America or Australia, but the sand hill region of western Nebraska affords a good illustration. The coasts of Brittany, Cornwall, the Landes of France, the shores of the Baltic in Europe; the whole eastern coast of North America from Cape Cod southward, and at places along the Pacific coast; and numerous leeward coasts of Africa, Australia and Asia serve as examples of oceanic coastal dunes. Lacustrine dunes are admirably developed on the east shore of Lake Michigan, the south shores of Lake Superior and Lake Erie, the shores of former Lakes Lahontan and Bonneville in the Great basin of North America, and on the east shores of the Caspian and Aral seas in western Asia. Examples of river bank dunes are found in almost every land, as for instance along the east banks of the Mississippi, Missouri and Rio Grande rivers in the United States.

Dunes migrate constantly unless the sand of which they are composed is prevented from blowing by grass or other vegetation. The rate at which dunes move varies, depending upon the velocity of the wind and the height of the dunes, small dunes migrating the faster. In Denmark the rate is from 3 to 20 ft. a year; in France, on the Bay of Biscay, the sands have advanced at a rate estimated from 1 j to 105 ft. a year, burying in their progress forests, farms, vineyards, churches and whole villages, some of which may in course of time be exhumed as the dunes migrate onward. On the south side of Lake Michigan forests which were buried by sand dunes have been uncovered as the dunes moved on. Hundreds, perhaps thousands of square miles of towns and cities in central Asia are buried under dunes. Moving dunes constantly encroach upon the Suez canal. Nor are dunes merely a contemporary geologic feature. Sand dune deposits are recognizable by the character of their bedding in sandstone rocks of many geologic periods, indicating that aeolian action has been prevalent throughout geologic history. Fossil dunes are widely distributed. See Downs. (W. E. E.)

DUNFERMLINE, JAMES ABERCROMBY, 1ST BARON (1776–1858), speaker of the House of Commons, third son of Gen. Sir Ralph Abercromby, was born on Nov. 7, 1776. He was

called to the bar at Lincoln's Inn in 1801. He sat in parliament for Midhurst (1807) and Calne (1812) in the Whig interest. In 1827 Abercromby was made judge-advocate-general, and chief baron of the exchequer of Scotland in 1830, when he resigned his seat in parliament. He joined the cabinet of Earl Grey in 1834 as master of the mint. In the new parliament of 1835, Abercromby was elected speaker of the House. As speaker he was not very successful in quelling disorder, but he introduced several important reforms in the management of private bills. On his resignation in May 1839 he was created Baron Dunfermline of Dunfermline. He died at Colinton House, Midlothian, on April 17, 1858, and was succeeded in the title by his only son, Ralph.

See Spencer Walpole, *History of England* (London, 1890); *Greville Memoirs*, edited *by* H. Reeve (London, 1896); Lord Cockburn's *Journal* (Edinburgh, 1874).

DUNFERMLINE, a royal burgh and parish, Fifeshire, Scotland (Gaelic, "the fort on the crooked linn"). Pop. (1911) 28.103, (1938) 37,058. The parish was enlarged in 1914, and now includes Rosyth. It is situated on high ground 3 m. from the shore of the Firth of Forth, with two stations on the L.N.E.R.—Lower Dunfermline 16¾ m., and Upper Dunfermline 19¼ m. N.W. of Edinburgh, via the Forth Bridge. The town is intersected from north to south by Pittencrieff Glen, a deep, picturesque ravine, from which the town derives its name and at the bottom of which flows Lyne Burn.

The early Celtic monks known as Culdees had an establishment here; but its fame dates from the marriage of Malcolm Canmore and his queen Margaret, solemnized in the town in 1070. The king then lived in a tower on a mound surrounded on three sides by the glen. A fragment of this castle exists in Pittencrieff Park, a little west of the later palace. Under the influence of Queen Margaret in 1075 the foundations were laid of the Benedictine priory, raised to an abbey by David I. Robert Bruce gave the town its charter in 1322.

The staple industry is the manufacture of table linen. The weaving of damask was introduced in 1718 by James Blake, who had learned the secret of the process in the workshops at Drumsheugh near Edinburgh. Other industries are dyeing and bleaching, brass and iron founding, engineering works, rope-making and the making of soap and fireclay, whilst there are numerous collieries in the immediate vicinity.

Public edifices, besides churches, include the County buildings, the Public, St. Margaret's, Music and Carnegie halls, the last in the Tudor style, Carnegie public baths, high school (founded in 1560), school of science and art and two hospitals. Andrew Carnegie (1835–1919) was a well-known benefactor of Dunfermline. He gave to his birthplace the free library and public baths, and, in 1903, the estate of Pittencrieff park and glen, rich in historical associations as well as natural charm, together with bonds worth £500,000 (increased by £250,000 in 1911) a year, in trust for the maintenance of the park, the support of a theatre for the production of plays of the highest merit, the periodical exhibitions of works of art and science, the promotion of horticulture among the working classes and the encouragement of technical education in the district. A statue of Carnegie has been placed in the park. and Dunfermline is now the headquarters of all the Carnegie trusts. The town is the seat of the sheriff-substitute for Western Fife; it is governed by a provost, bailies and council, and, with Cowdenbeath, Inverkcithing and Lochgelvy (the Dunfermline group) combines in returning a member to parliament.

With the exception of Iona, Dunfermline Abbey has received more of Scotland's royal dead than any other place in the kingdom Within its precincts were buried Queen Margaret and Malcolm Canmore; their sons Edgar and Alexander I., with his queen; David I. and his two queens; Malcolm IV.; Alexander III., with his first wife and their sons David and Alexander; Robert Bruce, with his queen Elizabeth and their daughter Matilda; and Annabella Drummond, wife of Robert III. and mother of James I. Bruce's heart rests in Melrose, but his bones lie in Dunfermline Abbey, where (after the discovery of the skeleton in 1818) they were reinterred below the pulpit of the New church. In 1891 the pulpit was moved back and a monumental brass inserted in the floor to indicate the royal vault. The tomb of St. Margaret and Malcolm, within the ruined walls of the Lady chapel, was restored and enclosed by command of Queen Victoria. During the winter of 1303 the court of Edward I. was held in the abbey, and on his departure next year most of the buildings were burned. When the Reformers attacked the abbey church in March 1560, they spared the nave, which served as the parish church till the 19th century, and now forms the vestibule of the New church (1821), a building in the Perpendicular style. The old building was a fine example of simple and massive Norman, and has a beautiful doorway in its west front. Another rich Norman doorway was exposed in the south wall in 1903. The building is maintained by the commissioners of woods and forests. Of the monastery there still remains the south wall of the refectory, with a fine window. The palace, a favourite residence of many of the kings, occupying a picturesque position near the ravine, was of considerable size, judging from the south-west wall, which is all that is left of it; the last royal tenant was Charles II., who occupied it just before the battle of Pitreavie (July 20, 1650), which took place 3 m. to the south-west, and here also he signed the National League and Covenant.

DUNGANNON, a market town of Co. Tyrone, Ireland, 8 m. W. of the south-western shore of Lough Neagh, 103 m. from Dublin by the G.N. railway, with a branch line thence to Cookstown. Population of urban district 3,762. Its early history is that of the O'Neills, whose chief residence was here, and a large rath or earthwork north of the town was the scene of the inauguration of their chiefs; but of the family castle and abbey there are no remains. In Dungannon the independence of the Irish parliament (to which the town returned two members) was proclaimed in 1782. The town was formerly corporate and was a parliamentary borough until 1885. The royal school, founded in 1614, was moved to new buildings at the end of the 18th century. Linens, muslin, and coarse earthenware are manufactured, tanning is carried on, and there is trade in corn and timber.

DUNGARPUR, an Indian State, in the Rajputana agency, in the extreme south of Rajputana. A large portion is hilly, and inhabited by Bhils. Its area is 1,447 sq m. In 1931 the total population was 227,544. Kherwara is the headquarters of the Mewar Bhil corps.

The chiefs of Dungarpur, who bear the title of maharawal and enjoy a salute of 15 guns, are descended from Mahup, eldest son of Karan Singh, chief of Mewar in the 12th century, and claim the honours of the elder line of Mewar. The town of Dungarpur (pop. 8,560 in 1931), the capital of the state, was founded towards the end of the 14th century and named after Dungaria, an independent Bhil chieftain. After the battle of Khanua in 1527, these territories were divided into the States of Dungarpur and Banswara. Dungarpur fell under the sway of the Moguls and Mahrattas in turn, and was taken under British protection by treaty in 1818.

DUNGARVAN, a market town and seaport of Co. Waterford, Eire, 28½ mi. W.S.W. from Waterford by rail. Pop. of urban district (1936) 5,361. It is situated on the Bay of Dungarvan, at the mouth of the Colligan, which divides the town into two parts. Dungarvan mas incorporated in the 1 jth century. Under John, walls were built, also a castle, of which there are still remains in the town. The eastern suburb is called Abbeyside, where remains of an ancient keep, erected by the M'Graths. still exist, together with portions of an Augustinian friary, founded by the same family in the 14th century and incorporated with a Roman Catholic chapel. Brewing is carried on and there are woollen mills. Trade is in agricultural produce.

DUNGENESS, promontory, south coast of Kent, England. near the town of Lydd. It is a low-lying bank of about 9.4 sq.mi. of shingle, forming the seaward apex of the great Romney marshes. Its seaward accretion by the formation of curved shingle beaches, is about 6 ft. annually. The sea quickly drops into deep water, which is not the case of the other headlands of the south coast. A lighthouse (50° 55′ N., 0° 58′ E.) stands on the ness. There are also here Lloyds' signalling station, a bird sanctuary, and the terminus of a branch of the Southern railway.

The name Dungeness has also been applied elsewhere; thus the point on the north side of the eastern entrance to Magellan strait is so called, and there is a town of Dungeness near a promontory on the coast of Washington, U.S.A. (Strait of Juan de Fuca).

DUNGEON, the prison in a castle. The word is an anglicization of *donjon,* the French for keep (*q.v.*), in whose cellars the prison is usually located. In modern usage, dungeon signifies, especially, the vaulted chambers that formed these prisons, hence any small, vaulted, prison-like room, particularly if dark or partially underground.

DUNKELD, burgh of barony and parish (with Dowally), Perthshire, Scotland, on the left bank of the Tay, 15½ mi. N.W. of Perth by the L M.S.R. The station is at Birnam, on the right bank. Pop. (1931) 946. The river is crossed by a bridge of seven arches designed by Thomas Telford and opened in 1808. The town lies in the midst of luxuriant trees, and the noble sweep of the Tay, the bridge, the grounds of Dunkeld house, and the protecting mountains combine to give it a beautiful site.

As early as 729—some authorities fix the date a hundred and fifty years before—the Culdees possessed a monastery at Dunkeld, converted into a cathedral by David I in 1127. At the Reformation it was unroofed and fell into ruin. The building, given to the nation by the duke of Atholl in 1918, consists of the nave, aisles, choir, chapter house and tower. The Pointed arches rest upon pillars, possibly Norman, and above them, below the Decorated clerestorey windows, is a series of semicircular arches with flamboyant tracery. The choir, founded by Bishop William Sinclair (d. 1337), has been repaired, and serves as the parish church, a blue marble slab in the floor marking the bishop's grave. The chapter house, adjoining the choir, was built by Bishop Thomas Lauder (1395–1481) in 1469, and the vault beneath is the burial place of the Atholl Murrays. Lauder also began the tower, completed in 1501. The most famous of the bishops was Gavin Douglas (1474–1522), translator of the Aeneid. Shortly after the battle of Killiecrankie (1689), the Cameronian regiment which was enrolled in the same year (afterwards the 26th Foot), was despatched to hold Dunkeld prior to another invasion of the Highlands. It was under the command of Colonel William Cleland (b. 1661), a poet of some merit. On Aug. 26 a force of 5,000 Highlanders suddenly appearing, Cleland posted his men in the church and behind the wall of the earl of Atholl's mansion. The Highlanders were forced to withdraw, but while leading a sortie Cleland was killed.

Adjoining the cathedral is Dunkeld house, a seat of the duke of Atholl. The 4th duke planted several square miles of the estate with larches, of which he had made a study. The oak and sycamore in front of Birnam house, a mile south, are believed to be the remnant of the wood of Birnam which Shakespeare immortalized in Macbeth. The Pass of Birnam, where the river narrows, was the path usually taken by Highlanders in their forays.

DUNKIRK, a seaport of northern France (Fr. Dunkerque), capital of an arrondissement in the department of Nord, on the Straits of Dover, 53 mi N.W. of Lille on the Northern railway. Pop. (1936) 31,017. Around a chapel founded by St. Eloi in the 7th century a small village sprang up, and, in the 10th century, was fortified by Baldwin III, count of Flanders. In 1658 Turenne's victory of the Dunes (*q.v.*) gave it into the hands of the French and it was ceded to Cromwell in return for services of the Ironsides. Charles II sold it to Louis XIV, who fortified it. By the terms of the peace of Utrecht (1713) the fortifications were demolished and its harbour filled up, a sacrifice demanded by England owing to damage inflicted by Jean Bart and other corsairs of the port. In 1793 it was besieged by the English under Frederick Augustus, duke of York, who was compelled to retire after the defeat of Hondschoote. It was heavily bombed and damaged in World War I, during which it was, for most of the time, 18 mi. behind the Allied front, and in World War II. Dunkirk is in the low but fertile district of the Wateringues. It lies, amid a network of canals, immediately to the west and south of its port, which disputes with Bordeaux the rank of third in importance in France. The populous suburbs of Rosendael and St. Pol-sur-Mer lie respectively to the east and west of the town; to the north-east is the bathing resort of Malo-les-Bains. The streets of Dunkirk are wide and well paved, the chief of them converging to the square named after Jean Bart (born at Dunkirk in 1651), whose statue by David d'Angers stands at its centre. Close to the Place Jean Bart rises the 16th-century belfry (290 ft. high) which contains a fine peal of bells and also serves as a signalling tower. It was once the western tower of the church of St. Eloi, from which it is now separated by a street. St. Eloi, erected about 1560 in the Gothic style, was deprived of its first two bays in the 18th century; the present façade dates from 1889. The roof was destroyed in World War I. The chapel of Notre Dame des Dunes possesses a small image, which is the object of a well-known pilgrimage. Dunkirk has a communal college, a school of drawing, architecture and music, a library and a rich museum of paintings. Dunkirk forms with Bergues, Bourbourg and Gravelines a group of fortresses enclosed by inundations and canals.

The harbour of Dunkirk (see Docks) is approached by a fine natural roadstead entered on the east and west, and protected on the north by sandbanks. From the roadstead, entrance is by a channel into the outer harbour, which communicates with seven floating basins about 115 acres in area and is accessible to the largest vessels. The port is provided with four dry docks and a gridiron, and its quays exceed 5 mi. in length. Canals bring it into communication with Belgium, the coal basins and industrial towns of Nord and Pas-de-Calais, and the rich agricultural regions of Flanders and Artois. The roadstead is indicated by lightships and the entrance channel to the port by a lighthouse which, at an altitude of 193 ft., is visible at a distance of 19 mi.

Dunkirk annually dispatches a fleet to the Icelandic cod-fisheries, and takes part in the herring and other fisheries. It imports great quantities of wool from the Argentine and Australia. and is in regular communication with New York, London and the chief ports of the United Kingdom, Brazil and the far East. Besides wool, leading imports are jute, cotton, tow, flax, timber, petroleum, coal, iron ore, pig iron, pitch, wine, cereals, oilseeds and oil cake, nitrate of soda and other chemical products, and metals. The principal exports are sugar, coal, cereals, wool, forage, cement, chalk, phosphates, iron and steel, tools and metal goods, thread and vegetables. The industries include the spinning of jute, flax, hemp and cotton, iron founding, and the manufacture of machinery, fishing nets, sailcloth, sacks, casks and soap. There are also saw- and flour-mills, petroleum refineries and oil works. Shipbuilding is carried on and the preparation of fish and cod-liver oil occupies many hands. (X)

Evacuation of Dunkirk, 1940.—The British-French retreat at Dunkirk constitutes one of the most memorable phases of the general battle of France in World War II, and the crucial point of the preceding battle of Flanders. The disaster in that area started with the surrender of the Belgian army (May 28, 1940) which was holding positions to the north of Dunkirk. Thus the Allied forces in Flanders saw themselves cut off from the main French army, in a desperate situation. Only evacuation by sea was left. It was accomplished with skill and heroism, and in spite of uninterrupted, terrific attacks by German dive bombers, some 330,000 French and British troops, with a few Belgian and Dutch forces who refused to surrender, reached England. This amounted to about three-quarters of the Allied effectives trapped in Flanders. The battle-worn troops mere evacuated by all available means of navigation; besides the navy units and merchant ships, yachts and even small private and fishing boats, mostly sent from Great Britain, took an active and gallant part in it, under the protection of the royal air force, which for a certain time held supremacy in the skies. (A. De.)

DUNKIRK, a city of Chautauqua county, New York, on Lake Erie, 40 mi. S.W. of Buffalo. It is a port of entry and is served by the Erie, the New York Central, the Pennsylvania, the Nickel Plate and the Dunkirk, Allegheny Valley railways. The population in 1940 was 17,713. It is a shipping point for great quantities of grapes (the agricultural specialty of the region), and has important manufactures, including stainless steel, shovels, hoes, oil-refining machinery, structural bridges, jellies, lamp globes, radiators, valves, automotive parts, aeroplane parts, sanitary receptacles, silk gloves and underwear. Dunkirk was settled

about 1805, incorporated as a village in 1837, with 700 inhabitants, and chartered as a city in 1880. It owes its name to the similarity of its harbour to that of Dunkirk, France.

DUNLIN or OXBIRD (Tringa alpina), one of the commonest of the sandpipers (*q.v.*). It breeds on elevated moors in Europe. N. Asia and N. America and in winter haunts the mud flats and sand banks in large flocks. A smaller species, *T.* schinzi, occurs in parts of Europe. In the breeding season, the male utters a peculiar whistle. A subspecies of the dunlin, the red-backed sandpiper (*Tringa,* or Pelidna, *alpina* sakhalina), is abundant on both the Atlantic and Pacific coasts of North America.

DUNLOP, JOHN BOYD (1840–1921), Scottish inventor, the pioneer of the pneumatic rubber tire, was born on Feb. 5, 1840, on a farm at Dreghorn, Ayrshire. He settled in 1867 as a veterinary surgeon in Belfast, where he had a large and successful practice. In 1887 he constructed a pneumatic tire for his little boy's tricycle. The invention was tested, and patented on Dec. 7, 1888. Two years later production on a commercial scale began, in conjunction with William Harvey Du Cros, by the Pneumatic Tyre and Booth Cycle agency, Belfast. Dunlop made over the patent to Du Cros for a moderate sum, and took 1,500 shares in the company. Some difficulty arose when it was discovered that the principle of the pneumatic tire had been patented in 1846 by an inventor named Thompson, but the company held various accessory patents which enabled them to establish their position. Dunlop himself did not make a great fortune by the invention, as he took no further part in the great developments which followed the sale of the company in 1896 to E. T. Hooley, who refloated it for £5,000,000. Dunlop died in Dublin, where he had an interest in a drapery firm, on Oct. 23, 1921. See Jean McClintock (his daughter), History of *the* Pneumatic Tyre (1923).

DUNLOP RUBBER COMPANY, LTD. In 1888 J. B. Dunlop invented a pneumatic tire which was really a re-invention, the first pneumatic tire having been patented in 1846. A company was registered in Ireland in 1889 to exploit Dunlop's invention with £15,010 issued capital. Prior to Dunlop's invention cycle tires were made of solid rubber. The first pneumatics were received with derision but quickly established their superiority; cycles were made lighter and propulsion was infinitely easier. The motor car benan to use them. In 1896 the Dunlop Pneumatic Tyre Co. was formed with f 5,000,000 capital.

Up to 1899 the Tyre Co. had no rubber mills, but it then acquired a rubber manufacturing company in Birmingham which had a capital of £20,000. The name of the company so acquired was changed to Dunlop Rubber Co., and in 1912 it acquired all the trading rights of the Tyre Co., thus amalgamating the manufacturing and selling in one company. The share and loan capital held by the public in the Dunlop Rubber Co. and its English subsidiaries amounted in 1939 to over £20,000,000. In addition to tires, the company manufactures wheels and rims for motor vehicles of all kinds, aeroplanes and cycles, footwear, clothing. general rubber goods of every description, tennis rackets, tennis and golf balls, and various other sports requisites. In addition to 11 factories in England it owns through subsidiary companies the largest cotton mills in the world (at Rochdale) and rubber estates in Malay with over 85,024 acres planted. There are Dunlop factories in America, France. Germany, Australia, Canada, India, South Africa, Eire, and Japan. (A. T. F.)

DUNMORE, JOHN MURRAY, EARL OF (1732–1809), English governor of Virginia, succeeded to the peerage in 1756. He sat in the House of Lords from 1761 until he became governor of the colony of New York in 1770. In 1771 he was also appointed governor of Virginia. He made himself unpopular by dissolving the assembly in 1772, 1773 and 1774 because of its expression of revolutionary sentiments. Early in 1775 he removed the powder from the magazine at Williamsburg, Va., and thus occasioned the first armed uprising of Virginia. This led him to remove the seat of government to a man-of-war lying off Vorktown. Further disagreements led the burgesses to contend that he had abdicated. Dunmore returned to England in 1776, and in 1787 was made governor of the Bahamas, a post which he held until 1796. Later critics have felt that the Indian War (see POINT PLEASANT) which bears his name was prompted largely by his greed for western land. He died at Ramsgate in May 1809.

See C. W. Alvord, The Mississippi Valley in British Politics (1917) and *Documentary History* of Dunmore's War, edited by R. G. Thwaites and L. P. Kellogg (Madison, Wis., 1905).

DUNMORE, a borough of Lackawanna county, Pa., U.S.A., adjoining Scranton on the north-east. It is served by the Erie, the Lackawanna, and the Lackawanna and Wyoming Valley (electric) railways. The population was 20,250 in 1920 (22% foreign-born white), and it was 23,086 in 1940 by the federal census. Anthracite mining and work on the railroads are the principal occupations. There are also car shops, silk mills, and stove works. The Pennsylvania Oral school is here. Dunmore was settled in 1783 and was incorporated as a borough in 1862.

DUNMOW or GREAT DUNMOW, a market town of Essex. England, on the river Chelmer, 40 mi. N.N.E. from London on a branch from Bishop's Stortford of the L.N.E. railway. Pop. of civil parish (1931) 2,882. The church of St. Mary is Decorated and Perpendicular. The town was corporate from 1556 until 1886. Roman remains have been discovered. The manufacture of baize was introduced there in the 17th century but became extinct. Two miles east is the village of LITTLE DUNMOW. The old church of St. Mary, Little Dunmow, contains some interesting early monuments. Here was buried Robert Fitzwalter, "Marshal of the Army of God and Holy Church," who was leader of the barons who negotiated Magna Carta. It was formerly the seat of an Augustinian priory, remarkable for the custom of presenting a flitch of bacon to any couple who could give proof that they had spent the first year of married life in unbroken harmony. Later in place of the monastic judicature, a jury of six bachelors and six maidens appears in the 16th century. A rhyming oath, quoted by Fuller, was taken. This institution, which had its parallel at Whichanoure (or Wichnor) in Staffordshire, at St. Moleine in Brittany, and apparently also at Vienna, appears to be of very ancient origin. The first recorded instance of its award is in the reign of Henry VI. But there are references which point to it in Piers *Plowman* and Chaucer. The manorial documents relating to it are kept in the church. The custom was revived in 1855 by Harrison Ainsworth, author of the novel The Flitch of Bacon, but the scene of the ceremony was transferred to the old town hall of Great Dunmow. (For details see Chambers' Book of Days, ii. 748–751; and W. Andrews, History of *the Dunmow* Flitch of Bacon *Cus*-tovns, 1877.)

DUNNE, FINLEY PETER (1867–1936), American journalist and humorist of Irish descent, was born in Chicago, Illinois, July 10, 1867, and educated in the public schools. In 1885 he became a newspaper reporter. Later he was a member of the editorial staff of the Chicago *Evening* Post, and of the Chicago *Times-Herald* (1892–97), and editor of the Chicago Journal (1897–1900).

For several years he contributed humorous sketches in Irish brogue to the daily papers, but he did not come into prominence until he wrote for the Chicago *Journal* a series of satirical observations and reflections on social and political topics of the day, attributed to an honest Irish-American, Martin Dooley, the shrewd philosopher of Archey road. They were widely copied by the press of America and England.

The first published collection, *Mr.* Dooley *in* Peace and in War (1898), was followed by several others, similar in subject matter and in method, including Mr. Doaley's Philosophy (1900), Observations by Mr. Dooley (1902), and Mr. Dooley *Says* (1910). These books made their author famous as the creator of a delightfully original character and as a humorist of shrewd insight.

DUNNOCK, a name for the European hedge-sparrow (*Prunella modularis*). (*See* SPARROW.)

DUNOIS, JEAN, COUNT OF (1403–1468), commonly called the "Bastard of Orleans," a celebrated French commander, was the natural son of the duke of Orleans (brother of Charles VI) and Mariette d'Enghien, Madame de Canry. His earliest feat of arms was the surprise and rout in 1427 of the English, who were besieging Montargis—the first successful blow against the English power in France following a long series of French defeats. In 1428 he

defended Orleans with the greatest spirit, and enabled the place to hold out until the arrival of Joan of Arc, when he shared with her the honour of defeating the enemy there in 1429. He then accompanied Joan to Reims and shared in the victory of Patay. After her death he raised the siege of Chartres and of Lagny (1432) and engaged in a series of successful campaigns which ended in his triumphal entry into Paris (April 13, 1436). He gradually drove the English northward; in 1450 he reconquered northern France, and in 1451 attacked the English in Guienne, taking among other towns Bordeaux and Bayonne. In 1465 he joined the league of revolted princes, but, assuming the function of negotiator, he was after a time reinstated in his offices. He died on Nov. 24, 1468.

DUNOON, police burgh and parish (with Kilmun), Argyllshire, Scotland, on the west shore of the Firth of Clyde, opposite to Gourock. Pop. (1931) 8,780. (These figures are increased in the holiday season.) Including Kirn and Hunter's Quay, it presents a practically continuous front of seaside villas, with an esplanade two miles long. The mildness of its climate and the beauty of its situation have made it one of the most prosperous watering-places on the west coast. On a conical hill above the pier stand the remains of Dunoon Castle, the hereditary keepership of which was conferred by Robert Bruce on the family of Sir Colin Campbell of Loch Awe, an ancestor of the duke of Argyll. It was visited by Queen Mary in 1563, and in 1643 was the scene of the massacre of the Lamonts by the Campbells. The grounds have been laid out as a recreation garden. The town itself is modern, having been a mere fishing village at the beginning of the 19th century. There is frequent communication daily by steamer with Glasgow. Hunter's Quay is the yachting headquarters, the Royal Clyde Yacht club's house adjoining the pier. Kilmun, on the northern shore of Holy loch, a portion of the parish of Dunoon and Kilmun, contains the ruins of a Collegiate chapel founded in 1442 by Sir Duncan Campbell of Loch Awe and used as the burial-ground of the Argyll family.

DUNS, burgh of barony, parish and county town, Berwickshire, Scotland. Pop. (1931) 1,788. It is situated 44 m. E.S.E. of Edinburgh by road, with a station on the branch line of the L.N.E.R. from Reston to St. Boswells. Trade in grain and flour is carried on, and stock sales are held. On Duns Law (joo ft.) the Covenanters, under Alexander Leslie, were encamped in 1639, and the Covenanters' Stone on the top of the hill has been enclosed. Duns castle, adjoining the town on the W., includes the tower erected by Thomas Randolph, earl of Moray (d. 1332).

DUNSANY, EDWARD JOHN MORETON DRAX PLUNKETT, 18TH BARON (1878–), Irish dramatist, was born in London on July 24, 1878. He was educated at Eton and Sandhurst, and succeeded his father as 18th Baron Dunsany in 1899. Entering the Coldstream Guards, he served in the Boer War, and, in the Royal Inniskilling Fusiliers, in the World War. As a playwright, he first attracted attention with *The Glittering Gate,* produced in Dublin, 1909. His plays are expressed in richly coloured language. They include: *The Gods of the Mountain* (1911), *A Night at an Inn* (1916), *If* (1921) and *Alexander and other Plays* (192j). He has also written numerous tales in similar style, to be found in, among other volumes: *The Gods of Pegana* (1905); *The .Sword of Welleran* (1908); *Tales of Wonder* (1916); the *Chronicles of Rodriguez* (1922); *Evil Kettle* (1926); *Old King's Tale* (1926).

DUNSINANE, a peak of the Sidlaw hills, in the parish of Collace, Perthshire, Scotland, 8 m. north-east of Perth. It is 1,012 ft. high, and commands a fine view of the Carse of Gowrie and the valley of the Tay. Its chief claim to mention, however, is due to its association with Birnam Wood (about 12 m. N.W.) in two well-known passages in Shakespeare's *Macbeth.* An old fort on the summit, of which faint traces are still discernible, is traditionally called Macbeth's castle.

DUNS SCOTUS, JOHN (*c.* 1265–1308), the famous *doctor subtilis* and the greatest British mediaeval philosopher, was born in the village of Duns, Scotland. He became a Franciscan and studied at Oxford, where shortly after 1290 he lectured on the *Sentences.* He then spent some four years in Paris, and after returning to Oxford, was again, by 1302, lecturer in Paris. There he received the master's licence. He was transferred to Cologne, where he died on Nov. 8, 1308.

Broadly speaking, Scotus, like Bonaventure and Pecham, seeks to defend the traditional Scholastic doctrines against Thomistic innovations (the same desire had already led Bishop Tempier of Paris to condemn in 1277 a number of Thomistic theories), and in so doing, incidentally manifests the scientific bent of the Oxford Franciscan school by his hesitation in accepting what others regard as proof. He is commonly represented only as a destructive critic of St. Thomas, which is to say, as a Franciscan antagonistic to a Dominican, but, in reality, the critical position involved in many of his famous speculations, *e.g.,* his doctrine of the Trinity, his formal distinction in God, the univocacy of being in God and creatures, and the importance of the *species intelligibiles,* applies to the system of Henry of Ghent, while his voluntaristic leanings are a protest against Godfrey of Fontaine's stress on the passivity of the will. His is the legitimate aim of contributing to philosophical speculation by evaluating the theories of others. Again, certain superficial readers have absurdly accused Scotus, whom Thomas Cromwell in the 16th century attacked as the great defender of Scholasticism, of pantheism, scepticism. Pelagianism, indeterminism, excessive realism, subjectivism and a host of other imaginable iniquities. These accusations are due either to the assumption of the genuineness of the *De Rerum Principio,* now rejected by all first-rate scholars, or to a lack of patience in coping with the subtle and extensive writings of Scotus.

Bearing in mind the common doctrines of the Schoolmen (*see* SCHOLASTICISM), the chief points of interest in the metaphysics of Scotus are his rejection of the Augustinian theory of *rationes seminales* in matter, a theory which he regards as uselessly multiplying entities and as destroying the true nature of becoming; his contention that matter is not pure passive potency but has some positive entity of its own and, therefore, by the absolute power of God, could exist apart from form; his denial of the numerical unity of matter in all things; his belief that the form is educed successively from the potency of matter, that the resulting composite has in itself both a universal and an individual nature, the latter, which for Scotus means repugnance to division into subjective parts, being due to none of the factors usually suggested, *e.g.,* negation, existence, accidents, matter and quantity, but to a positive entity *(haecceitas),* an *ultima realitas entis,* which is a unity of *this* matter with *this* form in *this* composite.

In cosmology his two most important doctrines are those which maintain that elements must remain at least virtually in compounds, since they can be regained from them, and that the Ptolemaic system of eccentric and epicycles is necessary to account for the phenomena observable in the movements of the celestial bodies.

In psychology, Scotus naturally upholds the theory of the plurality of forms in man, since he is interested in proclaiming the separability and independence of the rational soul and the body. The soul is created by God and is immortal, though its immortality for Scotus, contrary to the general Scholastic opinion, cannot be positively proved but only supported by possible persuasions. As regards the hylomorphic composition of the soul, a doctrine which had been proclaimed by all his Franciscan predecessors, Scotus neither accepts nor rejects it in his genuine works. The faculties of intellect, will and memory through which the soul acts, are for him, neither really distinct from the soul's essence, for that would imply their separability, nor only logically distinct, for then they would exist *potenfialiter* rather than *actualiter;* they are formally distinct, which is to say, they are inseparably founded in the essence *ex natura rei* and yet cannot be included in the same definition.

His view of cognition is very much the common Scholastic doctrine of moderate realism, except that he stresses the activity of the intellect, including the passive as well as the active intellect, and the importance of induction, that he rejects the Augustinian doctrine of Divine illumination, and that he maintains we have a direct though imperfect intuitive knowledge of singulars. In discussing our knowledge of spiritual beings, he denies that we have

an immediate knowledge of the self and that we can have any other than *a posteriori* proofs for the existence of God. His assertion that the concept of being which we apply to God is univocal with that applied to creatures, is meant to avoid agnosticism by proclaiming that our concept gives us some positive knowledge of the quiddity of being in God. He does not countenance pantheism by supposing that the actual realization of being in God is univocal with created being. All activities of the human intellect are closely related to those of the will, and hence, attention is a *sine qua non* for knowledge, just as much as a known object is essential for an act of will. Nevertheless, if the will requires such direction, it is not determined by the intellect. It is still able to deliberate and it alone must accept or reject. It is just this emphasis on the will which has led to Scotus being called an extreme voluntarist, but, in reality, the necessity of interaction between intellect and will is fully recognized by the subtle doctor, the primacy of the will being more pronounced only in the supernatural life.

In angelology, the chief contributions of Scotus are his indecision as to their hylomorphic composition, his denial that each angel is a complete species, his opinion that, if the angelic beings are capable of development, they must receive *species intelligibles* from externals and must also possess a passive as well as an active intellect, and his assertion that the angelic will has a dependency of activity as regards the intellect but a primacy of nature.

Finally in theodicy, the most important contributions of Scotus are his formal distinction between the Divine attributes and the Divine essence, which means that the attributes can be more than conceptual without imperilling the Divine simplicity; his rejection of Henry of Ghent's *esse essentiae simpliciter* for the existence of things in the mind of God before creation; his support of the Divine knowledge of singulars and of the necessity of interaction between the Divine intellect and will, the latter being limited only according to the distinction between God's absolute power and his ordained power; and lastly his discussion of the unsatisfactory objections both to the theory of the possibility of eternal creation and to that of the necessity of a temporal creation. The teaching of Scotus on the relation between reason and faith is practically that of St. Thomas.

BIBLIOGRAPHY.—The uncritical edition of the works of Scotus by Wadding, 13 vols. (Lyons, 1639) was reprinted at Paris, 26 vols. (1891–95). Of these, as E. Longpré, *La Philosophie du B. Duns Scot* (Paris, 1924), has shown, only the *Opus. Oxon.*, the *Rep. Paris, Quodl. De Primo Principio* and the *Quaestiones* on the *Metaphysics* can be unquestionably accepted as genuine.

As regards the life of Scotus, all that can be said with certainty has been summarized by A. G. Little, "The Franciscan School at Oxford" in *Arch. Fran. Hist.* (1926, p. 869 *sq.*). The most trustworthy accounts of the philosophy of Scotus are to be found in Longpré *(see* above); J. Klein, *Der Gottesbegriff des D. Scotus* (Paderborn, 1913); H. Klug, "Die Lehre des Scotus über Materie und Form" in *Philos. Jahrb.* (1917); P. Minpes, *Ist Duns Scotus Zndeterminirt* (Miinster, 1905) and *Der angeblich exzessive Realismus des Duns Scotus* (Miinster, 1908); R. Seeberg, *Die Theologie des Duns Scotus* (1900); *K.* Werner, *Die Psych. u. Erkenntnislehre des Scotus* (Vienna, 1877) and *Die Scholastik des spateren Mittelalters*, vol. i. (Vienna, 1881). B. Landry, *Duns Scot* (Paris, 1922) is most uncritical, and C. R. S. Harris, *Duns Scotus*, 2 vols. (Oxford, 1927) is largely based on the spurious *De Rerum Principio.* (D. E. SH.)

DUNSTABLE, a municipal borough and market town in the Luton parliamentary division of Bedfordshire, England, 34 mi. N.W. of London, served by the L.N.E. and L.M.S. railways. Pop. (1938) 13,760. Area 2,03j ac. It lies at an elevation of about 500 ft. on the northward slope of the Chiltern hills. The church of St. Peter embodies a fine fragment of the church of the Augustinian priory founded by Henry I including the west front and part of the nave, with rich Early English and Norman details. Foundations of a palace of Henry I are traceable near the church. The main part of the town extends for a mile along the Roman Watling street, while the high road from Luton to Tring, which crosses it in the centre of the town, represents the ancient Icknield way. The straw hat industry which formerly flourished here removed to Luton; but there is an extensive printing works, and brewing, foundry and chain works, besides a manufactory of spark plugs. The borough is under a mayor. 6 aldermen and 12 councillors, and has a separate commission of the peace.

It appears probable that there was a Romano-British village on this site corresponding to the *Forum Dianae* of the Romans. Many interesting fragments have been found, also a walled camp of *c.* A.D. 9, called "Maiden Bower." Dunstable *(Dunestaple, Donestaple)* appears as a royal borough in the reign of Henry I, who in 1331 founded and endowed a priory with the lordship of the manor and borough, which it retained till its dissolution in 1536–37. The *Dunstable Annals* deal exhaustively with the history of the monastery and town in the 13th century. At Dunstable Cranmer held the court which, in 1533, declared Catherine of Aragon's marriage invalid. At the Dissolution a plan was formed for the creation of a new bishopric to include Dunstable as cathedral city. The scheme was never realized, though plans for the cathedral were actually drawn up.

Dunstable has always been an agricultural town. The *Annals* abound with references to the prices and comparative abundance or scarcity of the two staple products, wool and corn. Henry I granted a market and fair, to which John added a second fair. A statute fair and the weekly market are still held. Dunstable had also a gild merchant and was affiliated to London. In 1864 the town was made a municipal borough. It was extended in 1933. Whipsnade, the country branch of the London zoo, was opened in 1931, occupying 500 ac. 33 mi. by road from Dunstable.

DUNSTAN, SAINT (909–988), English archbishop and son of a West Saxon noble, was born near Glsstonbury, where he was educated by the Irish pilgrims. He entered the household of King Aethelstan, but his love of books and of song and his mechanical skill soon excited the dislike of his kinsfolk at the court. Accused of practising the black arts, he took refuge with his kinsman, Alphege, bishop of Winchester, whose persuasion, seconded by a serious illness, induced him to become a monk. Dunstan then lived as a hermit near the old church of St. Mary until Aethelstan's successor, Edmund, recalled him as one of his counsellors. His enemies again procured his expulsion, but Edmund soon revoked the sentence, and about 943 made Dunstan abbot of Glastonbury. Under him the abbey became a famous school, monastic life was revived and St. Peter's re-erected. Edred, the successor of Edmund, left the administration of the realm largely in the control of Dunstan, who sought to establish royal authority, to conciliate the Danish section, to uproot heathenism and to reform the secular clergy and the laity. On the accession of Edwig, however, in 955, Dunstan's fortunes underwent a temporary eclipse. Having given offence to the influential and unprincipled Aelfgifu, he was outlawed and driven to Flanders. But in 957 the Mercians and Northumbrians revolted and chose Edgar as their king. The new king at once recalled Dunstan, who was appointed to the see of Worcester as soon as it fell vacant. In 959 he also received the bishopric of London. In the same year Edwig died and Edgar became sole king. Dunstan now became archbishop of Canterbury. On Edgar's death in 975 the archbishop secured the crown for his elder son, Edward. who was murdered three years later. On the accession of Aethelred Dunstan's public career came to an end; he retired to Canterbury. where he died on May 19, 988.

Dunstan was one of the chief English saints until his glory was overshadowed by Thomas à Becket. He sought to reform monasticism according to the strict observance of the Benedictine rule, which he had seen at the abbey of Blandinium, near Ghent, during his exile under Edwig, and by the re-building of churches and the promotion of education, he endeavoured to uplift his people. In political matters his policy was, as we have said, one of unification and of respect for law.

See *Memorials of St. Dunstan,* edit. *W.* Stubbs in the *Rolls Series* (1874); *Anglo-Saxon Chronicle,* edit. C. Plummer (Oxford, 1892–99); the *Bosworth Pralter,* edit. Bishop and Gasguet (1908); Freeman, *The Norman Conquest,* vol. i. (Oxford, 1870) and J. A. Robinson, *The Times of St. Dunstan* (Oxford, 1923).

DUNSTAN, SIR WYNDHAM ROWLAND (1861–), C.M.G. (1913), K.C.M.G. (1924), English scientist, was born at Chester on May 24, 1861. He was director of the Imperial Institute, London, from 1903 to 1924. Dunstan wrote many chemical papers, notably on the pharmacology of the alkaloids, and on the aconite alkaloids in particular. He was concerned in the identi-

fication of the new mineral, thorianite, which he isolated during an examination of the minerals of Ceylon. An account of the properties, composition and uses of this mineral are given by Dunstan in his parliamentary paper, *Mineral Survey in Ceylon 1903–04* (1905). During his term of office as director of the Imperial Institute, Dunstan visited Cyprus, Asia Minor, India and Newfoundland at the request of the Colonial Office. Reports on agricultural and mineral resources were presented to parliament. Dunstan, a distinguished member of many learned societies connected with science, geography and agriculture, has acted also as a member of a number of Government committees on mineral resources, agriculture, etc.

His works include *British Cotton Cultivation* (1904 and 1908), *Agricultural Resources of Cyprus* (1906), *Agricultural Resources in* Asia *Minor* (1908) and *Cotton Cultivation of the World* (1910)

DUNSTER, a town in the Bridgwater parliamentary division of Somersetshire, England, 1½ mi. from the shore of the Bristol channel, on the Minehead branch of the G.W. railway. Pop. of civil parish (1931) 839. Its streets, sloping sharply, contain many old houses. On an eminence stands the ancient castle, with its two massive gateways of the 13th and 15th centuries and other early portions, though it has been restored and modernized as a residence. The church of St. George, with its fine tower, is mainly Perpendicular, but has Norman and Early English portions. Near the church are traces of the Benedictine house to which it was attached. The Yarn market, a picturesque octagonal building with deep sloping roof, in the main street, dates from *c.* 1600. There were British, Roman and Saxon settlements at Dunster (*Torre Dunestorre, Dunester*), fortified against the piracies of the Irish Northmen. The Saxon fort of Alaric was replaced by a Norman castle, dating from the Domesday Survey, built by William de Mohun, first lord of Dunster, who founded the priory of St. George. Before 1183, Dunster had become a mesne borough, owned by the de Mohuns until the 14th century when it was sold to the Luttrells, the present owners. Reginald de Mohun granted the first charter between 1245 and 1247. John de Mohun granted other charters in 1301 and 1307. Dunster was represented in parliament in conjunction with Minehead, one of its tithings being part of that borough. Representation began in 1562, and was lost in 1832. During this time the port had a considerable wool, corn and cattle trade with Ireland. In the middle ages the Friday market and fair in Whit week, granted by the first charter, were centres for the sale of yarn and cloth called "Dunsters," made in the town. With the silting up of the harbour, its importance as a port disappeared. An 18th century tower on Conegar hill forms a well-known landmark.

See Sir *H. C.* Maxwell Lyte, *Dunster and its Lords* (1882); *Victoria County History, Somerset,* vol. ii.

DUNTOCHER (Gaelic, "The Fort of ill hap"), a small town on Dalmuir Burn, Dumbartonshire, Scotland, 9 m. from Glasgow. The district contains coal, limestone and ironstone, but there is not much mining. There are considerable Roman remains in the neighbourhood. Antoninus' Wall passed immediately to the south; the burn is crossed by a bridge doubtfully alleged to be of Roman origin; subterranean remains indicate a Roman structure; a Roman camp has been traced, and the vicinity has yielded a number of altars, urns, vases, coins and tablets, which are now in the custody of Glasgow university.

DÜNTZER, JOHANN HEINRICH JOSEPH (1813–1901), German philologist and historian of literature, was born at Cologne on July 12, 1813. Educated at Bonn and Berlin he settled in 1837 at Bonn as *Privatdocent* for classical literature. He had already, in his *Goethes Faust in seiner Einheit und Ganzheit* (1836) and *Goethe als Dramatiker* (1837), advocated a new critical method in interpreting the German classics, which he wished to see treated like the ancient classics. In 1846 he became librarian at the Roman Catholic gymnasium in Cologne, where he died on Dec. 16, 1901.

Of his works on the German classical poets, especially on Goethe, Schiller and Herder. may be mentioned *Aus Herders Nachlass* (3 vols., 1856–57); *Schiller und Goethe; Übersicht und Erläuterung zum Briefwechsel zwischen Schiller und Goethe* (1859); *Goethes Leben* (1880; 2nd ed. 1883; Eng. trans, 1884); *Schillers Leben* (1881); *Abhandlungen zu Goethes Leben und Werken* (a vols. 1885).

DUNWICH, a village in the Eye parliamentary division of East Suffolk, England, on the coast, 5 mi. S.S.W. of Southwold. Pop. of civil parish (1931) 174. This was in Anglo-Saxon days the most important commercial centre and part of East Anglia. It was probably a Romano-British site. Early in the 7th century, when Sigebert became king of East Anglia, Dunwich was chosen his capital and became the nursery of Christianity in eastern Britain. A bishopric was founded (according to Bede in 630, while the Anglo-Saxon chronicle gives 635), the name of the first bishop being Felix. Sigebert's reign was notable for his foundation of a school modelled on those he had seen in France; it was probably at Dunwich, but formed the nucleus of what afterwards became the University of Cambridge. By the middle of the 11th century Dunwich had already suffered from an evil which later caused its total ruin, namely the inroads of the sea upon the coast. At the Norman Conquest the manor was granted to Robert Malet. In 1173 the sight of its strength caused Robert earl of Leicester to despair of besieging Dunwich. The town received a charter from King John. In the reign of Edward I it is recorded to have possessed 36 ships and "barks," trading to the North seas, Iceland and elsewhere, with 24 fishing boats, besides maintaining 11 ships of war. The Benedictines, Franciscans and Dominicans all maintained establishments here. In 1347 more than 400 houses were washed away. In 1570, after a terrible storm, appeal was made to Elizabeth. But the old wealthy port was gradually engulfed and inroads of the sea still continue, the ruined tower of the old church having gone over the cliff during World War I. Many relics have been discovered by excavation, and even from beneath the waves. Until 1832 Dunwich returned two members to parliament. The corporation was abolished in 1886, and part of the civil parish was transferred to Southwold in 1934. In the same year a bishopric suffragan to St. Edmundsbury was constituted, receiving the name Dunwich.

DUPANLOUP, FÉLIX ANTOINE PHILIBERT (1802–1878), French ecclesiastic, was born at St. Félix in Savoy on Jan. 3, 1802, and educated at the seminaries of St. Nicolas de Chardonnet and of St. Sulpice, Paris. In 1825 he was ordained priest, and was appointed vicar of the Madeleine at Paris, being for a time tutor to the Orleans princes. He became the founder of the celebrated academy at St. Hyacinthe, and received a letter from Gregory XVI. eulogizing his work there, and calling him *Apostolus juventutis.* He became a canon of Notre-Dame in 1845. When made bishop of Orleans in 1849, he pronounced a fervid panegyric on Joan of Arc, which attracted attention in England as well as France. Before this he had been sent by Archbishop Affre to Rome, and had been appointed Roman prelate and protonotary apostolic. He was a distinguished educationalist who fought for the retention of the Latin classics in the schools and instituted the celebrated catechetical method of St. Sulpice. Among his publications are *De l'éducation* (1850), *De la haute éducation intellectuelle* (3 vols., 1866), *Oeuvres choisies* (1861, 4 vols.); *Histoire de Jésus* (1872), a counterblast to Renan's *Vie de Jésus.* He died on Oct. 11, 1878.

See F. Lagrange, *Life* (Eng. tr. *by* Lady Herbert, 1885) and E. Faguet, *Mgr. Dupanloup* (1914).

DUPERRON, JACQUES DAVY (1556–1618), French cardinal, was born at St. Lô, in Normandy, on Nov. 15, 1556, the son of a Protestant minister, who settled at Berne, Switzerland, where Jacques Davy received his education. Returning to Normandy he abjured Protestantism and took orders. On the death of Henry III., after having supported for some time the cardinal de Bourbon, the head of the league against the king, Duperron became a faithful servant of Henry IV., and in 1591 was created by him bishop of Evreux. He instructed Henry in the Catholic religion; and in 1594 was sent to Rome, where with Cardinal d'Ossat (1536–1604) he obtained Henry's absolution. At the conference at Fontainebleau in 1600 he argued with much eloquence and ingenuity against Du Plessis Mornay (1549–1623). In 1604 he was sent to Rome as *chargé d'affaires.* While still at Rome he was made a cardinal, and in 1606 became archbishop of Sens. In the states-general of 1614 he vigorously upheld the

ultramontane doctrines against the Third Estate. He died in Paris on Sept. 6, 1618.

See *Les Diverses Oeuvres de l'illustrissime Cardinal Duperron* (1622); Pierre Féret, *Le Cardinal Duperron* (1877).

DUPIN, ANDRE MARIE JEAN JACQUES (1783–1865), commonly called Dupin the elder, French advocate, president of the chamber of deputies and of the Legislative assembly, was born at Varzy, in Nièvre, on Feb. 1, 1783. Entering the chamber of deputies in 1815, he joined the Liberal opposition. At the election after the second restoration Dupin was not re-elected. He defended with great intrepidity the principal political victims of the reaction, among others, in conjunction with Nicolas Berryer, Marshal Ney; and in October 1815 published a tractate entitled *Libre Défense des accusés.* In 1827 he was again elected a member of the chamber of deputies and in 1830 actively supported the revolution. At the end of 1832 he became president of the chamber, which office he held successively for eight years. On Louis Philippe's abdication in 1848 Dupin introduced the young count of Paris into the chamber, and proposed him, in vain, as king, with the duchess of Orleans as regent. In 1849 he was president of the committee of the Assembly on legislation. After the *coup d'ktat* of Dec. 2, 1851, he retained his office of *procureur-général,* until effect was given to the decrees confiscating the property of the house of Orleans. In 1857 he was offered his old office by the emperor, and accepted it, explaining his acceptance by the words: "I have always," he said, "belonged to France and never to parties." He died on Nov. 8, 1865. Among Dupin's works, which are numerous, may be mentioned *Principia Juris Civilis,* 3 vols. (1806), *Mkmoires et plaidoyers de 1806 au Ier janvier 1830,* in 20 vols., and *Mkmoires ou souvenirs du barreau,* in 4 vols. (1855–57). But his greatest work was his share in the codification of the laws of the empire, of which he had sole charge after the interruption of the work of the commission after 1815.

His brother, FRANÇOIS PIERRE CHARLES DUPIN (1784–1873), wrote several geometrical works, treating of descriptive geometry after the manner of Monge, and of the theory of curves.

DUPIN, LOUIS ELLIES (1657–1719), French ecclesiastical historian, was born at Paris on June 17, 1657, and educated at the college of Harcourt and the Sorbonne, receiving his B.D. (1680) and D.D. (1684). The first volume of his *Bibliothèque universelle de tous les auteurs ecclésiastiques* appeared in 1686, but the liberty with which he treated the doctrines of the Fathers aroused the prejudice of ecclesiastics, including Bossuet, and, although he consented to a retractation, the book was suppressed in 1696. He was subsequently exiled to Châtellerault as a Jansenist, but the sentence of banishment was repealed on a new retractation. His correspondence with William Wake, archbishop of Canterbury, with a view to a union of the English and Gallican Churches, threw further suspicion upon him. The same zeal for union induced him, during the residence of Peter the Great in France, and at that monarch's request, to draw up a plan for uniting the Greek and Roman Churches. He died at Paris on June 6, 1719. Besides his great work, Dupin wrote a *Bibliothèque universelle des historiens* (2 vols., 1707); *L'Histoire de l'église en abrégé* (1712); and *L'Histoire profane depuis le commencement du monde jusqu'à présent* (4 vols., 1712).

DUPLEIX, JOSEPH FRANÇOIS (1697–1763), governor-general of the French establishment in India, the great rival of Clive (*q.v.*), was born at Landrecies, France, on Jan. 1, 1697. His father, François Dupleix, a wealthy farmer-general, sent him on a voyage to India in 1715 on one of the French East India Company's vessels. He made several voyages to America and India, and in 1720 was named a member of the superior council at Pondicherry. There, in addition to his official duties, he made large ventures on his own account and acquired a fortune. In 1730 he was made superintendent of French affairs in Chandernagore, which he administered with great success, and in 1742 he was appointed governor-general of all French establishments in India. He determined to acquire for France vast territories in India. The British took the alarm; but the danger to their settlements and power was partly averted by the bitter mutual jealousy between Dupleix and La Bourdonnais, French governor of the isle of Bourbon. When Madras capitulated to the French in 1746 Dupleix opposed the restoration of the town to the British thus violating the treaty signed by La Bourdonnais. He then sent an expedition against Fort St. David (1747), which was defeated on its march by the nawab of Arcot, the ally of the British. Dupleix succeeded in gaining over the nawab and again attempted the capture of Fort St. David, but unsuccessfully. A midnight attack on Cuddalore was repulsed with great loss. In 1748 Pondicherry was besieged by the British; but in the course of the operations news arrived of the peace of Aix-la-Chapelle. Dupleix next entered into negotiations which had for their object the subjugation of southern India, and he sent a large body of troops to the aid of two claimants of the sovereignty of the Carnatic and the Deccan. The British were engaged on the side of their rivals. After temporary successes the scheme failed. Though Dupleix was a great organizer, he did not possess Clive's genius for war. The conflicts between the French and the British in India continued till 1754, when the French government, anxious to make peace, sent out to India a special commissioner, Godeheu, a director of the *Compagnie des Indes,* with orders to supersede Dupleix and, if necessary, to arrest him. Dupleix's work was ruined at a blow, and he himself was compelled to embark for France on Oct. 12, 1754. He had spent his private fortune in the prosecution of his public policy; the company refused to acknowledge the obligation; and the government would do nothing for a man whom they persisted in regarding as an ambitious and greedy adventurer, The greatest of French colonial governors died in obscurity and want on Nov. 10, 1763. In 1741 he had married Jeanne Albert (d. 1756), widow of one of the councillors of the company, a woman of strong character and intellect, known to the Hindus as Joanna Begum, who proved of great use to her husband in his negotiations with the native princes. Dupleix defended his case against the company in a Mémoire—*Contre la Compagnie des Indes avec les pièces justicatives* (1751), to which Godeheu replied in his *Lettre à M. Dupleix* (1760).

See Tibulle Hamont, *Dupleix, d'après sa correspondance inédite* (1881); H. Castonnet, *Dupleix, ses expéditions et ses projets* (1888) and *La Chute de Dupleix* (Angers, 1888); G. B. Malleson, *Dupleix* (1890) and *History of the French in India* (1894); P. Cultru, *Dupleix, ses plans politiques; sa disgrace* (1901); E. Guérin, *Dupleix* (1908); A. A. Martineau, *Dupleix et l'Inde française, 1722–1754,* 3 vols. (Paris, 1920–27).

DUPLICATING MACHINES: *see* OFFICE APPLIANCES.

DUPONT, PIERRE (1821–1870), French song-writer, the son of a blacksmith, was born at Lyons on April 23, 1821. He was brought up in the country by his godfather, a village priest, and apprenticed to a notary at Lyons. In 1839 he found his way to Paris, and some of his poems were inserted in the *Gazette de France* and the *Quotidienne.* Two years later he was saved from the conscription and enabled to publish his first volume, *Les Deux Anges,* through the exertions of a kinsman and of Pierre Lebrun. Gounod's appreciation of his peasant song, "J'ai deux grands boeufs dans mon étable" (1846), settled his vocation as a song-writer. He had to engage Ernest Reyer to write down his airs. He sang his own songs, as they were composed, at the workmen's concerts in the Salle de la Fraternité du Faubourg Saint-Denis; the public performance of his famous *Le Pakz* was forbidden; *Le Chant des ouvriers* was even more popular; and in 1851 he was condemned to seven years' exile. The sentence was cancelled, and for a time Dupont renounced politics. He died at Lyons on July 24, 1870. His songs have appeared in various forms, *Chants et chansons* (3 vols., with music, 1852–1854), *Chants et poésies* (7th ed., 1862), etc. Among the best-known are "Le Braconnier," "Le Tisserand," "La Vache blanche," and "La Chanson du blé."

See Sainte-Beuve, *Causeries du lundi,* iv.; Ch. Baudelaire, *Notice sur P. Dupont* (1849); Déchaut, *Biographie de Pierre Dupont* (1871); Ch. Lenient, *Poesie patriotique en France* (1889), ii. 352 *et seq.*

DU PONT, THOMAS COLEMAN (1863–1930), American manufacturer and statesman, was born at Louisville, Ky., Dec. 11, 1863. He was educated at the Massachusetts Institute of Technology, and entered the Kentucky coal and iron mining industries in 1883. In 1900 he removed to Wilmington, Del.,

being president, 1902–15, of the E. I. du Pont de Nemours Powder company. Appointed senator in July 1321, in place of Josiah O. Wolcott, who had resigned, he failed to secure election on the Republican ticket in 1922, but was successful in 1924. He built a concrete motor highway at a cost of $4,000,000 in the State of Delaware, and made a gift of it to the State.

His cousin, PIERRE SAMUEL DU PONT (1870–), having graduated from the Massachusetts Institute of Technology in 1890, engaged in manufacturing at Wilmington. He became chairman of the board of the E. I, du Pont de Nemours Powder company, and also chairman of the General Motors Corporation. The E. I. du Pont company, which originally confined its activities to the making of explosives, under his guidance engaged in the manufacture of artificial silk, motion-picture films, paints and varnishes.

DUPONT, an anthracite-mining borough of Luzerne county, Pa., U.S.A., half way between Scranton and Wilkes-Barre, on the Lackawanna and Wyoming Valley railroad. The population in 1920 was 4,576 (33% foreign born), and 5,278 in 1940.

DUPONT DE L'ÉTANG, PIERRE ANTOINE, COUNT (1765–1840), French general, born at Chabanais on July 4, 1765, first saw active service as a member of Maillebois' legion in Holland, and in 1791 was on the staff of the Army of the North under Dillon. He rose rapidly, and in the campaign of 1800 he was chief of the staff to Berthier. After the battle of Marengo he defeated the Austrians at Pozzolo. In the campaign on the Danube in 1805, as the leader of one of Ney's divisions, he prevented the escape of the Austrians from Ulm, and so contributed to the subsequent capture of Mack and his whole army (see NAPOLEONIC CAMPAIGNS). At Friedland he won further fame. He entered Spain in 1808 at the head of a corps. After the occupation of Madrid, Dupont, newly created count by Napoleon, was sent to subdue Andalusia, but had to retire on the passes of the Sierra Morena. Pursued and cut off by the Spanish army under Castaños, his corps was defeated and capitulated (Baylen, July 19–23; see PENINSULA WAR). His troops were for the most part raw levies, and ill-luck contributed materially to the catastrophe, but Dupont was deprived of his rank and title, and imprisoned from 1812 to 1814. On April 3, 1814, his nomination as minister of war was confirmed by Louis XVIII., but his portfolio was removed from him on Dec. 3, owing to his incompetence. Appointed commander of the 22nd military division, he lost his post at the return of Napoleon, hut after Waterloo recovered it. After the Second Restoration he was a member of the *conseil privé* of Louis XVIII. From 1815 to 1830 he was deputy for the Charente. He lived in retirement from 1832 till his death in Paris on March 8, 1840.

Amongst the writings Dupont left are some poems, including *L'Art* de la *guerre* (1838), and verse translations from Horace (1836), and some military works.

See Lieut.-Col. Titeux, *Le Général Dupont: une erreur historique* (1903).

DUPONT DE L'ÉURE, JACQUES CHARLES (1767–1855), French lawyer and statesman, was born at Neubourg, Eure, in Normandy, on Feb. 27, 1767. In 1789 he was an advocate at the parlement of Normandy. In 1798 he was a member of the Council of Five Hundred, and in 1813 he became a member of the Corps Législatif. During the Hundred Days he was vice-president of the chamber of deputies, and when the allied armies entered Paris he was one of the commissioners to negotiate with the allied sovereigns. From 1817 till 1849 he was uninterruptedly a member of the chamber of deputies, acting consistently with the liberal opposition. For a few months in 1830 he held office as minister of justice, but resigned before the close of the year and resumed his place in the opposition. At the revolution of 1848 Dupont de l'Eure was made president of the provisional assembly as being its oldest member. He died at Rouge-Peniers, Eure, on Mar. 2, 1855. His fidelity to the cause of constitutional Liberalism won for him the name of the Aristides of the French tribune.

DU PONT DE NEMOURS, PIERRE SAMUEL (1739–1817), French economist and statesman, one of the founders of the school of "Physiocrats," was born at Paris on Sept. 14, 1739. He became intimate with François Quesnay, Turgot and other leaders of the school known as the "economists," and advocated their doctrine of free trade in his Exportation et importation *des* grains (1764). The Physiocratic School (*q.v.*) took its name from Du Pont's treatise, Physiocratie, ou constitution *naturelle du* gouvernement *le* plus *avantageux* au geare *humain* (1768). An admirably clear expression of the doctrine is given in his De *l'origine et* des *progrès d'une* science nouvelle (1767). Du Pont aided Turgot during his brief period of office (1774–76). He was recalled from retirement by Vergennes in 1782 to negotiate with the English commissioner, Dr. James Hutton, for recognition of the independence of the United States (1782), and to prepare a treaty of commerce with Great Britain (1786). Under Calonne he became councillor of State, and was appointed commissary-general of commerce.

Du Pont was a member of the states-general, and then of the Constituent Assembly, of which he was elected president on Oct. 16, 1790. But after Aug. 10, 1792, when he took the side of the king, he was driven into hiding. He was eventually arrested and imprisoned in La Force (1794). The death of Robespierre saved him from the guillotine. As a member of the Council of Five Hundred, Du Pont was a leader of the reaction. After the republican triumph on the 18th Fructidor (Sept. 4), 1797 his house was sacked by the mob, and in 1799 he emigrated to the United States. Jefferson requested him to prepare a scheme of national education, which was published in 1800 under the title *Sur l'éducation* notionale *dans les Etats-Unis d'Amérique.* Though the scheme was not carried out in the United States, several of its features have been adopted in the existing French code. On his return to France in 1802 he was elected to the *Institut.* In 1814 he was secretary to the provisional Government, and on the restoration he was made a councillor of State. In 1815 he returned to America, and died at Eleutherian Mills near Wilmington, Delaware, on hug. 6, 1817.

The powder-mills founded by his son Eleuthère at Wilmington, brought the family considerable wealth. Du Pont's grandson, Admiral Samuel Francis Du Pont (1803–65), played a conspicuous part as a U.S. naval officer in the American Civil War.

See Schelle, *Du Pont de Nemours et l'école physiocratique (1888).*

DU PONT DE NEMOURS AND COMPANY, E. I., organized in 1802 as a gunpowder company, has developed into a world-known chemical manufacturing corporation with 80 factories in 2; States and with connections in many foreign countries. Among the products of the company are explosives, acids and chemicals, synthetic ammonia, industrial alcohols, dyes, lacquers, paints, pigments, coated fabrics, rayon, cellulose film, photographic film and plastics. Its explosives have helped to build canals. railroads, highways and tunnels, and to extract coal, oil and minerals. Its dyes, nitrogen products, camphor, neoprene chemical rubber and nylon have contributed importantly to the nation's self-sufficiency. It has been the chief source of military explosives in all wars of the United States since 1802, and in the World War of 1914–18 it supplied 40% of the explosives used by the Allies. Since then, however, less than 2% of its income has been derived from military sales. It has had eight presidents, all members of the du Pont family. Headquarters are at Wilmington, Del., the site of the original powder plant, long since abandoned, built by Eleuthère Irénée du Pont de Nemours, its founder. nho had learned to manufacture powder in the French Government factory. (L. DU P.)

DU PONT HIGHWAY: see COLEMAN DU PONT ROAD.

DUPORT, JAMES (1606–1679), English classical scholar, was born in Cambridge. In 1639 he was appointed regius professor of Greek there, in 1664 dean of Pcterborough, and in 1668 master of Magdalen college. Throughout the Civil War, in spite of the loss of his clerical offices and eventually of his professorship, Duport continued his lectures. He is best known by his Homeri *gnomologia* (1660), a collection of the aphorisms in the Iliad and Odyssey, illustrated by quotations from the Bible and classical Literature. His other published works chiefly consist of translations (from the Bible and Prayer Book into Greek) and short original poems (Norae *subsecivae* or *Stromata* and *Sylvae*;

Duport did much to keep alive the study of classical literature in his day.

The chief authority for the life of Duport is J. H. Monk's "Memoir" (1825); *see* also Sandys, *Hist. Class. Schol.* (1908), ii. 349.

DUPPLIN MOOR, scene of the battle of Dupplin, Aug. 9, 1332. This battle is of importance not only as the turning point in the Scottish Wars but as the birthplace of the tactics which gained the English victories later against France in the Hundred Years War (*q.v.*). The series of defeats suffered by Edward II. in Scotland, and the initial failure of Edward III., had led to the Peace of Northampton. As a consequence, the Scottish supporters of the Plantagenets were disinherited. but, headed by Edward Baliol and Henry de Beaumont, they organized an expedition to regain their fiefs. Edward III., bound by the treaty, not merely refused help but prohibited them from crossing the border. Not to be baulked, they collected a small force of English archers and men-at-arms, hired ships, and, sailing from Ravenspur, landed at Kinghorn in Fife. Thence they marched on Perth but were met at the river Earn by a large Scottish army under the earl of Mar. Trying to discount their inferiority by the use of surprise, the "disinherited" crossed the river under cover of darkness and made an audacious night onslaught on the rear of the Scottish camp. But this only affected part of the enemy's bivouac, and at day-break the main force moved out in battle order to swamp their puny adversary. The "disinherited" fell back to the slopes of Dupplin muir, and there the knights and men-at-arms dismounted to form a phalanx of spears, while the archers spread out in a dispersed line amid the heather on either flank. Only 40 men-at-arms were kept mounted as a reserve. The Scottish, all dismounted according to their custom, charged direct at the opposing men-at-arms, disregarding the archers. Once spears were locked the charge lost impetus and the archers, closing in from either side, poured a hail of arrows into the press, which grew ever denser until the close-locked mass became helpless to use their weapons. Held in front and galled on both flanks, those who could, broke away and fled, pursued by the "disinherited" horse, and those in the centre fell easy victims.

See J. E. Morris, *Eng. Historical Review* (1897); Oman, *History of the Art of War in the Middle Ages* (1924).

DU PRAT, ANTOINE (1463–1535), chancellor of France and cardinal, was born at Issoire on Jan. 17, 1463. He began life as a lawyer, and rose rapidly in the legal hierarchy owing to the influence of his cousin Antoine Bohier, cardinal archbishop of Bourges. In 1507 he became first president of the parlement of Paris. Louise of Savoy had employed him as her adviser in her affairs, and had made him tutor to her son. When Francis I. ascended the throne he made Du Prat chancellor of France. During the regency of Louise of Savoy he, together with Florimond Robertet, was at the head of affairs. After the death of his wife in 1507 Du Prat had taken orders; he received the bishoprics of Valence, Die, Meaux and Albi, and the archbishopric of Sens (1525); in 1527 he became cardinal, and in 1530 papal legate. He was a determined adversary of the Reformation. He died at Nantouillet on July 9, 1535.

See the marquis Du Prat, *Vie d'Antoine* Du *Prat* (1857).

DUPRE, GIOVANNI (1817–1882), Italian sculptor, born in Siena on March 1, 1817. After having learned the craft of his father, a carver in wood, he worked in Siena, Pistoia, Pisa, Livorno and in Florence, where he associated with the sculptor Cambi. By drawing and modelling in his spare time he succeeded in winning the prize-competition of the academy in 1840 without having attended the academy schools. His first work of importance was "Abel" (1842, Pitti, Florence). It attracted much notice. He was befriended by L. Bartolini, a distinguished sculptor; the grand-duchess Maria of Russia commissioned him with a statue of "Cain" (1844, Pitti); the grandduchess of Tuscany with "Giotto" (1845, Arcades of the Uffizi, Florence). The mourning Sappho (1857) is his most famous work of this period. His success was due to his lifelike and original interpretation of form at a time when Italian sculpture was deteriorating into a mannered imitation of Canova. A visit in 1856 to Naples and Rome, where he admired Canova's monument to Pius VI., influenced him towards a more ideal conception of form, contrasting with the naturalism of his early period. Among his later work we may mention a "Pieta" in the cemetery of Siena, executed for the Bichi-Ruspoii family and the monument of Cavour in Turin. His realistic treatment of form here seems to conflict with the allegorical elements of the composition. Dupre also executed many portrait busts. He died in Florence on Jan. 10, 1882.

His autobiography *Pensieri sull' Arte e Ricordi Autobiographici* (1882) was translated into English by Peruzzi.

DUPRÉ, JULES (1811–1889), French painter, and one of the chief members of the Barbizon group of romantic landscape painters, was born at Nantes, and died at L'Isle Adam, Oct. 6, 1889. If Corot stands for the lyric and Rousseau for the epic aspect of the poetry of nature, Dupré is the exponent of her tragic and dramatic aspects. He was the son of a porcelain manufacturer and started his career in his father's works, whence he went to his uncle's china factory at Sèvres. Dupré exhibited first at the Salon in 1831, and three years later was awarded a second-class medal. In the same year he came to England, where he was deeply impressed by the genius of Constable. From him he learnt how to express movement in nature; and the district of Southampton and Plymouth, with its wide, unbroken expanses of water, sky and ground, gave him good opportunities for his special gifts. Late in life he changed his style, and gained appreciably in largeness of handling and arrived at greater simplicity in his colour harmonies. Among his best known works are the "Morning" and "Evening" at the Louvre, the early "Crossing the Bridge" in the Wallace collection, and the "River Scene" now in the Tate Gallery, London.

See Jules Claretie, *Peintres et sculpteurs contemporains* (2nd series, 1884).

DUPUIS, CHARLES FRANÇOIS (1742–1809), French author and politician, was born of poor parents at Trye-Château, near Gisors. He represented Seine-et-Oise in the Convention, was secretary to the Assembly in An III. and a member of the Council of Five Hundred in An IV. After the 18th Brumaire he was a member of the Legislative Body, eventually becoming its president. In 1781 he had published a memoir on the origin of the signs of the zodiac, which he placed in Upper Egypt, and on the connection with the whole fabric of the mythology of the ancients His chief work, *Origine de tous les cultes* (3 vols., 1795), developing his theories, aroused a bitter controversy, and was one of the factors which led Napoleon to send a scientific expedition to Upper Egypt. The *Origine* passed through many editions (modern ed. 1876), and the author himself published an abridged edition in 1798. Dupuis died on Sept. 29, 1809.

DUPUY, CHARLES ALEXANDRE (1851–1923), French statesman, born at Le Puy (Haute Loire) on Nov. 5, 1851. In 1885 he was elected to the chamber as an Opportunist Republican, and became minister of public instruction in Ribot's cabinet, in 1892. In April 1893 he formed a ministry himself, but resigned at the end of November, and on Dec. 5 was elected president of the chamber. During his first week of office the anarchist Vaillant, who had gained admission to the chamber, threw a bomb at the president, and M. Dupuy's collected bearing, and his historic words: "Messieurs, la séance continue," gained him much credit. In May 1894 he again became premier and minister of the interior; and he was by President Carnot's side when the latter was assassinated at Lyons in June. His cabinet remained in office till January 1895; it was under it that Captain Dreyfus (*q.v.*) was arrested and condemned (Dec. 23, 1894). In November 1898, after Brisson had at last remitted the case to the judgment of the court of cassation, Dupuy formed a cabinet of Republican concentration. It was no sooner discovered that the judges were likely to decide in favour of Dreyfus than Dupuy proposed a law in the chamber transferring the decision to a full court of all the divisions of the court of cassation. This arbitrary act, though adopted by the chamber, was at once construed as a fresh attempt to maintain the judgment of the first court-martial; but the whole court of cassation decided that there must be a new court-martial, and Dupuy at once resigned (June 1899). In June 1900 he was elected senator for the Haute-Saône. He died in 1923.

DUPUY, PIERRE (1582–1651), French scholar, otherwise known as PUTEANUS, was born at Agen (Lot-et-Garonne). In 1615 he was commissioned by Mathieu Molé, first president of the parlement of Paris, to catalogue the "Trésor des chartes." His ms. inventory is preserved in the original and in copy in the Bibliothèque Nationale, and transcriptions are in the national archives in Paris, at the record office in London, and elsewhere. Dupuy and his brother then bought from Rigault the post of keeper of the king's library, and drew up a catalogue of the library. He was author of some important books, written from the Gallican standpoint, on the history of the relations of Church and State in the middle ages. Dupuy died in Paris on Dec. 14, 1651.

DUPUY DE LOME, STANISLAS CHARLES HENRI LAURENT (1816–1885), French naval architect, the son of a retired naval officer, was born at Ploemeur, near Lorient, on Oct. 15, 1816. He entered the École Polytechnique in 1835, and in 1842 was sent to England to study and report on iron shipbuilding. Acting on his report, which was published in 1844, the Government built their first iron vessels under his supervision. He planned and built the steam line-of-battle ship "Napoléon" (1848–1852), and devised the method of altering sailing ships, of the line into steamers, which was afterwards extensively practised in both France and England. He also showed the practicability of armouring the sides of a ship, and the frigate "Gloire" gave a very clear demonstration of his views. It was the beginning of a great change in the construction of ships. At the beginning of the Franco-German War Dupuy sat on the committee of defence, and during the siege of Paris planned a steerable balloon, for carrying out which he was given a credit of 40,000 fr ; but the balloon was not ready till a few days before the capitulation. In 1877 he was elected a senator for life. He died in Paris on Feb. 1, 1885.

DUQUE DE ESTRADA, DIEGO (1589–1647), Spanish memoir writer, soldier and adventurer, was born at Toledo. He left a book of amazingly vivid memoirs, entitled *Comentarios* de el *Desengañado* de *si* Mismo, *prueba* de todos estados, y *elección del* Mejor de ellos—"The Commentaries of one who knew his own little worth, the touchstone of all the states of man, and the choice of the best."

The memoirs have been reprinted by Don Pascual de Gayangos in the Memorial histdrico *español,* vol. xii. (1860).

DUQUESNE, ABRAHAM, MARQUIS (1610–1688), French naval officer, was born at Dieppe in 1610. He spent his youth in the merchant service, and captured the island of Lerins from the Spaniards in May 1637. About the same time his father was killed in an engagement with the Spaniards, and the news raised his hatred of the national enemy to the pitch of a personal and bitter animosity. He distinguished himself in the engagement at Guetaria (1638), the expedition to Corunna (1639) and in battles at Tarragona (1641), Barcelona (1643) and the Cabo de Gata. Serving as a volunteer in the Swedish service in 1643, he defeated the Danish fleet near Gothenburg and thus raised the siege of the city. The Danes returned to the struggle with increased forces under the command of King Christian in person, but they were again defeated—their admiral being killed and his ship taken. On the conclusion of peace between Sweden and Denmark in 1645, Duquesne returned to France. The revolt at Bordeaux, supported as it was by material aid from Spain, gave him the opportunity of at once serving his country and gratifying his long-cherished hatred of the Spaniards. In 1650 he fitted out at his own expense a squadron with which he blockaded the mouth of the Gironde, and compelled the city to surrender. Peace with Spain was concluded in 1659, and Duquesne was then occupied in suppressing piracy in the Mediterranean. On the revolt of Messina from Spain, he was sent to support the insurgents, and encountered the united fleets of Spain and Holland under the command of de Ruyter. After several battles, in which the advantage was generally on the side of the French, a decisive engagement took place near Catania (April 20, 1676), when the Dutch fleet was totally routed and de Ruyter mortally wounded. The greater part of the defeated fleet was afterwards burned in the harbour of Palermo, where it had taken refuge, and the French thus secured the undisputed command of the Mediterranean. For this service Duquesne received a letter of thanks from Louis XIV., together with the title of marquis and the estate of Bouchet. His last achievements were the bombardment of Algiers (1682–83), to effect the deliverance of the Christian captives, and the bombardment of Genoa in 1684. He retired from service in 1684, on the ground of age and ill-health. It is probable also that he foresaw the revocation of the Edict of Nantes, which took place in the following year. He died in Paris on Feb. 2, 1688.

See Jal, Abraham Duquesne, et la marine de son temps (1873).

DUQUESNE, a city of Allegheny county, Pa., U.S.A., on the Monongahela river, 12m. S.E. of Pittsburgh; served by the Pennsylvania railroad. The population was 19,011 in 1920, of whom 5,790 were foreign-born white (largely from central and eastern Europe), and was 20,693 in 1940 by the federal census. It is an important steel-manufacturing centre, with a total production in 1940 of about 1,200,000 gross tons of pig iron, 1,500,000 tons of ingots and 950,000 tons of merchant bars. Duquesne was settled in 1885, incorporated as a borough in 1891 and chartered as a city in 1917.

DU QUOIN, a city of Perry county, Ill., U.S.A., in the fertile agricultural and coal-mining region southeast of St. Louis; on federal highway 51 and state highways 153 and 154 and the Illinois Central railroad. The population was 7.285 in 1920 (86% native white) and was 7,515 in 1940 by the federal census. It is a shipping point for coal, grain, livestock, fruit and the home of the Du Quoin state fair. Its manufacturing industries include machine shops, a dairy and bottling and a meat-packing plant. The largest strip coal mines in the country are there. The city was settled about 1845 and incorporated in 1860.

DURALUMIN. An aluminium alloy discovered by A. Wilm and originally made at Diiren in Germany. It possesses the valuable property of being greatly strengthened by heat treatment, as steel is hardened by quenching and tempering. In addition to 94% aluminium, 4% of copper and 1% of manganese, duralumin contains 1% of magnesium and owes its special qualities to the association of the last-named component with the silicon always present in aluminium as an impurity. (For a brief explanation see ALUMINIUM ALLOYS.) The original composition has been varied, manganese being sometimes eliminated and sometimes replaced by iron, nickel or chromium, but magnesium and silicon remain as essential constituents, while copper, which itself confers somewhat similar properties on aluminium (see ALUMINIUM ALLOYS), is also generally retained. Special trade names have been applied to some of these later alloys and the whole class is now frequently known as the "Strong Aluminium Alloys."

In the normal state these alloys are soft and ductile and may be rolled into sheets and bars or drawn into tubes, angles, etc. Such work hardens them, as all metals, but leaves them like many aluminium alloys, unduly subject to corrosion. Annealing at about 400°C. removes this "work hardness," but if the alloys be heated to temperatures which vary with the alloy and its intended use from 450°C.–550°C. and are then plunged into water, although at first softened and, therefore, still capable of being worked, hardening soon commences and continues for several days. By reheating at about 200°C. the hardening process can be hastened.

Heat treated duralumin is comparatively resistant to corrosion. It is ductile (elongation 8–15%), will bear a load of 30,000lb. per square inch without permanent distortion and breaks under a load of 55,000–62,000 lb. per square inch.

As the alloys are light (sp.gr.=2.8j) their strength per unit of weight (specific tenacity) is high (9·3) compared with nickel steel (5.9) and nickel chrome steel (7.2). These properties make them particularly suitable for aircraft construction, for which they have been used to a very great extent. It may be said that the development of the rigid airship would have been impossible without duralumin, which is used throughout for the framework of these gigantic craft (see illustration in article AIRSHIP), whilst all-metal heavier-than-air machines also depend on these alloys. Connecting rods forged from duralumin find favour for internal combus-

tion engines, whilst an alloy in which nickel replaces manganese (Y alloy) is used for the pistons of the large Diesel engines of submarines, for which it is particularly suited, because it can be cast to shape and retains its strength at comparatively high temperatures.

Like aluminium and its other alloys duralumin cannot be effectively soldered since joints so made corrode rapidly, nor can it be welded without losing the special properties to which it owes its utility.

To all ordinary fabricating processes as spinning, pressing, riveting, machining, etc., duralumin lends itself perfectly.

For a full account of these alloys see R. J. Anderson, *The* Metallurgy of *Aluminium and Aluminium Alloys,* where an extensive bibliography will be found. (R. S.)

DURAN, a Jewish Provencal family of rabbis and scholars. of whom the following are the most important: —

1. PROFIAT DURAN, called also EPHODI.

He was in 1391 compelled to profess Christianity, but remained devoted to Judaism. His chief works were grammatical and philosophical In the former realm his most important contribution was the *Ma'aseh 'Ephod* (completed in 1403); in the latter, his commentary to the Guide of the Perplexed by Maimonides (*q.v.*).

2. SIMON BEN ZEMAH DURAN (1361–1441), rabbi of Algiers. He was one of the first of the mediaeval rabbis to be a salaried official of the synagogue. Before the 14th century the rabbinical post had been almost invariably honorary, and filled by men who derived their income from a profession, especially medicine. Duran wrote a systematic work on theology, *Magen 'Aboth,* but is chiefly famous for his numerous Responsa (known as Tashbaz), published in 1738–39, which gives valuable information as to social and religious conditions of his day. (I. A.)

DURÁN, AGUSTIN (1789–1862), Spanish scholar, was born in 1789 at Madrid, where his father was court physician. He was sent to the seminary at Vergara. He studied philosophy and law at the University of Seville, and was admitted to the bar at Valladolid. He held a post in the education department at Madrid (1821–23), but was suspended on account of his political opinions. In 1834 he became secretary of the board for the censorship of the press, and shortly afterwards obtained a post in the national library at Madrid. The revolution of 1840 led to his dismissal; but he was reinstated in 1843, and in 1854 was appointed chief librarian; he retired, however, in the following year. In 1828 he published anonymously his *Discurso sobre* el *influjo* que *ha* tenido la *crítica* moderna en la decadencia det teatro *antiguo,* which greatly influenced the younger dramatists of the day. He next endeavoured to interest his fellow-countrymen in their ancient, neglected ballads, and in the forgotten dramas of the 17th century. His Romancero general was published in 5 volumes (1828–32; later ed. 2 vols., 1849–51); Talia *española* (1834) is a reprint of old Spanish comedies. Durán's Romancero *general* is the fullest collection of the kind.

DURANCE (anc. Druentia), one of the principal rivers draining the French slope of the Alps towards the Mediterranean. Its total length from its source in the High Alps of Dauphin6 to its junction with the Rhône, a little below Avignon, is 217½ miles It is commonly said to take its origin in some small lakes a little south of the Mont Genèvre pass, but has two other head streams of much greater length and volume. These are the Clairée, flowing in from the north, through the smiling Névache glen, at the head of which, not far from the foot of the Mont Thabor (10,440 ft.) it rises in some small lakes, on the east side of the Col des Rochilles; and the Guisane (flowing in from the north-west and rising near the Col du Lautaret, 6,808 ft.). Between its junction with the Cerveyrette and the Gyronde the Durance passes throcgh fine deeply-cut gorges. It then runs through a stony plain, where it frequently overflows and causes great damage, this being indeed the main characteristic of the Durance throughout its course. At the foot of the fortress of Mont Dauphin and some distance above the town of Embrun, it receives (left) the Guil, which flows through the Queyras valley from near the foot of Monte Viso. It becomes the boundary for a while between the departments of the Hautes-Alpes and of the Basses-Alpes, and receives the considerable Ubaye river, flowing from near the foot of Monte Viso past Barcelonnette (left).

Flowing through the Basses-Alpes it is joined above Sisteron (right) by the wild torrent of the Buech, flowing from the desolate region of the Dévoluy, the Bléone (left) (on which Digne, the capital of the department, is situated) and the Asse (left). The Verdon, flowing past the town of Castellane, joins it from the lower summits of the Maritime Alps. After passing through some narrow gorges near Sisteron the bed of the river becomes wide and liable to flood, the frequent overflows being kept within bounds by numerous dykes and embankments. These features are especially marked when the river, after leaving the Basses-Alpes, bends north-west and, always serving as the boundary between the departments of Vaucluse (north) and of the Bouches-du-Rhône (south), passes Cavaillon above its junction with the Rhône. The drainage area of the Durance is about 5,166 sq.m., while the height it descends is 6,550 ft., if reckoned from the lakes on the Mont Genèvre, or 7,850 ft. if we take those at the head of the Névache valley as the true source of the river.

DURAND, ASHER BROWN (1796–1886), American painter and engraver, was born at South Orange (N.J.), on Aug. 21, 1796. He worked with his father, a watchmaker; was apprenticed, in 1812, to an engraver named Peter Maverick; and his first work, the head of an old beggar after Waldo. attracted the attention of the artist Trumbull. Durand established his reputation by his engraving of Trumbull's "Declaration of Independence." After 1835, however, he devoted himself chiefly to portrait painting. He painted several of the presidents of the United States and many other men of political and social prominence.

In 1840 he visited Europe, where he studied the work of the old masters; after his return he devoted himself almost entirely to landscape. He died at South Orange on Sept. 17, 1886. He was one of the founders of the National Academy of Design in 1826, and was its president in 1845–61. Durand may be called the father of the Hudson River school. Although there was something hard and unsympathetic about his landscapes and unnecessary details and trivialities were over-prominent, he was a well-trained craftsman, and his work is marked by sincerity.

DURAND, GUILLAUME (DURANTI or DURANTIS) (*c.* 1230–1296), French canonist and liturgical writer, and bishop of Mende, was born at Puimisson, near Beziers. He studied law at Bologna, and about 1264 was teaching canon law at Modena. Clement IV. called him to the pontifical court as a chaplain and auditor of the palace, and in 1274 he accompanied Gregory X. to the Council of Lyons, the constitutions of which he helped to draw up. Martin IV. made him vicar spiritual in 1281, then governor of Romagna and of the March of Ancona (1283). In the midst of the struggles between Guelphs and Ghibellines, Durand successfully defended the papal territories, both by diplomacy and by arms. Honorius IV. retained him in his offices, and although elected bishop of Mende in 1286, he remained in Italy until 1291. In 1295 he refused the archbishopric of Ravenna, and in 1296 retired to Rome, where he died on Nov. 1.

Durand's principal work is the *Speculum* judiciale, which was drawn up in 1271, and revised in 1286 and 1291 (best ed. Turin, 1578). It is a general explanation of civil, criminal and canonical procedure, and also includes a survey of the subject of contracts. It is a remarkable synthesis of Roman and ecclesiastical law, distinguished by its clarity, its method, and especially its practical sense, in a field in which it was pioneer, and its repute was as lasting in the courts as in the schools. His Rationale *divinorum officiorum,* on the origin and symbolic sense of the Christian ritual, written before 1286, is one of the authorities on the Western liturgy (latest ed. Naples, 1866). The other important works of Durand comprise a *Repertorium juris canonici* (*Breviarium* aur*eum*), a collection of citations from canonists on questions of controversy, a *Commentarius in* sacrosancturn Lugdunense *concilium* (ed. 1569), of especial value owing to the share of Durand in the elaboration of the constitutions of this council (1274), and inserted by Boniface VIII. in the *Sextus.*

Durand's nephew, also named GUILLAUME DURAND (d. 1330),

and also a canonist, was rector of the university of Toulouse and succeeded his uncle as bishop of Mende. He wrote in 1311, in connection with the Council of Vienne, *De modo celebrandi concilii et corruptelis in Ecclesia reformandis.*

On the elder Durand *see* V. Leclerc in *Histoire littéraire de la France*, vol. xx. pp. 411–497 (1842); Schulte, *Geschichte der Quellen des canonischen Rechts* (1877); E. Male, *L'Art religieux au XIIIe siècle* en *France* (1898). On the nephew *see* B. Hauréau, in *Journal des savants* (1892).

DURAND, GUILLAUME (Durandus of St. Pourqain) (d. 1332), French scholastic theologian, known as *Doctor Resolutissimus,* was born at St. Pourqain, Auvergne. He entered the Dominican order at Clermont, and in 1313 was made a doctor in Paris, where he taught till Pope John XXII. called him to Avignon as master of the sacred palace, *i.e.,* theological adviser and preacher. He subsequently became bishop of Limoux (1317), of Le Puy (1318) and of Meaux (1326). He composed a commentary on the Sentences of Peter Lombard (Paris, 1508, etc.), in which, breaking with the moderate realism of Aquinas, he anticipated the *terminism* of William of Occam. Singularity alone exists in things, and is known immediately by the intellect. From this it follows that the active intellect, which is supposed to abstract universals, is superfluous and the problem of individuation absurd. Durand also denied a distinction between essence and existence, and opposed the realms of reason and faith. In the question of the beatific vision, arising out of opinions promulgated by John XXII. (*q.v.*), he sided with Thomas Walleis, Armand de Bellovisu and the doctors of Paris against the pope, and composed his *De statu animarum sanctarum.* Mention should also be made of his *De jurisdictione ecclesiastica et de legibus* (Paris, 1506).

See B. Hauréau, *Histoire de la philosophie scolastique* (1880); C Werner, *Die Scholastik des spateren Mittelalters,* vol. ii. (1883); J. Koch, *Durandus de S. Porciano,* O.P. (Miinster, 1927).

DURAWDO, GIACOMO (1807–1894), Italian general and statesman, was born at Mondovi in Piedmont. He was implicated in the revolutionary movements of 1831 and 1832. In 1848 he was one of those who asked King Charles Albert for the constitution. On the outbreak of the war with Austria he commanded the Lombard volunteers, and in the campaign of 1849 he was aide-de-camp to the king. He was elected member of the first Piedmontese parliament and was a strenuous supporter of Cavour; during the Crimean campaign he took General La Marmora's place as war minister. In 1855 he was nominated senator, lieutenant-general in 1856, ambassador at Constantinople in 1859, and minister for foreign affairs in the Rattazzi cabinet two years later. He was president of the senate from 1884 to 1887, after which year he retired from the army.

His brother, GIOVANNI DURANDO (1804–1869), also spent his early life abroad. Returning to Italy on the outbreak of the revolution of 1848, he was appointed commander of a division of the pontifical forces, and fought against the Austrians in Venetia until the fall of Vicenza, when he returned to Piedmont as major-general. In the campaign of 1849 he commanded the first Piedmontese division; he subsequently served in the Crimea, in the war of 1859, and in that of 1866 as commander of the I. Army Corps.

DURANGO, a city of south-western Colorado, U.S.A., 6,525ft. above sea-level; the county seat of La Plata county. It is on federal highways 160 and 550, and is served by the Denver and Rio Grande Western and the Rio Grande Southern railways. The population was 5,400 in 1930, and u-as 5,887 in 1940 by the federal census. Durango is the trading centre of a wide area, rich in coal, oils, metals and timber. Its manufacturing industries include a smelter and ironworks. The Durango national forest (3,000,000 ac.) is 11 mi. N.; and 60 mi. W. is the Mesa Verde national park, containing the most notable prehistoric cliff dwellings in the United States. At Hesperus (8 mi. W.) is the Fort Lewis School of Agriculture, a branch of the state agricultural college. The city was incorporated in 1880, four years after Colorado was admitted to statehood.

DURANGO, a state of northern Mexico, bounded north by Chihuahua, east and southeast by Coahuila, south by Zacatecas and the state of Nayarit, and west by Sinaloa. Pop. (1895) 292,549; (1937) 467,360. Area 47,692 sq. miles. Durango is a continuation southward of the high, semi-arid plateau of Chihuahua, with the Sierra Madre extending along its western side. The rainfall is very light in the eastern part of the State, a succession of years sometimes passing without any precipitation whatever, but in the west it is sufficient to produce good pasturage and considerable areas of forest. There are no rivers of any magnitude in the State. The largest are the Rio Nazas, and the Mezquital. The climate is generally dry and healthy. Cotton is produced to a limited extent, especially where irrigation is employed, and wheat, Indian corn, tobacco, sugar-cane and grapes are also grown. In the elevated valleys of the sierras stock-raising is successful. The principal industry of Durango, however, is mining, and some of the richest and best known mines of Mexico are found in the State. Besides silver, which has been extensively mined since the first arrival of the Spanish under Francisco de Ibarra (1554–62), gold, copper, iron, cinnabar, tin, coal and rubies are found. The famous Cerro del Mercado, 2m. from the city of Durango, is a hill composed in great part of remarkably pure iron ore, and is estimated to contain 300,000,000 tons of that metal. Near it are iron and steel works. In the district of San Dimas is the celebrated Candelaria mine, where the ores (largely argentite) assay between $70 and $140 a ton, the aggregate output being estimated as over $100,000,000 before the close of the 19th century. With the exception of silver, the mineral resources of the State have been but slightly developed because of difficult and expensive transportation. The Mexican Central railway crosses the eastern side of the State, and the Mexican International crosses north-east to south-west through the State capital on its way to the port of Mazatlán. The history of Durango is similar to that of Chihuahua, the State originally forming part of the province of Nueva Viscaya. The capital is Durango, and among the principal towns are Guanacevi (pop. [1900] 6,859) ([1930] 5,675), El Oro (12,015 in 1930), Nombre de Dios (the first Spanish settlement in the State), San Juan de Guadalupe, San Dimas and Villa Lerdo. These are comparatively small mining towns. Mapimí lies 130m. N.N.E. of Durango and gives its name to the great arid depression situated still farther north.

DURANGO, sometimes called CIUDAD DE VICTORIA, a city of Mexico, capital of the State of Durango, 574 m. N.W. of the Federal capital, in lat. 24° 25′ N., long. 105° 55′ W. Pop. (1930) 58,160. Durango is served by the Mexican International railway. The city stands in the picturesque Guadiana valley formed by easterly spurs of the Sierra Madre, about 6,200 ft. above the sea. It has a mild, healthy climate, and is surrounded by a district of considerable fertility. Durango is an important mining and commercial centre, and was for a time one of the most influential towns of northern Mexico. It contains a mint erected in 1811, and is famous for the great mountain of iron that lies north-west of the city. The city is provided with an abundant water-supply, and there are thermal springs in its vicinity. Its manufacturing establishments include reduction works, cotton and woollen mills, glass works, iron foundries, tanneries, flour mills, sugar refineries and tobacco factories. Durango was founded in 1563 by Alonso Pacheco under the direction of Gov. Francisco de Ibarra, who named it after a city of his native province in Spain. It was known, however, as Guadiana for a century thereafter, and its first bishops were given that title. It was the capital of Ibarra's new province of Nueva Viscaya, which included Durango and Chihuahua, and continued as such until their separation in 1823.

DURANI or **DURRANI,** the dominant race of Afghans, to which the ruling family at Kabul belongs. *See* AFGHANISTAN.

DURANT, a city of southeastern Oklahoma, U.S A., 15 mi. from the Red river, where a $50,000,000 hydroelectric dam is (1941) under construction; the county seat of Bryan county. It is on federal highways 69, 70 and 75, and is served by the Frisco, the Kansas, Oklahoma and Gulf and the Missouri-Kansas-Texas railways. The population was 7.463 in 1930; 10,027 in 1940. The county farms and raises livestock; has cotton gins and cotton oil mills; also a nursery and a fish hatchery. On its northern boundary is the Southeastern state teachers college (established 1909).

DURANTE, FRANCESCO (1684–1755), Italian composer, was born at Frattamaggiore, in the kingdom of Naples, on March 15, 1684. At an early age he entered the Conservatorio dei poveri di Gesù Cristo, at Naples, where he received lessons from Gaetano Greco; later he became a pupil of Alessandro Scarlatti at the Conservatorio di Sant' Onofrio. He is also supposed to have studied under Pasquini and Pitoni in Rome, but no documentary proof of this statement can be given. He is said to have succeeded Scarlatti in 1725 at Sant' Onofrio, and to have remained there until 1742, when he succeeded Porpora as head of the Conservatorio di Santa Maria di Loreto, also at Naples. This post he held for 13 years, till his death on Aug. 13, 1755, at Naples. His fame as a teacher was all but unrivalled, and Jommelli, Paesiello, Pergolesi, Piccini and Vinci were among his pupils. A complete collection of Durante's works, consisting all but exclusively of sacred compositions, was presented by Selvaggi, a Neapolitan lover of art, to the Paris library. The imperial library of Vienna also preserves a valuable collection of Durante's manuscripts. Two requiems, several masses (one of which, a most original work, is the *Pastoral Mass* for four voices) and the *Lamentations* of the prophet Jeremiah are among his most important settings.

DURAO, JOSE DE SANTA RITA (*c.* 1737–1784), Brazilian poet, was born in the parish of Cata Preta, near the boundary of Minas Geraes, Brazil, probably in 1737, though some authorities place his birth within the years 1718–22. He received his early education at the Jesuit college in Rio de Janeiro, and in 1756 obtained the degree of doctor of theology from the historic University of Coimbra, Portugal. Two years later he entered the Gratian convent of the order of St. Augustine. Famous already as a preacher, he offended his superiors by his liberality of thought, and particularly by his openly expressed regard for the proscribed Jesuits. In consequence he was forced to leave the country. He was detained in Spain as a spy in 1762, but was released in the following year, and then went to Rome, where he became acquainted with Alfieri, Pindemonte, Casti and other literary men of the time. In 1778 he returned to Portugal to accept the chair of theology at the University of Coimbra, and at the opening of the university for the year delivered an address in Latin, *De sapientia,* which marked him as one of the foremost intellectuals of his day. He soon retired, however, to the Gratian convent, and became its prior. In 1781 he published in Lisbon his great epic *Caramkru: poema épico do descubrimento da Bahia,* a poetic treatment in ten cantos of the discovery of Bahia (southern Brazil), by Diego Alvarez. This is one of the masterpieces of Brazilian literature, and is remarkable especially for the beauty of its descriptions of South American scenery and Indian life. Failure of the poem to command instant recognition embittered its author, and led him to burn nearly all his other works. A French translation of the *Caramkru* appeared in Paris in 1829. He died in Lisbon on Jan. 24, 1784.

See Adolfo de Varnhagen, *Epicos Brazileiros* (1845); Pereira da Silva, *Os Varões illustres do Brasil* (1858); Wolf, *Le Brésil littéraire* (Berlin, 1863); Sotero dos Reis, *Curso de litteratura Portugueza e Brazileira,* vol. iv (Maranhão, 1868); José Verissimo, *Estudos de literatura Brazileira, segunda serie* (1901); Ronald de Carvalho, *Pequena Historia Literatura Brazileira* (1922); and Isaac Goldberg, *Brazilian Literature* (1922). (*W.B.* P.)

DURATION AND TIME are commonly used as synonymous terms. In recent philosophy, however, great stress has been laid on the need of differentiating between them in order to avoid certain confusions. The difference has been expressed most clearly by Bergson, who, however, has only revived and elaborated the distinction drawn already by Spinoza (*see* Letter XII in *A.* Wolf, *The Correspondence* of *Spinoza, p.* 119). Time is commonly conceived abstractly and is thought of as composed of discrete instants or moments which follow one another in a uniform manner. For the purposes of science such an abstraction is often necessary. But *real* time, time as it actually passes, as it is actually experienced and lived in the world of changing events is not composed of such instants which replace one another. It is duration, that is a continuous change in which "the past gnaws into the future and swells as it advances" (H. Bergson, *Creative Evolution,* p. 5). When time is conceived as a succession of discrete parts it is incomprehensible how any period of time, say an hour, can ever elapse, seeing that it involves the sequence of an infinity of parts. Hence Zeno's paradox of Achilles and the tortoise. But real time is only apprehended in intuition, and is continuous duration. The abstract concept of time, as commonly used in science, is the result of an attempt to assimilate it to space, or at least to measure it by means of certain correlated positions in space. Such is the view of Bergson, whose views may be summarized as follows. When science speaks of time it really refers to the motion of a body M on its trajectory. This motion is taken to represent time, and, by definition, is assumed to be uniform. Let $M_1, M_2, M_3 \ldots$ be points which divide the path of the moving body, M, into equal parts from its starting-point Mo onwards. Then it will be said that 1, 2, 3, . . . units of time have elapsed when M is at $M_1, M_2, M_3 \ldots$ Hence to consider the state of the universe at a certain time, say t, is simply to consider its state when M will be at the position Mt. No attention is paid to the actual *flow* of time, much less to its effect, on consciousness. For only points or positions are taken into account. And all that is considered in connection with all other parts of the universe is their positions on their several paths. With each *virtual position* of M ($M_1, M_2, M_3, \ldots$) there is correlated a *virtual position* of all other moving bodies. But these correspondences in position are *simultaneities* which take no account of the *flow* of time, the continuous transitions from position to position in unbroken sequence. If real time could be measured by *feeling,* independently of physical events, then the sequence of physical events would continue to be expressed by the same equations, however much their actual *tempo* might be varied as judged independently by our duration-feeling, Science, as a matter of fact, has no symbols to express real succession or duration. *See* H. Bergson, *Time and Freewill* (1910); *see* also the article SPACE-TIME. (A. Wo.)

DURAZZO (DURRËS), a seaport of Albania. Pop. (1930) 8,739, of whom 70% were Mohammedans, 25% Orthodox, and 5% Roman Catholics. Most of the merchant class are of Vlach origin. Durazzo is the seat of a Roman Catholic archbishop and a Greek metropolitan. It is built on the slope of Mt. Durazzo and stretches down into a picturesque valley, but is surrounded by marshes, dotted with lakes, and the water supply, from wells, is far from satisfactory. The old crenellated walls are dilapidated; plane trees grow on the gigantic ruins of the old Byzantine citadel, and the harbour, commodious and safe when used by the Venetian galleys, is gradually becoming silted up, sandbanks rendering the approach difficult. The only features worthy of notice are the quay with its rows of cannon, and the viaduct, 750 ft. long, which crosses the marsh to the road to Tirana. The chief exports are olive oil, wheat, oats, barley, skins, tobacco, sumach and sheep. Salt is obtained by evaporation, and there are brick kilns in the district, while the making of the national costumes is an important industry.

Epidamnus, the ancient name of Durazzo, was founded by a joint colony of Corcyreans and Corinthians towards the close of the 7th century B.C., and from its admirable position and the fertility of the surrounding country, soon rose into considerable importance, and played a part in bringing about the Peloponnesian War (431–404 B.C.). In 312 B.C. the city was seized by the Illyrian king Glaucias, and shortly after it passed to the Romans, who changed its name to Dyrrachium, and it again rose to importance. It was a favourite point of debarkation for the Roman armies; the great military road known as the Via Egnatia led from Dyrrachium to Thessalonica (Salonica); and another highway passed southwards to Buthrotum and Ambracia. Broad swamps rendered the city almost impregnable, and in 48 B.C. Pompey made his last successful resistance to Caesar here. After the battle of Actium in 31 B.C. Augustus made over Dyrrachium to a colony of his veterans; it became a *civitas libera,* and reached the summit of its prosperity at the end of the 4th century when it was made the capital of Epirus Nova.

Its bishopric, created about A.D. 58, was raised to an archbishopric in 449. In 481 the city was besieged by Theodoric the

Goth, and during the 10th and 11th centuries was frequently attacked by the Bulgarians. In 1081 it was stormed by Robert Guiscard, the Norman, and in 1185 it fell into the hands of King William of Sicily; was surrendered to Venice in 1202, and in 1268 came into the possession of Charles of Anjou. In 1273 it was destroyed by an earthquake, but soon recovered from the disaster, and became an independent duchy under John of Anjou (1294–1304), and afterwards under Philip of Otranto. In 1333 it was annexed to Achaea, in 1336 to Serbia, and in 1394 to Venice. The Turks captured it in 1501, and held it till 1913. In that year Essad Pasha set up a government of his own in Durazzo, but in 1914 Prince William of Wied landed there as King of Albania, and Essad fled to Italy. His partisans, however, attacked the town, and three months later Prince William abandoned the country. At Kavaja, near Durazzo, an Albanian American school of agriculture was founded in 1925 for the promotion of better methods of cultivation and cattle raising.

Durazzo was a main point of disembarkation for the Italian troops invading Albania in 1939. During the Greek-Italian war of 1940–41 it was subjected to heavy air raids by the British. British warships also shelled the port from the Adriatic, disrupting Italian supplies to its armies facing the Greeks.

D'URBAN, SIR BENJAMIN (1777–1849), British general and colonial administrator, entered the British army in 1793. In 1794 he took part in operations in Holland and Westphalia. In 1795 he served under Sir Ralph Abercromby in San Domingo. He spent the years 1800–05 at the Royal Military college, and then served in Hanover under Lord Cathcart. In Nov. 1807 he went to Dublin as assistant-quartermaster-general, being transferred successively to Limerick and the Curragh. He joined the army in the Peninsula in 1808 and acted as quartermaster general to General (afterwards Viscount) Beresford in the reorganization of the Portuguese army. He served throughout the Peninsular War, being present at Busaco, Albuera, Badajoz, Salamanca, Vitoria, the Pyrenees, the Nivelle, the Nive and Toulouse. He was made a K.C.B. in 1815. He remained in Portugal until 1816. In 1819 he became major general and in 1837 lieutenant general. From 1829 he was colonel of the 51st Foot.

Sir Benjamin began his career as colonial administrator in 1820 as governor of Antigua. In 1824 he was transferred to Demerara and Essequibo, then in a disturbed condition owing to a rising among the slaves consequent on the emancipation movement in Great Britain. In 1831 he carried out the amalgamation of Berbice with the other counties, the whole forming the colony of British Guiana, of which D'Urban was first governor. The four years of his governorship in Cape Colony (1834–38) were of great importance in the history of South Africa. They witnessed the abolition of slavery, the establishment of a legislative council and municipal councils in Cape Colony, the first great Kafir war and the beginning of the Great Trek. The firmness and justice of his administration won the cordial support of the British and Dutch colonists. The greater part of 1835 was occupied in repelling an unprovoked invasion of the eastern borders of the colony by Xosa Kafirs. To protect the inhabitants of the eastern province Sir Benjamin extended the boundary of the colony to the Kei river and erected military posts in the district, allowing the Xosa to remain under British supervision. But Lord Glenelg, secretary for the colonies in the second Melbourne administration, adopted the view that the Kafirs had been the victims of systematic injustice. In a despatch dated Dec. 26, 1835, he instructed D'Urban to give up the newly annexed territory. At the same time Sir Andries Stockenstrom, Bart. (1792–1864), was appointed lieutenant governor for the eastern provinces of the colony to carry out the policy of the home Government, in which the Kafir chiefs were treated as being on terms of full equality with Europeans. One result of the new policy was to recreate a state of insecurity, bordering on anarchy, in the eastern province, and this condition was one of the causes of the Great Trek of the Dutch farmers which began in 1836. In various despatches D'Urban justified his position, characterizing the trek as due to "insecurity of life and property occasioned by the recent measures, inadequate compensation for the loss of the slaves, and despair of obtaining recompense for the ruinous losses by the Kafir invasion." (See **SOUTH** AFRICA, **UNION** OF, and CAPE COLONY.) D'Urban was relieved of his office (May 1, 1837), but remained governor until the arrival of his successor, Sir George Napier, in Jan. 1838.

During his governorship Sir Benjamin helped the British settlers at Port Natal, who in 1835 named their town D'Urban (now written Durban) in his honour, but his suggestion that the district should be occupied as a British possession was vetoed by Lord Glenelg. D'Urban remained in South Africa until April 1846. In 1840 he was made a G.C.B., and in 1842 declined a high military appointment in India offered him by Sir Robert Peel. In Jan. 1847 he took up command of the troops in Canada, and held it at the time of his death at Montreal on May 25, 1849.

DURBAN, a seaport on the coast of Natal, Union of South Africa, situated in 29° 52' S., 31° 1' E., just south of the Umgeni river. It is 6,992 nautical miles from London by the West Coast route, and 7,785 via Suez. Owing to its low latitude and proximity to the Mozambique current, its climate is humid and sub-tropical. The mean annual temperature is about 70°, and the temperature ranges, both daily and annual, are comparatively small. The monthly means for July and January are 64·6° and 76·6°, the mean minimum for July being 52·3° and the mean maximum for January 84.5'. Rains mostly fall in the summer months, October to March inclusive; the annual rainfall is just over 40 inches. The dry season, however, is not so marked here as it is further inland, the six winter months receiving 29% of the total rainfall. The average number of rainy days is between 110 and 118. The relative humidity is high, making the climate rather enervating, a fact that is probably reflected by the large number of jinrickshas, drawn by Zulus, which ply for hire in the streets. The health of the town is good, though malaria is liable to occur in the summer, and in 1926–27 there was a serious epidemic of dengue fever.

Durban is the largest urban centre in Natal, and is exceeded in the Union only by Johannesburg and Cape Town. In 1936 the European population was 95,033; total pop. 259,606. In 1921 the population consisted of 57,095 Europeans, 37,530 natives, 47,811 Asiatics and 3,874 Negroes, making a total of 146,310. The town is built near the shores of what was originally a shallow lagoon, 8 sq.m. in extent, cut off from the sea by a line of ancient partially consolidated sand dunes. The northern end of this barrier, known as the Bluff, 195 ft. high, overlooks the narrow entrance to the lagoon. On the northern side of the entrance is a low sandy spit, called the Point. The main business part of the city is laid out on a low-lying sandy tract on the north, and northwestern side of the bay (*i.e.,* the lagoon). In West street are most of the principal shops, the theatre, and, at the western end, a large technical college, near which is a colossal statue of the late Louis Botha in the dress of a Boer general, erected by citizens of Durban. About the middle of West street is a rectangular area occupied by gardens and a large war memorial. Along the West street side of this open space is the general post office, while on the opposite, southern side, is a hotel and an imposing block of insurance offices. The western flank is occupied by shops, and on the eastern side is a block of buildings containing the town hall, municipal offices, public library and art gallery. The town hall has an assembly room, which is capable of accommodating 3,000 people, and which is fitted with a fine organ. The art gallery has some good pictures by modern British painters. The border of the lagoon is laid out as an esplanade, and is known as the Victoria embankment. It forms a picturesque walk, lined with palms. About the middle is an equestrian statue of Dick King, commemorating his famous nine days ride to Grahamstown (600 m.) to obtain relief when Durban was besieged by the Dutch in 1840.

The Harbour.— The area about the Point is occupied by harbour works, loading sheds, etc. Here also is a memorial to Vasco da Gama. Owing to the presence of sandbanks it was originally difficult for any but smaller craft to enter the lagoon. The entrance has, however, been greatly improved. A wall has been constructed from the end of the Bluff for about 2,000 ft. out to sea. Nearly parallel with this the North pier was carried out to the same distance from the Point. The narrow entrance thus formed is kept

free from sand by the tidal scour and by dredging. The depth at L.W.O.S.T. is about 35 ft., and the average rise of a spring tide is 4 ft. 11 inches.

Along the lagoon side of the Point are the sheds and wharves, of which there are about 3 miles. The depth alongside ranges from 23 to 34 ft. For coaling purposes electrically-driven belt and bucket transporter appliances have been installed at the Bluff, capable of coaling five ships simultaneously. Oil depôts exist near by.

For repairs there is a floating dock capable of lifting 8,500 tons, and a patent slip capable of lifting craft up to 150 tons. At the south-western end of the bay, near Congella, is a graving dock, 1,150 ft. long and 110 ft. broad. The depth of the entrance channel is 32 feet.

Not far away is the largest grain elevator in South Africa, with a storage capacity of 42,000 tons.

Passengers landing at Durban and wishing to travel inland by railway have to reach the railway station in the centre of the town by car, tram or jinricksha.

Homes and Recreation. — Behind the business section rises a sharp ridge, the Berea, which runs in a more or less northerly direction until it meets the Umgeni river, where the Dwyka conglomerate, of which it is formed, is quarried for road metalling and harbour works. The Berea is the favourite residential quarter, and building sites are, therefore, dear. Most of the houses stand in their own grounds, surrounded by trees and shrubs, flowers and lawns.

The streets are lined with the beautiful flamboyant tree, which is sharply restricted to the coastal strip of Natal. The general appearance of this quarter, and the views out to sea are very pleasing.

A bridge was constructed across the mouth of the Umgeni.

On most of its other sides the town is hemmed in by a zone of Indian settlements, with squalid huts, untidy surroundings and sanitary conditions which could not be regarded as being satisfactory. On the sea front, north of the harbour, and stretching in the direction of the Umgeni, is a large esplanade, with its accompaniment of hotels, bathing conveniences, bandstands, etc. Near its northern end is a capacious concert hall, built in 1924. Between this and the river is an area of open beach and sand dunes. A part of the latter is occupied by the Country club and its golf links and tennis courts. Durban is one of the most important seaside holiday resorts in South Africa. Many people from the high country inland come down during the winter for relaxation, and to escape the severe frosts. During July important race meetings are held here.

Public Services. — The town is well supplied with public services. It has a good water supply, obtained from a large reservoir on the Umlaas river, a water borne sewage, electric light and a good tram service. The Botanical gardens on the lower slopes of the Berea contain a fine collection of plants, more tropical in character than those in most other parts of South Africa. There are several other open spaces, such as Albert park, between West street and the bay, Mitchell park, Bulwer park, etc. Opportunities for sport are provided by a race-course, near the centre of the town, polo and football grounds and golf links. Near the Point is a hospital capable of accommodating 135 patients. In addition to the usual primary and secondary schools, there is a large technical college, and in 1931, the Howard college, which houses the faculty of engineering of the Natal University college (University of South Africa), was built on a jo-ac. site.

Industry. — The first settlers on the site of Durban were a few British elephant hunters, who arrived in 1824. In 1835 a township was laid out, and named after Sir Benjamin d'Urban, the then governor of the Cape. Since that date the town has experienced many alternations of prosperity and depression. It derived much benefit from the increase of trade due to the discovery of diamonds and gold in South Africa, and to the Zulu and Boer Wars. It owes its importance largely to the fact that it is the only reasonable port between East London and Delagoa bay, and that there is a comparatively easy way leading inland. Much of its trade is with the Transvaal and Orange Free State. It also deals with practically all the overseas trade of Natal. Among its chief exports are maize from the high veld, coal, for bunking and export, from the Natal coalfields, wattle bark from the midlands of Natal, and wool. It is also the chief focus of the sugar industry, which occupies most of the coastal belt of Natal. Durban is second only to Cape Town as a shipping centre in the Union. In 1939, 1,699 vessels entered the harbour, with a total tonnage of 6,730,390, and in 1938–39, 63,566 passengers landed or embarked at Durban. Durban is also the centre of the whaling activities on this coast. The season lasts from May to November, and a whaling station has been established on the seaward side of the Bluff. The oil is used by local soap factories. The establishment of industries in the town is favoured by the plentiful supplies of coal, water, electricity and coloured labour that are available, and by the facilities for importing and exporting raw material and finished products. Land is being reclaimed at the south-western end of the bay, and is quickly taken up for industrial development. Among the industries already established are those dealing with the production of soap, matches, jams and preserves, biscuits, furniture, etc.

See G. Russell, *History of* Old *Durban (to 1860)* (Durban, 1899); *Fifty Years of* Municipal *History,* compiled for the Corporation by the town clerk, 1904; *South* Africa *Year Book.* (R. U.S.)

DURBAR, a term in India for a court or levee, from the Persian *darbar. A* durbar may be either a council for administering affairs of state, or a purely ceremonial gathering. In the former sense the native rulers of India in the past received visitors and conducted business in durbar. A durbar is the executive council of a native state. In the latter sense the word has come to be applied to great ceremonial gatherings like Lord Lytton's durbar for the proclamation of the queen empress in India in 1877, or the Delhi durbar of 1911.

DUREN, a town in Rhenish Prussia. Germany, on the right bank of the Roer, 19 mi. E. from Aix-la-Chapelle on the main line of railway to Cologne. Pop. (1939) 45,441. The Gothic St. Annakirche is said to contain a portion of the head of the saint, to the shrine of which frequent pilgrimages are made. There are several high-grade schools, and, in the town hall, a collection of antiquities. It is the seat of considerable manufactures, notably cloth, paper, flax-spinning, carpet, artificial wool, sugar, beer and spirits, iron wares, needles, machinery, glass.

Diiren derives its name from the *Dura* or *Duria,* assemblies held by the Carolingians in the 8th century. It received civic rights early in the 13th century. Hypothecated by the emperor Frederick II. to Count William of Jülich, it became incorporated with the duchy of that name, and with it passed to Prussia in 1816.

DURENE (1·2·4·5 tetramethylbenzene) $C_6H_2(CH_3)_4$, a hydrocarbon occurring in the light oils of coal-tar and prepared by the action of methyl iodide on brompseudocumene or 4.6 dibrom metaxylene, in presence of sodium; or by the action of methyl chloride on toluene, in presence of anhydrous aluminium chloride. It crystallizes in plates, having a camphor-like smell, melting at 79–80°C. and boiling at 189–191°C.

DURER, ALBRECHT (1471–1528), German painter, draughtsman and engraver, was born at Nuremberg on May 21, 1471. Albrecht Diirer the elder, born at Gyula, Hungary, in 1427, was a goldsmith by trade, and settled soon after the middle of the 15th century in Nuremberg. He served as assistant under a master-goldsmith of the city, Hieronymus Holper, and in 1468 married his master's daughter Barbara, the bridegroom being 40 and the bride 15 years of age. They had 18 children, of whom Albrecht was the second. Diirer painted the portrait of his father (who died in 1502) twice, in 1490 and again in 1497. The former of these is in the Uffizi at Florence; of the latter, four versions exist, that in the National Gallery, London (formerly in the Ashburton-Northampton collection) having the best claim to originality.

The young Albrecht was his father's favourite son, and was apprenticed at the age of fifteen and a half to the principal painter of the town, Michael Wolgemut. Wolgemut furnishes a complete type of the German painter of that age. There were

produced in the workshop of Wolgemut a great number of woodcuts for book illustration. We cannot with certainty identify any of these as being by the prentice hand of the young Durer. Authentic drawings done by him in boyhood, however, exist, including one in silver-point of his own likeness at the age of 13 in the Albertina at Vienna, and others of two or three years later in the print room at Berlin, at the British Museum and at Bremen.

At the end of his apprenticeship in 1490 he entered upon the usual course of travels — the Wanderjahre — of a German youth. It had at one time been his father's intention to apprentice him to Martin Schongauer of Colmar. But after travelling two years in various parts of Germany, the young Durer arrived at Colmar in 1492, only to find that Schongauer had died the previous year. He was received kindly by three brothers of the deceased master established there, and afterwards, still in 1492, by a fourth brother at Basle. Under them he evidently had some practice both in metal-engraving and in furnishing designs for the woodcutter. There is in the museum at Basle a wood-block of St. Jerome executed by him and elaborately signed on the back with his name. This was used in an edition of Jerome's letters printed in the same city in 1492. In the early part of 1494 he was working at Strasbourg, and returned to his home at Nuremberg immediately after Whitsuntide in that year. Of works certainly executed by him during his years of travel there are extant, besides the Basle wood-block, only a much-injured portrait of himself, dated 1493 and originally painted on vellum but since transferred to canvas (this is the portrait of the Felix Goldschmid collection); a miniature painting on vellum at Vienna (a small figure of the Child-Christ); and some half-a-dozen drawings, of which the most important are the characteristic pen portrait of himself at Erlangen, with a Holy Family on the reverse much in the manner of Schongauer; another Holy Family in nearly the same style at Berlin; a study from the female nude in the Bonnat collection; a man and woman on horseback in Berlin; a man on horseback, and an executioner about to behead a young man, at the British Museum, etc. These drawings all show Durer intent above all things on the sternly accurate delineation of ungeneralized individual forms by means of strongly accented outline and shadings curved, somewhat like the shadings of Martin Schongauer's engravings, so as to follow their modellings and roundness.

Within a few weeks of his return (July 7, 1494) Durer was married, according to an arrangement apparently made between the parents during his absence, to Agnes Frey, the daughter of a well-to-do merchant of the city. By the autumn of the same year he must have made an excursion of some months to Italy. The evidences of this travel consist of: (1) some fine drawings, three of them dated 1494 and others undated, but plainly of the same time, in which Durer has copied, or rather boldly translated into his own Gothic and German style, two famous engravings by Mantegna, a number of the "Tarocchi" prints of single figures which pass erroneously under that master's name, and one by yet another minor master of the North-Italian school; with another drawing dated 1495 and plainly copied from a lost original by Antonio Pollaiuolo, and yet another of an infant Christ copied in 1495 from Lorenzo di Credi; (2) several landscape drawings done in the passes of Tirol and the Trentino; (3) two or three drawings of the costumes of Venetian courtesans, one of which is used in his great woodcut Apocalypse series of 1498; (4) a general preoccupation from this date with the problems of the female nude, treated in a manner for which Italy only could have set him the example; and (5) the clear implication contained in a letter written from Venice in 1506 that he had been there already 11 years before. Some time in 1495 Durer must have returned from this first Italian journey to his home in Nuremberg, where he seems to have lived for the next ten years.

The hour when Durer, the typical artist of the German nation, attained maturity was one of the most pregnant in the history of his race. It was the crisis, in northern Europe, of the transition between the middle ages and our own. The art of printing had been invented in good time to help and hasten the new movement of men's minds Nor was it by the diffusion of written ideas only that the new art supplied the means of popular enlightenment. Along with word-printing, or indeed in advance of it, there had sprung into use another kind of printing, picture-printing, or what is commonly called engraving. Just as books were the means of multiplying, cheapening and disseminating ideas, so engravings on copper or wood were the means of multiplying, cheapening and disseminating images which gave vividness to the ideas, or served, for those ignorant of letters, in their stead. The genius of Albrecht Durer cannot be rightly estimated without taking into account the position which the arts of engraving on metal and on wood thus held in the culture of this time. He was indeed professionally and in the first place a painter; but throughout his career a great, and on the whole the most successful, part of his industry was devoted to drawing on the block for the woodcutter or engraving with his own hand on copper. Nuremberg was a favourable home for the growth and exercise of his powers. Of the free imperial cities of central Germany, none had a greater historic fame or a more settled and patriotic government. Nuremberg had imported before the close of the 15th century a fair share of the new learning of Italy, and numbered among her citizens distinguished humanists like Hartmann Schedel, Sebald Schreier, Willibald Pirkheimer and Conrad Celtes. From associates like these Durer could imbibe the spirit of Renaissance culture and research; but the external aspects and artistic traditions which surrounded him were purely Gothic, and he had to work out for himself the style and form-language fit to express what was in him. During the first seven or eight years of his settled life in his native city from 1495, he betrays a conflict of artistic tendencies as well as no small sense of spiritual strain and strife. His finest work in this period was that which he provided for the woodcutter. After some half-dozen miscellaneous single prints — "Samson and the Lion," the "Annunciation," the "Ten Thousand Martyrs," the "Knight and Men-at-arms," the "Men's Bath," etc. — he undertook, and by 1498 completed, his famous series of 15 great designs for the Apocalypse. Founding himself to some extent on traditional motives, Durer conceived and carried out a set of designs in which the qualities of the German late Gothic style, its rugged strength and restless vehemence, its love of gnarled forms, writhing actions and agitated lines, are fused by the fire of the young master's spirit into vital combination with something of the majestic power and classic severity which he had seen and admired in the works of Mantegna. Of a little later date, and of almost as fine a quality, were the first seven of a large series of woodcuts known as the "Great Passion"; and a little later again (probably after 1500), a series of 11 subjects of the Holy Family and of saints singly or in groups: then, towards 1504–05, came the first 17 of a set illustrating the life of the Virgin: neither these nor the "Great Passion" were published till several years later.

In copper-engraving Durer was at the same time diligently training himself to develop the methods practised by Martin Schongauer and earlier masters into one suitable for his own self-expression. He contented himself for the most part with Madonnas, single figures of scripture or of the saints, some nude mythologies founded upon the impressions received in Italy, and groups, sometimes bordering on the satirical, of humble folk and peasants. In the earliest of the Madonnas, the "Virgin with the Dragon-fly" (1495–96), Durer has thrown something of his own rugged energy into a design of the traditional Schongauer type. In examples of a few years later, like the "Virgin with the Monkey," the design of Mother and Child clearly betrays the influence of Italy and specifically of Lorenzo di Credi. On the other hand, he treats the subjects of the "Prodigal Son" and "St. Jerome in the Wilderness" in an almost purely northern spirit. In the nudes of the next four or five years, which included a "St. Sebastian," the so-called "Four Witches" (1497), the "Dream" or "Temptation," the "Rape of Amymome," and the "Jealousy" or "Great Hercules," Venetian, Paduan and Florentine memories are found, in the treatment of the human form. In these early engravings the highly wrought landscape backgrounds, whenever they occur, are generally the most satisfying feature, This feature reaches a climax of beauty and

elaboration in the large print of "St. Eustace and the Stag," while the figures and animals remain still somewhat cramped and immature. In the first three or four years of the 16th century we find Durer in his graver work still contending with the problems of the nude, but now with added power, though by varying methods. Thus the "Nemesis," belonging probably to 1503, is a marvellously wrought piece of quite unflinching realism in the rendering of a common type of mature, muscular, unshapely German womanhood. The conception and attributes of the figure are taken, as has lately been recognized, from a description in the "Manto" of Politian: the goddess, to whose shoulders are appended a pair of ,huge wings, stands like Fortune on a revolving ball, holding the emblems of the cup and bridle, and below her feet is spread a rich landscape of hill and valley. In the "Adam and Eve" of 1504 we find Diirer treating the human form in an entirely opposite manner; constructing it, that is, on principles of abstract geometrical proportion. The Venetian painter-etcher, Jacopo de Barbari, whom Durer had already, it would seem, met in Venice in 1494–95, and by the example of whose engravings he had already been much influenced, came to settle for a while in Nuremberg in 1500. He was conversant to some extent with the new sciences of perspective, anatomy and proportion, which had been making their way for years past in Italy, and from him it is likely that Durer received the impulse to similar studies and speculations. At any rate a whole series of extant drawings enables us to trace the German gradually working out his own ideas of a canon of human proportion in the composition of his famous engraving of "Adam and Eve" (1504), which at first, as a drawing in the British Museum proves, had been intended to be an Apollo and Diana conceived on lines somewhat similar to one of Barbari's. Two or three other technical masterpieces of the engraver's art, the "Coat-of-Arms with the Skull," the "Nativity," with its exquisite background of ruined buildings, the "Little Horse" and the "Great Horse," belong to 1505.

The pictures of this earlier Nuremberg period are not many in number and not very admirable. Among the earliest seem to be two examples of a method practised in Italy especially by the school of Mantegna, but almost without precedent in Germany, that of tempera-painting on linen. One of these is the portrait of Frederick the Wise of Saxony, formerly in the Hamilton collection and now at Berlin; the second, much disfigured by restoration, is the Dresden altar-piece with a Madonna and Child in the middle and St. Anthony and St. Sebastian in the wings. A mythology reminiscent of Italy is the "Hercules and the Stymphalian Birds" in the Germanic museum at Nuremberg, founded directly upon the "Hercules and Centaur Nessus" of Pollaiuolo, now at New Haven, Conn., U.S.A. Of portraits, besides that of his father already mentioned as done in 1497, there is his own of 1498 at Madrid. Two totally dissimilar portraits of young women, both existing in duplicate examples, for each of which has been claimed the name Furlegerin, that is, a member of the Fürleger family at Nuremberg, belong to nearly the same time. Other panel portraits of the period are three small ones of members of the Tucher family at Weimar and Cassel, and the striking, restlessly elaborated half-length of Oswald Krel at Munich. In some devotional pictures of the time Durer seems to have been much helped by pupils, as in the two different compositions of the Maries weeping over the body of Christ preserved respectively at Munich and Nuremberg. Two examples of high value are the Paumgartner altar-piece at Munich, with its romantically attractive composition of the Nativity with angels and donors in the central panel and the fine armed figures of St. George and St. Eustace on the wings; and the "Adoration of the Magi" in the Uffizi at Florence.

In the autumn of 1505 Durer journeyed for a second time to Venice, and stayed there until the spring of 1507. One of the motives for this journey was the prospect of a commission for an important picture from the German community settled at Venice, who had caused an exchange and warehouse—the Fondaco de' *Tedeschi*—to be built on the Grand canal, and who were then desirous of dedicating a picture in the church of St. Bartholomew. The picture painted by Durer on this commission was the "Adoration of the Virgin," better known as the "Feast of Rose Garlands"; it was subsequently acquired by the emperor Rudolf II., and carried as a thing beyond price upon men's shoulders to Vienna; it now exists in a greatly injured state in the monastery of Strahow at Prague. Of all Durer's works, it is the one in which he most deliberately rivalled the combined splendour and playfulness of certain phases of Italian art. A similar festal intention in design and colouring, with similar mastery in passages and even less sense of harmonious relations in the whole, is apparent in a second important picture painted by Durer at Venice, "The Virgin and Child with the Goldfinch," formerly in the collection of Lord Lothian and now at Berlin. A "Christ disputing with the Doctors" of the same period, in the Barberini gallery at Rome, is recorded to have cost the painter only five days' labour. The most satisfying of Durer's paintings done in Venice are the admirable portrait of a young man at Hampton Court (the same sitter reappears in the "Feast of Rose Garlands"), and two small pieces, one the head of a brown Italian girl modelled and painted with real breadth and simplicity, formerly in the collection of Mr. Reginald Cholmondeley and now at Berlin, and the small and very striking little "Christ Crucified" with the figure relieved against the night sky, which is preserved in the Dresden gallery and has served as model and inspiration to numberless later treatments of the theme. An interesting, rather fantastic, portrait of a blonde girl wearing a wide cap, now in the Berlin museum, is dated 1507 and may have been done in the early months of that year at Venice. A portrait of a Venetian woman, discovered in 1924 at Vienna, belongs to this period, and possibly also the famous portrait of himself at Munich bearing a false signature and date, 1500. In the latter the artist modified his own lineaments according to a preconceived scheme of facial proportion, so that it must be taken as an ideal rather than a literal presentment of him.

From the spring of 1507 until the summer of 1520, Durer was again a settled resident in his native town. Except the brilliant existences of Raphael at Rome and of Rubens at Antwerp and Madrid, the annals of art present the spectacle of few more honoured or more fortunate careers. His reputation had spread all over Europe. He was on terms of friendship or friendly communication with all the first masters of the age, and Raphael held himself honoured in exchanging drawings with Durer. 'In his own country, all orders of men, from the emperor Maximilian down, delighted to honour him; and he was the familiar companion of chosen spirits among the statesmen, humanists and reformers of the new age. His temper and life seem to have been remarkably free from all that was jarring, jealous and fretful; unless, indeed, we are to accept as true the account of his wife's character which represents her as an incorrigible shrew and skinflint. The name of Agnes Diirer was for centuries used to point a moral, and among the unworthy wives of great men the wife of Durer became almost as notorious as the wife of Socrates. It is to be noted that neither in Durer's early correspondence with his intimate friend, Willibald Pirkheimer, nor anywhere in his journals, does he use any expression of tenderness or affection for his wife, only speaking of her as his housemate and of her help in the sale of his prints, etc. But it is fair to remember in her defence that Pirkheimer, when he denounced her in the letter which forms the basis of these imputations, was old, gouty and peevish, and that the immediate occasion of his outbreak against his friend's widow was a fit of anger because she had not let him have a pair of antlers out of the property left by Diirer. After her husband's death Agnes Durer behaved with generosity to his brothers.

The 13 or 14 years of Durer's life between his return from Venice and his journey to the Netherlands (spring 1507–midsummer 1520) may be divided according to the classes of work with which he was principally occupied. The first five years, 1507–11, are pre-eminently the painting years of his life. In them he produced what have been accountrd his four capital works in painting, besides several others of minor importance The first is the "Adam and Eve" dated 1507, two version: sf

which exist, one in Florence at the Pitti palace, the other, which is generally allowed to be the original, at Madrid. To 1508 belongs the life-sized "Virgin with the Iris," a piece remarkable for the fine romantic invention of its background, but plainly showing the hand of an assistant, perhaps Hans Baldung, in its execution: the best version is in the Cook collection at Richmond, an inferior one in the Rudolphinum at Prague. In 1508 Durer returned to a subject which he had already treated in an early woodcut, the "Massacre of the Ten Thousand Martyrs of Nicomedia." The picture, painted for the elector Frederick of Saxony, is now in the Imperial gallery at Vienna. In 1509 followed the "Assumption of the Virgin" with the Apostles gathered about her tomb, a rich altar-piece with figures of saints and portraits of the donor and his wife in the folding wings, executed for Jacob Heller, a merchant of Frankfurt, in 1509. This altar-piece was afterwards replaced at Frankfurt (all except the portraits of the donors, which remained behind) by a copy, while the original was transported to Munich, where it perished by fire in 1674. In 1511 was completed another famous painting, multitudinous in the number of its figures though of very moderate dimensions, the "Adoration of the Trinity by all the Saints," now at Vienna.

In the meantime Durer had added a few to the number of his line-engravings and had completed the two woodcut series of the "Great Passion," begun about 1498–99, and the "Life of the Virgin." In 1511 these two works were brought out for the first time, and the Apocalypse series in a second edition; and for the next three years, 1511–14, engraving both on wood and copper, but especially the latter, took the first place among Durer's activities. Besides such fine single woodcuts as the "Mass of St. Gregory," the "St. Christopher," the "St. Jerome," and two Holy Families of 1511, Durer published in the same year the most numerous and popularly conceived of all his woodcut series, that known from the dimensions of its 37 subjects as the "Little Passion" on wood; and in the next year, 1512, a set of 15 small copper-engravings on the same theme, the "Little Passion" on copper. Both of these must represent the labour of several preceding years: one or two of the '(Little Passion" plates, dating back as far as 1507, prove that this series at least had been as long as five years in his mind. In thus repeating over and over on wood and copper nearly the same incidents of the Passion, or again in rehandling them in yet another medium, as in the highly finished series of drawings known as the "Green Passion" in the Albertina at Vienna, Durer shows an inexhaustible variety of dramatic and graphic invention, and is never betrayed into repeating an identical action or motive.

In 1513 and 1514 appeared the three most famous of Durer's works in copper-engraving, "The Knight and Death" (or simply "The Knight," as he himself calls it, 1513), the "Melancolia" and the "St. Jerome in his Study" (both 1514). These are the masterpieces of the greatest mind which ever expressed itself in this form of art. The idea at the bottom of the "Knight and Death" seems to be a combination of the Christian knight of Erasmus's *Enchiridion militis Christiani* with the type, traditional in mediaeval imagery, of the pilgrim on his way through the world. The "Melancolia," numbered "I" as though intended to be the first of a series, with its brooding winged genius sitting dejectedly amidst a litter of scientific instruments and symbols, is hard to interpret in detail, but impossible not to recognize in general terms as an embodiment of the spirit of intellectual research (the student's "temperament" was supposed to be one with the melancholic), resting sadly from its labours in a mood of lassitude and defeat. Comparatively cheerful beside these two is the remaining subject of the student saint reading in his chamber, with his dog and domestic lion resting near him, and a marvellous play of varied surface and chequered light on the floor and ceiling of his apartment and on all the objects which it contains. Besides these three masterpieces of line-engraving, the same years, 1512–15, found Durer occupied with his most important experiments in etching, both in dry-point ("The Holy Family and Saints" and the "St. Jerome in the Wilderness") and with the acid bath. At the same time he was more taken up than ever, as is proved by the contents of a sketch-book at Dresden, with mathematical and anatomical studies on the proportions and structure of the human frame. A quite different kind of study, that of the postures of wrestlers in action, is illustrated by a little-known series of drawings, still of the same period, at Vienna. Almost the only well-authenticated painting of the time is a "Virgin and Child" in the Imperial museum at Vienna. The portraits of the emperors Charles the Great and Sigismund (1512), in their present state at any rate, can hardly be recognized as being by the master's hand. An interval of five years separates the Vienna "Madonna" from the two fine heads of the apostles Philip and James in the Uffizi at Florence, the pair of boys' heads painted in tempera on linen in the Bibliothèque Nationale at Paris, the "Madonna with the Pink" at Augsburg, and the portrait of Wolgemut at Munich, all of 1516. Among engravings of the same time are three Madonnas, the apostles Thomas and Paul, a bagpiper and two peasants dancing, and three or four experiments in etching on plates of iron and zinc. In wood-engraving his energies were almost entirely given to his share in the great decorative schemes commanded by the emperor Max in his own honour: namely, the Triumphal Gate and the Triumphal March or Procession. A third and smaller commemorative design, the Triumphal Car, originally designed to form part of the second but in the end issued separately, was entirely Diirer's own work. A far more successful effort of his genius is to be found in the marginal decorations done by him in pen for the emperor's prayer-book. This unequalled treasure of German art and invention has been broken up, the part executed by Durer being preserved at Munich, the later sheets, which were decorated by other hands, having been transported to Besançon. Durer's designs, drawn with the pen in pale lilac, pink and green, show an inexhaustible richness of invention and an airy freedom and playfulness of hand beyond what could be surmised from the sternness of those studies which he made direct from life and nature.

All these undertakings for his imperial friend and patron ceased with the emperor's death in 1519. A portrait-drawing by the master done at Augsburg a few months previously, one of his finest works, served him as the basis both of a commemorative picture and a woodcut. In line engravings we have four more Madonnas, two St. Christophers, one or two more peasant subjects, the well-known St. Anthony with the view of Nuremberg in the background, and the smaller of the two portraits of the cardinal-elector of Mainz; and in wood-engraving several fine heraldic pieces, including the arms of Nuremberg.

In the summer of 1520 he set out for the Netherlands, together with his wife and her maid, in order to be present at the coronation of the young emperor Charles V., and if possible to conciliate the good graces of the all-powerful regent Margaret. He journeyed by the Rhine, Cologne, and thence by road to Antwerp, where he was handsomely received, and lived in whatever society was most distinguished, including that of Erasmus of Rotterdam. Besides his written notes, interesting traces of his travels exist in the shape of the scattered leaves of a sketch-book filled with delicate drawings in silver-point, chiefly views of places and studies of portrait and costume. Several of his finest portrait-drawings in chalk or charcoal, including those of his brother artists Lucas Van Leyden and Bernard Van Orley, as well as one of two fine portrait paintings of men, belong to the period of this journey. So does a magnificent drawing of a head of a nonagenarian with a flowing beard who sat to him at Antwerp, together with a picture from the same head in the character of St. Jerome; the drawing is now at Vienna, the picture at Lisbon. Besides going to Aachen for the coronation, he made excursions down the Rhine from Cologne to Nimwegen, and back overland by Hertogenbosch; to Brussels; to Bruges and Ghent; and to Zealand with the object of seeing a natural curiosity, a whale reported ashore. The diary contains a passionate outburst of sympathetic indignation at the supposed kidnapping of Luther by foul play on his return from the diet of Worms. Without being, properly speaking, a reformer, Durer in his art and his thoughts was the incarnation of those qualities

of the German character and conscience which resulted in the Reformation; and, personally, with the fathers of the Reformation he lived in the warmest sympathy.

On July 12, 1521, Durer reached home again. Drawings of this and the immediately following years prove that on his return his mind was full of schemes for religious pictures. There exist fine drawings for a "Lamentation over the body of Christ," an "Adoration of the Kings," and a "March to Calvary"; of the last-named composition, besides the beautiful and elaborate pen-and-ink drawing at Florence, three still more highly wrought versions in green monochrome exist; whether any of them are certainly by the artist's own hand is matter of debate. But no religious paintings on the grand scale, corresponding to these drawings of 1521–24, were ever carried out. The artist allowed much of his time and thoughts to be absorbed in the preparation of his theoretical works on geometry and perspective, proportion and fortification. Like Leonardo, but with much less than Leonardo's genius for scientific speculation and divination, Durer was a confirmed reasoner and theorist on the laws of nature and natural appearances. The consequence was that in the last and ripest years of his life he produced as an artist comparatively little. In painting there is the famous portrait of Hieronymus Holtzschuher at Berlin. This and the Antwerp head of Jerome are perhaps the most striking examples of Durer's power of forcing into subordination to a general impression such a multiplicity of insistent detail as would have smothered any weaker conception than his. To the same period belong a "Madonna and Child" at Florence, and finally, still in the year 1526, the two famous panels at Munich embodying the only one of the great religious conceptions of the master's later years which he lived to finish. These are the two pairs of saints, St. John with St. Peter in front and St. Paul with St. Mark in the background. The John and Paul are conceived and executed really in the great style, with a commanding nobility and force alike in the character of the heads, the attitudes, and the sweep of draperies; they represent the highest achievement of early German art in painting. In copper-engraving Diirer's work during the same years was confined entirely to portraits, those of the cardinal-elector of Mainz ("The Great Cardinal"), Frederick the Wise, elector of Saxony, Willibald Pirkheimer, Melanchthon and Erasmus. To the tale of his woodcuts, besides a few illustrations to his book on measurements (that is, geometry and perspective), and on fortification, he added only one Holy Family and one portrait, that of his friend Eoban Hesse. Of his theoretical books he succeeded in getting only two finished and produced during his lifetime, that on geometry and perspective or measurements—to use his own title—which was published at Nuremburg in 1525, and that on fortification, published in 1527; the work on human proportions was brought out shortly after his death in 1528. His labours, whether artistic or theoretic, had for some time been carried on in the face of failing health. In the canals of the Low Countries he had caught a fever, of which he never shook off the effects. We have the evidence of this in his own written words, as well as in a sketch which he drew to indicate the seat of his suffering to some physician, and again in a portrait engraved on wood just after his death, from a drawing made no doubt not long before: in this portrait we see his shoulders already bent, the features somewhat gaunt, the old pride of the abundant locks shorn away. The end came suddenly on the night of April 6, 1528. An appropriate *Requiescat* is contained in the words of Luther, in a letter written to their common friend Eoban Hesse:—"As for Durer, assuredly affection bids us mourn for one who was the best of men, yet you may well hold him happy that he has made so good an end, and that Christ has taken him from the midst of this time of trouble and from greater troubles in store, lest he, that deserved to behold nothing but the best, should be compelled to behold the worst. Therefore may he rest in peace with his fathers: Amen."

The principal extant paintings of Durer, with the places where they are to be found, have been mentioned above. Of his drawings, which for students are the most vitally interesting part of his works, the richest collections are in the Albertina at Vienna, the Berlin museum and the British Museum. The Louvre also possesses some good examples, and many others are dispersed in various public collections, as in the Musée Bonnat at Bayonne, at Munich, Hamburg, Bremen, Frankfurt, Dresden, Basle, Milan, Florence and Oxford, as well as in private hands.

The principal editions of Diirer's theoretical writings are:

Geometry and Perspective.—*Underweysung* der Messung mit dem Zirckel und Richtscheyt, in *Linien,* Ebnen und *ganzen* Corporen (Nuremberg, 1525, 1533, 1538). A Latin translation of the same, with a long title (Paris, Weichel, 1532) and another ed. in 1535. Again in Latin, with the title *Institutionum* geometricarum libri quatuor (Arnheim, 1605).

Fortification.—*Etliche* Underricht *zu* Befestigung der Stett, Schloss und *Flecken* (Nuremberg, 1527), and other editions in 1530, 1538 and 1603 (Arnheim). A Latin translation with the title De urbibus, arcibus, castellisque muniendis ac condendis (Paris, Weichel, 1535).

Human Proportion.—*Hierinnen sind* begriffen vier *Bücher* von menschlicher Proportion (Nuremberg, 1582, and Arnheim, 1603). Latin translation: De symetria partium in rectis *formis* humanorum corporum libri in *latinum* conversi, de varietate *figurarum,* etc., libri ii. (Nuremberg, 1528, 1532 and 1534); (Paris, 1535, 1537, 1557). French translation (Paris, 1557, Arnheim, 1613, 1614). Italian translation (Venice, 1591, 1594); Portuguese translation (1599); Dutch translation (Arnheim, 1622, 1662).

The private literary remains of Diirer, his diary, letters, etc., were published most completely in Lange and Fuhse's Durers schriftlicker *Nachlass* (Halle, 1903); W. M. Conway's Literary Remains of A. Durer (London, 1889) contains extensive transcripts from the mss. in the British Museum.

The principal remaining literature on the subject will be found in the following books and treatises: F. Lippmann, *Zeichnungen* von A. *Dürer* in Nachbildungen (1883–1905); A. Springer, Albrecht Durer (1892); D. Burckhardt, Diirers Aufenthalt in *Basel, 1492–94* (Munich, 1892); G. von Terey, A. Diirers venezianischer Aufenthalt, *1494–95* (Strasbourg, 1892); S. R. Koehler, A Chronological Catalogue of the Engravings, Dry Points and Etchings of A. *Dürer* (New York, 1894); L. Cust, A. Durer, a Study of his Life and Works (1897). Durer Society's Publications (1898–1907), edited by C. Dodgson and S. M. Peartree; M. Thausing, Diirer, die Geschichte seines Lebens (2nd ed. 1884; English translation 1882); B. Haendcke, Die Chronologie der Landschaften *A.* Durers (Strasbourg, 1899); H. Wolfflin, Die Kunst A. Diirers (Munich, 1905; 2nd ed. 1908); V. Scherer, *A. Dürer* (Klassiker der Kunst, iv.), (3rd ed. 1908); Max Friedländer, A. Diirer (1921); Pierre de Colombier, Albert Diirer (1927).

See also the *Jahrbücher* of the Berlin and Vienna museums, *Repertorium* fur Kunstwissenschaft, Zeitschrift *für* bildende Kunst, etc.; Prof. H. W. Singer's Versuch einer *Dürer-Bibliographie* (Strasbourg, 1903); A. Jellinek's Internationale *Bibliographie* der Kunstwissenschaft (Berlin); an *édition* de luxe of Dr. Willi Kurth's Complete Woodcuts of Albrecht Diirer (intro. by Campbell Dodgson) was published in 1927. (S. C.; X.)

DURESS, in law, constraint or compulsion. Duress may be of two kinds. It may consist of personal restraint or actual violence or imprisonment; or it may be by threats (per minus), as where a person is compelled to an act by threats of immediate death or grievous bodily harm. (See COERCION; CONTRACT.)

D'URFEY, THOMAS (1653–1723), better known as Tom d'Urfey, English song-writer and dramatist, belonged to a Huguenot family settled at Exeter. Honoré d'Urfé, the author of *Astrée,* was his uncle. His first play, The Siege of Memphis, or the *Ambitious* Queen, a bombastic rhymed tragedy, was produced at the Theatre Royal in 1676. He was much more successful with his comedies, which had brisk, complicated plots carried out in lively dialogue. He had a light touch for fitting words on current topics to popular airs; moreover, many of his songs were set to music by his friends Dr. John Blow, Henry Purcell and Thomas Farmer. Many of these songs were introduced into his plays. Addison in the Guardian (No. 67) relates that he remembered to have seen Charles II. leaning on Tom d'Urfey's shoulder and humming a song with him. Even William III. liked to hear him sing his songs, and as a strong Tory he was sure of the favour of Princess Anne, who is said to have given Tom fifty guineas for a song on the Electress Sophia, the next heir in succession to the crown. "The crown's far too weighty, for shoulders of eighty," said d'Urfey, with an indirect compliment to the princess, "So Providence kept her away,—poor old Dowager Sophy." He was poor in his old age; but his gaiety and invincible good humour had made him friends in the craft, and by the influence of Addison his Fond Husband, or The Plotting Sisters was revived for d'Urfey's benefit at Drury Lane on June 15, 1713. He died on Feb. 26, 1723.

Collections of his songs with the music appeared during his lifetime, the most complete being the 1719–20 edition (6 vols.) of *Wit and Mirth; or Pills to Purge Melancholy*. The best known of the twenty-nine pieces of his which actually found their way to the stage were *Love for Money; or The Boarding School* (Theatre Royal, 1691), *The Marriage-Hater Match'd* (1692), and *The Comical History of Don Quixote*, in three parts (1694, 1694 and 1696), which earned the especial censure of Jeremy Collier. In his burlesque opera, *Wonders in the Sun; or the Kingdom of the Birds* (1706, music by G. B. Draghi), the actors were dressed as parrots, crows, etc.

DURFORT, a family distinguished in French and English history and taking its name from a feudal lordship situated at the village of Durfort. in south-western France. formerlv in the province of Guienne, now in the department of Tarn-et-Garonne, 18 m. north-west of Montauban. The pedigree of the family is only clearly traceable to Arnaud de Durfort (*fl.* 1305), who acquired the fief of Duras by his marriage with a niece of Pope Clement V. His descendant, Gaillard de Durfort, having embraced the side of the king of England, went to London in 1453, and was made governor of Calais and a knight of the Garter.

The greatness of the family dates from the 17th century. Guy Aldonce (1605–65), marquis de Duras and comte de Rozan, had, by his wife Elizabeth de la Tour d'Auvergne, sister of Marshal Turenne, six sons, three of whom played a distinguished part. The eldest, Jacques Henri (1625–1704) was governor of Franche Comté in 1674 and a marshal of France. The second, Guy Aldonce (1630–1702), comte de Lorges and duc de Quintin (known as the duc de Lorges), became a marshal of France in 1676, commanded the army in Germany from 1690 to 1695, and captured Heidelberg in 1693. The sixth son, Louis (1640?–1 jog), marquis de Blanquefort, came to England in the suite of James, duke of York, in 1663, and was naturalized in the same year. On Jan. 19, 1672–73, he was raised to the English peerage as Baron Duras of Holdenby, his title being derived from an estate in Northamptonshire bought from the duke of York. In 1676 he married Mary, daughter and elder co-heiress of Sir George Sondes, created in that year Baron Throwley, Viscount Sondes and earl of Feversham. On the death of his father-in-law (April 16, 1677), Duras succeeded to his titles under a special remainder. He was appointed by Charles II. successively to the command of the third and second troops of Horse Guards, was sent abroad on several important diplomatic missions, and became master of the horse (1679) and lord chamberlain to the queen (1680). In 1682 he was appointed a lord of the bed-chamber, and was present at the king's deathbed reconciliation with the Roman Church. Under James II. Feversham became a member of the privy council, and in 1685 was given the chief command against the rebels under Monmouth, in which he mainly distinguished himself by his cruelty to the vanquished. He was rewarded with a knighthood of the Garter and the colonelcy of the first troop of Life Guards, and in 1686 he was appointed to the command of the army assembled by King James on Blackheath to overawe the people. On James's flight, Feversham succeeded in making his peace with William, on the intercession of the queen dowager, at whose instance he received the mastership of the Royal Hospital of St. Catherine near the Tower (1698). He died without issue on April 8, 1709. (See G. E. C[ockayne], Complete Peerage, and art. in D.N.B.)

Jean Baptiste (1684–1770), duc de Duras, son of Jacques Henri, was also a marshal of France. His son Emmanuel Félicité (1715–89), duc de Duras, took part in all the wars of Louis XV. and was made a marshal of France in 1775. His grandson, Amédée Bretagne Malo (1771–1838), duc de Duras, is mainly known as the husband of Claire Louise Rose Bonne de Coetnempren de Kersaint (1778–1828), daughter of Armand Guy Simon de Coetnempren Kersaint (*q.v.*), who, as duchesse de Duras, presided over a celebrated salon and wrote several novels once widely read.

The family of Durfort is represented in France now by the branch of Durfort-Civrac, dating from the 16th century.

DURGA, one of the many cult-titles of Devi, "the Goddess," in Hindu mythology. Durga first appears in the Epics, as a name of Umā, wife of Siva (*q.v.*), and she may have been originally worshipped by savage aborigines. She is also a manifestation of Kālī (*q.v.*), and the hook-swinging rite of self-devotion is done in her honour. One of her principal festivals, as a war-goddess, is the Durga-puja (see DASEHRA). Durga is pictured, in spite of her fierce nature, with a gentle face.

DURHAM, JOHN GEORGE LAMBTON, 1ST EARL OF (1792–1840), English statesman, son of William Henry Lambton of Lambton Castle, Durham, was born in London on April 12, 1792. His mother was Anne Barbara Villiers, daughter of the 4th earl of Jersey. Lambton succeeded to large estates when he was five years old. In 1805 he went to Eton, and in 1809 obtained a commission in the 10th Hussars. In 1812, while still a minor, he made a runaway match with Henrietta, natural daughter of Lord Cholmondeley, whom he married at Gretna Green; she died in 1815. In 1813 he was elected to the House of Commons as member for the county of Durham in the Whig interests.

In 1816 he married Louisa Elizabeth, eldest daughter of Lord Grey, and as early as 1818 he was taken into the political confidence of his father-in-law and other Whig leaders. But Lambton belonged to the avowedly Radical wing of the party, with whose aims Grey had little sympathy; and when he gave notice of a resolution in 1819 in favour of shortening the duration of parliaments, and of a wide extension of the franchise, he found himself discountenanced. He warmly espoused the cause of Queen Caroline. In April he made his first great speech in the House of Commons on parliamentary reform, when he proposed a scheme for the extension of the suffrage to all holders of property, the division of the country into electoral districts and the disfranchisement of rotten boroughs. He was now one of the recognized leaders of the advanced Liberals, forming a connecting link between the aristocratic Whig leaders and the Liberals of the great towns. His opposition to any compromise on the question of Catholic emancipation led (1825) to his first conflict with Brougham, with whom he had been on terms of close friendship. While supporting the candidature of his brother-in-law, Lord Howick, for Northumberland in the elections of 1826, Lambton fought a duel with T. W. Beaumont, the Tory candidate, but without bloodshed on either side. Lambton supported the ministry of Canning, and after Canning's death that of Lord Goderich, on whose advice he was raised to the peerage in 1828 with the title of Baron Durham. Lord Durham was on terms of friendship with Prince Leopold of Saxe-Coburg, who, after he became king of the Belgians as Leopold I., continued to correspond with Durham as a trusted confidant; the same confidential relations also existed between Durham and Leopold's sister, the duchess of Kent, and her daughter, afterwards Queen Victoria.

In November 1830 Durham entered the Grey cabinet as lord privy seal. To ardent reformers in the country the presence in the cabinet of "Radical Jack" was a pledge that thorough-going reform would not be shirked by the Whigs, now in office for the first time for 20 years. Lord Grey gave him the task of preparing a scheme to serve as the basis of the proposed legislation. He was chairman of the famous committee of four, which met at his house in Cleveland Row and drew up the scheme submitted by the government to parliament. It was Durham who selected Lord John Russell, not then in the cabinet, to introduce the bill in the House of Commons. When the deadlock between the two Houses occurred over the second Reform Bill (1832), he pressed on the prime minister the necessity for a creation of peers to overcome the resistance of the House of Lords.

After the passing of the Reform Act, Durham was sent on a difficult diplomatic mission to Russia. On his return he resigned office in March 1833, ostensibly for reasons of health, but in reality owing to his disagreement with the government's Irish policy as conducted by Lord Stanley; in the same month he was created earl of Durham and Viscount Lambton. His advanced opinions gradually alienated the more moderate of his late colleagues, such as Melbourne and Palmerston, and even Lord Grey often found his son-in-law intractable and self-assertive; but the growing hostility of Brougham was mainly due to Durham's undoubted popularity in the country, where he was regarded by many, including J. S. Mill, as Grey's probable successor in the leadership of the Liberal party. At the great banquet given to

Lord Grey at Edinburgh in Sept. 1834 Brougham made a venomous attack on Durham, repeated shortly afterwards at Salisbury, and anonymously in the *Edinburgh Review*. But the strength of Durham's position in the country was shown when a concourse of more than a hundred thousand persons assembled to hear him speak at Glasgow Green in October. Durham however found no place in the Melbourne administration, partly because of his difficult temper, and partly on account of his radicalism.

In 1837 Durham accepted the post of governor-general and lord high commissioner in Canada, with the almost dictatorial powers conferred on him by an act passed in Feb. 1838, by which the constitution of Lower Canada was suspended for two years. Having secured the services of Charles Buller (*q.v.*) as first secretary, and having appointed Thomas Turton and Edward Gibbon Wakefield (*q.v.*) to be his unofficial assistants, Durham arrived at Quebec on May 28, 1838. Papineau's rebellion had been quelled, but the French Canadians were sullen, the attitude of the United States equivocal, and the general situation dangerous, especially in the Lower Province where government was practically in abeyance. Durham at once issued a conciliatory proclamation. He dismissed his predecessor's executive council and created a new and unprejudiced one. On June 28, the day of Queen Victoria's coronation, he issued a proclamation of amnesty, from which eight persons only were excepted; these were to be transferred from Montreal to Bermuda, where they were to be imprisoned without trial. Papineau and 15 other fugitives were forbidden on pain of death to return to Canada.

These proceedings were violently attacked in England by Brougham. Of the ministers Lord John Russell alone defended the public servant to whom they had promised "the most unflinching support"; and the prime minister and the colonial secretary, who had signified their "entire approval," now disallowed the ordinance, and carried an Act of Indemnity the terms of which were insulting to Durham. The latter immediately resigned; but before returning to England he put himself in the wrong by attempting a public justification of his actions. He laid his memorable "Report on the Affairs of British North America," before parliament on Jan. 31, 1839. This report, one of the greatest state papers in the English language, laid down the principles, then unrecognized, which have guided British colonial policy ever since. It was not written or composed by Charles Buller, as Brougham was the first to suggest, and the credit for the statesmanship it exhibits is Lord Durham's alone, though he warmly acknowledged the assistance he had derived from Buller, Wakefield and others in preparing the materials on which it was based. With regard to the future government of British North America, Durham had at first inclined towards a federation of all the colonies on that continent; but as a more immediately practical policy he advised the legislative union of Upper and Lower Canada. He further urged the creation of an executive council responsible to the colonial legislature; he advised state-aided emigration on the broadest possible scale, and the formation of an intercolonial railway for the development of the whole country. Meantime Durham, who almost alone among the statesmen of his time saw the importance of imperial expansion, interested himself in the emigration schemes of Gibbon Wakefield (*q.v.*); he became chairman of the New Zealand Company, and was thus concerned in the enterprise which forestalled France in asserting sovereignty over the islands of New Zealand in Sept. 1839. He died at Cowes on July 28, 1840, just five days after the royal assent had been given to the bill giving effect to his project for uniting Upper and Lower Canada.

Lord Durham filled a larger place in the eyes of his contemporaries than many statesmen who have been better remembered. He was in his lifetime regarded as a great popular leader; and his accession to supreme political power was for some years considered probable by many; his opinions were, however, too extreme to command the confidence of any considerable party in parliament before 1840. That Brougham hated him and Melbourne feared him, is a tribute to his abilities; and in the first Reform Act, of which he was the chief author, and in the famous *Report* on the principles of colonial policy, he left an indelible mark on English history. His personal defects of character did much to mar the success of a career, which, it must be remembered, terminated at the age of 48. He was impatient, hot-tempered, hypersensitive to criticism, vain and prone to take offence at fancied slights; but he was also generous and unvindictive, and while personally ambitious his care for the public interest was genuine and untiring.

By his first wife Durham had three daughters; by his second, who was a lady of the bedchamber to Queen Victoria but resigned on her husband's return from Canada, he had two sons and three daughters, the eldest son, Charles William, the "Master Lambton" of Sir Thomas Lawrence's celebrated picture, died in 1831; the second, George Frederick d'Arcy (1828–1879), succeeded his father as 2nd earl of Durham. The latter's son, John George Lambton (1855–1928), became 3rd earl in 1879.

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DURHAM, a county of England bounded north by Northumberland, east by the North sea, south by Yorkshire, and west by Westmorland and Cumberland. Area 1,014.7 sq.mi. The Derwent, a tributary of the Tyne, forms part of the northern boundary with Northumberland, while the Tees in the south forms almost the whole of the boundary with Westmorland and Yorkshire. The county is divided into a highland west and a lowland east. No clearly marked contour separates these regions but geologically the Permian scarp, forming the right bank of the middle Wear and continuing north-north-eastwards to just south of Tynemouth is a suitable dividing line. West of this the Carboniferous limestone series prevails, a succession of thick beds of limestone with intervening sandstones and shales. This series forms the high ground of the north Pennines which are the backbone of the western section of the county. It is, however, broken by intrusive dykes and sills of basalt, especially in the Tees valley above Middleton; one of these, the Great Whin Sill, extends 120 miles. The Cockfield dyke and Little Whin Sill are similar intrusions of basalt. Millstone Grit caps many of the higher points in the west as at Muggleswick and Walsingham commons. On these plateaux, Bolts Law reaches 1,778 ft. and Fatherly hill 1,504 feet. The outcrop of the Millstone Grit broadens eastward until it is covered by the Durham coalfield which occupies the centre of the county from Newcastle and South Shields to Barnard Castle. There are some small Silurian outcrops near Cronkley on the Tees, once famous for its slate pencils. South and east of the Permian Scarp the newer rocks are exposed and dip eastwards or south-eastwards. The Permian magnesian limestone reaches from the Tees to South Shields in a broad tract and occupies the coast between that town and Hartlepool. The south-eastern corner of the county is low-lying with Triassic and Jurassic material — red marls and sandstones with beds of gypsum and rock salt.

The drainage system as represented by the major streams, the Wear, Derwent and Tees, bears a curious relation to the geology. When flowing over the older rock of the west they follow a general north-west to south-east line, well marked in the Upper Wear and Tees, but, once they enter the newer rocks, the general direction of the drainage runs almost at right angles south-west to north-east. Of additional interest is the final section of the Wear from Chester-le-Street to the sea. In pre-glacial times the south-west to north section of the middle course continued and the Wear was a tributary of the Tyne entering it just to the west of Gateshead. The blocking of its former lower course by glacial débris caused it to turn at Chester-le-Street to the eastward and it cut through the low Permian scarp and found the sea at its present mouth at Sunderland. Between the Wear and lower Tees is the strange valley of the Skerne. This river flows on Permian rock in an

opposite direction to the general trend of the larger rivers and enters the Tees just as it changes its course (near Darlington) from the upper north-west to south-east section on the older rocks (where it takes advantage of important fault lines) to its lower course on newer rocks in a broad open valley with wide stretches of sand near the coast.

Glacial deposits containing derived material from the Cheviots and Pennines obscure the older rocks. There are evidences from sunk meanders in the middle courses of the Wear and Tees, raised beaches, and submerged forests off the coast at West Hartlepool and other points of post-glacial earth movements. Except in the western moorlands only a few scraps of the county have been left in their natural state. The ballast-hills at Shields, Jarrow and Hartlepool, have many foreign plants elsewhere unknown in England. Stockton was almost the last retreat in England of the native black rat. Peatbog remains testify to the former abundance of deer, wild ox and boar, which appear to have existed in the reign of Henry VIII.; records of red deer are found in the 18th century.

Early Settlement. — Evidence of early man is scarce. It would seem that the area was but sparsely populated at least until Saxon times. Copt hill, Houghton-le-Spring, has a barrow which shows a series of burials, the earliest of which may be of neolithic date. Finds of the Bronze age are more numerous, yet from their characteristic distribution along the river valleys, especially those of the Tyne and Wear, it may be taken that the Bronze age invaders were more "birds of passage" than settlers. The Bronze hoard at Heathery Burn Cave has yielded important finds. Evidence of the Iron age is very scanty—a fine late Iron age sword, at Barnston, near Sadberge being its only representative.

History. — In Roman and Romano-British times, county Durham was an outpost and the main concern of the Romans was for the safely of communication to the frontier walls. Through the county ran the great north road, from outside York via Cataractonium to Vinduia at the bend of the Wear and thence northward to the Tyne at Corstopitum. Chester-le-Street and South Shields were Roman stations. The post-Roman centuries saw the county overrun by northern raiders until the Saxon settlement and the establishment of the kingdom of Northumbria. The church sites at Monk Wearmouth (Sunderland), Jarrow, Escomb, near Bishop Auckland, and numerous sculptured crosses (as those at Aycliffe) are of the Anglo-Saxon period.

In the 6th century Northumbria was divided into Bernica and Deira, separated by the Tees, the latter including the district afterwards known as Durham. The post-Norman palatinate grew around a grant of land originally made by Egfrith to St. Cuthbert on his election to the see of Lindisfarne in 685. On the transference of the see to Chester-le-Street in the 9th century, Guthred the Dane endowed it with the whole district between the Tyne and the Wear, stretching west as far as Watling street, a grant confirmed by Alfred; the endowment was again enriched at the establishment of the see at Durham in 995. The ravages of the Danes caused much disruption in this area in the 9th century when the Tees formed the northern boundary of the Danelaw. Durham continued, however, to form part of the earldom of Northumbria, and it was not until after the purchase of the earldom by Bishop Walcher in 1075 that the bishops began to exercise regal rights in their territory. The term palatinus is applied to the bishop in 1293. At the time of the Conquest the bishop's possessions included nearly all the district between the Tees and the Tyne, except Sadberge, and also the outlying districts of Bedlingtonshire, Norhamshire, Islandshire and Crayke, together with Hexhamshire, the city of Carlisle, and part of Teviotdale. Henry I. deprived the bishopric of the last three but made over to it three vills of the earldom of Northumberland. The wapentake of Sadberge was purchased by Bishop Pudsey in 1189, but continued independent in administration. The division into the four wards of Chester-le-Street, Darlington, Easington and Stockton existed in the 13th century. The diocese was divided into the archdeaconries of Durham and Northumberland.

The palatinate was administered by a steward with a sheriff. coroners, chamberlain and chancellor. The palatine assembly represented the whole county and dealt chiefly with fiscal questions. The bishop's council, consisting of the clergy, the sheriff and the barons, regulated judicial affairs. The prior of Durham had his own court. The repeated efforts of the crown to check the powers of the palatinate bishops culminated in 1536 in the Act of Resumption, which deprived the bishop of much of his judicial power. In 1596 further restrictions were imposed and in 1646 the palatinate was abolished. It was revived, however, after the Restoration, and continued with much the same power until the Act of 1836, which finally vested the palatine jurisdiction in the crown. The most important palatinate barons of the 12th century were the Hiltons, the Bulmers, the Conyers, the Hansards and the Lumleys. The Nevilles owned large estates in the county, which they ruled from Raby castle. Owing to its isolated position the palatinate took little part in the great rebellions of the Norman and Plantagenet period. On the outbreak of the Civil War Durham inclined to support the cause of parliament, and in 1640 harboured the Scottish army. In 1642 the earl of Newcastle organized the western counties for the king, but in 1644 the palatinate was again overrun by the Scottish army, and after Marston Moor fell entirely into the hands of the parliament.

Agriculture. — Agriculture centres in the river valleys. East of the line from Barnard Castle to Consett the hills are covered with a dry loam, whose fertility varies with its depth. West of the line the bills are in great part waste moorland. About 58½% of the total area of 645,739 ac. was under cultivation in 1939 and of this two-thirds was in permanent pasture, including 132,482 ac. of rough pasture. Oats, with 33,854 ac., were the main crop, with wheat (20,652 ac.) and barley (5,797 ac.) coming next. Potatoes and turnips and swedes, with 24,156 ac. almost equally divided, were prominent among the green crops. Cattle are imported. The sheep are esteemed, particularly the Teesdale and Weardale breeds. The National Trust owned only 18½ ac. in Durham in 1942.

Industrial Activities. — The coal-field has two sections, that west of Durham on the Pennine plateau where early mining occurred, and that east of the Wear. In the former region the coal measures outcrop on the valley sides and the mines are shallow. In the latter the coal is beneath the Permian rocks and the mines deep but productive. Little mining is done now west of Durham as the mines are shallow and the habitations consequently scattered, hut east of the Wear large quantities of coal are raised, which can easily be transported to the coast for exportation. Here the big industrial towns are gathered. The Frosterley marble has been quarried for many centuries near Stanhope, and excellent slate is quarried at several places. Fireclay is obtained in various parts of Durham, and exported in considerable quantity. The industrial districts may be taken to lie almost wholly east of a line from Darlington through Bishop Auckland to Consett. The manufacture of machines, appliances, locomotives, trams and tools is important, and the ship-building yards on the Tyne are second only to those on the Clyde; building is carried on also at Sunderland, the Hartlcpools and Stockton-on-Tees. The use of the waste gases from the iron foundries gives an impetus to the manufacture of chemicals, glass and bottles and earthenware. The heavy chemical industry has developed on Tees-side. Local iron ore was formerly used, but now vast quantities are imported. The Tyne and the Tees mouth are the main areas. Much timber is imported from Scandinavia. There is a large production of salt gypsum and artificial manures on the Tees mouth. The sea fisheries of Sunderland and Hartlepool are valuable.

The decline in shipping and the contraction of foreign markets (especially for coal), combined with the cessation of intensive wartime activity, led to widespread unemployment and poverty in the industrial section of Durham and Tyneside in the decades between World Wars I and II. Unemployment in June 1933 reached a peak of about 34% of the insured population, and relief from public funds was annually more than double the amount per capita expended in the country as a whole. Complete recovery from this condition was almost impossible and was made the more difficult by the deteriorated financial position of the local industries and the water-logged condition of many mines in the southwest of the county. When, therefore, under the act of 1934 almost all Durham became a "special area," the commissioner's attention was primarily directed toward the attraction of new industries to the area. A development board for the northeast as a whole was formed, along with local development councils. Derelict sites were cleared, public works were undertaken by the local authorities with the aid of government grants and a trading estate of 700 ac. was established in 1936 at Gatesbead, within two mi. of Newcastle, for light industries, while facilities were created to provide capital to potentially successful small businesses. In addition. land settlement schemes were promoted. The success of these measures led to an expansion of the commissioner's powers undrr the 1937 act, so that further sites were cleared and new factories set up outside trading estate areas.

The L.N.E R. main line runs northward through Darlington, Dur-

ham and Gateshead, and there are branches through the mining and industrial districts. The company also owns some docks. From Stockton to Darlington ran the railway engineered by George Stephenson and opened in 1825. Its main object was to transport coal to the coast for exportation.

Administration and Population. — The area of the administrative county is 973.7 sq.mi., with a population (est. 1938) of 1,440,000. Wartime movements, caused mainly by evacuation, led to a decline of 6% in the county population between Sept. 1939 and Feb. 1941. The county boroughs are Darlington, Gateshead, South Shields, Sunderland and West Hartlepool. Municipal boroughs are the city of Durham, Hartlepool, Jarrow and Stockton-on-Tees. There are 21 urban districts. Durham is in the northeastern circuit, and assizes are held at Durham. There are two courts of quarter sessions and the county is divided into 25 petty sessional divisions. It is in the diocese of Durham, excepting part of one parish in that of York, and contains 168 civil parishes. The bishop strongly opposed in 1614 a bill for securing representation to the county and city of Durham and the borough of Barnard Castle. The county mas first summoned to return members to parliament in 1654. After 1918 it returned one member for each of 11 divisions. The five county boroughs and Stockton-on-Tees also return one member each, except Sunderland, which returns two.

See W. Hutchinson, *History and Antiquities of the County Palatine of Durham* (3 vols., Newcastle, 1785–1794); R. Surtees, *History and Antiquities of the County Palatine of Durham* (4 vols., 1816–40); B. Bartlet, *The Bishoprick Garland, Collection of Legends, Songs, Ballads . . . of Durham* (1834); J. Raine, *History and Antiquities of North Durham* (1852); Perry and Herman, *Illustrations of the Mediaeval Antiquities of the County of Durhanz* (1867); G. T. Lapsley, *The County Palatine of Durham* (New York, 1900); *Victoria County History, Durham. See* also the Surtees Society's Publications and *Transactions of the Architectural Society of Durhanz and Northumberland; Reports of Investigations into Industrial Conditions in Certain Depressed Areas* (1934); *Reports of Commissioner for the Special Areas* (1935–38).

DURHAM, a city, and county town of Durham, England, in the Durham parliamentary division, 256 mi. N.W. from London, on the L.N.E.R. Pop. (est. 1938) 19,370. Area 6.3 sq.mi. The nucleus of the site is a narrow, rocky peninsula formed by a sharp bend of the river Wear, on which stands the cathedral and castle Though the mediaeval city grew around this site there are indications of earlier settlement, particularly on Maiden hill, where there is a Romano-British encampment. On the projecting rock rising some 70 ft. above the river the monks of Lindisfarne found, in 995, a resting place for the body of St. Cuthbert, which they had removed from its tomb in fear of Viking raids. The naturally strong position selected was possibly artificially fortified also, thereby laying the foundations of one of the few examples in Britain of a mediaeval fortress city. In 1928 it was reported that Durham castle was in danger of collapse from moving foundations. A national appeal for £150,000 "to save the castle from falling into the river" was made, and the restoration was successfully completed.

On the peninsula, which was called Dunholm (softened in Norman times to Duresme, whence Durham), a church was built by Bishop Ealdhun and the see was removed hither from Chester-le-Street in 995. In 1093 Ealdhun's church was rebuilt by Bishop Saint Calais, who changed the early establishment into a Benedictine abbey. The grand Norman building in which his designs were carried out remains, with numerous additions. The cathedral library, formerly the dormitory and refectories of the abbey, contains a number of printed books and mss. and the relics found in St. Cuthbert's grave.

In 1072 Earl Waltheof erected the castle to the north of the cathedral, but Ranulph Flambard was the designer of the Norman fortifications as they can be traced today. Of this there remains a beautiful crypt chapel. Other interesting portions are the Norman gallery, with its fine arcade, Bishop Hatfield's Hall of *c.* 1350, a reconstruction of the previous Norman one by Bishop Pudsey, and the Black Staircase of fine woodwork of the 17th century.

The church of St. Mary le Bow in the North Bailey is a 17th century building on a very ancient site, while that of St. Mary the Less possesses slight traces of Norman work. Of other churches in Durham, the site of St. Oswald is apparently pre-Norman, and the building contains Norman work of Bishop Pudsey, also some fine early 1 jth century woodwork. St. Margaret's and St. Giles's churches show work of the same period, while the latter has earlier portions.

The remarkable meander of the Wear served as a natural defense and replaced, in parts, the usual mediaeval town wall. Three of the present bridges across the river are old, that of Elvet having been built 1153–95. Framwellgate was rebuilt in the early 15th century. Outside the city on the Wear is the priory of Finchale (1196), of which there are considerable remains of Early English and later styles, but in the main Decorated. The earliest charter, dated 1179 or 1180, is a grant of exemption from toll merchet and heriot. Before that time, however, the monks had a little borough at Elvet, which is divided from Durham by the Wear and afterward became part of the city. In 1183 the city mas at farm and rendered 60 marks. The bishop of Durham. among other privileges, claimed a mint in the city, which according to Boldon Book rendered ten marks yearly until its value was reduced by that established by Henry II at Newcastle, and it was temporarily abolished by the same king.

The palatinate of Durham in the middle ages was a great border ecclesiastic state occupying the extent of the present county, with many outlying portions, and the cathedral functioned as "half church of God, half castle against the Scots." In the neighbourhood of the city is Neville's Cross. of which little remains. A battle was fought there in 1346 resulting in the defeat of the Scots. With the Reformation came the rise of other city buildings. A grammar school was founded by Henry VIII in place of the monastic school. The town hall, a 16th century building, was reconstructed in 1851. The city possesses a gild hall and shire hall, together with other county buildings. Four miles west of the city is the great Roman Catholic college of St. Cuthbert, Ushaw, the representative of the old college at Douai.

Durham was at first governed by a bailiff appointed by the bishop, but in 1j6j Bishop Pilkington ordained that the government should consist, in addition to the bailiff, of one alderman and twelve assistants, the latter to continue in office for life and the former to be chosen every year from among their number. This form of government was replaced in 1602, under the charter of Bishop Matthew, by that of a mayor, 12 aldermen and 24 burgesses, the aldermen and burgesses forming a common council and electing a mayor every year from among the aldermen. This was confirmed by James I, but in 1684 the corporation were obliged to resign their charters to Bishop Crew, who granted them a new one, probably reserving to himself a right of veto on the election of the mayor and aldermen. At the time of the Revolution, however, Bishop Matthew's charter was revived and continued to be the governing charter of the city until 1770, when. owing to dissensions as to the election of the common council, the number of aldermen was reduced to four and the charter became void. No mayor or aldermen were elected for 10 years, but in 1780 Bishop Egerton, on the petition of the burgesses, granted them a new charter, which was practically a confirmation of that of 1602 and remained in force until the Municipal Reform act of 183 j. Being within the county palatine, the city of Durham sent no members to parliament, until, after several attempts beginning in 1614, it was enabled by an act of 1673 to return two members, which it did until 1885, when the number was reduced to one. It was disfranchised in 1918.

The University. — Prior Richard de Hoton (1290–1308) erected a hall in Oxford for students from Durham. In 1380 Bishop Hatfield refounded this hall as Durham college, which became Trinity college (see OXFORD) on a new foundation (1 jjj). Henry VIII had the unfulfilled intention of founding a college in Durham, and a similar attempt failed during the Commonwealth. In 1831 the scheme for a college was projected by the chapter; an act of 1832 specified the foundation as a university, which was opened in 1833. In 1837 the university received its charter from William IV. Instruction in civil engineering and mining was established as early as 1837. In 1871 the university and the North of England Institute of Mining and Mechanical Engineers co-operated to found a college at Newcastle-upon-Tyne, which was incorporated with the university in 1874. The College of Medicine at Newcastle has been connected with Dur-

ham university since 1852. In 1895 women were admitted to degrees. In 1889 music degrees were instituted, and a professorship was founded in 1897.

In 1908 the university was reconstituted to consist of the Durham and the Newcastle divisions. The latter had the College of Medicine and Armstrong college, while the Durham colleges, University college, Hatfield college, St. Chad's college, St. John's college, St. Mary's college (women) and three residential colleges are controlled by the former. The university was later reorganized along lines suggested by a royal commission appointed in 1934, so that, although it still consisted of two divisions known as Durham colleges and King's college, Newcastle, the senate received greatly increased powers over the university as a whole.

Industries.—The corporation of Durham claim their fair and market rights under Bishop Pudsey's charter of 1179, confirmed in 1565, as a weekly market and three yearly fairs. There is also a fourth fair. In 1610 the bishop recovered the markets and fairs, which he afterward leased to the corporation for a rent of £20 yearly until they were purchased from the Ecclesiastical commissioners in 1860. Durham has never been noted for any particular trade; and the attempts to introduce the manufacture of cloth and wool in the 17th and 18th centuries were failures. The manufacture of carpets was begun in 1814.

The uplands have many collieries, and iron working and smelting is important. Durham is no longer one of the great cities of the north, but has become a small market town for the industrial population.

DURHAM, a city of North Carolina, U.S.A., 25 m. W. of Raleigh; the county seat of Durham county. It is on Federal highways 15, 70, 264 and 501, and is served by the Durham and Southern, the Norfolk and Western, the Norfolk Southern, the Seaboard Air Line and the Southern railways. The population was 21,719 in 1920 (35% Negroes), and was 60,195 in 1940 by the Federal census. It is the seat of Duke university (*q.v.*), and is one of the leading tobacco markets and tobacco-manufacturing centres of the country.

In the city of Durham there are large cotton mills, hosiery mills and various other manufacturing industries. The factory output within the city limits in 1933 was valued at $160,336,002. The assessed valuation of property in 1940 was $86,168,000 and bank debits amounted to $411,878,666. The North Carolina college for Negroes, Lincoln hospital (one of the finest in the country for Negroes), and the largest Negro life insurance company in the country are situated here. The tobacco industry of Durham was founded soon after the Civil War by W. T. Blackwell (1839–1904) and Washington Duke (1820–1910). The city was incorporated in 1869; became the county seat of the newly constituted county in 1881; and in 1921 adopted a council-manager form of government. In the Bennett house, near the city, Gen. J. E. Johnston on April 26, 1865, surrendered to Gen. Sherman.

DURIAN, the fruit of *Durio zibethinus,* a tree of the family Bombacaceae, which attains a height of 70 or Soft., has oblong, tapering leaves, rounded at the base, and yellowish-green flowers, and bears a general resemblance to the elm. The durian is cultivated in Sumatra, Java, Celebes and the Moluccas, and northwards as far as Mindanao in the Philippines; also in the Malay Peninsula, in Tenasserim, on the Bay of Bengal, to 14° N. lat., and in Siam to the 13th and 14th parallels. The fruit is spherical, and 6 to 8in. in diameter, approaching the size of a large coco-nut; it has a hard external husk or shell, and is completely armed with strong pyramidal tubercles, meeting one another at the base, and terminating in sharp, thorny points. On dividing the fruit at the joints of the carpels, where the spines arch a little, it is found to contain five oval compartments, each filled with a cream-coloured, glutinous pulp, in which are embedded from one to five seeds about the size of chestnuts. The pulp and the seeds, which latter are eaten roasted, are the edible parts of the fruit. With regard to the taste of the pulp, A. R. Wallace (The Malay Archipelago, 1872) remarks, "A rich butter-like custard, highly flavoured with almonds, gives the best idea of it, but intermingled with it come wafts of flavour that call to mind cream-cheese, onion-sauce, brown sherry and other incongruities; . . . it is neither acid, nor sweet, nor juicy, yet one feels the want of none of these qualities, for it is perfect as it is." The fruit, especially when not fresh from the tree, has an exceedingly offensive smell, which has been compared to that of rotten onions or of putrid animal matter.

DURIS, of Samos, Greek historian, according to his own account a descendant of Alcibiades, was born about 340 B.C. He must have passed his early years in exile, since from 352 to 324 Samos was occupied by Athenian cleruchs, who had expelled the original inhabitants. He was a pupil of Theophrastus of Eresus, whom he met at Athens. When quite young he won a prize at the Olympic games; a statue by Hippias was set up to commemorate his victory (Pausanias vi. 13, 5). He was for some time despot of Samos. Duris was the author of a history (*Historiae*) from the battle of Leuctra (371) down to the death of Lysimachus (281), and a life of Agathocles of Syracuse (both used by Diodorus), the annals (*ὧροι*) of Samos, arranged according to the lists of the priests of Hera, and treatises on literary and artistic subjects. Plutarch (Pericles, 28) expresses doubt as to his trustworthiness, Dionysius of Halicarnassus (De *compos. verborum,* 4) criticises his style, and Photius (cod. 176) the arrangement of his work. Cicero (ad Att. vi. 1) accords him qualified praise as an industrious writer.

Fragments in C. W. Müller, Frag. *Hist. Graec.* ii. 446, where the passage of Pausanias referred to above and the date of Duris's victory at Olympia are discussed.

DURKHEIM, EMILE (1858–1917), French philosopher, was born on April 15, 1858, at Les Vosges, and studied at the École Normale Supérieure under Boontroux. After travelling in Germany, he accepted the chair of sociology founded for him at Bordeaux in 1887, and five years later became professor in Paris. Contending that progress is a mechanical fact, Durkheim maintained that social investigations should be scientifically carried out and special attention given to facts capable of exact determination. The mentality of the group, he thought, is not simply that of the individual, but has its own specific reality. Because the mental life of the individual comes principally from his social environment, education is a "filling-up" process as well as a "drawing-out" one.

Durkheim's chief publications are De la division *du* travail social (1893); Les *règles* de la me'thode sociologique (1894); Le Suicide (1897); Les formes *élémentaires* de la vie religieuse, *le système* tote'mique en Australie (1912; Eng. trans., 1915); and Sociologie et *philosophie* (1924). In 1898 he founded *L'Année* Sociologique, which he edited annually.

See C. E. Gehlke, Durkheim's Contributions to Sociological Theory (1915); and R. Lacombe, La *Méthode* Sociologique de Durkheim (1926).

DÜRKHEIM, a town in the Bavarian Palatinate, Germany, near the foot of the Hardt mountains, and at the entrance of the valley of the Isenach, 15 mi. N.W. of Spires on the railway Monsheim-Neustadt. Population 7,770. The town hall occupies the site of the castle of the princes of Leiningen-Hartenburg. It is well known as a health resort, for the grape cure and for the baths of the brine springs of Philippshalle which produce marketable salt. There is a brisk trade in wine. As a dependency of the Benedictine abbey of Limburg, built and endowed by Conrad II., Diirkheim or Thurnigheim came under the counts of Leiningen, who in the 14th century made it the seat of a fortress. It was often damaged in wars but was rebuilt after the French invasion of 1689. The ruins of the Benedictine abbey of Limburg lie about 1 m. S.W. of the town; and in the neighbourhood rises the Kastanienberg, with ancient fortification of the Heidenmauer or Heathen's Wall.

DURLACH, a town in the *Land* of Baden, Germany, 2½m. by rail from Karlsruhe, with which it is connected by canal, on the left bank of the Pfinz, at the foot of the vineyard-covered Thurmberg. Pop. (1933) 18,658. It possesses a castle (1565) now a barracks, and an ancient town hall. It has manufactures of brushes, chemicals, machinery, gloves, leather, tobacco, beer, vinegar and chicory; and considerable trade in market produce.

Durlach was bestowed by the emperor Frederick II. on the margrave Hermann V. of Zahringen as an allodial possession, but afterwards came into the hands of Rudolph of Habsburg. It was chosen as his residence by the margrave Charles II. in 1565, and retained this distinction till the foundation of Karlsruhe in 1715, though it was almost totally destroyed by the French in 1688.

DUROC, GÉRAUD CHRISTOPHE MICHEL, DUC DE FRIULI (1772–ISIS), French general, was born at Pont à Mousson (Meurthe et Moselle) on Oct. 25, 1772. He was gazetted second lieutenant (artillery) in the 4th regiment in 1793, and advanced steadily in the service. Captain Duroc became aide-de-camp to Napoleon in 1796, and distinguished himself at Isonzo, Brenta and Gradisca in the Italian campaigns of 1796–97. He served in Egypt, and was seriously wounded at Aboukir. His devotion to Napoleon was rewarded by complete confidence. He became first aide-de-camp (1798), general of brigade (1800) and governor of the Tuileries. After the battle of Marengo he was sent on missions to Vienna, St. Petersburg, Stockholm and Copenhagen. As grand marshal of the Tuileries he was responsible for the measures taken to secure Napoleon's personal safety whether in France or on his campaigns, and he directed the minutest details of the imperial household. After Austerlitz, where he commanded the grenadiers in the absence of General Oudinot, he was employed in negotiations with Frederick William of Prussia, with the elector of Saxony (December 1806), in the incorporation of certain states in the Confederation of the Rhine, and in the conclusion of the armistice of Znaim (July 1808). In 1808 he was created duke of Friuli, and after the Russian campaign he became senator (1813). He was in attendance on Napoleon at the battle of Bautzen (May 20–21, 1813) in Saxony, when he was mortally wounded, and died in a farmhouse near the battlefield on May 23.

The chief source for Duroc's biography is the *Moniteur* (May 31, 1797, Oct. 24, 1798, May 30, 1813, etc.).

DURRA: *see* KAFIR.

DURUY, JEAN VICTOR (1811–1894), French historian and statesman, was born in Paris. He studied under Michelet at the École Normale Supérieure, and taught at the Collège Henri IV. at Paris for over a quarter of a century. Already known as a historian by his *Histoire des Romains et des peuples soumis à leur domination* (2 vols., 1843–44), he was appointed minister of education in 1863.

Among his measures may be cited his organization of higher education ("enseignement spécial"), his foundation of the "conférences publiques," which later became universal throughout France, and of a course of secondary education for girls by lay teachers, and his introduction of modern history and modern languages into the curriculum both of the *lycées* and of the colleges. He greatly improved the state of primary education in France and proposed to make it compulsory and gratuitous, but was not supported in this project by the emperor. In 1884 he was elected to the Academy. He died on Nov. 25, 1894.

Duruy's fame rests mainly on the revised edition of his Roman history, which appeared in a greatly enlarged form in 7 vol. under the title of *Histoire des Romains depuis les temps les plus reculés jusqu'à la mort de The'odose* (1879–85), Eng. trans. by W. J. Clarke, 6 vol., 1883–86. He also wrote *Histozre des Grecs* (3 vol., 1886–91; Eng. trans., 4 vol., 1892); *Histoire de France de 1453 à 1815* (1856; new enlarged ed. 1891); and other works on French history.

A memoir by Ernest Lavisse appeared in 1895 under the title of *Un Ministre: Victor Duruy*. *See* also the notice by Jules Simon (1895) and S. Monod, *Portraits et souvenirs* (1897).

DURYEA, an anthracite mining borough of Luzerne county, Pa., U.S.A., on the Susquehanna river and the Lackawanna railroad, 8 mi. S.W. of Scranton. The population in 1920 was 7,776 (28% foreign-born white) and 8,275 in 1940.

The borough, originally called Babel because the first inhabitants came from so many different countries and spoke so many different languages, was called Duryea after Abram Duryea, who began working coal mines in that region in the middle of the 19th century.

DU RYER, PIERRE (1606–1658), French dramatist, was born in Paris in 1606. His masterpiece, *Sckvole*, probably dates from 1644 (the date generally given is 1646). *Alcionke* (1638) was so popular that the abbé d'Aubignac knew it by heart, and Queen Christina is said to have had it read to her three times in one day. Among du Ryer's other works may be mentioned *Saül* (printed 1642) and a comedy, *Les Vendanges de Suresnes* (1635 or 1636). He died in Paris on Nov. 6, 1658.

DUSART (DU SART) **CORNELIS,** the younger (1660–1704), Dutch painter and engraver. He was born at Haarlem on April 24, 1660, and became one of the most distinguished pupils of Adriaen van Ostade, following his master closely both as regards style and subject matter. His engravings are much sought after. He died at Haarlem on Oct. 1, 1704.

DUSE, ELEONORA (1859–1924), Italian actress, belonged to a family of actors from Chioggia, near Venice. Her grandfather, Luigi Duse, a celebrated actor of Goldoni plays, created the 18th century Venetian masque of Giacometto, round which a whole dialect repertory turned. Born on a tour in Lombardy on Oct. 3, 1859, Eleonora Duse was carried to her christening at Vigevano in a gilt theatrical property-box; some Austrian soldiers presented arms, thinking it was a reliquary. She acted the part of Cosette in *Les Misérables* at the age of four in a booth at Chioggia. At Verona she played Juliet when just 14, and drew public attention by her love of flowers and the use she made of them in her art. The incident is always referred to as "the device of the roses" *(la trovata delle rose)*.

About this time her mother, to whom she was passionately attached, died, and thrown on her own resources, often in dire poverty, she passed from one travelling company to another, eventually reaching fame through sheer hard work, no less than by genius and the exceptional beauty of her speaking voice. She acted in *Alcibiades* of Felice Cavallotti, in *Orfeo* of Alfieri, and took the part of Shakespeare's Ophelia with success. She gained wider recognition in 1878 when, one night at Naples, she was called upon suddenly to take the leading part in *Les Fourchambault* by Augier. In the following year, after securing a real triumph in the part of Zola's *Thérèse Raquin,* Cesare Rossi engaged her for his famous company as *prima diva* and she added *La Princesse de Bagdad* to her repertory. A memorable year was 1882: she saw Sarah Bernhardt act at Turin in *La Dame aux Camélias* of Dumas fils, and felt inspired to give her own interpretation of Marguerite Gautier—"fille galante, extrêmement distinguée," a character which both actresses idealized, The Frenchwoman, less realistic and temperamental, possessed a more subtle style; but, in certain scenes, the passionate, almost volcanic, powers of the Duse admitted of no rival. The greatest triumph, perhaps, in her career was gained in this part, and she was induced to act it in Paris in 1897, when the Parisians were taken by storm, Sarah Bernhardt leading the applause. She also acted in *Frou Frou* and *La Femme de Claude.* Her *Magda,* in the opinion of Sudermann the author, was never surpassed. In the character of Mirandolina *(La Locandiera* of Goldoni) she also showed a remarkable gift for light comedy. She created the character of Santuzza in *La Cavalleria Rusticana,* given for the first time in 1884, and such was her success that Verga said the play belonged as much to her as to him. Her acting during all this period was characterized by realism devoid of any excess; hers was the highest kind of romantic realism which had passed through the flame of intense feeling. Coquelin the elder said of her: "No one draws from humanity as she does; she is passionately beautiful and great." Her own words still further help to explain her vivid and varied personality: "How I have loved life!" she wrote to a friend, and again: "There are a thousand women within me, and each one makes me suffer in turn."

Eleonora Duse was a woman of wide culture; her intellectual life had been greatly influenced early in life through a close friendship with Arrigo Boito, the composer, whose sound criticism proved of considerable value to her art. The books she steeped herself in included the writings of Pascal, Keats, and Thomas à Kempis; *The Letters of St. Catherine of Siena, The Confessions of St. Augustine* and *L'Action by* Maurice Blondel.

Essentially religious by nature, she was untouched by organized religion. She travelled a great deal both for her profession and for pleasure: Matilde Serao called her "the impassioned pilgrim." She had no fixed home; the nearest approach to one was her summer house at Asolo. She lived simply but spent large sums on producing plays and in financing her company of actors whom she would sometimes keep idle for long spells on account of health. She made her first appearance in Paris in 1884; went to London and New York in 1893, and to Moscow in 1892 and 1897, and to Egypt. She always particularly liked acting in Vienna.

Her restless, soaring spirit eventually grew weary of Dumas and Augier, finding in La Dame aux *Camélias* alone "a thread of gold to hold together the string of false pearls"; and, towards middle age, the Duse turned definitely to poetry and "les oeuvres de pensée." In 1896 she commissioned Panzacchi to translate *L'Abbesse* de Houarre, which she acted in Rome with so much success that Renan wrote her a letter full of praise and gratitude. At this time she passed under the spell of the later works of Ibsen, to be closely followed by the aestheticism of D'Annunzio. In the Scandinavian dramatist she saw the poet more vividly than the scourger of society. Ellida, The Lady from the Sea, with whom she felt some affinity, was her favourite heroine. Ibsen was not altogether satisfied with her interpretation of Hedda Gabler; he is reported to have said as he left the theatre: "She believes Hedda to be a neurotic, but she is absolutely wrong."

Her life-consuming friendship with D'Annunzio began in 1897; they parted in 1902, only to meet 18 years later at a patriotic gathering in Milan. D'Annunzio immortalized their friendship in Fuoco, the novel of the lagoons, incorporating many of her letters and sayings. La *Città morta* he had dedicated to Sarah Bernhardt; La Gioconda he wrote for "Eleonora Duse of the beautiful hands," and wrote many other plays under her enthusiastic inspiration. She took up the cause of D'Annunzio as a dramatist with almost mystic exaltation, and threw all her energies into trying to found a theatre which was to be a D'Annunzio Bayreuth for the glory of a pure art. A site was offered to her on the shores of Lake Albano, near the Baths of Diana, but to her grief the scheme fell through, chiefly because the public did not recognize the real Duse in the drama of D'Annunzio. La Gloria was hissed at Naples in 1898 and no better success attended Sogno *di* un *mattino* di *primavera,* but she won some applause for Francesca da *Rimini* in 1902. Undaunted, the Duse insisted upon acting only the plays of D'Annunzio when she went to America in 1902–3 with Ermete Zacconi, and, in spite of financial losses, she refused to revive old favourites. Some people think that D'Annunzio had an enervating effect upon her art, and that her recitation tended towards monotony; while, in the opinion of others, her style lost rough edges and gained in classical grandeur, and her general culture was enriched.

At the height of her fame in 1909, Eleonora Duse definitely left the stage, mainly on account of health. For twelve years she retired into private life. But, owing to pecuniary losses arising out of the World War, she had to face the necessity of returning to the stage. After much anxious thought she accepted collaboration once more with Ermete Zacconi, appearing at Turin in 1921 in The Lady from the Sea. "I only want to act the part of mothers," she said, "women without age, creatures of eternity, like Ellida and so many heroines of the great Ibsen. . . . No wigs, they must accept me with my white hair." They did, and Eleonora Duse found that she had conquered the world a second time. A desire to do something for Italy acted as an incentive to work at this time. Animated by a passionate desire to participate in the joys and sorrows of her fellow creatures, she strove to teach "the good and beauty of life" to a world devastated by a spirit of violence, which was abhorrent to her nature. For the purpose of this spiritual crusade, and also for the benefit of young authors, she tried to found an Italian theatre—Teatro dei Giovani. She complained that her scheme was not supported by the Government, but her ideas were vague and perhaps, too, time was not ripe for the venture.

This, the last period in her career, was marked by a wonderful revival of her youthful genius, rather than by any new creations or change of style. She continued to play Ibsen, D'Annunzio and La Porta *Chiusa* of Marco Praga. After touring Italy she made her last appearance in London in June 1923 when she acted to far fuller houses than in the heyday of her glory. She courageously accepted a tour in America the following spring, where she also received a triumphal reception. But her health was broken, and often she had to be revived with oxygen after a performance, though her vitality never gave out during the play. She died from the results of a chill at Pittsburgh on April 21, 1924, at the age of 64. She was pitifully anxious not to die far away from Italy, and gave feverish orders, almost with her last breath, to pack up quickly so as to catch the boat home. Italian emigrants knelt on the quay as her coffin was lowered on to the battleship "Duilio" at New York, and national mourning was proclaimed in Italy. Her countrymen desired to see her laid at rest with other illustrious Italians in Santa Croce at Florence, but they respected her wishes to be quietly buried at Asolo.

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DUSSEK, JAN LADISLAV (1761–1812), Bohemian pianist and composer, was born at Caslar, Bohemia, on Feb. 9, 1761, the son of the cathedral organist. He played in public at the age of 6, became a choir boy, and then studied theology at Prague. He found a pattern in Count Manner, whom he accompanied to Malines, Belgium. He was organist there for some time, then at Bergen-op-Zoom. He then spent some time at Amsterdam and the Hague, and attained a great reputation as a pianist. He had already written a large number of sonatas for the pianoforte with string accompaniments, when he went to Hamburg about 1783 to study under Karl Philipp Emanuel Bach. Dussek found a patron in Prince Radziwill and in Paris in Marie Antoinette. He spent twelve years in London from 1792 onwards, marrying in that year a singer, the daughter of Domenico Corri. Later he entered into partnership with Corri in a music shop, which failed. He left England in 1800 for Hamburg. His later patrons were Prince Louis Ferdinand of Prussia, the prince of Ysenburg and finally Talleyrand. In Talleyrand's household, where he lived from 1809 until his death at St. Germain-en-Laye (Nov. 20, 1812) he was a great and honoured figure. A complete list of Dussek's works will be found in Grove's Dictionary of Music and Musicians. It includes a large number of pianoforte works and a considerable amount of chamber music. His sonatas for the pianoforte represent him at his best.

See L. Schiffer, J. L. Dussek (1915).

DÜSSELDORF, a government district (Regierungsbezirk) of Rhenish Prussia, Germany. Area 2,121 sq.mi. Pop. (1939) 4,153,691. (2) A town, the capital of the district. Pop. (1939) 539,905. It is situated on the right bank of the Rhine 24 mi. northwest (by rail) from Cologne. It was long a place of small importance until, in 1288, it was raised to the rank of a town by Count Adolf of Berg. It suffered severely in the Thirty Years' War and the War of the Spanish Succession, but recovered its prosperity under the patronage of the elector John William of the Palatinate who dwelt in the castle many years until his death in 1716. In 1795 the town after a violent bombardment was surrendered to the French; and after the peace of Lunéville it was deprived of its fortifications. In 1805 it became the capital of the Napoleonic duchy of Berg; and in 1815 it passed with the duchy into Prussian possession. After 1870, it developed into an important industrial and commercial town. It is the commercial and manufacturing centre of the Wupper and Ruhr areas and is a great centre of the metallurgical, engineering, machinery, glass and chemical industries; other important industries are paper, enamel, weaving, spinning, silk. dyes, furniture and brewing. It is an important railway junction. The extensive quays provide accommodation for large steamers ordinarily sailing to England

Northern Europe and certain Mediterranean ports. The famous Academy of Painting founded by the elector Charles Theodore in 1767 was reorganized by King Frederick William III in 1822 Among the celebrities of the town are Johann Georg and Frederick Henrich Jacobi; Heinrich Heine and Peter von Cornelius; and Louise Dumont, who founded a theatre. Large international industrial exhibitions were held at Dusseldorf in 1880, 1902 and 1937. In order to facilitate better city-planning in regard to streets, traffic and parks, several adjacent towns and suburbs (Benrath, Garath, Urdenbach. Kaiserwerth, Lohausen and Ludenberg) were incorporated into Dusseldorf on Aug. 1. 1929. During World War II the city suffered severely from frequent British bombing attacks.

See H Ferber, *Historische Wanderung durch die alte Stadt Düsseldorf (Diisseldcrf,* 1889–90); Wilden, *Grundlagen und Triebkrafte der Wirtschaft in Dusseldorf* (1923); H. Stolz, *Düsseldorf* (1925).

DUST. Dust is earth or other solid matter in a fine state of subdivision, so that the particles are light enough to be easily raised and carried as a cloud by the wind. The presence of dust in the atmosphere is obvious on the most casual inspection. Particles of dust, varying from the motes in the sunbeam to big flakes of soot, are readily visible to the naked eye. The origin of the dust is varied in character. Smoke from domestic and factory chimneys contains particles of carbon (soot), as well as small particles of ashes and drops of liquid tar. These particles are carried by the wind, and even spread upward through considerable heights by the turbulent or eddy motion of air *(see* METEOROLOGY: *Turbulence)*

Over the deserts coarse dust is raised from the ground by windstorms, and can be carried for thousands of miles by the wind. The "red rain" which has been observed in Europe from time to time is due to the washing down of desert dust which has originated in tropical deserts. A notable example of "red rain" occurring on Feb. 21 and 22, 1903, is described in the *Quarterly Journal Roy. Met. Soc.,* xxx., 1904 p. 57, where it is shown that the dust must have travelled from north-west Africa round the western edge of an anticyclone over southern Europe. The amount of dust which fell in England during the two days in question was estimated at about ten million tons. The *harmattan,* a dry easterly wind which blows off the west coast of Africa between Cape Verde and Cape Lopez, carries with it quantities of dust, causing thick haze for a distance up to 1 j m. from the shore. Enormous quantities of volcanic dust are poured into the atmosphere by the eruption of volcanoes. The eruption of Krakatoa near Java in 1883 produced, among many effects, a vast cloud of small particles which is said to have taken two years to settle down completely. The dust from Krakatoa produced the most extraordinary colours in the sky. Even in the British Isles sunsets of unusually gorgeous colours were observed Meteoric matter disintegrating in the air is another source of atmospheric dust. A phenomenal dust storm visited the United States in May 1934. Rising from the parched soil of the Western plains, where drifts as deep as six inches often covered the highways, a vast cloud of dust moved slowly eastward, hung for a time in yellow haze over the cities along the coast and finally was precipitated in the Atlantic Ocean.

The particles of dust or soot, from whatever source they originate, are distributed over a wide area by the wind. Granted a sufficient wind velocity, the smoke from the largest city will be distributed over such a wide area, and through so great a volume of air, that it cannot acquire a sufficient density to be troublesome. But when the wind falls below a certain limit, it ceases to be an effective distributor. Another factor of importance in connection with the concentration of smoke is the turbulence in the atmosphere, which scatters the smoke through a greater range of height than it would otherwise attain. When there is an increase of temperature with height (*i.e.,* an inversion) instead of the normal decrease, turbulence is suppressed; since inversions of temperature at the ground are usually associated with light winds, they generally give smoke fogs in large towns.

The rate of settlement of spherical particles of dust through a still atmosphere is given approximately by the formula,

$$V = \text{density} \times R^2 \times 12 \times 10^5$$

where V is the velocity in centimetres per second and R is the radius of the particle in centimetres. Thus a particle of unit density and of diameter 1 micron will fall through still air at a rate of about 0.003 centimetres per second, which is equivalent to a fall of 30 metres (100 ft.) in 278 hours, during which time a wind of 10 m p.h. would carry it 2,780 miles. It is thus readily seen that smoke particles can travel over immense distances under favourable conditions. A drop of water of diameter 10 microns would fall with a velocity of ·3 cm/sec. or roughly 10 metres in one hour.

The first investigations of the amount of dust in the atmosphere were those of John Aitken in 1880. Aitken succeeded in showing that water drops will not form, even in supersaturated air, in the complete absence of solid nuclei upon which the molecules of water can collect. It was but a step further, to utilize this idea to count the number of condensation nuclei in a given volume of air. Aitken's method consisted in placing the air under examination in an airtight receiver and saturating it with water vapour. It was then caused to expand adiabatically until condensation was produced, the drops being collected on a reticule and counted by the aid of a short focussed lens. Certain precautions were necessary in carrying out this procedure. It was found that if more than 500 nuclei were present in each cubic centimetre of air, they would not all form water drops. In such cases it was necessary first to dilute the air with air which had been carefully filtered, subsequently allowing for the dilution in computing the number of particles per second. Aitken's method was applied in thousands of tests in different parts of the world, and in no case was the air found to be completely free of nuclei. The numbers of particles per c.c. in cities such as London and Paris were often found to exceed 100,000. Fridlander used Aitken's dust counter on a voyage across the Atlantic and never found values below 2.000 per c.c. but in crossing the Pacific and Indian oceans he found values as low as about 250 per c.c. But we can safely conclude that air, no matter where it is sampled, contains an ample supply of particles capable of acting as condensation nuclei. The instrument which Aitken devised for counting the particles suspended in air was called a "dust-counter," but subsequent research has shown that the particles which Aitken counted were not dust in the ordinary sense of the word, but what are known as hygroscopic nuclei.

The only effective nuclei are particles of certain hygroscopic salts, in particular the chlorides of sodium and magnesium derived from salt spray, and sulphates. Ordinary dust, except such particles as may be hygroscopic, will not act as nuclei for condensation, and particles of soot, being of a tarry nature, tend to repel water rather than to attract it. The hygroscopic nuclei are so small as to be in general invisible in the field of a high-power microscope, but on account of their hygroscopic properties they are capable of producing water drops in air whose humidity falls short of saturation. Thus particles of common salt will produce condensation when the relative humidity is only 75%, and are thus capable of producing fogs at times when the conditions do not otherwise seem favourable for their formation.

It was first suggested by Wigand (A. Wigand, *Meteor. Zeitschrift.* 30 p. 10 Jan. 1913) that the particles counted by Aitken's dust counter were not dust in the ordinary sense of the word. Wigand compared the figures obtained by Aitken's method in air which was artificially made dusty and found that the number of condensation nuclei per c.c. was not dependent on the amount of dust introduced into the atmosphere. This is confirmed by Owen's observations. A recent investigation by Boylan *(Proc. Roy. Irish Acad.* vol. 37A. N.O. 6, 1926) shows very definitely that the dust and nuclei are different, and that ordinary dust particles will not act as nuclei for condensation.

The horizontal visibility of objects on the earth's surface depends upon the degree of pollution of the atmosphere. Poor visibility is due to the obscuration of the atmosphere by water-drops or by solid particles. The condition known as haze is due to the presence in the atmosphere of small solid particles, whose diameter is about ·5 micron (·0005 mm.), together with varying quantities

of water-drops. In a series of observations of haze by Owens it was found that in some cases no water-drops were present, while in other cases large numbers of water-drops were found. The distinction is largely a question of relative humidity, since haze is probably always a mixture of insoluble particles and hygroscopic nuclei. If the relative humidity is low, the haze effect is almost entirely due to small solid particles of dust whose diameter is of the order of $\frac{1}{2}$ micron; but if the humidity increases sufficiently, condensation takes place on the hygroscopic nuclei, and the haze changes into a true mist. Similarly fog may be divided into two classes—smoke fogs and water fogs. The diameter of the solid particles in a smoke fog vary from $\frac{1}{2}$ micron up to several micron, while the diameter of water drops in a water fog vary from 5 to 20 microns. The fine smoke particles which produce the dust horizon frequently seen in the British isles have diameters of about ·8 micron, while the Indian dust horizon consists of blown sand of similar size.

The most troublesome aspect of atmospheric dust is provided by the smoke produced in great cities. The problem of pollution produced by smoke has been the study of a special Advisory Committee on Atmospheric Pollution. The work of this committee has been summarized by Sir Napier Shaw and Dr. J. S. Owens in *The Smoke Problem of Great Cities*. Smoke as it issues from the chimney consists of particles of soot of varying sizes as well as acid products of combustion, small particles of ash, and small drops of tar. The larger aggregations of soot fall in the near neighbourhood of their source, while the smaller particles of diameter rather less than one micron are carried to considerable distances. Shaw and Owens describe a variety of methods for the detection and measurement of the quantities of different forms of pollution in the atmosphere, and the reader is referred to their treatise for fuller details of these methods. Of particular interest, however, is the jet dust counter devised by Dr. J. S. Owens, depending upon the principle that when air containing dust and a sufficient quantity of water vapour has its pressure suddenly reduced, there is a fall of temperature and a condensation of moisture into water drops.

It is not clear how the ordinary dust particles become attached to their share of water, but it appears probable that the particles which are hygroscopic become nuclei of condensation and that the condensed water captures the dust. When the dust-bearing water drops are brought into contact with a glass surface they adhere to it. In the Owens dust-counter the dusty air is drawn through a slit as a fine ribbon-shaped jet, and impinges on a coverglass placed at a millimetre from the slit. The air is first passed through a damping chamber in which it acquires sufficient moisture to produce condensation. The lowering of pressure by which the air is drawn through the jet is sufficient to produce condensation in the air striking the coverglass. As the velocity falls off, the pressure and temperature rise, and the waterdrops evaporate from the coverglass, leaving the dust deposited. By a careful adjustment of the amount of air drawn through the jet, a record is obtained on which the dust particles can be examined and counted by means of a microscope with $\frac{1}{12}$ inch oil-irnmersion objective.

The results derived by the use of the Owens dust-counter show a wide variation in the number and nature of the particles in the atmosphere. For example, in a dense fog on Jan. 22, 1922, there were 21,710 particles per cubic centimetre. The average diameter of the particles was 0·85 microns, but a large proportion had diameters twice as great as the average. Somewhat similar results were obtained from a fog on Oct 26, 1921, but in this case there were numerous small spherical particles of diameters up to 0·85 microns. A slight haze in dry sunny weather yielded 100 to 200 particles per cubic centimetre, of sizes from 0·3 microns up to 1·7 microns. Further, it was found that when the damping chamber of the Owens dust-counter was slightly warmed, and a large quantity of air drawn through the jet, the condensed water flowed out sideways in streams, and on evaporation left the soluble matter crystallized in the dried-up stream beds. The crystals could then be examined microscopically and micro-chemically. The deposit on the coverglass frequently showed needle-shaped and rhomboid crystals, sometimes with a tarry deposit. Most of the records obtained showed a number of transparent spherical particles, occasionally accounting for as much as 50% of the total number of particles counted. When very small these particles appear opaque, but when the diameter exceeds about 0·75 micron they show a bright centre. The spherical particles are insoluble in water, xylol, and cedarwood oil.

Perhaps the most remarkable fact brought out by the observations mentioned above is the remarkable uniformity as to the size of the particles. Shaw and Owens in the book referred to (p. 185) give a comparison between numbers of particles counted by the jet dust-counter, and the total impurity present in the atmosphere, showing a remarkably close proportionality. The number of particles counted should therefore give a measure of the degree of obscurity of the atmosphere. These numbers bear no relationship to the numbers of particles obtained in the Aitken dust-counter, since the latter may give extremely high values in apparently clear air.

The fact that the particles measured by the Owens dust-counter differ from those observed by Aitken is also confirmed by the observations made by Owens while crossing the Atlantic. No dust was to be recognized in any of the records, though some showed numbers of crystals, some of which were not hygroscopic and were only sparingly soluble in water. Aitken, on the other hand, never found less than about 2,000 particles in one cubic centimetre of air over the Atlantic.

Optical Effects.—The scattering of light by small obstacles was exhaustively studied by the late Lord Rayleigh, who showed that true scattering only takes place when the diameter of the obscuring particles is smaller than the wave length of the incident light. Rayleigh showed also that the coefficient of scattering was inversely proportional to the fourth power of the wave length. so that light in the blue end of the spectrum is scattered more than light in the red end of the spectrum. Thus a cloud of tobacco smoke (consisting of small liquid particles of about ·2 microns in diameter) or a smoke haze in the atmosphere will appear blue by scattered light, while the sun appears red when viewed through a thick smoke fog, but white when viewed through a country fog consisting of water drops. Water drops are too large to produce true scattering, their effect being of the nature of diffraction and reflection which is almost equally effective for all wave lengths. Hence water drops appear white, whether viewed by scattered or direct solar radiation.

During the first two or three years after the eruption of Krakatoa a reddish brown corona was often observed around the sun. It had an angular radius of 22° to 23°, and was 10° to 12° wide. Pernter explained this phenomenon, which was known as Bishop's ring, as a result of diffraction of sunlight by small dust particles, and assuming the particles to be spherical he found their diameter to be 1·85 microns. It is of interest to combine this figure with Stokes's formula for the rate of fall of particles. We find their rate of fall should be 0·02 cm/sec. or 10 km. in a time between one or two years.

Another aspect of the optical effects of dust in the atmosphere upon sunlight relates to the loss of ultra-violet rays which is directly produced by dust and smoke pollution. In the *Times* of Dec. 22, 1924, Professor Leonard Hill gave a comparison of the relative amounts of ultra-violet light at different places in the British isles, showing the lowest values in the centre of London. In view of the importance of ultra-violet rays to human health, the results are highly suggestive.

It has been frequently suggested that a smoke fog such as a London fog might be penetrated by the longer infra-red rays. On theoretical grounds we should expect that infra-red rays of wave length large by comparison with the mean diameter of the smoke particles (0·8 micron), should show some degree of penetration. In Wood's *Physical Optics* (3rd Edition p. 416), there is a statement that a film of smoke which was absolutely opaque to light was transparent to infra-red rays of wave length 100 microns. This result in itself is not suggestive of any practical solution of penetration, since there still remain the problems of finding not only suitable sources for such radiation but also a means of rendering visible the rays which have penetrated the fog.

The problem is a long way from solution, and no definite observations of the penetration of fogs by infra-red rays of different wavelength appear to have been published.

Country fogs, composed of drops of water whose diameter is of the order of 10 microns, show no appreciable selective effect in the transmission of light, and there is no obvious reason for supposing that infra-red rays would penetrate such fogs.

F. Entwistle (Jour. Ry. Aer. *Soc.* vol. xxxii., p. 374, 1928) reproduces two interesting photographs by C. J. P. Cave, of a landscape—the one photograph taken in the usual way without a screen, and the second with a red screen, which cuts out all the blue light. The first shows a light fog, while in the second only slight traces of the fog are visible.

Vulcanism.—In Physics of the Air, W. J. Humphreys has discussed in considerable detail the effect of clouds of volcanic dust on solar and terrestrial radiation. He finds that these clouds have an inverse green-house effect, in that they would obstruct the inward passage of solar radiation more than the outward passage of terrestrial radiation. For since solar radiation at its point of maximum intensity has a wave length of a little less than half a micron, it would be reflected rather than scattered by the dust particles whose diameter is of the order of 2 microns. Terrestrial radiation, on the other hand, has a wave length of about 12 microns at the point of maximum intensity, and should therefore be scattered by the dust particles in accordance with Rayleigh's law. On this basis Humphreys evaluates the coefficients of attenuation of solar and terrestrial radiation by volcanic dust, and concludes that a shell of volcanic dust is some thirty times more effective in shutting out solar radiation than it is in keeping in terrestrial radiation. Humphreys' computation is admittedly a rough approximation only. It assumes that all the dust is uniformly of the size of the particles which give Bishop's ring by diffraction. This we know to be incorrect. The wonderfully coloured sunsets produced by Krakatoa dust indicated a scattering of solar rays by dust particles of a diameter considerably less than 2 microns. Such dust would scatter both direct solar and terrestrial radiation, in proportion to the inverse fourth power of their wavelengths. This would increase the ratio of 30:1, given above.

Humphreys develops in considerable detail the theory that the emission of large quantities of volcanic dust into the atmosphere can produce large variations of climate, of a sufficient magnitude to account for ice-ages. It is clearly established that after the eruption of Krakatoa in 1883 there were marked changes in the pyrheliometric measurements of solar radiation (Arctowski, *Annals* New York Acad. Sci. 26, 1915, p. 149, and Kimball, Monthly Weather Review, 46, 1918, p. 355). The theory, known as the vulcanism theory, has by no means met with general acceptance, though there is some evidence, especially in eastern Australia, of the association of glaciation with volcanic activity, which appears to bear out the theory. In any case, volcanic dust may well have been a deciding factor in starting glaciation when other factors were also favourable. For further details the reader is referred to Humphreys' Physics of the Air, and to works on climatology.

BIBLIOGRAPHY.—See works mentioned in text and the following: *The Collected Papers* of *John Aitken* (Cambridge Univ. Press); J. S. Owens, "Condensation of Water from the Air upon Hygroscopic Nuclei," *Proc. Roy. Soc.* A vol. 110, p. 738. (D. BRU.)

DUST STORMS: See DUST.

DUTCH AUCTION. A form of auction in which the property for sale is put up at a certain figure, and if not bid for at that price, offered successively at lower prices until a bid is obtained. The starting price is assumed to be higher than the seller hopes to get. (See AUCTIONS AND AUCTIONEERS.)

DUTCH EAST INDIA COMPANY, THE (*Oostindische Vereenigde Maatschappij*), a body founded by a charter from the Netherlands states-general on March 20, 1602. It had a double purpose: first to regulate and protect the already considerable trade carried on by the Dutch in the Indian ocean, and then to help in prosecuting the long war of independence against Spain and Portugal. Before the union between Portugal and Spain in 1580–81, the Dutch had been the chief carriers of eastern produce from Lisbon to northern Europe. When they were shut out from the Portuguese trade by the Spanish king they were driven to sail to the East in order to make good their loss. Unsuccessful attempts were made to find a route to the East by the north of Europe and Asia, which would have been free from interference from the Spaniards and Portuguese. It was only when these failed that the Dutch decided to intrude on the already well-known route by the Cape of Good Hope, and to fight their way to the Spice islands of the Malay archipelago. A first expedition, commanded by Cornelius Houtman, a merchant long resident at Lisbon, sailed on April 2, 1595. It was provided with an itinerary or book of sailing instructions drawn up by Jan Huyghen van Linschoten,[1] a Dutchman who had visited Goa. The voyage was marked by many disasters and losses, but the survivors, who reached the Texel on their return on Aug. 20, 1597, brought back some valuable cargo and a treaty made with the sultan of Bantam in Java.

These results were sufficient to encourage a great outburst of commercial adventure. Companies described as "Van Ferne"—that is, of the distant seas—were formed, and by 1602 from 60 to 70 Dutch vessels had sailed to Hindustan and the Indian archipelago. On those distant seas the traders could neither be controlled nor protected by their native government. They fought among themselves as well as with the natives and the Portuguese, and their competition sent up prices in the eastern markets and brought them down at home. Largely at the suggestion of Jan van Oldenbarneveldt, and in full accordance with the economic principles of the time, the states-general decided to combine the existing separate companies into one united Dutch East India Company, which could discharge the functions of a government in those remote seas, prosecute the war with Spain and Portugal, and regulate the trade. A capital estimated variously at a little above and a little under 6,500,000 florins, was raised by national subscription in shares of 3,000 florins. The independence of the states which constituted the United Netherlands was recognized by the creation of local boards at Amsterdam, in Zealand, at Delft and Rotterdam, Hoorn and Enkhuizen. The boards directed the trade of their own districts, and were responsible to one another, but not for one another as towards the public. A general directorate of 60 members was chosen by the local boards. Amsterdam was represented by 20 directors, Zealand by 12, Delft and Rotterdam by 14, and Hoorn and Enkhuizen also by 14. The real governing authority was the "Collegium," or board of control of 17 members, of whom 16 were chosen from the general directorate in proportion to the share which each local branch had contributed to the capital or joint stock. Amsterdam, which subscribed a half, had eight representatives; Zealand, which found a quarter, had four; Delft and Rotterdam, Hoorn and Enkhuizen had two respectively, since each of the pairs had subscribed an eighth. The 17th member was nominated in succession by the other members of the United Netherlands. A committee of ten was established at The Hague to transact the business of the company with the states-general. The "collegium" of 17 nominated the governors-general who were appointed after 1608. The charter, which was granted for 21 years, conferred great powers on the company. It was endowed with a monopoly of the trade with the East Indies, was allowed to import free from all custom dues, though required to pay 3% on exports, and charged with a rent to the states. It was authorized to maintain armed forces by sea and land, to erect forts and plant colonies, to make war or peace, to arrange treaties in the name of the stadtholder, and to coin money. It had full administrative, judicial and legislative authority over the whole of the sphere of operations, which extended from the west of the Straits of Magellan westward to the Cape of Good Hope. Its headquarters were early fixed at Batavia in Java. Only the main

[1] Linschoten was born at Haarlem in or about 1563. He started his travels at the age of 16 and, after some years in Spain, went with the Portuguese East India fleet to Goa, returning in 1589. In 1594 and 1595 he took part in the Dutch Arctic voyages, and in 1598 settled at Enkhuizen where he died on Feb. 8, 1611. His *Navigatio ac itinerarium* (1595–96) is a compilation based partly on his own experiences, partly on those of other travellers with whom he came in contact. It was translated into English and German in 1598; two Latin versions appeared in 1599 and a French translation in 1610. The English version was reprinted for the Hakluyt Society in 1885. Large selections, with an Introduction are published in C. Raymond Beazley's *Voyages and Travels*, vol. ii. *(English Garner,* 1903).

dates of its progress can be mentioned here. By 1619 it had founded its capital in Batavia in Java on the ruins of the native town of Jacatra. It expelled the Portuguese from Ceylon between 1638 and 1658, and from Malacca in 1641. Its establishment at the Cape of Good Hope, which was its only colony in the strict sense, began in 1652. A treaty with the native princes established its power in Sumatra in 1667. The flourishing age of the company dates from 1605 and lasted till the closing years of the century. When at the summit of its prosperity in 1669 it possessed 150 trading ships, 40 ships of war, 10,000 soldiers, and paid a dividend of 40%. In the last years of the 17th century its fortunes began to decline. Its decadence was due to a variety of causes. The rigid monopoly it enforced wherever it had the power provoked the anger of rivals. When Pieter Both, the first governor-general, was sent out in 1608, his instructions from the Board of Control were to see that Holland had the entire monopoly of the trade with the East Indies, and that no other nation had any share whatever. The pursuit of this policy led the company into violent hostility with the English, who were also opening a trade with the East. Between 1613 and 1632 the Dutch drove the English from the Spice islands and the Malay archipelago almost entirely. The English were reduced to a precarious footing at Bantam in Java. One incident of this conflict, the torture and judicial murder of the English factors at Amboyna in 1623, caused bitter hostility in England. The success of the company in the Malay archipelago was counterbalanced by losses elsewhere. It had in all eight governments: Amboyna, Banda, Ternate, Macassar, Malacca, Ceylon, Cape of Good Hope and Java. Commissioners were placed in charge of its factories or trading posts in Bengal, on the Coromandel coast, at Surat, and at Gambroon (or Bunder Abbas) in the Persian Gulf, and in Siam. Its trade was divided into the "grand trade" between Europe and the East, which was conducted in convoys sailing from and returning to Amsterdam; and the "Indies to Indies" or coasting trade between its possessions and native ports.

The rivalry and the hostilities of French and English gradually drove the Dutch from the mainland of Asia and from Ceylon. The company suffered severely in the War of American Independence. But it extended and strengthened its hold on the great islands of the Malay Archipelago. The increase of its political and military burdens destroyed its profits. In the early 18th century it was already embarrassed, and was bankrupt when it was dissolved in 1798, though its credit remained unshaken, largely, if its enemies are to be believed, because it concealed the truth and published false accounts. In the later stages of its history its revenue was no longer derived from trade, but from forced contributions levied on its subjects. The immediate causes of its destruction were the conquest of Holland by the French revolutionary armies, the fall of the government of the stadtholder, and the establishment of the Batavian Republic in 1798.

BIBLIOGRAPHY.—The great original work on the history of the Dutch East India Company is the monumental *Beschryving van oud en niew oost Indien* (Dordrecht and Amsterdam, 1724), by François Valentyn, in 8 vols., folio, profusely illustrated. Two modern works of the highest value are: J. K. J. de Jonge, *De Opkomst van het Nederlandsch Gezag in oost Indien* (The Hague and Amsterdam, 1862–88), in 13 vols.; J. J. Meinsma, *Geschiedenis van de Nederlandsche oost-Indische Bezittingen* (3 vols. Delft and The Hague, 1872–75). *See* also John Crawford, *History of the Indian Archipelago,* (Edinburgh, 1820); Clive Day, *The Dutch in Java* (New York, 1904); Sir W. W. Hunter, *A History of British India* (1899); and Pierre Bonnassieux, *Les Grandes Compagnies de commerce* (1892).

DUTCH LANGUAGE AND LITERATURE. Dutch is spoken in Europe by about 10,000,000 people spread over the present kingdom of the Netherlands, the northern half of Belgium and the northern part of the French Département du Nord. Outside Europe it is spoken in the Dutch Indies, Dutch Guiana and the Dutch Antilles.

Cape Dutch (Afrikaans), spoken in South Africa, has developed into an independent language; its resemblance to Dutch, however, is very great for although its grammar has been considerably simplified, its vocabulary has for the greater part remained the same as that of "High" Dutch.

In the United States of America, there are about 250,000 people whose mother-tongue is Dutch, and in Canada the number is estimated at 125,000. In Ceylon, where Dutch was used in the 18th century as a Church and Government language, it is almost extinct; only a few Dutch words now remain. The Negro-Dutch with its strong Creole admixtures, spoken at the former Danish Antilles, is doomed.

At an early date the language of the Netherlands occupied an independent position among the Low German dialects spoken along the coasts of the North Sea and Baltic from Dunkirk to Poland. At first it was chiefly the language of western Flanders (with the world-market Bruges), which was dominant, but in the course of the 15th century, Brabant came more to the fore. Antwerp at the height of its prosperity was a metropolis of about 100,000 inhabitants. In the course of the 16th century, the centre of Dutch culture moved to the northern Netherlands, especially to Holland. During the Eighty Years' War (1568–1648) the province of Holland formed the centre of the resistance against Spanish rule. The northern provinces rallied round Holland, and when free from the Spanish yoke, rose to great prosperity in the 17th century. The southern provinces remained in Spanish possession and fell into decay. French threatened to supersede the original language. The development of the language in the north was aided by the exodus to Holland of refugees from the provinces occupied by the Spanish. In the language of Holland this southern Dutch influence is distinctly noticeable. In the 16th century the inhabitants of Holland pronounced the words *bijten* (to bite), *vijf* (five), *huis* (house), *muis* (mouse), etc., still monophthongal. From the middle of the 16th century the southern Dutch diphthongization spread more and more and has now become general in the educated language of north and south, though the monophthongs still survive in numerous dialects. There still exists considerable difference between the colloquial and the written language of Holland. The more dignified, formal, official terms are originally southern Dutch, whereas colloquial speech has preserved the original linguistic forms. It is also owing to this old southern influence that the written language of the north differs comparatively little from that of the south and the authorized version of the Bible, the *Statenbijbel* (executed at Dordrecht 1626–35) was written in a language coloured by certain southern characteristics.

The history of the Netherlands is distinctly reflected in the spread of the Dutch language and its dialects. The original language of the Belgian provinces West-Flanders, East-Flanders, Antwerp, Brabant and Limburg and of French-Flanders is still characterized by a wealth of dialects as in the middle ages. The dialects of all these districts are generally grouped together under the name *Flemish.* In these Flemish districts the dialect is spoken by preference, although the written language is taught in the schools. By the side of it French has taken a prominent place from the time of the middle ages. In Brussels the language of the greater part of educated people is at present chiefly French. As a protest against this increasing Frenchification the Flemish language-conflict has arisen. Before the law French and Flemish now have equal legal recognition.

The state of affairs in Holland is less complex. The name "Holland", which originally only referred to the present provinces of north and south Holland, is now also used at home and abroad to designate the whole kingdom of the Netherlands. As a consequence of the expansion of the province of Holland in the 16th and 17th centuries, the language of this province was gradually adopted as the language of daily intercourse by all the provinces grouped round Holland. Provincial dialects are still spoken, a peculiar position being occupied by Frisian in the province of Friesland, which is separated from the Dutch dialects proper by a sharp linguistic boundary-line. The other dialects cannot be sharply differentiated. If we move eastward from the centre of culture, Amsterdam, an increasing "eastern" colour can be remarked in the dialects, as they merge imperceptibly into those of the Low German group, where, in the adjoining German districts, numerous Dutch influences are found.

BIBLIOGRAPHY.—The *Middelnederlandsch Woordenboek* bij *E.* Verwijs and J. Verdam (The Hague, 188; *seq.*) embraces almost all the material of Middle Dutch, which has been handed down since the

middle of the 13th century, and is one of the best dictionaries of mediaeval languages existing; this standard work is complete except for part ix. Excellent is also the great *Woordenboek der Nederlandsche Taal* (The Hague, 1882, *seq.*) of which 15 parts have been completed. Jac. van Ginneken, *Handboek der Nederlandsche Taal* i.–ii. (Nijmwegen, 1913, *seq.*) pays special attention to the dialects; J. Verdam, *Uit de Geschiedenis der Nederlandsche Taal*, 4th ed. by F. A. Stoett (Zutphen, 1923) is adapted to the requirements of the general public; M. Schonfeld, *Historiese Grammatika van het Nederlands* 2nd ed. (Zutphen, 1924) is useful as an introduction to historical grammar and has a good bibliography. Of the *Historische Grammatik der niederlandischen Sprache* bij M. J. van der Meer (Heidelberg, 1927), the first part *(Einleitung und Lautlehre)* has been completed; the numerous bibliographical references have been brought up to 1927. For some years the geographical method has been employed in an increasing degree in dialect investigation. In his work *De Hollandsche Expansie in de 16de en 17de eeuw en haar weerspiegeling in de hedendaagsche Nederlandsche dialecten* (The Hague, 1927), G. G. Kloeke shows with the aid of a map of the Dutch speaking territory how the language spoken in the cultural centre spreads over the surrounding dialect districts. For the practical study of the Dutch language the following work may be recommended: E. Kruisinga, *A grammar of modern Dutch* (1924). The best English-Dutch and Dutch-English Dictionary is: K. ten Bruggencate's *Engelsch Woordenboek*, 10th ed. bij A. Broers (Groningen). (G. G. K.)

LITERATURE

The oldest literary writings to be found to-day in Netherlandish or Dutch are the works of Heynrik van Veldeken, who lived near Maastricht in Limburg at the end of the 12th century. He wrote a Life of St. Servatius, the patron saint of the town, after a Latin original, and an *Eneide* (Aeneid) after the French *Roman d'Enéas*. He also wrote love songs which, like his *Eneide*, were translated into German and exercised a very considerable influence upon German poetry. But his influence on Middle Dutch literature was less considerable, although it is probable that the mystical poets of the Netherlands, and in particular the poetess Hadewych, borrowed from him.

The Influence of France. — The great efflorescence of Dutch literature occurred in the middle of the 13th century in Flanders and Brabant. Most of the works written there were translations from the French. This applies in particular to the romances of chivalry. The French originals of these romances came into existence at different periods, but their translations into Dutch belong more or less to one period. Among others, there exist in Middle Dutch fragments of a translation of the *Chanson de Roland*, of a *Willem van Oringen*, a *Renout van Montalbaen*, *De Lorreinen*, *Aiol*, etc. All these are "Frankish" romances. To this section also belongs *carel end Elegast*. It is almost certain that there was a French original of this remarkable work, but so far it has not been discovered.

In the section of Celtic romances, there exists one, or rather a double romance, by Jacob van Maerlant, about whom more will be said in connection with the didactic poems of the *bourgeoisie*. This romance is the *Historie van den Grale* (History of the Grail) and *Merlijns Boeck*. It is a translation and, as regards the beginning, a rather abbreviated and free adaptation of the *Joseph d'Arimathie* and the *Merlin* of Robert de Borron. These adaptations date from approximately 1261. In 1326 Lodewijc van Velthem added to this the translation of a much more extensive work called *Koning Artur's Boek* after *Le Livre du Roi Artus*. Maerlant also adapted a romance of Torec, while books about the adventures of Lancelot, Percival and the death of Arthur have also come down to us. Under the name *Roman van Lancelot* we possess a vast work of compilation, in which a number of British stories have been put together, and which also contains the original Dutch romance of *Moriaen*. And there is the *Ferguut*, which tells how a peasant lad was turned by love into a perfect knight.

The most important of the eastern romances is the adaptation of *Floris ende Blancefloer* by Diederic van Assenede. It is the story of the love of two children who are brought up together, one a heathen prince, the other the daughter of a Christian count. Another eastern romance is that of *Partenopeus en Melior*, which describes the love of a young man for a mysterious beauty who proves to be the daughter of the emperor of Constantinople. Of the classical romances we may mention the *Alexander* of Maerlant, after a Latin model. and his *Historie van Troyen* after Benoît de St. More's *Roman de Troie*.

Religious Literature. — Religious poetry occupies a prominent place in Middle Dutch literature. There exists among other poems a *Leven ons Heren* (Life of our Lord), compiled from various sources, written between 1260 and 1270. Various lives of saints were also narrated in verse. We have a life of St. Lutgarde by Willem van Afflighem, and fragments of several other lives of saints. Maerlant, whom we have already mentioned when speaking of the romances of chivalry, wrote a life in verse of St. Francis of Assisi, after St. Bonaventura.

The ecstatic mystical songs of the nun Hadewych, who also wrote visions and letters, are the most important, from the aesthetic point of view, of the 13th century religious poems. The 14th century saw the decay of the romance of chivalry, while, on the other hand, religious literature acquired still greater importance. From that period also date a few lives of saints which, however, have no great literary value. Most of them are translations from the Latin, and are written in a rather clumsy style. More importance must be ascribed to the poem about Theophilus and to the beautiful legend of *Beatrijs*, which are poetic version? of "Exempelen" (models or examples) displaying the favours which the Virgin Mary is able to obtain for those who serve her. The really significant religious literature of the period is the mystic prose, notably that of Jan van Leeuwen, "the good cook of Groenendaal," and, even more important, that of Jan van Ruusbroec, prior of the monastery at Groenendaal, near Brussels (1294–1381). His principal work was *Die Chierheit der geesteleker Brulocht*. Some of his other works are *Spieghel der ewigher Salicheit*, *Vingherlinc of vanden blinckenden Steen*, *Van den Gheestelijken Tabernacule*, *Van den Twaalf Beghinen*. In all these works the relations between God and the soul which loves Him are described, and the ways in which one can turn to Him.

Maerlant's Significance. — There further exists an interesting and original literature of the third estate in the middle ages. Jacob van Maerlant is its first and principal representative. We have seen that he also produced romances of chivalry and religious poetry. He was a Fleming by birth, went to live first at Maerlant in the isle of Oost-Voorne, where he was a sacristan, and finally at Damme in Flanders. His special significance lies in the fact that he satisfied the craving of the new *bourgeoisie* for useful reading. So he wrote the *Rijmbijbel*, which is an adaptation of the *Historia Scolastica* of Petrus Comestor. With this work and with his *Sente Franciscus' Leven* he had entered a new field. Five lyrical poems, which were partly translated but also very probably original in parts, belong to this section of his work. He wrote didactic poetry in the same very skilful strophic arrangement. There are two dialogues between Jacob (who represents Maerlant himself) and Martijn, about society and the church, about the relations between social classes, love, God, sin and similar subjects. But there are also works on a larger scale and of more scientific content, written to instruct the *bourgeoisie*. His *Heimelijkheid der Heimelijkheden* (Secret of Secrets) is a guide for princes. *Der Naturen Bloeme* (The Flower of Nature) is a moralizing handbook of natural history. These works are adaptations of Latin models. His last creations were again two strophic lyrical songs, the first a complaint about bad priests, the second preaching a new crusade after the fall of St. Jean d'Acre. For us Maerlant is principally a source of information about his time, rather than an artist. Nevertheless he proved himself a real poet. His original contributions in the sphere of didactic poetry found many imitators during the 14th century, among whom Boendale deserves special notice.

We may further mention among mediaeval poets the "Sprookspreker" (*i.e.*, a poet who also recites poems, which are usually of a moralizing character) Willem van Hildegaersberch (d. shortly after 1308); and Dirc Potter van der Loo (d. 1428), who put into inartistic rhymes a vast collection of love stories with a moralizing aim. The title of the work is *Der Minnen Loop*.

The mediaeval bestiary is represented by *Esopet*, a volume of fables after a Latin original (*Romulus*). But of much greater importance is *Van den Vos Reinaerde*, one of the masterpieces of Dutch literature. It was a free translation from the French branch

of the Reynard romance *Le Plaid,* by one Aernout, made about 1250, while a certain Willem, who tells us that he also had written a Madoc story, completed this adaptation with a piece about equal in length, which described how Reynard succeeded in escaping the gallows by a series of extremely clever, though false accusations. made at the court of King Nobel. The whole Dutch Reynard is a beautiful work, full of the most delicate popular humour and psychology. At a later period a further addition was made and this eventually became the so-called *Reinaert II.* The poem is much less plastic, life among the animals is less vividly imagined, and there is more moralizing.

Mediaeval Drama. — Among what remains of the drama of the middle ages, there are a number of religious plays, and a quantity of very interesting secular plays, from which the religious element however is usually not lacking. The "Abele Spelen," *i.e.,* serious secular plays, which have come down to us, are *Esmoreit, Gloriant,* and *Lanseloet van Denemarken.* Each "Abel Spel" was followed by a farce ("Sotternie"). Six "Sotternien" are still known, dating from the 13th century. They are pleasant pictures of daily life. Of a later period is the similar *Nu noch.*

The mystery plays date from the 15th century. Seven such plays had been written about the seven joys of the Virgin, one of them being performed in each of seven successive years. There are still extant *Die Erste Bliscap van Maria,* and *Die Sevenste Bliscap van Maria.* There also exists *Tspel van de Vroede ende van de Dwase Maegden,* in which the wise and foolish virgins bear the names of different virtues and sins. This takes us far upon the way to allegory. Other plays, dating probably from a later period in the 15th century, are the two miracle plays *Van den Heylighen Sacramente van der Nyeuwervaert* by Smeken, and *Mariken van Nieumeghen.* The second, like the *Reinaert* and a few of the mystical songs of the nun Hadewych and of Sister Bertke, a hermit of Utrecht, is one of the jewels of mediaeval Dutch literature. The later middle ages produced a considerable number of popular songs, many of which are very beautiful.

Chambers of Rhetoric. — The 16th century was, in the provinces of the Netherlands, the century of the "Rederijkers," a name which is a popular rendering of rhetoricians, or members of the Chambers of Rhetoric. These Chambers were of much more ancient date, and their curious literature goes back to about 1400. They were societies of burghers who wished to practise literature by recitations, theatrical performances, and even by poetic composition. In this domain also the southern Netherlands gave the lead. In the north, the oldest Chamber, "Het Bloemken Jesse" of Middelburg, dates from 1430. A highly placed person usually acted as patron. The real leader of the activities was the "factor," who often wrote the plays himself and produced them. These Chambers really had a great significance in social history. If they diffused notions about poetry and its technique among the masses, they were also instrumental in spreading new ideas of every kind. They did not, however, produce anything of real artistic value. In 1548 Matthijs de Casteleyn published his *Const van Rhetoriken.* It was an *ars poetica* for rhetoricians, and placed the emphasis on the technique of poetry. The importance attached by the Chambers of Rhetoric to difficult forms and complicated rhyme arrangements gradually increased. Still real sentiment is expressed in three volumes of *Refereynen* by the Antwerp schoolmistress, Anna Bijns, who proved herself a very militant servant of the old church in the fight against the "damnable Lutheran doctrines." Most of the extant works by rhetoricians are allegorical plays, so-called moralities or "Spelen van Sinnen." The morality *Elckerlyc,* written at the end of the 15th century, is unmistakably related to the English *Everyman.* It has not been decisively established which of the two is of earlier date. The mediaeval farce also persisted: by the rhetoricians it was usually called "Esbattement." There is a collection of 16th century plays which form the archives of the former Chamber of Rhetoric of Haarlem called *Trou moet blijcken.* This collection contains several such "Esbattements." The principal poet of this genre is Cornelius Everaert of Bruges (1485–1556). To "Esbattement" as well as to allegory he made important and fine contributions

The great moments in the life of the rhetoricians were the "landjuweelen," or poetic and dramatic competitions between different Chambers. The name of "land-jewels" comes from the prizes that were given.

The Early Renaissance. — The effect of the Renaissance was noticeable. In this connection it is unnecessary to say much about the world-famous Desiderius Erasmus, of Rotterdam, because he wrote exclusively in Latin. A few quite interesting writers who belonged to the early Renaissance used the national language: the Brabander Jan van der Noot, and Carel van Mander, who also wrote an important book on painting *(Het Schilderboeck).* There was also Jan van Hout, secretary to the town of Leyden. These men differ altogether from the rhetoricians who adorned their style with mythological names. They have communed with the pure spirit of the Renaissance through the poets of the French Pléiade.

Greater, however, was the effect of the Reformation, a movement which touched and agitated the whole of the population. We have mentioned already a poetess who opposed the movement— Anna Bijns. The other side is amply represented in the political and religious struggle against Spain by the so-called "Geuzenliedjes," which tried to spur people on to action. Marnix van St. Aldegonde (1538–98) wrote the *Biencorf der Heiligher Roomscher Kercke,* perhaps the bitterest satire ever written against the Catholic Church, which called forth a number of replies. The poet D. V. Coornhert (1522–90) occupied a peculiar neutral position between the warring factions, which duly persecuted him each in its turn. His principal work is the *Zedenkunst, dat is Wellevenskunst.*

Meanwhile in Amsterdam the Chamber of Rhetoric "De Eglantier" was flourishing as a centre of literary culture. Its motto was "In liefde bloeyende" (*i.e.,* flourishing in love). During the later part of the 16th century and the beginning of the 17th one of the principal members of this Chamber was the humanist Hendrik Laurenszoon Spieghel (1549–1612), whose principal work was the *Hertspieghel,* a rather elaborately composed poem, which expounded a doctrine not unlike that of Coornhert's. Another important member was Roemer Visscher, who wrote familiar and comical little rhymes (Brabbeling), and also wrote little mottoes in prose to accompany printed pictures ("Sinnepoppen").

The Golden Century. — The Chamber "De Eglantier" also made great efforts to refine the national language, to polish it, and to free it from French bastard-words. In 1584 it published a *Tweespraack van de Nederduytsche letterkunst,* a Renaissance grammar with an important preface by Coornhert. A factor of the greatest significance in relation to the civilization and culture of the Netherlands was the emigration of Calvinists from the southern Netherlands.

The principal poets and prose writers of the Golden Century are Jacob Cats (1577–1660); Pieter Corneliszoon Hooft (1581–1647); Gerbrand Adriaanszoon Bredero (1585–1618); Joost van den Vondel (1587–1679) and Constantijn Huygens (1596–1687).

Jacob Cats, born at Brouwershaven, studied at Leyden and at Orleans. He became "advocate" of the town of Middelburg (1603), made a fortune by reclaiming land from the sea, successively occupied the position of pensionary of Middelburg (1621) and of Dordrecht (1623). From 1636 to 16jo he was pensionary of Holland, after which he retired to his country house "Zorgh-vlied" near The Hague. His work is wordy but easy to understand, and during the whole of the 17th and 18th centuries it was read by the people and had its place beside the Bible It is a treasurehouse of moral precepts and practical worldly wisdom. His principal works are: *Houwelijck* (1625); *Spieghel van den ouden ende nieuwen Tijdt* (1632); *Trou-Ringh* (1637); and *Ouderdom, Buytenleven en Hofgedachten op Zorgh-vliet* (1656). This work, the title of which means "Old Age, Country Life and Courtly Thoughts at Zorgh-vlied" (the poet's country house), is autobiographical. Cats was only a'mediocre poet, but culturally his significance has been immense. He is the representative of the ideas of the Calvinist masses.

Constantijn Huygens was born at The Hague. In 1616 and 1617 he studied law at Leyden, and travelled several times as secretary of embassy (he made three journeys to England). In 1625 he became secretary to the Stadholder Frederic Henry, after-

wards to Prince William II., and finally to Prince William III. He considered his professional work to be the principal part of his existence, and his poems were "flowers in his cornfield." He has little fantasy and in his work mainly depicted himself and his surroundings. His principal works in Dutch—for he also wrote in Latin—are *Voorhout* (1621), a description of the well-known promenade at The Hague; *Costelick Mal* (1622), a satire on eccentric fashions; *Dagwerck* (1639), a description of the manner in which he spends his day; *Oogentroost,* a poem in which he tried to console his blind friend Lucretia van Trello by explaining how nearly all people go through life blinded by their passions; *Hofwijck* (1653), a description of his little country home; *Zeestraat* (1666), which describes the road made after his plan between The Hague and Scheveningen. There is also a play called *Trijntje Cornelis Dochter,* and an autobiography of his later years, *Cluyswerck* (1680), which was only published in the 19th century.

The Influence of **Amsterdam.**—We now pass to Amsterdam. There, at the beginning of the 17th century, two Chambers of Rhetoric were flourishing, "De Eglantier" already mentioned and "'t Wit Lavendel," which was the "Braband" Chamber, where refugees from the southern Netherlands came together. Differences of opinion made themselves felt in the "Eglantier." Many of the best members, in whose view the practice of "rhetoric" did not mainly consist in pleasant gatherings, seceded in 1617. Among their number were Hooft and Bredero. Under the direction of Dr. Samuel Coster, a medical man who also wrote, they founded the "Duytsche Academie," which aimed at giving instruction; after some time, however, the activities of the new chamber limited themselves to the production of plays. In 1635 the old "Eglantier" amalgamated with the seceders and the result was the foundation of the "Amsterdamsche Schouwburg" (Amsterdam theatre) in 1637.

One of the more talented writers in this circle was G. A. Bredero, who was an exception among the great authors of his day, in that he had received no classical education. His voluminous lyrical poetry has been collected in his *Boertigh, Amoureus en Aendachtigh Groot Liedboeck.* The first part of the book contains comical poems, little sketches of popular life, representing in the sphere of literature those things which in painting characterized the work of Jan Steen, Brouwer and Ostade. The amorous poems of the volume are in the vein fashionable at the time. As a dramatic author Bredero wrote in the first place romantic plays, the subject matter of which came from Spanish romances of chivalry. The comical interludes in these plays, full of popular realism, showed a talent for comedy which reached its full height in his farces *Klucht van de Koe* (1612); *Klucht van Symen ender Soelighyd* (1612–13); *Klucht van den Molenaer* (1613); and also in his two comedies: *Het Moortje* (1616) and *De Spaansche Brabander* (1617). The first was based on the *Eunuch* of Terence, the second was after Lazarillo de Tormez. The local colour in both plays was entirely derived from Amsterdam.

Another lyric poet and playwright whose gifts were more modest, but who was decidedly related to Bredero, was Jan Starter (1594–1628), born in England, who was a member of the "Eglantier" at the same time as Bredero. Afterwards he became a bookseller and founded a Chamber of Rhetorique at Leeuwarden. His poetry has been collected in the volume *De Friesche Lusthoj* (1621).

Pieter Hooft is the most typical representative of the Renaissance in the literature of the Netherlands. His art is personal and refined. He came from an Amsterdam merchant family, was destined for commerce, and was sent on a commercial journey to Italy (1598–1601). The love poems which he wrote after his return, and the pastoral play *Granida* (1605) show the influence of the Italian Renaissance. In 1606 he was allowed to study law at Leyden. When his studies were finished he was appointed *drost* of Muiden. In this function he lived in the famous *Muiderslot* or castle of Muiden. Inspired by the place in which he was living and also strongly influenced by the tragedies of Seneca, he wrote in 1613 *Geeraerd van Velsen* and in 1626 *Baeto.* In both plays he has expressed his political ideas in a very anachronistic manner. We also adapted Plautus's *Aulularia* into a comedy of Amsterdam called *Warenar* (1617). Particularly after 1627 his home became the centre of artistic and intellectual life, formed by the "Muiderkring" (circle of Muiden). During the last 20 years of his life, he devoted himself almost exclusively to historical prose. In 1626 he wrote *Henrik de Grote;* in 1628–47, *Nederlandsclze Historien,* which he left unfinished. The artistic prose of these writings, strongly influenced by Latin, exercised a great influence on the literary prose style of the 17th century

The Genius of **Vondel.**—Joost van den Vondel is the greatest poet of the Golden Century in Holland. He was born in Cologne of parents who came from Antwerp, whence they had fled as Anabaptist refugees. When Joost was still very young his parents migrated to Amsterdam. There he had a hose shop in the Warmoesstraat, but his wife Maaiken de Wolf entirely managed the business and allowed her husband to give all his time to study and to art. He was a real product of the Renaissance, full of veneration for the ancients whom he tried to imitate, particularly in his tragedies.

Vondel's work is voluminous. There are in the first place the satirical poems occasioned by the religious and political struggles between Arminians and Gomarists: *Geuzenvesper,* which was written against the doctrine of predestination; *Rommelpot van 't Hanekot; Otter in 't Bolwerk.* His tragedy *Palamedes* (1635) represents the struggle between Prince Maurice and Oldenbarnevelt in an allegorical form and belongs to his satirical work. There are further *Roskam,* which criticizes the abuses of the government of the Regents, and *Harpoen,* which compares the good and the bad minister. We may mention, among his songs celebrating the national greatness of the Dutch republic, the glory of the House of Orange, and of Amsterdam, *Lof der Zeevaert* (1622); *Geboortklock van Willem van Nassau* (1625); *Inwijding van izet Stadhuis* (1655). He showed the interest which he took in important events abroad in *Maeghdeburghs Lijckoffer* (1631), *Olijftack van Gustaaf Adolf* (1632). After he had become a Catholic he wrote three long poems in defence of his faith: *Altaergeheimenissen* (1645); *Bespiegelingen van Godt en Godsdierzst* (1662); *Heerlijckheit der kercke* (1663). But the principal work of Vondel consisted of 24 original dramas. The first was *Pascha of de Uyttocht der Kinderen Israels uit Egypte.* Among his other dramas are *Gysbreght van Aemstel* (1637); *Maeghden* (1639), *a* dramatic version of an episode of the life of St. Ursula; *Joseph in Dothan* (1640); *Maria Stuart* (1646); *Leeuwendalers* (1647), a play written on the occasion of the Peace of Munster. His masterpiece was *Lucifer* (1654), describing the revolt of the angels against God. *Jephtha* (1659) and *Adam in Ballingschap* (1664) are other plays of his.

Three religious poets from the great period of the 17th century deserve separate notice. The first is Johannes Stalpaert van der Wielen, parish priest at Delft (1579–1630), whose *Life of St. Agnes* and *Geestelijcke Lofsangen,* imbued with *a* true mediaeval spirit, are his best known works. Jacobus Reefsen of Revius (1586–1658), was a Protestant minister of Deventer (*Over-Yselsche Sangen en Dichten,* 1630), and D. R. Camphuysen (1586–1627) wrote *Stichtelijcke Rijmen.*

The Late **17th** Century.—Later in the 17th century comes Jan Vos whose rhetorical pieces *Aran en Titus* (1641) and *Medea* (1666), were produced with elaborate stage machinery, which made quite a sensation. Geraert Brandt (1626–85) was a prose author who wrote *Historie der Reformatie, Leven van Adr. de Ruyter, Leven van P. C. Hooft, Leven van Vondel.* Heiman Dullaert (1636–84) was a painter, pupil of Rembrandt, who wrote a few poems full of true sentiment which were among the best of his time.

The last generation of the 17th century is represented by the following writers: Johannes Antonides van der Goes (1647–84) was an imitator of Vondel. His principal work was *De Ystroom.* His language has something of the ease and grace of Vondel's but rather lacks simplicity. Jan Luiken (1649–1712), a world famous etcher and engraver, ranks as a poet near to Hooft and Vondel. The work of his youth was *De Duitse Lier,* a volume of love and nature poems. When he was 26 he became converted to a mystic and ascetic conception of life. Henceforth he only wrote pious

verses, of which the best is the first, *Jesus en de Ziel.* Thomas Asselyn and Pieter Bernagie wrote comedies. The first is known mainly for his play *Jan Klaesz of de gewaende Dienstmaegd,* in which he makes fun of the Quakers.

The decadence which had already set in by the end of the 17th century became accentuated in the 18th. The so-called "Pruikentijd" or period of wigs was a time of great wealth, when people were seized with a mania for collecting, and the art of poetry was practised in an amateurish way. Written in a form that was bound by the strictest rules, it was nothing but servile imitation of French models. The best known among the societies where that kind of poetry was practised, the "Nil volentibus arduum," was established at Amsterdam in 1669. One of its leading members was Andries Pels, who published in 1677 an *ars poetica.*

Gallican Dramatists. — The three principal authors of the first half of the 18th century are Pieter Langendijk (1683–1756), known to our own day as an author of comedies which are still performed, the moralist Justus van Effen (1684–1735), and the peasant poet Huibert Poot. The principal works of Langendijk were: *Het Wederzijds Huwelijks Bedrog* (1712–14); *Krelis Louwen of Alexander de Groote op het Poeetemaal* (1715), and *De Wiskenstenaars of 't Gevluchte Juffertje* (1715). He is an imitator of Molière, and in the polish of his smooth alexandrines shows himself a real man of the 18th century. His comedy of manners *De Spiegel der Vaderlandsche Kooplieden,* in which he opposes old fashioned solidity to new-fangled lightheartedness, remained unfinished. Justus van Effen was mainly the author of moralizing works written in French. He followed the example of the English reviews, *The Tatler* and *The Spectator,* and applied their methods also when later in life (1731–35) he published *De Hollandsche Spectator.* Between 1741 and 1800 at least 30 weekly papers of the same kind appeared. The, best known are *De Denker* and *De Grijzaard.* These *Spectatoriale vertoogen* had a great influence on the Dutch "Verlichting." Poot was a peasant with much poetical talent, but was unhappily too much under the influence of a dead classicism.

Some further typical representatives of the period are: Hoogvliet, author of *Abraham de Aartsvader;* Feitama, translator of the *Télémaque* of Fénelon and of the *Henriade* of Voltaire; Huydecoper, a philologist and author of tragedies in the style of the French classics. The two Friesian noblemen, Willem and Onno Zwier van Haren, have a certain imaginative originality, and are remarkable for the choice of more national subjects for their poetry.

English Influence on the **Novel.**—In the last quarter of the 18th century started the movement of "Verlichting." Classicism, which had gradually become a rigid and soulless form, was the special butt of the critics. The "enlightened" Betje Wolff-Bekker (1738–1804) and her friend Aagje Deken (1741–1804), who started by being more piously inclined, joined forces after they had for some time been publishing independently. Their collaboration produced some novels in letter form. Of these the first two *Sara Burgerhart* (1782) and *Willem Leevend* (1784–85), are the more important. In construction and in form they belong entirely to the school of Richardson. They are remarkable for their easy style and facility of expression. Rhijnvis Feith (1753–1824) is an entirely different type, a sentimentalist strongly influenced by Young, d'Arnaud, and Klopstock. He wrote a few sentimental novels, *Julia* (1783) and *Ferdinand en Constantia* (1785). Later in life he wrote didactic poems (e.g., *De Ouderdom* 1803) and many songs which are still used as church hymns. He also had a certain significance as a writer on aesthetics, but in that sphere he was less important than Hieronymus van Alphen (1746–1803), who translated Riedel's *Theory of Fine Arts* and provided it with an important introduction. He is now better known as the author of children's poems. Another poet, also very patriotic, was Jacobus Bellamy (1757–86). His style was rather bombastic.

Bilderdijk.—Willem Bilderdijk (1756–1831) is a great figure, who exercised considerable influence upon the spiritual life of Holland. He was an Orangist, an opponent of the party of the Patriots. In 1795 he refused to take the oath of allegiance to the Government of the Batavian republic which had been established by the French, and received the unusually severe penalty of exile. He roamed about Hamburg and London, where he fell in love with Katerina Wilhelmina Schwerckhardt, who later became his second wife. When Louis Napoleon became king of Holland, Bilderdijk was recalled to Holland and treated with much consideration. After the restoration, King William I. gave him a pension. He was not appointed a professor at Leyden as he had hoped to be, but established himself in that town as a private tutor (1817–27) and had a number of very able students who attended his courses in national history, venerated him as a prophet, and adopted a considerable part of his political and religious views. The movement which aimed at propagating these religious ideas was called the "Réveil."

Bilderdijk wrote ballads and longer narrative poems such as *Elius* and *Urzijn en Valentijn.* The epic *De Ondergang der Eerste Wereld* (1810), which he left unfinished, contains beautiful passages. The immense bulk of his lyric poetry contains some expressive poems, especially among his love songs, and others full of very deeply felt religious emotion, such as *Gebed* (1796) and *Boetzang* (1826). Among the longer poems the *Ode Van Napoleon* (1806) and *Afscheid* (1810) are celebrated. His *Geschiedenis des Vaderlands* contains part of an autobiography.

Johannes Kinker (1764–1845) was also a critic, a philosopher and a philologist. He criticized the insignificance of his conventional and sentimental contemporaries. Among the numerous but insignificant writers of the French period mention may be made of Adriaan Loosjes, whose *Maurits Lijnslager* is a forerunner of the historical novel, and Frederik Helmers (1767–1813) who published his bombastic but deeply patriotic poem *De Hollandsch Natie* in 1812 during the French domination.

The 19th Century. — The first part of the 19th century was less distinguished even than the revolutionary period. It was a time of rhetorical self-complacency. The orator Van der Palm (1763–1841), whose *Geschied-en-Redekunstig Gedenkschrift van Nederlands Herstelling* (1816) is the best known work, re-established formalism after the laxity of the revolutionary period. The typical representative in Holland of familiar fireside poetry was Hendrik Tollens (1780–1856). During that period we may notice Bilderdijk's ardent admirer and disciple Isaak da Costa (1798–1860). Da Costa's main work, directed against Liberalism, was *Bezwaren tegen den Geest der Eeuw* (1823). Among his poetic works the best known are his *Tijdzangen,* which Da Costa himself called his political poetry. His biblical poem *Hagar* (1848) had a symbolical meaning: Islam will one day bend the knee before Christ. In 1859 he wrote a historical poem *De Slag bij Nieuwpoort.*

Antoni Christiaan Winand Staring (1747–1840), an excellent poet who stood almost entirely by himself, was a gentleman farmer of Gelderland. Apart from many lyric poems and some epigrams ("sneldichten"), he wrote a few fine storks in verse: *De Twee Bultenaars,* the cycle of *Jaromir, Marco, De Hoofdige Boer, De Leerling van Pankrates, De Verjongingskuur.*

Jacob Geel (1789–1862), excellent prose writer, became librarian of Leyden university in 1822, and afterwards a professor. His main work consists of a series of treatises and essays, of which the eight principal ones have been brought together in one volume, *Onderzoek en Phantasie.* One of them, *Gesprek op den Drachenfels* (1835), attempts a just appreciation of romanticism, which had made its way into Holland about that period. Jacob van Lennep (1802–68) and Jan Frederik Oltmans (1806–54) are gifted followers of Scott, but their subject matter was national. Van Lennep wrote poetic stories, a few plays, but mainly historical novels and short stories which gave him considerable popularity. He started with mediaeval stories: *De Pleegzoon, De Roos van Dekama, Onze Voorouders.* His later novels *Ferdinand Huyck* and *Elizabeth Musch,* written under the influence of *De Gids* (about which more presently) describe the period of the Dutch republic. Van Lennep is easy and entertaining, but superficial. Under the influence of French naturalism, he also wrote a contemporary novel called *Klaasje Zevenster.* Under the pseudonym J. van den Hage, Oltmans wrote two novels: *Het Slot Loevestein* and *De Schaapherder.*

National Consciousness. — Typical of the romantic movement in Holland was the periodical De Gids. The critic and author Aernout Drost, who died young, started a review in 1836, called De *Muzen,* which had only a short existence. Everardus Johannes Potgieter followed him in 1837 with De Gids, in which he tried to strengthen the national consciousness of his compatriots. He was haunted by the ideal of national strength, represented by the grandeur of the 17th century. From 1837 to 1865 he directed De Gids, contributing to it a number of important criticisms and many sketches, the most characteristic of which is *Jan, Jannetje,* en hun jongste *Kind* (1842), where he contrasts the past and present of Holland. In Het *Rijksmuseum* (1844) he extolled the Holland of the 17th century. Potgieter's style is difficult and full of learned allusions. This also applies to his poetry, especially to his Zangen des Tijds and to his *Nalatenschap* van den *Landjonker.* Before he died Potgieter had come to despair of the success of his enterprise, and among the younger men he could discover no one whom he judged able to take over his task. The learned historian (later archivist) Reinier Bakhuizen van den Brink (1810–65), mainly known through his studies of the 17th century, published in De Gids, was a kindred spirit.

In the Dutch literature of that period a very peculiar place is occupied by Nicolaas Beets (1814–1903). During his student days he was an enthusiastic admirer of the English and French romantics. Under the influence more particularly of Byron, he wrote four stories in verse. But he owes his fame entirely to Camera *Obscura,* a book which has become a classic. It consists of a number of sketches which give a delicately humorous picture of the middle-class society of his day. Beets also wrote many poems, most of which are in the manner of Tollens.

Pieter Hasebroeck (1812–96) was, like Beets, a Protestant minister. His volume Waarheid en Droomen, published under the pseudonym of Jonathan, somewhat resembles the Camera *Obscura.* A similar resemblance appears in the sketches of student life by Johannes Kneppelhout, who wrote under the pseudonym Klikspaan (1814–85). Another important figure in the romantic movement is Anna Louise Geertruida Bosboom-Toussaint (1812–86), who, like Beets. began to write under the influence of the English romantics (*Almagro,* De Graaf van Devonshire). The criticism of De Gids made her choose national subjects. She wrote in praise of the heroes of Protestantism during the 80 years war against Spain. Her best known works are: Het *Huis Lauernesse* (1840), the cycle about Leicester in ten volumes (1845–55), and De Delftsche *Wonderdokter.* Like Van Lennep she deserted the historical novel during her later period and wrote a novel in the form of a diary entitled Majoor *Frans* (1874).

There is also a Catholic romantic, Josephus Albertus Alberdingk Thym (1820–89). Like Potgieter he loved the Amsterdam of the 17th century, but his description of that period is mainly restricted to Catholic circles. The modernist Protestant minister Petrus Augustus de Genestet (1829–61) was a popular poet and also wrote a series of Leekedichtjes (lay poems) about the religious struggle between the orthodox and the modernists.

Conrad Busken Huët (1826–86), of French descent, was mainly important as a critic, and adopted the method of Sainte-Beuve. From 1862 to 1865 he contributed a regular series of critical articles called *Kroniek* en Kritiek to De Gids. He worked as a journalist in the Dutch East Indies, and spent the last part of his life in Paris.

Eduard Douwes Dekker (1820–87) was a forerunner of the movement of 1880. Under the pseudonym of Multatuli, he wrote his Max *Havelaar,* a glowing protest against the treatment of the Javanese by the Dutch authorities. Dekker had been an official in India. The book created an immense sensation. In 1861 there followed the Minnebrieven (love letters). This book is extremely loose in form. Between 1862 and 1877 he published seven volumes of *Ideeën,* which contain his unfinished ncvel *Woutertje* Pieterse. Douwes Dekker was a neurotic who lacked equilibrium, but he had real flashes of genius.

In the southern Netherlands, where in the course of the several successive foreign dominations popular education had been stagnant, a new movement arose after 1830, the Flemish movement, of which the novelist Hendrik Conscience (1812–83) was for some time the best known literary representative. Conscience celebrated the grandeur of the past of Flanders. His best known novels are: De Leeuw van Vlaanderen, Jacob van Artevelde, De Loteling. Among the poets of the movement the foremost is Guido Gezelle (1830–99), one of the very greatest poets in the Dutch language.

The Renaissance of the '80s.—In the northern Netherlands an important renaissance of literature took place about 1885. It is usually considered to have started in Oct. 1885 with the publication of the first number of the review *De* Nieuwe Gids. The forerunners of this movement were Dekker, the novelist and poet Marcellus Emants and the delicate lyric poet Jacques Perk (1859–81). The Nieuwe Gids differs from De Gids in that it pursues an exclusively aesthetic ideal. The leaders of the movement were the poets Willem Kloos (1859–1938), Albert Verwey (1865–1937) and Lodewijk van Deyssel, the pseudonym of Karel Alberdingk Thym (b. 1864). Kloos sings the beauty that pleases the senses. Verwey passed from impressionist to symbolical verse. He also did good work in literary history (among other works he wrote a book about Potgieter). Van Deyssel is the violent and lyrical critic of the movement. Frederik van Eeden (1860–1932), dramatist, poet and prose writer, occupied a special place in the movement. His best work in prose is De Kleine *Johannes,* the story of the soul of a child. His Van de koele Meren des Doods is an important pathological novel. Van Eeden also took part in an experiment at communistic life which proved a failure. His plays are largely the expression of his social feelings and opinions. The poetess, Hélène Swarth (b. 1859) stands very near to the movement with her lyrical works written in particularly delicate language full of resonance. Herman Gorter (1864–1927) has acquired a foremost position in Dutch poetry by his poem Mei.

Among the men of the '80s (De Tachtiger) we must also place Jacobus van Looy (1855–1930), a writer of beautiful prose (*Proza,* Gekken, *Feesten,* Jaapje, Jaap, the last two of which are autobiographical). The great novelist Louis Couperus (1863–1923) describes the life of The Hague (*Eline* Vere, De Boeken der Kleine Zielen) and makes splendid imaginative reconstructions of antiquity (De Berg van Licht, Antiek *Toerisme, Herakles,* De *Komedianten,* Zskander). The movement of the '80s was mainly individualistic. Immediately afterwards came a group of authors whose feelings were more social. The dramatist and writer of sketches, Herman Heyermans (1864–1924), wrote social dramas which are among the greater triumphs of the Dutch stage (Ghetto, Het Zevende Gebod, *Op* Hoop van Zegen, Ora et labora, *Allerzielen,* De Opgaande Zon, *Schakels,* etc.). The novelist Israel Querido (1872–1932) mas one of the greatest Dutch naturalists (Levensgang, Menscherzwee and the cycle De *Jordaen* in four volumes). Herman Robbers wrote among other novels De *Bruidstijd* van Annie de *Boogh* and De *Roman* van een *Gezin.* To the same movement also belong Henriette Roland Holst (b. 1869), an emotional poet who professes extreme revolutionary doctrines, and the popular poet Adam van Scheltema, a Socialist.

Recent Writers. — This generation has again been followed by an entirely new one, poets and prose writers, whose mottoes and tendencies differ considerably from one another. They are too near us to be grouped and classified, and it must suffice to mention a few names of those whose work is generally recognized as excellent. Peter Cornelis Boutens first wrote in an obscure fashion but gradually obtained a mastery of his poetic form and became able to express himself in strongly rhythmic verse. Jan Hendrik Leopold (1865–1925) wrote sensitive poems, Carel and Margo Scharten-Antink are novelists (Een *Huis* vol *Menschen,* De Vreemde *Heerschers, 't* Geluk Hangt als een Druiventros). Other women novelists are: Augusta de Wit (*Orpheus* in de Dessa), Ina Boudier Bakker, Top Naeff, Carry van Bruggen and Jo van Ammers-Kuller. There is a young poetic school about which it is still difficult to pronounce a definite opinion. Martinus Nyhoff and van Schagen are talented representatives of this school. Contemporary Flanders represents a strong element of feeling and also a striking power in modern Dutch literature. There are the prose writers Stijn Streuvels (pseudonym of Frank Lateur) and Felix Timmer-

mans, and the classicist and imaginative poet, Karel van den Woestijne. (J. WAL.)

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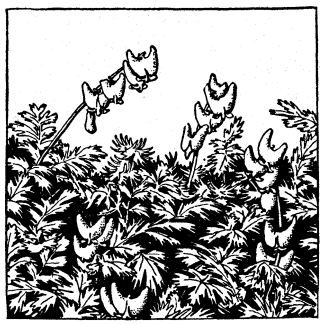
DUTCHMAN'S BREECHES *(Dicentra Cucullaria)*, a North American plant of the fumitory family (Fumariaceae), known also by various local names, as butterfly-banner, boys-and-girls, ear-drops and soldier's-cap, native to woods from Nova Scotia to South Dakota and southward to North Carolina and Kansas. It is a smooth, delicate plant, rising from a granulated bulb, with the slender-stalked, finely dissected leaves, appearing to spring from the surface of the ground. In shape the irregular flowers, about ¾ in. broad, resemble a pair of baggy trousers, whence the popular name. The flowers are white or pinkish, tipped with yellow, and hang tremulously from a slender stalk, 5 in. to 10 in. long. This plant, which blossoms abundantly in early spring, is one of the most dainty of North American wild flowers. (See DICENTRA.)



BY COURTESY OF THE WILD FLOWER PRESERVATION SOCIETY

DUTCHMAN'S BREECHES. AN EARLY SPRING FLOWER IN NORTHERN AND EASTERN UNITED STATES

DUTCH METAL. A variety of brass, in which the proportion of zinc is high, giving the alloy a yellow colour, simulating gold. The proportions of copper and zinc in dutch metal range from 88:12 to 85:15, the colour becoming paler with the higher zinc content. Dutch metal is used in bronzing, and in the preparation of imitation gold-leaf, its great ductility lending itself to the purpose. Gilding with dutch metal costs less than one-third the price of real gilding, but the work rapidly tarnishes unless coated with a lacquer. (See BRASS.)

DUTCH OVEN. This utensil was in general use in American colonial days for baking before the open fire, which was the only means of cooking except the brick oven (*q.v.*). It was round, square or oblong, with the front open. The round variety was often fitted with a spit, turned by a handle on the outside, for roasting meat. Otherwise, the oven was used for baking only. The open side was set close to the fire, to receive the full heat of flames or coals. Usually of tin, it was often called "tin kitchen" or "Dutch kitchen." The bake kettle—a covered receptacle on high legs to set over the fire-wag sometimes called a Dutch oven.

DUTCH WARS, a general title for the three naval wars fought between England and the United Provinces (1652–74); but also for the almost continuous series of land campaigns fought by the Dutch against Louis XIV. (1667–78).

NAVAL OPERATIONS

First Dutch War (1652–54).—The immediate causes of the war were the continuous diplomatic rebuffs given by the Dutch to the English Commonwealth government. The real and underlying cause, however, was the commercial rivalry of the two nations, especially in the North Sea and Spitzbergen fisheries and in the East Indian trade, while in addition the English disputed the Dutch claim to make their neutral flag cover goods consigned to France, with whom England was already unofficially at war. (See HOLLAND: History; ENGLISH HISTORY; SHIPPING; and NAVIGATION LAWS, etc.)

Despite the great maritime strength of the Dutch, which had developed unchecked for nearly fifty years, England began the war with three overwhelming advantages. Geographically, she dominated the Dutch trade route passing through the Straits of Dover; her navy was directed by a single and united body, the Council of State, whereas the Dutch relied on the sporadic co-operation of five different provincial admiralties; finally, the Commonwealth government was prepared to lavish huge capital sums on the war, seized from the Royalists, while the Dutch were compelled to finance the war from an income largely derived from their threatened carrying trade and fisheries.

In the spring of 1652 Admiral Martin Tromp (*q.v.*) took a strong Dutch fleet into the Channel to protect the returning trade. Neither country was anxious to appear as the aggressor; but a collision occurred with Admiral Robert Blake's squadron on May 19 off Dover on Blake making the claim to the salute, some Dutch ships having been attacked further down the Channel for the same cause. Admiral Bourne came up later with a squadron from the Downs to assist Blake, and Tromp was eventually driven over to the French coast with the loss of two ships.

Blake was now ordered north to destroy the Dutch herring fisheries, which he succeeded in doing; also if possible to intercept the Dutch East Indiamen, said to be returning by the north of Scotland, and to harry their Baltic trade. Meanwhile Tromp and later on de Ruyter (*q.v.*) had matters their own way in the Channel against Sir George Ayscue who had only 14 ships, the remainder being with Blake. As soon as the Dutch understood this, Tromp was ordered north to engage Blake. He sighted his adversary; but a storm scattered his fleet off the Shetlands, and in returning home he was superseded by Cornelius de Witt (*q.v.*) as a result of the outcry caused by the loss of the herrings. In September de Witt concentrated his force, as did Blake, each having over 60 sail, and an action was fought on Sept. 28, when the English admiral cleverly neutralized de Witt's attempt to exploit the leeward side of the Kentish Knock as a defended anchorage. The Dutch were severely handled, while many of their captains refused action towards the close, being jealous of de Witt on personal and political grounds.

Tromp was now reinstated in command by the States General with over 80 ships, and ordered to force the outgoing convoy through the Channel; but the English Council of State, thinking that the season for active operations was passed, reduced the fleet considerably, and when Tromp appeared off the Goodwins on Nov. 29 Blake had only 40 ships ready in the Downs, many of them being only hired merchantmen. However, he determined to attack, and on Nov. 30 both fleets were clear of the Goodwins on parallel courses. Off Dungeness a general action was fought in the late winter afternoon, in which Tromp was successful, his convoy passing down mid-channel without loss.

An immediate naval reorganization followed this set-back. The Council of State ordered several captains to be tried for unsatisfactory conduct and issued articles of war by which all captains of merchant ships engaged on government service were in future to be entirely under government discipline. The seamen's pay was increased, the victualling improved, and the command was strengthened by the addition of the generals George Monk (*q.v.*) and Richard Deane for service at sea.

Early in Feb. 1653 Blake took his fleet of about 70 sail down channel to intercept Tromp, who was known to be attempting to conduct the home-bound Dutch convoy of merchantmen through the Channel. Thick fog made reconnaissance difficult, and the English fleet was somewhat scattered when Tromp suddenly appeared off Portland on Feb. 18 with about 80 sail, the wind being north-west. Blake's squadron having become separated had to withstand the whole of the Dutch fleet alone for some hours, till at last help arrived, when Tromp drew off to rejoin his convoy which had meanwhile slipped by unmolested. Next day, Blake pressed the Dutch vigorously and a running fight took place past the Isle of Wight, Tromp forming his fleet in a crescent to protect his convoy which sailed ahead. On Feb. 20, both fleets were off Beachy Head, and Blake again attacked; the English frigates

pressed through to the convoy, which became seriously disorganized, so that night alone saved them from disaster. It seemed impossible for the Dutch to round Cape Gris Nez, but Tromp managed to get the remainder of his fleet and convoy clear away before next morning, after a total loss of 17 men-of-war and over 50 merchantmen.

Both countries were now feeling the strain of the war, and for some time administrative and financial difficulties incapacitated their fleets, though Tromp was active in protecting convoys coming round the north of Scotland. Blake had been wounded off Portland, and upon Deane and Monk at last getting to sea in force, Tromp at once sought action, and on June 2 and 3 there was heavy fighting, beginning off the Gabbard and ending near the Dutch coast. For the first time the English fleet showed a decided superiority, recent fighting instructions having strictly enjoined them to maintain a line ahead formation and so develop their broadside fire to the utmost. Deane was killed, but Blake joined in with reinforcements on the second day and the Dutch fleet was routed, losing over 20 ships. Blake and Monk at once blockaded the Dutch coast, without returning to harbour. This imposed a great strain on the English resources, but it was amply justified by the disorganization of Dutch trade which quickly followed; Tromp with the main fleet being confined to the Weilings while a small force under de Witt lay in the Texel. Early in July the English fleet had to withdraw to land the sick (among them Blake) and to reprovision, but it was back in position in three weeks, during which time Tromp was unable to make any move owing to lack of men, ammunition and stores. At last on July 25 Tromp put to sea and, heading north, succeeded in drawing Monk south from the Texel in a running fight, after which he slipped north during the night of July 29 and effected a junction with de Witt. The action which followed on July 31 (O.S.) was the fiercest of the whole war. Tromp, who throughout the operations had shown marked superiority in seamanship, obtained the wind and attacked with over 100 sail. The fight lasted nearly 12 hours, by which time the Dutch were completely beaten and had lost 30 ships, while many deserted earlier in the action, and Tromp himself was killed. No other operations of any importance followed, and by the Treaty of Westminster, concluded in April 1654, the Dutch conceded all trade questions under dispute, acquiesced in the Navigation Act, and paid a heavy indemnity. In the Far East their commercial expansion was checked, though in the Mediterranean they remained supreme.

Second Dutch War (1664–67).—Charles II.'s government pursued a vigorous commercial policy, and was soon embroiled with the Dutch over the West African slave trade, and the interpretation of the Navigation Act. In Oct. 1663, therefore, Captain Robert Holmes was sent to raid the Dutch West African trading posts, and in 1664 he crossed the Atlantic and captured the Dutch colony of New Amsterdam (New York). The Dutch at once sent out Admiral de Ruyter, who recaptured the African ports and attacked Barbados. He was on his way home when, in May 1665, official operations of war began, and a Dutch fleet of over 100 sail under the lord of Opdam captured some English ships which were bringing naval stores from Hamburg. The English fleet, of equal strength, was at once hurried to sea under James, duke of York, then lord high admiral. He was assisted by Prince Rupert, Lord Sandwich and Sir William Penn, and encountered the Dutch off Lowestoft on June 3 (O.S.). The action lasted all day and resulted in the decisive defeat of the Dutch, after a total loss of over 30 ships, Opdam being blown up in his flagship and Cornelius Van Tromp, the son of Admiral Martin Tromp, covering the Dutch retreat with great skill. Great dissatisfaction was shown at the duke of York's failure to pursue the enemy, and he was quickly replaced by Sandwich who, after a short time, was himself replaced by Monk (now duke of Albemarle), together with Prince Rupert.

The Plague, meanwhile, had so disorganized English administration that no further operations could be undertaken till May 1666, when Monk and Rupert were ready in the Downs with 80 sail. Here they received orders from Charles II. to detach one of their three squadrons, to meet a French squadron said to be approaching up channel from the Mediterranean, whence all English warships had recently been withdrawn. The French had declared war, but their squadron never came north of Lisbon, and the east wind, which took Rupert to Portsmouth with 25 sail, brought de Ruyter out with 85 ships against Albemarle's weakened force. Nevertheless, when the wind changed to south-west on June 1 (O.S.), he attacked the Dutch brilliantly, trying to concentrate the whole of his force against their van In this he was partially successful; the Dutch vice-admiral Evertzen was killed during the action, which lasted all day. On June 2 the Dutch were reinforced, and continued the fight. Their van was disorganized owing to Evertzen's death, and Albemarle concentrated all his force against the rear under Tromp, who was at last relieved by de Ruyter, when Albemarle retired. On June 3 Albemarle continued his retirement, protecting his injured ships with great skill, though Sir George Ayscue surrendered the "Royal Prince" after running on the Galloper shoal. In the evening Rupert and his squadon returned, and on June 4 Albemarle again offered battle and a great *mêlée* ensued, the English finally retiring into the Thames after a total loss of nearly 20 ships. De Ruyter now blockaded the Thames, based on the Essex shore, but Albemarle and Rupert quickly refitted and, working their way through the shoals, eventually forced him into action on St. James's day, July 25, off the North Foreland, where he was completely defeated with a loss of 20 ships. Albemarle now crossed to the Dutch coast and on Aug. 8–9 a special force under Sir Robert Holmes burnt 160 merchantmen anchored in the Vlie Channel and a million pounds' worth of goods in storehouses on shore.

Peace negotiations now began; but the English, exhausted by the war, the Plague and the Great Fire, laid up their line of battle ships for the winter; and the Dutch, pretending to do the same, resolved on a desperate raid in order to obtain better terms. Early in June 1667 de Ruyter suddenly appeared in the Thames and, forcing an entrance into the Medway Channel, despite the forts and boom protecting it, did immense damage to the shipping lying there, burning three first-raters, capturing another, and causing a panic in London. By the Peace of Breda (July 1667) the Dutch ceded New York, and the Navigation Act was amended in their favour.

Third Dutch War (1672–74).—Unlike the two previous wars, which were entirely commercial, this war was part of a great European political struggle. Louis XIV. who was intent on seizing the Spanish Netherlands, had recently been checked by the Triple Alliance of England, Sweden and the United Provinces; but in 1670 by the "Secret Treaty of Dover" he had persuaded Charles II. to abandon his former allies and co-operate with the French. The English and French fleets were to be combined under an English admiral; Charles was to establish Roman Catholicism in England, and was to receive large money subsidies. The Dutch, anxious to avoid a simultaneous war by land and sea, made every possible concession demanded of them and finally no better way of provoking them could be found than to order Sir Robert Holmes to attack their Smyrna convoy in the Channel (March 13, 1672).

De Ruyter with about 80 sail was at once ordered to sea, but administrative difficulties made him too late to prevent the junction of the French fleet of 35 sail under d'Estrees with the English fleet of 55 sail under James, duke of York, assisted by Lord Sandwich, Sir John Harman and Sir Edward Spragge. The allies, however, were also suffering from hasty preparation, and went to Solebay on the Suffolk coast to complete their complements and stores. Early in the morning of May 28, 1672, they were surprised by de Ruyter while still at anchor. Sandwich with the Blue squadron at once stood to the north and engaged the Dutch, and though his flagship was burnt and he himself drowned, his squadron routed the one opposed to it under Van Ghent, who was also killed. Meanwhile, the French turned south and held off from the battle, and de Ruyter, merely detaching a small force to watch them, concentrated his attack on the English centre. Here the duke of York was very hard pressed and had to shift his flag twice, and only the arrival of the ships of the Blue

squadron prevented complete disaster; after which de Ruyter drew off.

The Test Act now forced the retirement of the duke of York and many other Catholic officers, and no further operations were attempted till 1673, when the allied fleet was commanded by Prince Rupert, and it was planned to land troops on the Dutch coast. The Dutch, who were also attacked by Louis XIV. on land, passed through an internal revolution which brought William, prince of Orange, to the chief naval and military command. He at once ordered de Ruyter to sea, but there was hardly enough ammunition for both army and fleet. De Ruyter occupied a well-chosen anchorage in the Schoonveldt channel from where he could command his own coast. On May 28, 1673, the allied fleet attacked him with fireships and frigates, but were severely handled and driven back on their main fleet, de Ruyter counter-attacking with great skill and the fight lasting till night, when the Dutch again retired to their own coast.

On June 4 de Ruyter himself made a sortie and caught the allies somewhat dispersed, and after a running fight again retired to his shoals, the allies returning to the Thames to refit. De Ruyter now attempted to blockade them, but was driven back by plague in his ships, and at the end of July the allies returned in force to blockade the Dutch ports, and threatened an invasion from the east coast. William of Orange ordered de Ruyter to break the blockade and relieve the Dutch trade at all costs. De Ruyter found the allies off the Texel and, through the deliberate slowness of the French, easily out-manoeuvred them and obtained the weather gauge. On Aug. 11, 1673, he again had the wind, and attacked them running south. The French, who were leading, attempted to surround his van and, having failed, withdrew from the action. Spragge in the rear fought a magnificent but detached action with Cornelius Tromp, regardless of the general tactics of the battle. The French having disappeared, de Ruyter was again able to concentrate superior numbers against the English centre, which was very hard pressed. The centre and rears now became confused in a general *mêlée* and Spragge was drowned while crossing in a boat to his third ship. Great efforts were made to capture his first ship, the "Royal Prince," but she was splendidly defended, and towards evening the French returned and the Dutch withdrew. The unpopularity of the war in England compelled the English government to make peace with the Dutch in the following year.

Meanwhile, a revolt in Sicily led the insurgents to seek help from the French against their Spanish rulers, and a French army occupied Messina. The Spaniards appealed to the Dutch for help, and de Ruyter took out a squadron and fought an indecisive action on Jan. 8, 1676, with Duquesne who was bringing French reinforcements to Sicily. Later, a combined Hispano-Dutch attack on Messina failed, and de Ruyter was mortally wounded off Augusta on April 22. Charles II. now made a treaty of alliance with the Dutch, despatched troops to help them in Flanders, and sent Sir John Narbrough to the Mediterranean, on which the French evacuated Sicily and, in 1678, made the peace of Nijmwegen.

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OPERATIONS ON LAND

The contemporary military history of Europe included, first, the war between France and Spain, 1654–59, usually called the Spanish Fronde (see FRONDE, THE), of which the most notable incident was the great battle of the Dunes (*q.v.*). About the same time a war was fought in northern Europe (1655–60), celebrated chiefly for the three days' battle of Warsaw (July 28–30, 1656), and the successful invasion of Denmark by the Swedes, carried out from island to island over the frozen sea (Feb. 1658), and culminating in a long siege of Copenhagen (1658–59). Between the second and third wars of England and the United Provinces came the short War of Devolution (1667–68)—a war of sieges in the Low Countries in which the French were commanded chiefly by Turenne. In 1668 the French under Condé made a rapid conquest of Franche-Comté. This was, however, given up at the peace, The war of 1672–78, the first of the three great wars of Louis XIV., was fought on a grander scale.

Invasion of Holland, 1672.—The diplomacy of Louis had, before the outbreak of war, deprived Holland of her allies—England (Treaty of Dover, 1670), Sweden (Treaty of Stockholm, 1672) and the emperor, and when he declared war on the United Provinces in March 1672, it seemed that the Dutch could offer little resistance. The French army under Louis in person started from Charleroi and marched down the Meuse unopposed. The powerful Dutch fortress of Maastricht was masked, and the French then moved towards Dusseldorf. In the electorate of Cologne they were in friendly country, and the main army soon moved down the Rhine from Dusseldorf, the corps of Turenne on the left bank, that of Condé on the right. At the same time a corps under Marshal Luxemburg, composed of Louis' German allies (Cologne and Miinster) moved from Westphalia towards Over-Yssel and Groningen. The Rhine fortresses offered but little resistance to the advance of Turenne and Condé. William of Orange with a weak field army tried to defend the Yssel-Rhine line, but the French rapidly forced the passage of the Rhine at Tolhuis (June 12) and passed into the Betuwe (between the Lek and the Waal). Condé now advised a cavalry raid on Amsterdam, but Louis, acting on the suggestion of the war minister, Louvois, preferred to reduce Nijmwegen, Gorinchem and other places, before entering Utrecht province. Condé's plan was, however, partially carried out by Count Rochefort, who with 1,800 troopers captured successively Amersfoort and Naarden. His further progress was checked at Muyden, which the Dutch garrisoned in the nick of time, and he returned to the main army, taking Utrecht en route. Louis now moved on Amsterdam, brushing aside the feeble opposition which was offered, and it seemed that the French must achieve their object in one short campaign. But the Dutch people were roused. The month before, the citizens of Utrecht had refused to raze their suburban villas, and defence of the fortifications had consequently been impossible. Now, the dikes were cut and the sluices opened, and Amsterdam was covered by a wide inundation, against which the invader was powerless. At the same time the men of Zeeland repulsed a French raid from Ath on Aadenburg, and this infraction of the neutrality of the Spanish Netherlands served but to raise up another enemy for Louis. Luxemburg too, at first successful, was repulsed before Groningen. A revolution placed William of Orange at the head of the Government. The alliance of Brandenburg and the Mainz electorate had already been secured, and Spain, justly fearing for the safety of her Flemish possessions, soon joined them. The emperor followed, and Louis was now opposed, not by one State, but by a formidable coalition.

War Against the Coalition.— In the autumn the war spread to the Rhine. No attempt could be made on Amsterdam until the ice should cover the floods. Turenne was therefore despatched to Westphalia and Condé to Alsace, while a corps of observation was formed on the Meuse to watch the Spanish Netherlands. But the coalition had not yet developed its full strength, and Turenne's skill checked the advance of the Imperialists under Montecucculi and of the Brandenburgers under the Great Elector. A war of manoeuvre on the middle Rhine ended in favour of the French, and the allies then turned against the territories of Cologne and Miinster, while William, disappointed in his hopes of joining forces with his friends, made a bold, but in the end unsuccessful, raid on Charleroi (Sept.–Dec. 1672). The allies in Germany were now not merely checked, but driven from point to point by Turenne, who displayed a degree of energy rare in the military history of the period. After a severe winter campaign, the elector, defeated in combat and manoeuvre, was forced back to the Weser, and being but weakly supported by the Imperialists, found himself compelled to make a separate peace (June 6, 1673). Turenne then turned his attention to the Imperialists who were assembling in Bohemia, and made ready to meet them at Wetzlar. Meanwhile the other French armies were

fully employed. During the winter, Luxemburg made a bold attempt to capture Leyden and The Hague by marching a corps from Utrecht across the frozen inundations. But a sudden thaw imperilled his force and he had to make a painful retreat along the dikes to Utrecht. And Condé, who then returned to the command of the army in Holland, failed to make headway against the defence of Amsterdam. Louis' own army, originally collected for the relief of Charleroi in Dscember (advanced on Maastricht, and after a brief siege, in which Vauban directed the besiegers, captured this most important fortress (June 29, 1673). Louis, after the capture of Maastricht, led his army southwards into Lorraine and overran the electorate of Trier. But nothing of importance was gained, and Turenne's summer campaign was wholly unsuccessful.

Capture of Bonn.—From Wetzlar he moved to Aschaffenburg. Soon the Imperialists advanced in earnest, greatly superior in numbers. Marching via Eger and Nuremberg (Sept. 3) on the Main, Montecucculi drew Turenne to the valley of the Tauber; then, having persuaded the bishop of Wiirzburg to surrender the bridge of that place, he passed to the right bank of the Main before Turenne could intervene. The Imperialists soon arrived at Frankfurt, and the French position was turned. Montecucculi thus achieved one of the greatest objects of the 17th century strategist, the wearing down of the enemy in repeated and useless marches. The French retreat to the Rhine was painful and costly, and Montecucculi then passed that river at Mainz and made for Trier. Turenne followed, unable to do more than conform to his opponent's movements, and took post to defend Trier and Alsace. Thereupon Montecucculi turned northward to meet William of Orange, who evaded Condé's weak army and marched rapidly via Venló (Oct. 22) on Coblenz. The elector of Trier, who had not forgotten the depredations of Louis' army in the spring, followed the example of the bishcp of Würzburg and gave a free passage at Coblenz. William and Montecucculi joined forces in the electorate and promptly besieged Bonn. This fortress fell on Nov. 12, and the troops of the coalition gained possession of an unbroken line from Amsterdam to the Breisgau, while Louis' German allies (Cologne and Münster), now isolated, had to make peace at once. Louis' allies were leaving him one by one. The German princes and the empire itself rallied to the emperor, Denmark joined the coalition (Jan. 1674), the Great Elector reentered the war, and soon afterwards England made peace.

Operations of 1674.—In 1674 therefore Louis reluctantly evacuated those of the United Provinces occupied by his army. He had derived a considerable revenue from the enemy's country, and he had moreover quartered his troops without expense. The resources of the French Government were almost intact for the coming campaign; the corps of observation in Roussillon, under Marshal Schomberg, made a successful campaign against the Spaniards, and the war was carried even into Sicily. Condé, in the Spanish Low Countries, opposed with inferior forces the united army of Spaniards, Dutch and Austrians under William, and held the Meuse from Grave to Charleroi on the Sambre. The war in this quarter was memorable for Condé's last, and William's first, battle, the desperate and indecisive engagement of Seneffe (Aug. 11), in which the two armies lost one-seventh of their strength in killed alone. The king's part in the campaign was, as usual, a war of sieges; an army under his personal command overran Franche-Comté in six weeks, and Louis, aided by the genius of Vauban, reduced Besançon in nine days. Turenne's Rhine campaign began with an invasion of Germany, undertaken to prevent interference with Louis in Franche-Comté. Bournonville, the imperial commander who now replaced Montecucculi, lay in the Cologne and Trier electorates. An army of South Germans, in the Breisgau, under the duke of Lorraine and Count Caprara, moved northward to the Neckar valley to unite with Bournonville. Turenne determined to attack the southern army before the junction could be effected. He crossed the Rhine at Philipsburg early in June, and on the 16th fell upon the inferior forces of Caprara in their entrenched position of Sinsheim. The result of the battle was a complete victory for the French, who followed up their success by driving a portion of Bournonville's army (on which the duke of Lorraine had rallied his forces) from the Neckar (action of Ladenburg near Heidelberg, July 7). Turenne then laid waste the Palatinate, in order that it should no longer support an army, and fell back over the Rhine, ignoring the reproaches of the elector palatine, who vainly challenged him to a duel. This devastation has usually been considered as a grave stain on the character of the commander who ordered it, but Turenne's conception of duty did not differ in this respect from that of Cromwell, Marlborough, Wellington and the generals of the American Civil War. It was held to be necessary and expedient, and it was accordingly carried out. Bournonville's army near Frankfurt was still to be dealt with, and the Great Elector and his Brandenburgers were rapidly approaching the Main valley. After a slight attempt to invade Lorraine, which Turenne easily stopped, the Imperialists suddenly recrossed the Rhine and marched rapidly into the neighbourhood of the Strasbourg bridge.

Turenne's Winter Campaign in Alsace.—The magistrates of this city were not less amenable than had been the bishop of Würzburg in 1673. Bournonville obtained a free passage, and Turenne was too late to oppose him. The French general, however, determined to fight, as he had done at Sinsheim, to prevent the junction of the two hostile armies. The Great Elector was still in the Neckar valley when the battle of Enzheim (8m. from Strasbourg) was fought on Oct. 4. This time it was indecisive, and Bournonville's superior forces, soon augmented by the arrival of the elector, spread into Alsace. Turenne steadily retired to his camp of Dettweiler, unable for the moment to do more, and the Germans took up winter quarters in all the towns from Belfort to Strasbourg (Oct.–Nov. 1674). But Turenne was preparing for another winter campaign, the most brilliant in the great commander's career.

First he placed the fortresses of middle Alsace in a state of defence, to deceive the enemy. Then he withdrew the whole of the field army quietly into Lorraine. Picking up on his way such reinforcements as were available, he marched southward with all speed behind the Vosges, and in the last stages of the movement he even split up his forces into many small bodies, that the enemy's spies might be misled. After a severe march through hilly country and in the midst of snowstorms, the French reunited near Belfort, and without a moment's delay poured into Alsace from the south. The scattered Imperialists were driven towards Strasbourg, every corps which tried to resist being cut off. Bournonville stood to fight at Mulhausen with such forces as he could collect (Dec. 29, 1674), but Turenne's men carried all before them. The advance continued to Colmar, where the elector, who was now in command of the Germans, stood on the defensive with forces equal to Turenne's own. The battle of Tiirkheim (*q.v.*) (Jan. 5, 1675) nevertheless resulted in another and this time a decisive victory for the French; a few days after the battle Turenne could report that there was not a soldier of the enemy left in Alsace. His army now went into winter quarters about Strasbourg, and drew supplies from the German bank of the Rhine and even from the Neckar valley (Jan. 1675).

Operations of 1675.—This opening of the campaign promised well, and Louis as usual took the field as early as possible. In the course of the spring (May–June) the king's army recaptured some of the lost fortresses of the Meuse and took in addition Liège and Limburg, The expeditionary corps in Sicily also gained some successes in this campaign, and Schomberg invaded Catalonia. On the Rhine was fought the last campaign of Turenne and Montecucculi. The elector having withdrawn his forces to Brandenburg *(see* SWEDEN: *History),* Montecucculi resumed command, and between Philipsburg and Strasbourg the two great commanders manoeuvred for an advantage, each seeking to cover his own country and to live upon that of the enemy. At last Turenne prevailed and had the Imperialists at a disadvantage on the Sasbach, where, in opening the action, he was killed by a cannon-shot (July 27). The sequel showed how dependent was even the best organized army of the time upon the personality of its commander.

All the advantages won were hastily surrendered, and Montecucculi, sharply following up the retreat of the French, drove

them over the Rhine and almost to the Vosges. At the same time the duke of Lorraine defeated Marshal Créqui (Aug. 11) at Conzer Briicke on the Moselle, and recaptured Trier (Sept. 6), which, as a set-off against Bonn, Turenne had taken in the autumn of 1673. The situation was more than alarming for the French, but Condé was destined to achieve a last success—for once a success of careful strategy and prudent manoeuvre. Luxemburg was left in charge in Flanders, and Condé took command of the remnant of Turenne's old army and of the fugitives of Créqui's. Montecucculi's skill failed completely to shake his position, and in the end Condé compelled him to retire over the Rhine. Both retired from their commands at the close of the year, Turenne was dead, and a younger generation of commanders henceforward carried on the war.

Operations of 1676.—In 1676 the naval successes of France in the Mediterranean enabled the corps under Marshal Vivonne in Sicily to make considerable progress, and he won an important victory at Messina on March 25. Vivonne was made viceroy of Sicily. Louis himself, with his marshals and Vauban, conducted the campaign in the north. The town of Condé fell on April 26, and the king then manoeuvred against the prince of Orange in the neighbourhood of Valenciennes. An attempt made by the latter in the summer to besiege Maastricht was frustrated by Marshal Schomberg with a detachment of the king's army (August). Rochefort meanwhile covered the Meuse country and Luxemburg. Créqui, who had now returned from captivity (he had been taken after the battle of Conzer Briicke) opposed the Imperialists in Lorraine, but he was unable to prevent the fall of Philipsburg, which occurred on Sept. 17. The French now laid waste the land between the Meuse and Moselle for the same reason which brought about the devastation of the Palatinate in 1674, and the year closed with a war of manoeuvre on the upper Rhine between the Imperialists under the duke of Lorraine and the French under Luxemburg.

Operations of 1677 **and 1678.**—The chief event of the campaign of 1677 in the Netherlands was the siege of Valenciennes, which fortress was invested by Louis in the first weeks of the campaigning season. Five marshals of France served under the king in this enterprise, but their advice was of less value than that of Vauban, whose plans the king followed implicitly, even so far as to order an assault de vive force against the unanimous opinion of the marshals. This succeeded beyond Vauban's own expectation; the picked troops entrusted with the attack of an outwork forced their way into the town itself (March 17). The success was followed by the siege of St. Omer and the defeat of William's relieving army by the duke of Orleans (battle of Mont Cassel, April 11, 1677). The summer campaign was a contest of skill between Luxemburg and William, which resulted in favour of the French.

In Germany the credit of the French successes was due to Créqui, who was no longer the defeated general of Conzer Brucke, but the most successful of Turenne's pupils. He began by driving back the duke of Lorraine to the Rhine. Another attempt by the Lorraine family to reconquer their duchy was thus foiled, and at the same time a second imperial army, which had crossed the Rhine by Philipsburg, was shut up in an island of the Rhine and forced to make terms with the French. A large reinforcement sent by the duke of Lorraine to its assistance was completely defeated by Créqui in the battle of Kochersberg near Strasbourg (Oct. 7) and the marshal followed up his successes by the capture of Freiburg on Nov. 14. During the year there was a brisk war in the West Indies, and also in Catalonia, where the French maintained the ground won by Schomberg in the previous campaign.

In 1678 Louis took the field in February. The skilful manoeuvres of the French, whether due to Louis' own generalship or that of his advisers, resulted in the speedy capture of Ghent and Ypres (March), and the retention of the prizes in the usual war of posts which followed. The last battle of the war was fought at St. Denis (outside Mons) between William and Luxemburg on Aug. 14, three days after the peace of Nijmwegen had been concluded. William sustained another defeat, but the battle was one of the most fiercely contested of the whole war. On the Rhine, Créqui began by winning the battle of Rheinfelden (July 6), after which he inflicted upon the Imperialists another defeat at Gengenbach (July 23) and took Kehl. In the short campaign of 1679, before France and the empire had concluded peace, he was equally successful.

In Spain the French army under Marshal de Navailles had also made steady progress, and thus the last campaign was wholly in favour of the French. The peace of Nijmwegen gave Louis many of the Netherlands frontier fortresses, and little else. He was threatened by the intervention of England on the side of the coalition, and would have made peace earlier but for his reluctance to abandon his ally Sweden. The French army had, however, well established its reputation. Vauban was unique amongst the officers of his time, and Créqui and Luxemburg were not unworthy successors of Turenne and Condé. The two marshals added to their reputation in the "Reunion War" of 1680–84. Créqui died in 1687, Luxemburg's greatest triumph was won seven years later (see GRAND ALLIANCE, WAR OF THE). Vauban retired from active service as a marshal 25 years after the peace of Nijmwegen. But the interest of the war does not reside wholly in the personalities of the leaders. There were great commanders before Turenne and Condé. It is as the début of a new method of military organization and training—the first real test of the standing army as created by Louvois—that the Dutch War of 1672–79 is above all instructive. (C. F. A.)

DUTCH WEST INDIA COMPANY, THE (De Westindische *Compagnie*), a company founded by letters-patent from the Netherlands states-general dated June 3, 1621. The purpose for which the company was formed was to regulate and protect the contraband trade already carried on by the Dutch in the American and African possessions of Spain and Portugal, and to establish colonies on both continents and their islands. By the terms of the charter the company was to be composed of five boards or branches, established in Amsterdam, Zeeland, the Meuse (Rotterdam), the North Department (Friesland and Hoorn), and Groningen. Each was to be represented on the general governing board according to the importance of the capital contributed by it. Thus Amsterdam, which contributed four-ninths of the capital, had eight directors on the board. Zealand, which subscribed two-ninths, had four. Rotterdam was represented by two directors. The northern district and Groningen appointed one director each.

The company was granted the monopoly of the trade with America and Africa and between them, from the Arctic regions to the Straits of Magellan, and from the Tropic of Cancer to the Cape of Good Hope. The policy the company proposed to follow was to use its monopoly on the coast of Africa in order to secure the cheap and regular supply of negro slaves for the possessions it hoped to acquire in America. The trade was thrown open by the voluntary action of the company in 1638. The general board was endowed with ample power to negotiate treaties, and make war and peace with native princes; to appoint its officials, generals and governors; and to legislate in its possessions subject to the laws of the Netherlands. The states-general undertook to secure the trading rights of the company, and to support it by a subvention of one million guilders (about £100,000). In case of war the states-general undertook to contribute sixteen vessels of 300 tons and upwards for the defence of the company, which however, was to bear the expense of maintaining them. In return for these aids the states-general claimed a share in the profits, stipulated that the company must maintain sixteen large vessels (300 tons and upwards) and fourteen "yachts" (small craft of 50 to 100 tons or so); required that all the company's officials should take an oath of allegiance to the Netherlands as well as to the board of directors; and that all despatches should be sent in duplicate to the government and to the board.

The history of the Dutch West India Company is one of less prosperity than that of the Dutch East India Company. In early days the trade was not sufficient to meet the heavy expense of the armaments raised against Spain and Portugal. The company was never able to secure the control of the supply of slaves from Africa. Its settlement of New Netherland was lost to England.

In the West Indies it gained a valuable footing among the islands. It occupied St. Eustatius in 1634, Curaçao with Bonaire and Aruba in 1634 and 1635, Saba in 1640 and St. Martin in 1648. But its greatest conquests and its greatest losses were alike met on the continent of South America. After a first unsuccessful occupation in 1623 of Bahia, which was immediately retaken by a combined Spanish and Portuguese armament, the company obtained a firm footing in Pernambuco. The story of the wars which arose out of this invasion belongs to the history of Brazil. The company had been largely guided in its policy of assailing the Portuguese possessions by the advice of the Jews, who were numerous in Brazil, and who found means to communicate with their fellows in religion, the refugees in Amsterdam. The most prosperous period of the company was during the tolerant and liberal administration of Count John Maurice of Nassau-Siegen (1636–44).

The monopolist tendency of all Dutch colonization, the religious hostility of the Roman Catholic Portuguese, and the support given by France and England to Portugal after her revolt from Spain combined at last to make the position of the company in Brazil untenable. It resigned all claim on the country by the treaty of 1661. But though deprived of its establishment in Brazil, the. company found a compensation in Surinam and Essequibo (Dutch Guiana), where there was no Spanish or Portuguese population to resist it, and where the resources of the country offered great profits. The advantages of the settlement in Guiana were not, however, reaped by the company founded in 1621. In 1674 it had become so embarrassed that it was dissolved, and reconstructed in 1675. The newly formed company continued to exploit the Dutch possessions in America till 1794, when they were all swept into the general reorganization consequent on the French invasion of Holland. The West India Company founded after the Napoleonic epoch in 1828 was only meant to develop trade, and was not successful

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DUTT, MICHAEL MADHU SUDAN (1824–1873), the greatest native poet of India in the 19th century, was born at Sagandari, in the district of Jessore in Bengal, on Jan. 25, 1824. His father was a pleader in Calcutta, and young Madhu Sudan received his education in the Hindu college of Calcutta. In 1843 he ran away to avoid a marriage into which his father wished to force him, and embraced the Christian religion. Continuing his studies now in the Bishop's college, Madhu Sudan learnt Greek and Latin and some modern European languages, and in 1848 went to Madras. There he wrote English verses, and married the daughter of a European indigo-planter, but was soon separated from her. He then married an English lady. with whom he returned to Calcutta in 1856, and soon discovered that the true way to win literary distinction was by writing in his own language, not by composing verses in English. His three classical dramas—*Ratnavali* (1858; Eng. trans, 1904), *Sarmishtha* (1859; Eng. trans. 1859, 1914) and *Krishna* Kumari—appeared between 1858 and 1861, and were recognized as works of merit. But his great ambition was to introduce blank verse into Bengali. His knowledge of Sanskrit poetry, his appreciation of the Greek and Latin epics, and his admiration of Dante and of Milton, impelled him to break through the fetters of the Bengali rhyme, and to attempt a spirited and elevated style in blank verse. His first poem in blank verse, the *Tilotfama,* was only a partial success; but his great epic which followed in 1861, the *Meghanad-Badha,* took the Indian world by surprise, and at once established his reputation as the greatest poet of his age and country. He took his story from the old Sanskrit epic, the *Ramayana,* but the beauty of the poem is all his own. and he imparted to it the pathos and sweetness of Eastern ideas combined with the vigour and loftiness of Western thought. In 1862 Madhu Sudan left for Europe. He lived in England for some years, and was called to the bar; and in 1867 returned to his country to practise as a barrister in Calcutta. He still wrote much, but nothing of enduring merit. He died in a Calcutta hospital on June 29, 1873.

DUTT, TORU (1856–1877), Indian poetess, was born in Calcutta on March 4, 1856, and died there of tuberculosis on Aug. 30, 1877. She was the youngest child of Govin Chunder Dutt, member of a distinguished Christian family in Bengal who were noted for their poetical gifts. Toru visited Europe with her parents in 1869 and spent some time in Nice and at Paris. Toru Dutt became an enthusiastic lover of France and French literature, James Darmesteter, in his *Essais de Littérature Anglaise,* states that "French became her favourite language and France the country of her election." Early in 1870 the family arrived in London, removing in 1871 to Cambridge. On their return to India in 1873 Toru contributed to the *Bengal Magazine* translations into English from the Romantic school of French poetry, which were afterwards published, with other pieces, in a volume entitled *A Sheaf Gleaned in French Fields* which won the praise of André Theuriet and Sir Edmund Gosse. Her translations of speeches delivered by Victor Hugo and Thiers in the French Legislative Assembly were also published in the *Bengal Magazine* for June and July, 1875. Her most remarkable work was a French novel, *Le Journal de Mlle. D'Arvers,* dedicated to Lord Lytton, and published post-humously by Didier (Paris, 1879), with a preface by the Orientalist, Mlle. Clarisse Bader. This book was highly praised by Madame de Saffray, and James Darmesteter has included an appreciation of it in his *Essais. Ancient Ballads and Legends of Hindustan* (London, 1882) constitute Toru Dutt's best work in English. In this book she made available, for the appreciation of English readers, some of the great stories of Indian classical literature and also some beautiful miscellaneous poems. Of these, *Our Casuarina Tree* is rich in imagery and musical cadences.

See H. Das, *Life and Letters of Toru Dutt* (1921). (*H.* DA.)

DUTY, a term loosely applied to any action or course of action which is regarded as morally incumbent, apart from personal likes and dislikes or any external compulsion. Such action must be viewed in relation to a principle, which may be abstract in the highest sense (*e.g.,* obedience to the dictates of conscience) or based on local and personal relations. That a father and his children have mutual duties implies that there are moral laws regulating their relationship; that it is the duty of a servant to obey his master within certain limits is part of a definite contract, whereby he becomes a servant engaging to do certain things for a specified wage. Thus it is held that it is not the duty of a servant to infringe a moral law even though his master should command it. For the nature of duty in the abstract, and the various criteria on which it has been based, *see* ETHICS.

From the root idea of obligation to serve or give something in return, involved in the conception of duty, have sprung various derivative uses of the word; thus it is used of the services performed by a minister of a church, by a soldier, or by any employee or servant. A special application is to a tax, a payment due to the revenue of a state, levied by force of law. Properly a "duty" differs from a "tax" in being levied on specific commodities, transactions, estates, etc., and not on individuals; thus it is right to talk of import-duties, excise-duties, death- or succession-duties, etc., but of income-tax as being levied on a person in proportion to his income.

DUUMVIRI or **DUOVIRI,** in ancient Rome, the official style of two joint magistrates. Such pairs of magistrates were appointed in Rome itself and in the colonies and municipia. (1) *Duumviri iuri* (*iure*) *dicundo,* municipal magistrates, whose duties were concerned with the administration of justice. (2) *Duumviri quinquennales,* municipal officers, who were elected every fifth year for one year to exercise the function of the censorship. (3) *Duumviri sacrorum,* officers who originally had charge of the Sibylline books *(see* DECEMVIRI). (4) *Duumviri aedi locandae,* originally officers specially appointed to supervise the erection of a temple. (5) *Duumviri navales,* officers appointed for the equipment of a fleet. Originally chosen by consuls or dictator, they were elected by the people after 311 B.C. (6) *Duumviri perduellionis,* the earliest criminal court for trying offences against the State *(see* TREASON: *Roman Law).* (7) *Duumviri viis extra urbem purgandis,* subordinate officers under

the aediles, whose duty it was to look after those streets which were outside the city walls. By 12 B.C. their duties were transferred to the *Curatores viarum.*

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DU VAIR, GUILLAUME (1556–1621), French author and lawyer, was born in Paris. Du Vair was in orders, and, though during the greater part of his life he exercised only legal functions, he was, from 1617 till his death, bishop of Lisieux. His reputation, however, is that of a lawyer, a statesman and a man of letters. He became in 1584 counsellor of the parlement of Paris, and as deputy for Paris to the Estates of the League he pronounced his most famous politico-legal discourse, an argument nominally for the Salic law, but in reality directed against the alienation of the crown of France to the Spanish infanta. In 1595 appeared his treatise *De l'éloquence française.* He was sent to England in 1596 with the marshal de Bouillon to negotiate a league against Spain; he became (1599) first president of the parlement of Provence (Aix), and in 1616 keeper of the seals. He died at Tonneins (Lot-et-Garonne) on Aug. 3, 1621. The most celebrated of his treatises are *La Philosophie morale des Stoïques,* translated into English (1664) by Charles Cotton; *De la constance et consolation ès calamités publiques,* composed during the siege of Paris in 1589, and translated into English as *A Buckler against Adversitie* (1622), and *La Sainte Philosophie,* in which religion and philosophy are intimately connected. Pierre Charron drew freely on these and other works of Du Vair, who had a great indirect influence on the development of style in French, for Malherbe was an admirer of his writings. The reformer of French poetry learned much from the treatise *De l'éloquence française,* to which the counsels of his friend were no doubt added.

Du Vair's works were published at Paris in 1641. *See* Nicéron, *Mémoires,* vol. xliii.; and monographs by C. A. Sapey (1847 and 1858).

DUVAL, ALEXANDRE VINCENT PINEUX (1767–1842), French dramatist, was born at Rennes on April 6, 1767. He was in turn sailor, architect, actor, theatrical manager and dramatist. Of his 60 or more plays *Les Projets de ménage* (1790), *Les Tuteurs vengés* (1794) and *Les Héritiers* (1796) have been revived on the modern French stage. In 1812 he was elected to the Academy. He died on Sept. 1, 1842.

DUVAL, CLAUDE (1643–1670), a famous highwayman, was born at Domfront, Normandy, in 1643. Having entered domestic service in Paris, he came to England at the time of the Restoration in attendance on the duke of Richmond, and soon became a highwayman notorious for the daring of his robberies and his gallantry to ladies. In the end he was captured in London, and hanged at Tyburn on Jan. 21, 1670. His body was buried in the centre aisle of Covent Garden church, under a stone with the following epitaph:—

"Here lies Du Vall: Reader if male thou art,
Look to thy purse: if female to thy heart."

A full account of his adventures, ascribed to William Pope, was reprinted in the *Harleian Miscellany,* and Samuel Butler published a satirical ode *To the Happy Memory of the Most Renowned Du Val.*

DUVENECK, FRANK (1848–1919), American figure and portrait painter, was born at Covington, Ky., Oct. 9, 1848. He was a pupil of Diez in the Royal Academy of Munich, and a prominent member of the group of Americans who in the '70s overturned the traditions of the Hudson river school and started a new art movement. His work shown in Boston and elsewhere about 1875 attracted great attention, and many pupils flocked to him in Germany and Italy, where he made long visits. After returning from Italy to America, he gave some attention to sculpture, and modelled a fine monument to his wife, now in the English cemetery in Florence. In 1915 he presented to the Cincinnati (O.) Museum a large collection of his own works. He died in Cincinnati, Jan. 3, 1919.

DU VERGIER DE HAURANNE, JEAN (1581–1643), abbot of St. Cyran, father of the Jansenist revival in France, was born of wealthy parents at Bayonne and studied theology at Louvain. After taking holy orders he settled in Paris, where he became known as a mine of miscellaneous erudition. His friendship with Cornelius Jansen, a young champion of Augustinianism, led him to oppose the Louvain Jesuits who stood for Scholasticism. The two divines retired to Du Vergier's home at Bayonne, where he became a canon of the cathedral, and Jansen a tutor in the bishop's seminary. Here they remained some years, intently studying the fathers. Eventually, Jansen went back to Louvain, while Du Vergier became confidential secretary to the bishop of Poitiers, and was presently made sinecure abbot of St. Cyran. Thereafter he was generally called M. de St. Cyran. At Poitiers he met Richelieu—as yet simply the zealous young bishop of the neighbouring diocese of Luçon. Western Touraine being the headquarters of French Protestantism, the two prelates turned St. Cyran's learning against the Huguenots. He began to dream of reforming Catholicism on Augustinian lines, and thus defeating the Protestants by their own weapons. They appealed to primitive antiquity; he answered that his Church understood antiquity better than theirs. They appealed to the spirit of St. Paul; he answered that Augustine had saved that spirit from etherealizing away, by coupling it with a high sacramental theory of the Church. They flung practical abuses in the teeth of Rome: he entered on a bold campaign to bring those abuses to an end. Before long, his reforming zeal necessitated his removal to Paris where his attempt to gain the support of influential people led to his friendship with the Arnauld family. Jansen was now attacking Jesuit dialectics, which he thought had corrupted theology, by writing a book on Augustine, the great master of theological method.

St. Cyran attacked their hand-to-mouth utilitarianism which had played havoc with traditional church institutions, and their defiance of episcopal authority by his *Petrus Aurelius* (1633).

This work so annoyed Richelieu, now the powerful and extremely Erastian prime minister, that St. Cyran was imprisoned until Richelieu's death in 1642. St. Cyran himself died of a stroke of apoplexy in Oct. 1643.

St. Cyran's character has been always something of a puzzle. Many excellent contemporary judges were profoundly impressed; others, as one of them said, went away bewildered by this strange abbe, who leapt from one point to another in incoherent phrases. Grace of expression he had none; perhaps no man of equal spiritual insight ever found it so hard to make his meaning clear. On the other hand, Jansenism, considered as a practical religious revival, is altogether his work.

He dragged the Augustinian mysticism out of the Louvain classrooms, and made it a spiritual force in France. Without him there would have been no Pascal—no Provincial Letters, and no *Pensées.*

See C. Lancelot, *Memoires de M. de S. Cyran* (Cologne, 1738); Sainte-Beuve, *Port-Royal,* 5 ed. (1888). J. Laporte, *La doctrine de Port-Royal,* vol. 1 (1923) contains a list of the printed and ms. works of St. Cyran.

DUVEYRIER, HENRI (1840–1892), French explorer of the Sahara, was born in Paris, and at the age of 19, having already learnt Arabic, began a journey in the northern parts of the Sahara which lasted nearly three years. In 1864 he published *Exploration du Sahara: les Touareg du nord.* After 1870 he made several other journeys in the Sahara. He also examined the Algerian and Tunisian *shats* and explored the interior of western Tripoli.

Duveyrier devoted special attention to the customs and speech of the Tuareg, and to the organization of the Senussi. In 1881 he published *La Tunisie,* and in 1884 *La Confrérie musselmane de Sidi Mohammed Ben Alî-Es-Senôusi et son domaine géographique.*

See C. Maunoir and H. Schivmer, *Sahara, Algérien et Tunisien,* with a Biography of Duveyrier by C. Maunoir (1905).

DUX, BOHEMIA: *see* DUCHCOV.

DUX (Lat., leader), in music, an old name for the opening statement of the subject in a fugue, so called because, coming first, it is the "leader"; the second statement, or answer, being

called, in the same fanciful spirit, the *comes* or companion. *(See* FUGUE and CONTRAPUNTAL FORMS.)

DUXBURY, a town of Plymouth county, Massachusetts, on Plymouth bay, 36 mi. S.S.E. of Boston. The population in 1930 was 1,696, and in 1940 it was 2,359 by the federal census. Duxbury was settled in 1631 by Miles Standish, William Brewster, John Alden and a few others, and it was named- after the Lancashire seat of the Standish family. A church was organized in 1632 and the town was incorporated in 1637 The house built in 1666 by Alexander Standish, son of Miles, is still standing. The cod, mackerel and clam fisheries were formerly important, and in the 18th century and the first half of the 19th there were large shipyards here.

DVINA, the name of two rivers of European Russia.

1. The Northern Dvina, or *Dvina Syevernaya,* belongs to the basin of the White sea, and is formed by the junction of the Sukhona and the Yug, which meet in the neighbourhood of Velikiy-Ustyug, at a height of 300 ft. above the sea, in 61°20′ N. and 46°20′ E. The conjoint stream then flows north-west to the Gulf of Archangel, which it reaches 50 m. below the city of Archangel. From its mouth to the confluence of the co-tributary streams the distance is about 470 m., and to the source of the Sukhona 780 m. The drainage area is estimated at 141,000 sq.m. Except at the rapids the current of the Dvina is comparatively slow, as the average fall per mile is only 9 in. Till its union with the Vychegda, a river which exceeds it in volume, it flows for the most part in a single, well-defined and permanent channel; but below that point it often splits into several branches, and not infrequently alters its course. Near Archangel it divides into three distinct arms, which form a regular delta, but of these that of Berezov alone is navigable for sea-going vessels, and even it is impeded by a bar at the mouth, with not more than $14\frac{1}{2}$ or $15\frac{1}{2}$ ft. of water at full tide. Just above the point where the delta begins the river is joined by a large tributary, the Pinega, from the right. Above the confluence of the Vychegda the breadth is about 1,750 ft.; below that point it widens out to 3,500 ft.; and near Archangel it attains more than three times that measure. The channel is free from ice for about 174 days in the year. By means of the Duke Alexander of Wiirttemberg Canal, the river is connected with the Neva and the Volga.

2. The Southern Dvina, or *Dvina Zapadnaya* (western Dvina) belongs to the Baltic basin, and takes its rise in a small lake about 800 ft. above the level of the sea, not far from the sources of the Volga and the Dnieper. It flows south-west through the province of Pskov, and through the White Russian S.S.R. But some distance west of Vitebsk it turns north-west, forming part of the boundary between White Russia and Poland, and then flows through Latvia where it enters the southern end of the Gulf of Riga. Its length is 640 m. and it drains an area of 32,960 sq.m. From Daugavpils (Dvinsk) to Riga, a distance of 135 m., there is altogether a fall of 295 ft., of which 105 ft. are in the 40 m. from Jakobstadt to Friedrichstadt. In the lower part of its course the river attains an ordinary depth of 30 ft. and an average breadth of 1,400 ft.; but during the spring flood it sometimes rises 14 ft. above its usual level, and its waters spread out to a mile in width. Near the mouth the river is usually free from ice for 245 days in the year, and in White Russia 229. It is navigable from the confluence of the Mezha (*i.e.,* from Vitebsk) downwards, but the number of rapids and shallows greatly diminishes its value. Navigation can also be carried on by the following tributaries: the Usvyat, Mezha, Kasplya, Ulla, Disna and Bolder-aa. Salmon and lampreys abound in its waters. The river was formerly called the Khezin or Turunt, and is known to the White Russians as the Polot and to the Latvians as the Daugava. It is the natural outlet for timber from the west of Russia, and timber rafts, usually in charge of gypsies living in grass huts on them, are still floated down it. Its strategic importance has always been great and Riga and Daugavpils (*q.v.*) have witnessed many struggles for power. The construction of a hydro-electric station on the Daugava to provide power equivalent to that from 3,000,000 tons of coal, are now under consideration by the Latvian Government.

DVINSK: *see* DAUGAVPILS.

DVORAK, ANTON (dvor'zhahk) (1841–1904), Bohemian musical composer born at Nelahozeves (otherwise Miihlhausen) in Bohemia on Sept. 8, 1841, was the son of Frantisek Dvořák, a small publican and village butcher. At the door of his father's inn Dvořák first appeared as a practical musician, taking his place among the fiddlers who scraped out their "furiants" and other wild dances for the benefit of the holiday-making local beaux and belles. At the village school he learnt from Josef Spitz both to sing and to play the violin, with so much effect that soon he was able to assist in the parish church services. At 12 years old he was sent by his father to Zlonic, near Schlan, to an uncle, with whom he lived while passing through the higher-grade classes at school. Here, too, he was fortunate enough to find a valuable friend in **A.** Liehmann, organist and chief musician of the little town, a competent musician, who instructed the boy in elementary theory, organ and pianoforte playing. The theory studies, however, could not long be continued, since Liehmann soon acknowledged in his own dialect that the boy was extraordinarily full of promise ("Aus Tonda, dem Sappermentsbuben 'mal 'was werden konnte"), at the same time realizing that he could not do much to assist. But Dvofdk soon left Zlonic for Bohmisch-Kamnitz, where he learnt German and advanced his musical studies under Hancke. A year later he was summoned to return to Zlonic to assist his father, who had set up in business there. But his craving for a musical career was not to be checked, and after considerable trouble, his father's consent was obtained to his settling in Prague to devote himself entirely to the study of music.

In Oct. 1857 Dvořák ent'ered the organ-school of the *Gesellschaft der Kirchenmusik,* where he worked for three years. The small financial aid his father was at first able to lend soon ceased, and after being in Prague but a very few months Dvofdk found himself practically thrown on his own resources. By playing the viola in a private orchestra and in various inns of the town he succeeded in obtaining a precarious livelihood. On the opening in 1862 of the Bohemian Interimstheater, Dvořák, with part of this band, formed the nucleus of the theatrical orchestra, and remained connected with it for 11 years, when he became organist of the church of St. Adalbert. At this time his small stipend was augmented slightly by the fees of a few pupils, though the privations suffered by him and his wife (for he had recently married) must have been great. But in spite of financial worry and of the amount of time he had to devote to his professional duties and private pupils, Dvořák found leisure not only for his own studies of the classics, but also to compose. His work, like his daily life, was beset with difficulties, for he had not the means to prbvide himself with sufficient music-paper, much less to hire a pianoforte; and it is possible that several of his important early works would never have been written had it not been for the generosity of Karel Bendl, the composer, who helped him in many ways.

Dvořák himself said afterwards that he retained no recollection of much that he then composed. In and about 1864 two symphonies, a host of songs, some chamber-music, and an entire opera, *Alfred,* lay unheard in his desk. The libretto of this opera was made up from materials found in an old almanac. Most of these works were burnt long ago. In 1873 he made his first bid for popularity by his patriotic hymn *Die Erben des weissen Berges* (published many years later as op. 30). Its reception was enthusiastic, and Dvořák's subsequent works were eagerly awaited and warmly received on production. In 1874 his opera *König und Köhler* resulted in a fiasco at Prague, owing to its mixture of styles. Nothing daunted, Dvořák recomposed the whole work in three months. In 1875, on the recommendation of Brahms and Hanslick, he obtained a stipend from the Kultus-Ministerium at Vienna, which freed him from care and enabled him to indulge in composition to his heart's content. Following on this success came a commission in 1877 for a series of Slavonic dances, which took the public by storm. Immediately compositions, old and new, began to pour from the publisher. English sympathy was entirely won by the *Stabat Mater* in 1883, and increased by the symphonies which succeeded it, and the cantata *The Spectre's Bride,* based on K. J. Erben's elaboration of

the Bohemian version of the saga treated in Biirger's *Leonore*. The favoarable impression produced by these works was somewhat lessened by the oratorio *St. Ludmila*, a comparatively feeble work written "to suit English taste" for the Leeds Festival of 1886. Of the three overtures, op. 91, 92, 93, only the *Carneval* holds its place; but the New World symphony has become one of the most popular works in the modern repertory, and much of the chamber-music, of which there is abundance, may also be regarded as having permanently established itself, and with good reason, too, for it teems with beauties of every kind. So, too, his *Requiem* (op. 89), written for the Leeds Festival of 1890, will certainly be rediscovered, though it will never be regarded as religious music. In 1892, after having frequently visited England, Dvořák became head of the National Conservatory of Music of America in New York. There he remained till 1895, when he returned to Prague, where he died on May 1, 1904.

Dvořák's talent for composition was of the highest order, but success came to him after a long experience of uneducative hardships. The world then informed him in a loud instructive voice that his music had the charm of bucolic naïveté; and he thereupon extensively wrote himself down in affectations of his own simplicity. His first three symphonies, the Scherzo Capriccioso and the Symphonic Variations will be recognized as great music as soon as criticism ceases to worry about forms, fashions and derivations and proceeds to attend to permanent values. Brahms, assuredly no friend to diffuse form, was so delighted with Dvořák's violoncello concerto (op. 104, one of his most diffuse yet most inventive works) that he said to Hausmann, "Why did nobody tell me that one could write a 'cello concerto like this?"

See W. H. Hadow, *Studies in Modern Music* (second series, 1908). (X.; D. F. T.)

DVŮR KRÁLOVÉ or KÖNIGINHOF, a town of north-east Bohemia, on the left bank of the Elbe. It is a very old city founded by King Wenceslas II. of Bohemia in the 13th century and given by him to his wife, thus deriving its name (the court of the queen). During the Hussite and Austro-Prussian Wars, owing to its important strategic site, it suffered severely. The fertile basin around produces cereals, the basis of its brewing and flour-milling industries, and the town also shares in the cotton-weaving of the neighbouring highland valleys. Population, 16,588. The town became widely known as a result of the supposed discovery by the notorious Václav Hanka in 1817 of a 13th century ms. containing epic and lyric poems in Czech. Critics. headed by Gebauer and Masaryk, proved conclusively that the ms. is a forgery.

DWARF, the term generally used to describe an extraordinarily under-sized individual of a race of normal stature *(see* PYGMY). In Scandinavian mythology the word connoted smallness and deformity, and was used of the elfins and goblins who were supposed to live on the mountains or in the bowels of the earth, and to be kings of metals and mines.

Deficiency in stature is sometimes associated with infantilism, in other cases with injury or deficiency of the pituitary gland, or general endocrine deficiency, with failure of cerebral development. There are two classes, those who are normal in proportions and the disproportionate.

From the earliest historic times there was much competition on the part of kings and the wealthy to obtain dwarfs as attendants. Members of the Akka race of equatorial Africa figured at the courts of the Pharaohs of the early dynasties. Philetas of Cos. poet and grammarian (c. 330 B.C.), tutor of Ptolemy Philadelphus, was alleged to be so tiny that he had to wear leaden shoes lest he should be blown away. The Romans practised artificial dwarfing, and the Latin *nanus* or *pumilo* were terms alternatively used to describe the natural and unnatural dwarf. Julia, the niece of Augustus, had a dwarf named Coropas aft. 4in. high, and a freed-maid, Andromeda, who measured the same.

In later days there have been many dwarf-favourites at European courts. British tradition of dwarfs begins in the old ballad "In Arthur's court Tom Thumb did live." The first authentic English dwarf appears to be John Jarvis (2ft. high), who was page to Queen Mary I. Her brother, Edward VI., had his dwarf Xit. Jeffery Hudson (1619–82), the son of normal parents, at nine years measured scarcely 18in., though gracefully proportioned. At a dinner given by the duke to Charles I. and his queen he was brought in to table in a pie out of which he stepped, and was at once adopted by Henrietta Maria. He followed the fortunes of the court in the Civil War, and was a captain of horse, earning the nickname of "strenuous Jeffery" for his activity. He fought two duels—one with a turkey-cock, and a second with Crofts, who came to the meeting with a squirt, but who in the more serious encounter which ensued was shot dead by Hudson, who fired from horseback, the saddle putting him on a level with his antagonist. Twice was Jeffery made prisoner—by the Dunkirkers as he was returning from France, and by Turkish pirates. His sufferings during this latter captivity made him grow, and he steadily increased until he was 3ft. gin. At the Restoration he returned to England, where he lived on a pension granted him by the duke of Buckingham. He was later accused of participation in the "Popish Plot," and was imprisoned in the Gate House. He was released and shortly after died in the 63rd year of his age.

Henrietta Maria had two other dwarfs, Richard Gibson and his wife Anne. They were married by the queen's wish; and the two together measured only 2in. over 7ft. They had nine children, five of whom, who lived, were of ordinary stature. Edmund Waller celebrated the nuptials, Evelyn called the husband as the "compendium of a man," and Lely painted them hand in hand. Gibson was miniature painter to Charles I., and drawing-master to the daughters of James II., Queens Mary and Anne, when they were children. He began his career as a page, first in a "gentle," next in the royal family, died in 1690, in his 75th year, and is buried in St. Paul's Covent Garden. The last court dwarf in England was Coppernin, a lively little imp in the service of the princess (Augusta) of Wales, the mother of George III. The last dwarf retainer in a gentleman's family was kept by Beckford, the author of *Vathek* and builder of Fonthill.

Of European court dwarfs the most famous were those of Philip IV. of Spain, the hunchbacks whose features have been immortalized by Velazquez. Stanislaus, king of Poland, owned Nicholas Ferry (Bébé), who measured 2ft. gin. He died in his 23rd year (1764). Richebourg, who died in Paris in 1858, at the age of go, was only 23in. high. He began life as a servant in the Orleans family. In later years he was their pensioner. In the Revolution—he passed in and out of Paris as an infant in a nurse's arms, but with despatches, dangerous to carry, in his baby-wrappings!

The Pole, Borulwaski (1739–1837), at six measured 17in., and in his 30th year reached 39 inches. He had a sister shorter than himself by the head and shoulders. Borulwaski was a handsome man, a wit, and something of a scholar. He travelled over all Europe; and—born in the reign of George 11.—died in retirement near Durham, in the reign of Victoria, where he is buried at Durham by the side of the Falstaffian Stephen Kemble.

In 1837 Charles Stratton, better known as "General Tom Thumb," was born. When 25 he was 31in. high. In 1844 he appeared in England, where he had an extraordinary success. After extensive travel in both hemispheres, Stratton again visited England in 1857, but the man, despite many personal and intellectual qualities, was less attractive than the boy. In 1863, the "General" married the very minute American lady, Lavinia Warren (born in 1842). He died on July 15, 1883.

Other modern dwarfs include Mary Jane Youngman (Australia), who at 1j was 35in. high. She was called the "dwarf-giantess" because she was 3ft. 6in. round the shoulders, 4ft. gin. round the waist, and 2ft. round the leg. The so-called Aztec dwarfs were exhibited in London in 1853. In 1867 the pair were married. Che-mah, a Chinese, 42 years old and 25in. high, appeared in London in 1880. George Prout (1774–1851), who was less than 3ft. high was well known in London in the early Victorian period, as a messenger at the Houses of Parliament.

See E. J. Wood, *Giants* and *Dwarfs* **(1860)**; C. Dieckhoff, *The Position of the Iberians and the Dwarfish Races in the Ethnology of the British Isles* (Inverness, 1918–25).

DWARF TREE: see BON-SAI.

DWARKA or **JIGAT,** town, British India, in Baroda State, near the extremity of the peninsula of Kathiawar, Bombay. Pop. (1931) 7,632. As birthplace and residence of Krishna, it is one of the most sacred spots in this part of India, and attracts many thousands of pilgrims. The port of Ruphan, 1 m. N., is a point of call on the Bombay-Karachi route. Steamers lie offshore.

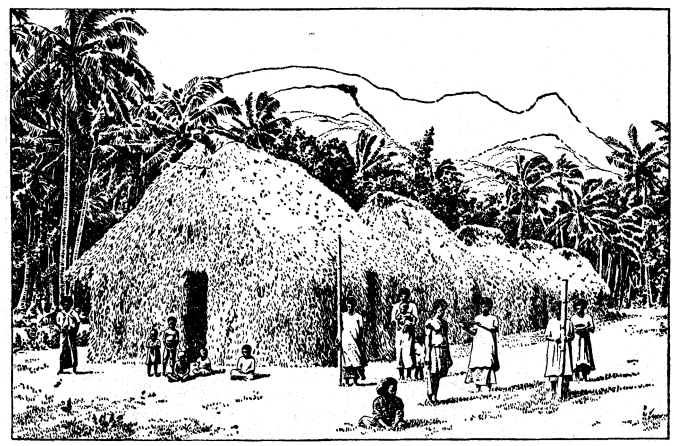
DWARS, a tract of country in north-east India. It consists of two divisions, the Western Dwars and the Eastern Dwars, both of which belonged to Bhutan prior to the Bhutan War of 1864–65, as a result of which they passed into possession of the British, when the Eastern Dwars were assigned to Assam and the Western to Bengal. Since 1905 both divisions have been in the province of Eastern Bengal and Assam. (See BENGAL.) The Western Dwars are an important centre of the tea-planting industry. (See ASSAM.)

DWELLING: *see* HOUSE.

DWELLINGS, PRIMITIVE. Climate imposes the need of shelter, and man can build only with what nature gives him. Even in the civilized 20th century the building materials are mainly local, and in primitive dwellings a closer dependence is shown in the Eskimo *iglu,* the Blackfoot *tipi,* the Australian *wurly* or the Andaman hut, of snow, skins, birch bark and turf or palm leaves. Where nature provides caves or rock shelters man builds no houses at all, and these homes are used by the Vedda of Ceylon, the Bushmen of South Africa, the cave dwellers of Kenya or Tanganyika, China, or the Pueblo region of Arizona, as in Europe in Palaeolithic times. (See CAVE.)

In Neolithic settlements pit dwellings or beehive huts formed the family habitations, and wattle and daub houses characteristic of the bronze age continued into the iron age. For pit dwellings, the earth was scooped out and piled in a circular bank, on which a wall of stone was built. The bank, with a drain outside, kept out the wet, and the hollowing of the floor gave more head room under the low roof. This was made of converging stones in the beehive dwellings, or perhaps of skins stretched across or of brushwood or turf where easily procurable. Prehistoric beehive dwellings of loose stones can be seen in outlying parts of the British Isles, and the Scottish shieling or the Norwegian saeter, shelters for girls tending cattle in their summer pastures, are of the same type. With skins stretched across the large bones of whale or walrus, similar huts are found among tundra and polar peoples from Lapland to Kamchatka, and from Alaska to Labrador. There is a long entrance tunnel, and the hut may also be entered through the roof, a hole in which acts as door, window and chimney in one. Links may be found to connect these pit or bee-hive dwellings with the earth lodges of Missouri and the *kiva* of Arizona. Wattle and daub huts, such as those of the Swiss lake dwellings or of the lake village of Glastonbury, are very easily built. Stakes are driven into the ground, and withes or branches wattled in and out for walls, the hollows in the wattling being filled in and plastered over with mud; the thatched roof has overhanging eaves to protect the mud walls. Such houses were used in Scotland down to the end of the 18th century. They are found across Africa from east to west, north and south of the forest region, and are specially characteristic of the central and Lake Chad areas, in which rainless districts walls and roof may be made in one. They occur rarely in America, except in Mexico and Peru, and in the south-east of the United States, east of the Mississippi.

Pygmy **Huts.**—In a mixed ethnic region, huts are often a truer test of race than language. The most backward peoples show the simplest types. Just as gypsies or travelling tinkers, or boy scouts drive sticks in the ground and hang a piece of sacking or a blanket across to act as a windscreen, so the Negrito of the Philippines, the Andaman islander or the Semang of the Malay peninsula, who rarely stay two nights in the same place, fix up a plaited mat or a row of boughs and sleep to leeward. If the Semang need more shelter, the boughs may be plaited in a circle and joined overhead, or two screens may be tilted against each other, as in building a house of cards. In their camps the Andamanese raise their mat screens to form a roof propped up on four posts, 2ft. to 4ft. high at the back, and 5ft. to 7ft. in front, and better houses are made of two of these mats, forming a saddle roof, with two extra posts to support it, but no walls. These huts are placed in a rough circle round the cleared dancing ground. The Bushmen of the Kalahari desert scoop out hollows in which to curl up, as in a nest, sheltered if possible by natural bushes or by brushwood covered with a skin. The leaf-roofed huts or booths of the Negrilloes of Central Africa are much alike from the Cameroons to Semliki valley. Sticks are bent over with both ends in the ground and roughly thatched with leaves. They are very low, with entrances barely 3ft. high, and are scarcely distinguishable in the gloom and thick foliage of the equatorial forest.



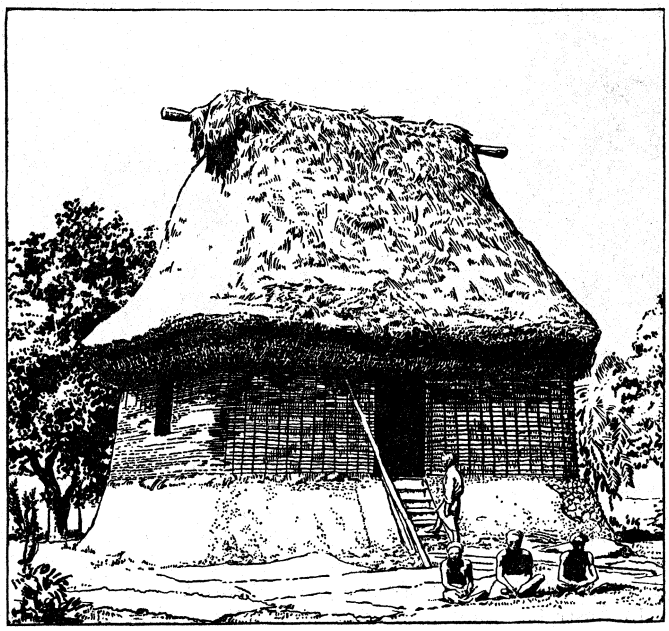
BY COURTESY OF THE CANADIAN PACIFIC RAILWAYS

VILLAGE SCENE IN THE FIJI ISLANDS, SHOWING THE STRAW THATCHED DWELLINGS OF THE NATIVES

In Australia, when men are camping for a night or two, the windscreen of brushwood is sufficient; in bad weather the boughs are interlaced overhead to form a horseshoe hut; for longer residence in favoured districts where the search for food does not require constant moves, a regular framework of branches is set up, covered with sheets of bark, leaves or grass, skins, sods of earth or a plastering of clay. An Australian folk-tale (collected before 1850) describes a hut built of the bones of the emu and the kangaroo, covered with skins. To this home the hero brings the admiring heroine (or heroines) and "it was the most beautiful camp ever made" (W. Dunlop, J.A.Z. 1899, p. 32). In South America the natives of British Guiana, when on hunting expeditions, put up temporary shelters or benabs, which may be a few palm leaves laid flat one over the other with their stalks bound together and stuck into the ground, so that the natural curve of the leaf affords sufficient roof. A more pretentious *benab* is made by sticking three posts in a triangle and laying a bunch of palm leaves over the top. The Arawak and Carib tribes living in dense forests, sheltered by surrounding trees, build wall-less houses; the Macusi, living in the open savannah, add walls, filling in the sides and daubing them thickly with clay to keep out the cold winds blowing from the mountains.

Eskimo Snow House.—Without the snow *iglu* life in winter would be impossible for the Eskimo. The original construction was a ring of stones filled in with earth, the roof of sods being supported on branches, as is still the custom to the east and west of the Eskimo territory where wood is obtainable; but from the mouth of the Mackenzie eastward, where the supply of driftwood dwindles, snow houses are the common residence in winter and skin tents in summer. Even where there are stone and wooden houses (and wooden houses spread with Christianity), the snow *iglu* is put up for special occasions or on journeys, as it is quickly built and is impervious to weather. A man cuts a trench some 5ft. long and 20in. deep in a newly made snowdrift, where he means to place his house. From the face of the trench he cuts blocks with his bone knife. These are slightly concave so that they lean inward when set up on edge. A circle of blocks is laid and then shaved down so that the succeeding blocks form an ascending and narrowing spiral, the builder cutting the material from the inside of his house as he works. A key-stone with edges wider above than below is dropped into the space at the top, and

all cracks and crevices are filled in with soft snow. A small house can be built in a couple of hours, but for longer residence more care and time are taken, and on special occasions houses of a large size can be built on the same plan. One erected to welcome the Stefansson-Anderson expedition to Akuliakattagmiut, near Coronation gulf, was 9ft. in height and accommodated 40 people standing up, with a circular space of about 5ft. left in the centre for the



BY COURTESY OF THE CANADIAN PACIFIC STEAMSHIP CO.

CHARACTERISTIC DALA HOUSE OF THE FIJI ISLANDS

dancers; and festival halls 16ft. high and 70ft. across are reported from Labrador. If it is wanted for more than temporary residence, an alley-way 10ft. to 20ft. long is built outside the house as a shelter for the dogs and gear, with recesses where food can be stored out of the dogs' reach. When the house has been built with the snow platforms for beds inside — this is the man's work — the housewife takes possession. She lights her blubber lamp, feeds it generously so that it burns with all possible heat, closes the door with a block of ice and makes all air-tight. The snow soon begins to melt and, owing to the curve of the domed roof, it does not drip, but soaks gradually into the blocks so that they are nearly wet through. When they are sufficiently sodden the woman puts out her lamp and opens the door. In rushes the intensely cold air, and in a few minutes the house is transformed from a fragile structure of snow that would crumble if touched carelessly, to a vaulted dome of ice so strong that a polar bear might crawl over the roof (as often happens) without the danger of breaking it in.

When the long winter is nearing its end and the temperature rises, the snow houses, however solidly built, begin to melt. The roof is the first to go, and if this caves in, an old skin can be stretched across, but the inhabitants lead an uncomfortable life until they can camp in the open in the skin tents which are their common summer dwellings. These may be merely little bits of three-cornered shelters where skins are spread over the sides of a tripod leaving the lee side open, or large affairs, 6ft. by 14ft., with a ridge-pole supported on a tripod at each end, and a door in the middle of one of the long walls. This, like so many of the snow houses, may contain two families, one to the right and one to the left of the door.

NORTH AMERICA, OCEANIA, AFRICA

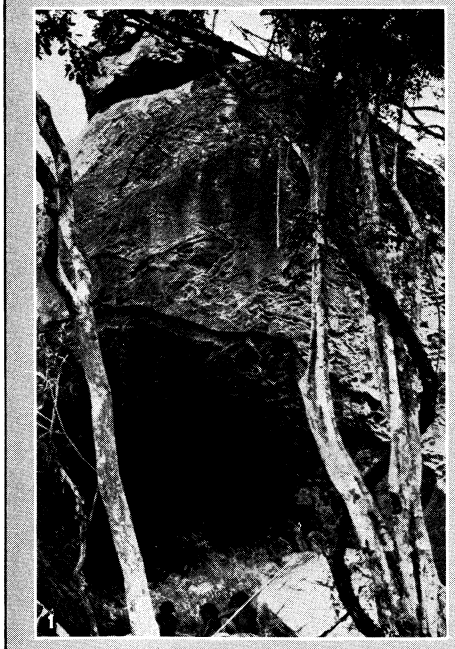
Of the three Eskimo types of dwelling, the semi-underground earth house occurs down the west coast as far as San Francisco bay and is met with again in the "earth lodge" of the Missouri region; while the tent, made of skins in the bison area, of birch bark where birches abound, and sometimes of mats among the Ojibway (Chippewa), was the universal shelter across the centre of the continent to the barrier of the Rocky mountains. On the west coast were the timber-built houses, such as those of the Haida and Tlingit or the Coast Salish. These were built entirely of massive posts of red "cedar" (*thuja* gigantea), and planks split with elk horn or maple wood wedges, tied to the uprights. These houses, with almost flat roofs, often 40ft. deep and some hundreds of feet in length, stretched along the shores of river or sea. Inside they were divided by grass mats into separate family compartments, and again into "hearths" or "fireplaces." In front were the totem poles carved and painted with the emblems of the occupants. Further south are the brush shelters of California, or shelters of branches, covered with grass, but nothing of substantial structure is found until the Pueblo region of Arizona and New Mexico is reached. In the Rio Grande (which is also the area of the cliff-dwellers) the houses are built of adobe (sun-dried bricks), wattle and daub, or stone. The Pueblo stone buildings are linked on to the earlier Nahua or Maya culture, for in Mexico and Peru alone was architecture developed in masonry, though neither had attained to the knowledge of the arch. The buildings were massive, and height was gained by platforms of natural or artificial mounds. Inca influence did not spread far in South America. A shelter for the hammock was sufficient in the Amazon region, though large communal thatched houses are not unknown; a skin tent is characteristic of the guanaco area, and this, in the extreme south, dwindles to little more than a lean-to.

In Oceania, although the huts of the indolent are poor and mean, especially in Melanesia, the abundance of timber and various palms, reeds and grasses, the universal agriculture and fishing, with fairly easy life, have raised the general standard of house-building to a high level. Round houses are associated with earlier culture, but for the most part houses are oblong, built either on the ground or on piles. Some of the chiefs' houses are of enormous size. One at Pare (Tahiti) was 397ft. long, and held two or three thousand people. This was rectangular with rounded ends, built by men specially trained to the craft.

African houses are easily made, whether by nomadic hunters, pastors or agriculturalists, and as easily deserted. To the south of the Sahara, uninhabited save for the sun-dried brick houses of the oases and the goats' hair cloth tents of the nomads, round beehive or conical huts with low entrances and thick grass thatches are typical of the plains and open country and of Bantu culture in general. In hotter, drier regions the walls are often plastered with mud. Across the centre of Africa, west of the great lakes (Wa Nyamwezi, Manyema and some of the Ba Rotse), to the west coast stretches a belt of rectangular huts, in striking contrast to the circular shapes north and south of it. This is the forest region, and the contrast has been variously attributed to *(a)* influence of street formation rather than kraal formation, (*b*) derivation from the lean-to shelter, rather than the circular tent, or (c) recent or Arab contact.

Tree-houses and Pile-dwellings. — The need for defence against enemies led to the construction of tree-houses, pile-dwellings, crannogs and floating islands in many dilferent parts of the world. The need of portable shelters by wandering hunters or nomadic pastors developed the Bedouin tent, the Dakota *tipi*, the Mongol gher and the Khirgiz *yurt*. Similar or contrasted social conditions produced the communal houses in Africa, the East Indies, Melanesia and North and South America.

Houses built in trees are for temporary use, either as look-out places or for refuge in case of attack. A platform is often built in a tall tree from which the incursions of enemies are discovered, or crops watched and guarded. More substantial structures are made as refuges in case of an enemy raid. In the inland unsettled parts of New Guinea small strongly built houses are erected in trees. They are reached by ladders, which can be pulled up when the refuge has been gained. It is by no means an easy or rapid matter to cut down a large tree with stone axes, especially when overhead foes are hurling down stones and spears. Houses are also built for defence on piles standing out of the water. A platform is laid on the piles, and huts are built on the platform., Dwellings of this type were built on the edges of lakes in prehistoric Europe, and occur on shallow shores of the sea, lakes or rivers in North and South America, Africa, the East Indian archipelago and Me-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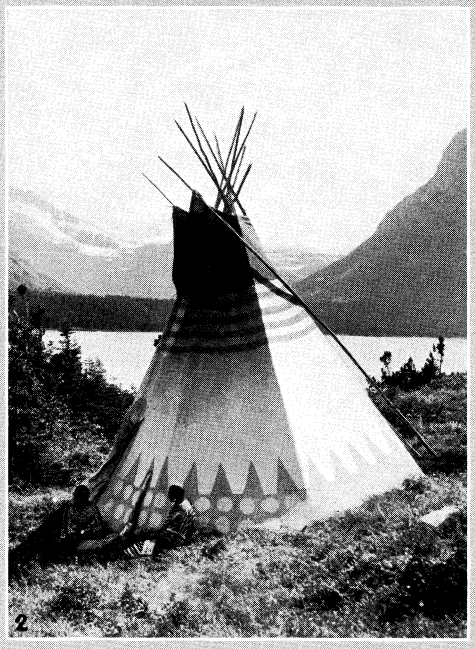
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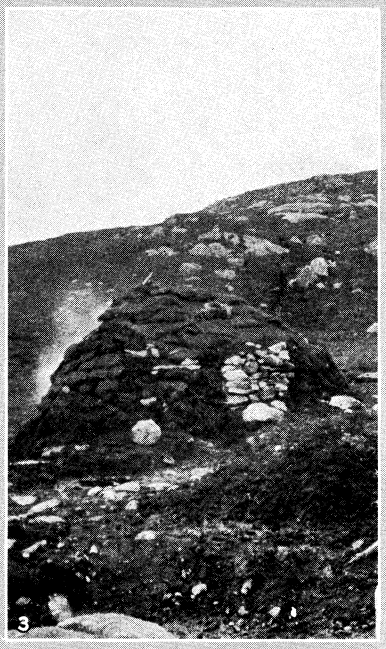
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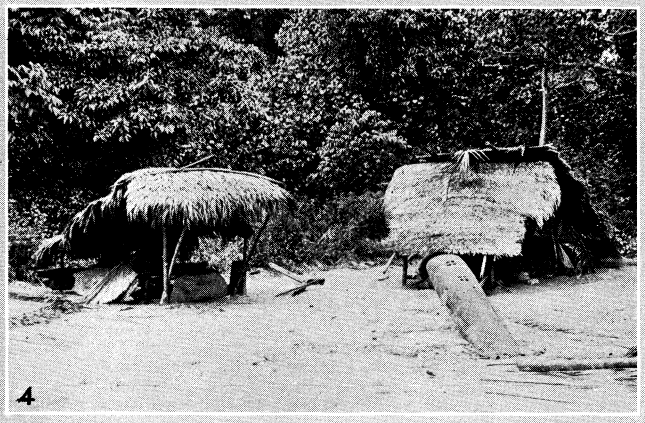
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TYPES OF PRIMITIVE DWELLINGS

1. Ceylon. Vedda rock shelter. Caves and overhanging rocks provide shelter for jungle dwellers
2. A Blackfoot camp or *tipi* on Two Medicine Lake, Glacier National Park, Montana. A tripod of poles against which other poles are propped, is covered over with stitched skins pegged down all around at the bottom. Occasionally birch bark is used instead of skins. A skin flap covers the entrance, which usually faces the east. A hole at the top allows smoke to escape
3. Hebridean *shieling* made of stones and turf. The floors of these dwellings are scooped out to make more head room under the low roofs
4. An Andaman hut. A roof of mat screens is propped up on four posts from 2 to 4 ft. high at the back, and from 5 to 7 ft. in front. Better huts are made by using two mats to form a saddle-roof
5. Pile dwellings in New Guinea. Hard-wood poles, sometimes 30 ft. long, are sunk at ebb-tide, and are then covered with a platform of planks upon which the huts are built
6. Mount Ruwenzori, Africa, Ba-Kongo hut. Bamboo sticks are bent over with both ends to the ground, to be thatched later with leaves or grass
7. Ba-Kongo hut completed, with banana leaf thatch. Note the low entrance, barely 3 ft. high

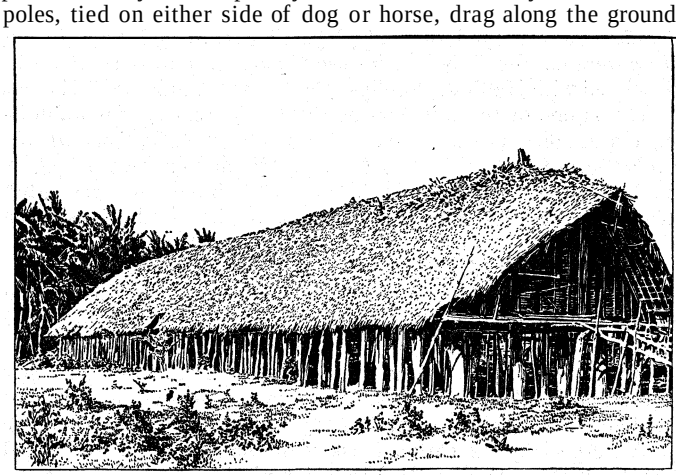
lanesia. Pile-houses may be built on land, forming wet season houses in districts which are liable to be inundated. In the pile village of Bulaa in the Rigo district of British New Guinea, the piles are often 30 ft. in height, of very hard wood, with one end roughly pointed. This end is dropped into a hole at low tide by the help of several men and ropes, and the pole is swayed backwards and forwards, until by its own weight it worms its way into the ground. Heavy planks are laid on the piles to form a platform and on this the houses are built.

Crannogs are built on natural or artificial islands formed of brushwood, logs, stones and clay. They were common in prehistoric times in Ireland, and used down to the reign of Elizabeth.

The lake village of Glastonbury was made of brushwood on layers of tree trunks, pegged down with small piles. Above was a platform of logs laid side by side, and on this was plastered clay several feet thick. The round wattle and daub huts were erected on this foundation. In the African lakes floating islands of papyrus are artificially strengthened and huts built on the top.

PORTABLE DWELLINGS

Tents.—People who are constantly shifting camp, whether wandering hunters in pursuit of game or nomadic herdsmen moving their flocks to pasture, have invented portable dwellings, varying from the flimsy skin tent of the Eskimo, or the equally skimpy tent of the guanaco area of South America, to the luxurious and spacious yurt of the rich steppe lands of Asia. The Eskimo tent, the common summer residence from Alaska to Labrador, is found also in Siberia, and is perhaps linked on to the cloth-covered tent of the reindeer Lapps in Scandinavia. South of the Eskimo area the typical *tipi* (its Dakota name) is found from northern New England throughout the Cree and Ojibway (Chippewa) country and across the bison area to north-west Canada. The nucleus is a tripod of poles against which other poles are propped, and over this is stretched a cone-shaped cover of stitched skins, pegged out all round. A skin curtain hangs across the entrance, which faces the rising sun, and poles on the outside regulate smoke flaps on either side of the hole at the top. In wooded areas where birches grow, sheets of bark are used as coverings, but skins are more suitable for transport. This is the ideal dwelling of nomadic peoples; it is easy to set up, easy to take down and easy to shift. The poles, tied on either side of dog or horse, drag along the ground,



BY COURTESY OF DR. G. LANDTMAN

MOTU COMMUNAL HOUSE OF NEW GUINEA

the cover wraps the scanty household gear in a bundle and lies across their trailing ends. The Ostiak *choom* in the lower Obi district is made of 20 or 30 thin poles fixed in a circle and fastened together at the top, covered with sheets of birch bark boiled to make them pliant, and cut with convex curves to fit over the cone shape of the framework. Extra skins may be added outside with an opening to leeward. The most luxurious tents in all Asia are those of the rich steppe lands of the centre, from the Khalka in eastern Mongolia to the Khirgiz nearing the Urals in the west. In this mainly treeless area long tent poles are not easily found, and the foundation is made of latticework hurdles (usually willow) lashed to posts firmly fixed in the ground. From these, smaller poles radiate towards the centre. Over this framework are stretched the covers of skins or felt, threefold in winter to mitigate the intense cold. There is a hole in the centre of the roof, through which the smoke from the fire of argol or cattle dung can escape, though it is usually kept closed by a piece of felt drawn across by a string. A felt curtain, often beautifully embroidered, falls over the entrance facing south, and curtains fastened to the sides of the tent can be let down to form separate compartments. This form of tent is heavy and cumbersome, but camels, horses and cattle provide abundant beasts of burden, and the setting up and taking down of the tent is always woman's work.

A far simpler tent suffices for the hardy desert herdsmen of western Asia and north Africa. The typical Bedouin tent is of sticks, sometimes forked with a ridge-pole, which irregularly supports a cover made of woven goats' hair strips sewn together, usually black from use if not by nature. The cover may be pegged down at the back or banked up with stones and sand, but it is an awning rather than a tent.

Long Houses.—A great stimulus is given to house building in those primitive societies in which the house belongs not to the individual but to the clan; or where there are secret societies or men's club-houses; or where it is the custom for the unmarried men or the warrior class to sleep in a separate house. These customs lead to the building of houses such as the long houses of British Columbia; the circular houses on the Putumayo, 70ft. in diameter, holding 70 families under one roof; the long houses built of piles along the river banks in Borneo, containing 40 to 50 families; the Kiwai houses, on piles, off the New Guinea coast, two or three hundred feet in length, holding 180 people; and the men's club-houses that are a conspicuous feature of Melanesian villages generally. The best of the long houses in Borneo are built by the Kayan. The piles are massive posts of iron-wood, 25ft. to 30ft. high, supporting a ridge-pole roof. The floor is laid on piles 7ft. or 8ft. high, with cross beams mortised to these and large planks laid across, running the length of the house. The side furthest from the river is walled in, forming separate rooms, but on the river side is a long gallery, protected by the overhanging roof. This is the sleeping place for bachelors and male visitors and the place for receiving guests and carrying on the daily work, such as *padi* husking, etc. The floors of the inner rooms are of split bamboo, placed a little way apart like latticework, so that all rubbish falls to the ground underneath. The pigs live under the house, and this also serves as a place for storing boats. Entrance to the house is by a notched pole at one end of the verandah.

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DWIGHT, JOHN (d. 1703), the first distinguished English potter. The date of his birth has been variously given from 1637 to 1640, and he died at Fulham in 1703. He took the degree of B.C.L. of Christ Church, Oxford, in 1661, and was appointed in that year registrar and scribe to the diocese of Chester. **At** Chester he was secretary to four successive bishops. He seems also to have resided at Wigan where three of his children were baptized between 1667 and 1671. He was granted in 1671 his first patent for the "Mistery of transparent earthenware, commonly known by the names of porcelain or china, and of stoneware, vulgarly called Cologne ware." He probably moved to Fulham about that time. His name appears on the rate books for a house in Bear street in 1674. It has been claimed, though without proof, that Dwight made the first porcelain in England. It has, however, been proved that he preceded John and David Elers in the manufacture of that fine red stoneware which these foreign potters were supposed to have first made in Great Britain. The British and Victoria and Albert Museums contain a number of his pieces, of which the finest is the bust of Prince Rupert.

See Sir *A. H.* Church, *The Family of John Dwight, B.C.L., Potter* (reprinted from *The Genealogist*, 1910).

DWIGHT, THEODORE WILLIAM (1822–1892), American jurist and educator, cousin of Theodore Dwight Woolsey and of Timothy Dwight, was born July 18, 1822, in Catskill, New York. He graduated at Hamilton college in 1840 and studied law for one year at Yale. After tutoring at Hamilton and teaching law privately he was made Maynard professor of law, history, civil polity, and political economy in 1846; and in 1858 accepted an invitation to Columbia to teach law upon his own condition that he should found a law school. For many years he himself was the school and did not retire from it until about a year before his death, in Clinton (N.Y.), on June 28, 1892.

A man of broad culture, he used the Socratic method of teaching. For several years he was a non-resident professor of law at Cornell and at Amherst. An able jurist, he frequently acted as referee in difficult questions and engaged in other legal and judicial work. He was a prominent figure in political and social (notably prison) reforms. He published in 1867 a *Report on the Prisons and Reformatories of the United States and Canada* (with *E.* C. Wines); favoured indeterminate sentences; drew up the bill for the establishment of the Elmira Reformatory, and organized the State Charities Aid Association. He edited Sir Henry Maine's *Ancient Law* (1864); was associate editor of the *Anzerican Law Register* and legal editor of *Johnson's Cyclopaedia,* and published *Ckaritable Uses: Argument in the Rose Will Case* (1863).

DWIGHT, TIMOTHY (1752–1817), American divine, writer, and educationalist, was born at Northampton (Mass.), May 14, 1752. His father, Timothy Dwight, a merchant, was a graduate of Yale; his mother, Mary, was the third daughter of Jonathan Edwards. After his graduation from Yale in 1769 he taught in a grammar school at New Haven, and he was a tutor in Yale college from 1771 to 1777; then, having been licensed to preach, he was a chaplain for a year in a revolutionary regiment. He inspired the troops by his sermons and by several war songs, the most famous of which is "Columbia." From 1778 until 1783 he lived at Northampton, studying, farming, preaching and dabbling in politics. From 1783 until 1795 he was pastor of the Congregational church at Greenfield (Conn.), where he opened an academy which at once acquired a high reputation. From 1795 until his death at Philadelphia (Penn.), Jan. 11, 1817, he was president of Yale college, and by his judicious management, by his remarkable ability as a teacher, and by his force of character he won great influence and did much to raise the standard of the college. President Dwight was also well known as an author. In verse he wrote an ambitious epic in 11 books, the *Conquest of Canaan,* virtually finished in 1774 but not published until 1785; a somewhat ponderous and solemn satire, *The Triumph of Infidelity* (1788), directed against Hume, Voltaire and others; *Greenfield Hill* (1794); and a number of minor poems and hymns. Many of his sermons were published posthumously in *Theology Explained and Defended* (5 vol., 1818–19), to which a memoir of the author by his two sons, W. T. and Sereno E. Dwight, is prefixed, and in *Sermons by Timothy Dwight* (2 vols., 1828), which had a large circulation. Probably his most important work, however, is his *Travels in New England and New York* (4 vols., 1821–22), which contains much material of value concerning social and economic New England and New York during the period 1796–1817.

His fifth son, SERENO EDWARDS DWIGHT (1786–1850), born in Greenfield (Conn.), graduated at Yale in 1803, was a tutor there, a lawyer, a preacher and president of Hamilton college, Clinton, New York. His publications include *Life and Works of Jonathan Edwards* (10 vol., 1830); *The Hebrew Wife* (1836); and *Select Discourses* (1851), to which was prefixed a biographical sketch by his brother, William Dwight (1795–1865), who was also successively a lawyer and a Congregational preacher.

President Dwight's grandson, TIMOTHY DWIGHT (1828–1916), preacher and educationalist, was born at Norwich (Conn.), Nov. 16, 1828. Educated at Yale, Bonn and Berlin, he was professor in the Yale Divinity school from 1858 to 1886, was licensed to preach in 1861, and from 1886 to 1899 was president of Yale, which during his administration greatly prospered. Dr. Dwight was also a member in 1872–85 of the American committee for the revision of the English Bible, was an editor from 1866 to 1874 of the *New Englander,* which corresponded to the *Yale Review;* and in addition to his translating and editorial work he published numerous magazine articles and a collection of sermons, *Thoughts of and for the Inner Life* (1899).

For the elder Timothy Dwight, *see* W. B. Sprague's "Life of Timothy Dwight" in vol. iv, and series, of Jared Sparks's *Library of Anzerican Biography;* also, *"A* Great College President and What He Wrote" in M. C. Tyler's *Three Men of Letters* (1895). For the younger Timothy Dwight, see *Timothy Dwight: Memorial Addresses,* issued *by* Yale university; also, for a full record of his scholastic life, *see* his *Memories of Yale Life and Men, 1845–1899* (1903).

DYAKS or DAYAKS, the name given to the wild tribes found in Borneo by the Malays on their first settlement there. The principal groups are: (1) The sea Dyaks or Ibans, (2) Kayans, (3) Kenyahs, (4) Klemantans, (5) Muruts, (6) Punans. *(See* BORNEO: *Ethnology.)*

DYCE, ALEXANDER (1798–1869), British dramatic editor and literary historian, was born in Edinburgh on June 30, 1798. He was educated at Edinburgh high school and Exeter college, Oxford. He took holy orders, and became a curate at Lantegloss, in Cornwall, and subsequently at Nayland, in Suffolk. In 1827 he settled in London. His first books were *Select Translations from Quintus Smyrnaeus* (1821), an edition of Collins (1827), and *Specimens of British Poefesses* (1825). He issued annotated editions of George Peele, Robert Greene, John Webster, Thomas Middleton, Marlowe, and Beaumont and Fletcher, with lives of the authors and much illustrative matter. He completed, in 1833, an edition of James Shirley left unfinished by William Gifford, and contributed biographies of Shakespeare, Pope, Akenside and Beattie to Pickering's Aldine Poets. He also edited (1836–38) Richard Bentley's works, and *Specimens* of *British Sonnets* (1833). His carefully revised edition of John Skelton, which appeared in 1843, did much to revive interest in that trenchant satirist. In 1857 his edition of Shakespeare was published by Moxon; and the second edition, much improved, was issued by Chapman and Hall in 1866. He also published *Remarks on Collier's and Knight's Editions of Shakespeare* (1844); *A Few Notes on Shakespeare* (1853); and *Strictures on Collier's new Edition of Shakespeare* (1859), a contribution to the Collier controversy *(see* COLLIER, JOHN PAYNE), which ended a long friendship. He undertook the publication of Kempe's *Nine Days' Wonder* for the Camden Society; and the old plays of *Timon* and *Sir Thomas More* were published by him for the Shakespeare Society. He was associated with Halliwell-Phillips, John Payne Collier and Thomas Wright as one of the founders of the Percy Society, for publishing old English poetry. Dyce also wrote *Recollections of the Table Talk of Samuel Rogers* (1856). He died on May 15, 1869. He bequeathed his valuable library, containing amongst other treasures many rare Elizabethan books, to the South Kensington Museum.

DYCE, WILLIAM (1806–1864), Scottish painter, was born Sept. 19, 1806, in Aberdeen, where his father, a fellow of the Royal Society, was a physician of some repute. He attended Marischal college, Aberdeen, took the degree of M.A. at 16 years of age, and studied in the school of the Royal Scottish academy in Edinburgh, then as a probationer in the Royal Academy of London. In 1825, and again in 1827, he went to Italy, where he studied especially the earlier masters of the Florentine and allied schools. In 1829 Dyce settled in Edinburgh and in Feb., 1837, he was appointed master of the school of design of the Board of Manufactures, Edinburgh, whence he was transferred to London as superintendent of the then recently established school of design at Somerset house. In 1844 he was appointed professor of fine art in King's college, London, and became an associate, and in 1848 a full member, of the Royal Academy. He died at Streatham on Feb. 14, 1864.

Dyce's finest productions are the frescoes in the robing-room in the Houses of Parliament, begun in 1848. They depict scenes from the legend of King Arthur, but he died before the series was completed.

See Redgrave's *Dictionary of Artists* (1878), and *Dictionary of National Biography.*

DYEING. The art of colouring textile and other materials in such a way that the colour appears to be a property of the dyed material and not a superficial effect such as that produced by painting. The result of a dyeing operation may be regarded as satisfactory and the substance can be truly termed dyed when the colour is not removed by rubbing or washing or by the action of light. Comparatively few colours pass all tests to these influences; other types of fastness such as resistance to perspiration, street mud, bleaching and finishing are frequently required, and dyeings are approved if they meet some specific demand. A coloured effect, which is comparatively slight considering the amount of colour required to produce it, is regarded by the dyer as a worthless stain. Such stains are produced by dipping fabrics in the aqueous extracts of many fruits and flowers. It is natural to suppose that a desire to transfer the beautiful colours of these substances to textile fabrics may have been the origin of dyeing, but the art is such an ancient one that this is mere conjecture.

Fabrics found in the tombs of Egypt prove that those who dyed them must have been expert in the application of substances which do not immediately reveal their colouring power, but must be associated with other products in a manner which admits of variation only within well defined limits. The dyeing of red with madder or some allied product and of blue with indigo are processes which appear to have been familiar to the people of India, China, Persia and Egypt several thousand years before the Christian era. Some information regarding the dyeing processes used was evidently communicated to Europeans by Phoenicians and Alexandrian merchants, but possibly owing to the state of barbarism which followed the civilizations of Greece and Rome records of the methods practised by these people are very scarce. Pliny gives a description of the dyeing of Tyrian purple and some other colours. In the early period of its development dyeing was probably a home industry carried on mainly by women.

In the 13th century there was a notable revival in the art, for a Florentine named Federigo discovered how to prepare and use certain lichens found in Asia Minor for the dyeing of purple. For this he was awarded great honour and the privilege of adopting the family name *Rucellia.* (The lichen he used was *Roccella tinctoria.*) In 1429 the first European book on dyeing was published at Venice, *Mariegola dell'arte de tentori.* After that time knowledge of the subject spread to Germany, France and Flanders, from which latter country the English king Edward III. procured dyestuffs for England and a Dyers' Company was incorporated in 1472 in London.

The discovery of America in 1492 and the opening up of the Cape route to the East Indies resulted in new products (dyewoods) and new methods of dyeing being used in Europe. In 1518 the Spaniards imported cochineal from Mexico where they had observed the natives employing the insects for dyeing. It is of interest to note that the Incas were skilled in the art of dyeing, but how they acquired the knowledge is unknown. In 1630 a Dutchman named Drebbel discovered how to obtain a brilliant scarlet on wool with tin and cochineal. The process was communicated to other dyers, and the new scarlet was dyed as a specialty at the Gobelin works in Paris, and, in 1643, at a dyeworks at Bow, near London.

On the initiative of the Royal Society, the first English book on dyeing entitled *An apparatus to the history of the common practices* of *dyeing* was published in 1662. In France much attention was given to the promotion of the art by the various ministers of State. Colbert, published a code of instructions to wool dyers and manufacturers, but the greatest service was rendered by a number of eminent chemists who investigated the processes in vogue and attempted to explain and improve them. In different ways Dufay, Hellot, Macquer, Berthollet, Roard and Chevreul in France, and Henry, Home and Bancroft in England did much to improve the methods of dyeing and to establish the industry on a more systematic basis. During this period (1700–1825) a number of important chemical product3 were introduced and prejudice against the use of dyewoods was overcome. it was not until the middle of the 19th century that dyers began to consider the possibility of using coal-tar products for their work. In 1856 the first colour made from coal tar dyed wool and silk directly but could not be applied to cotton until Perkin and Pullar devised the method of tanning and fixing the tannic acid with tartar emetic, before immersing the cotton in the colour solution.

As early as 1834 Runge had conceived the idea of producing colour on the fibre by the oxidation of aniline, but it was the Accrington chemist Lightfoot who, in 1859, discovered the catalytic action of copper, in using sodium chlorate to oxidize aniline on cotton fabric, and produced a black by this method. The method of dyeing cotton with a solution of colour in sodium sulphide was introduced with the colour cachou de Laval in 1873 by Croissant and Bretonniere.

The substitution of naturally occurring substances used in indigo dyeing commenced about the middle of the 18th century with the introduction of ferrous sulphate (copperas) and lime In 1845 the zinc-lime vat was first used, and for many years it was the most important vat for dyeing cotton. It reduced the loss of indigo from 20 to 10%; and the time occupied in waiting for the sediment formed in the copperas vat to settle was saved, the zinc vat clearing quickly. A product of outstanding importance is sodium hydrosulphite discovered in 1868 by Schutzenberger and Lalande. Its use was suggested by these chemists in 1872, but it was some time before any extensive use was made of the discovery. Some dyers prepared calcium hydrosulphite in solution for themselves, with sodium bisulphite, zinc dust and lime, but in 1897 the Badische Anilin und Soda Fabrik offered to dyers a commercial product which produced a clear solution of icdigo white in the presence of alkali without sediment. This was improved by the solid white anhydrous sodium hydrosulphite, which was put on the market in 1903. Hydrosulphite, as the product is generally called, is extensively employed in the dyeing of vat colours. It might be dispensed with, if colours of the indigosol (1922) and soledon jade green type were less expensive.

One of the most interesting and valuable dyeing processes was discovered in 1880 by R. Holliday. This was the formation of para-nitraniline red on cotton, a process which soon achieved great importance and formed a basis for the production of a range of allied colours on cotton (insoluble azo colours). Dyeing by this method has been greatly assisted by the introduction of the intermediate products such as Naphthol A.S. (1912), which yields faster colours. The rapid fast colours are admixtures of this with stabilized diazo compounds. These can be applied directly to cotton and produce the colour on the fibre by steeping in hot dilute acetic acid.

It is to Mercer and Greenwood that we owe the discovery of the effect of sulphuric acid on oils in producing more satisfactory results in turkey-red dyeing than could be obtained with the oil emulsions. Turkey-red oil, sulphated oil and allied products have found extended application in dyeing since the introduction of acetate silk. The study of their influence on the fastness of dyed colours is important. J. R. Hannay and F. W. A. Ermen have contributed to this knowledge concerning sulphur and vat colours respectively.

General Principles. — The art of dyeing is a branch of applied chemistry in which the dyer is continually making use of chemical and physical principles in order to bring about a permanent union between the material to be dyed and the colouring matter applied. If cotton or wool is boiled in water containing finely powdered charcoal, or other insoluble colourgd powder, the material is not dyed, but merely soiled or stained. This staining is entirely due to the entanglement of the coloured powder by the rough surface of the fibre, and a vigorous washing and rubbing suffices to remove all but mere traces of the colour.

There must always be some marked physical or chemical affinity existing between fibre and colouring matter, and this depends upon the physical and chemical properties of both. It is well known that the typical fibres, wool, silk and cotton, behave very differently towards the solution of any given colouring matter, arid that the method of dyeing employed varies with each fibre. As a general rule wool has the greatest attraction for

colouring matters and dyes most readily; cotton has much less attraction, while silk occupies in this respect an intermediate position. These differences may be to some extent due to differences of physical structure in the fibres, but they are mainly due to their different chemical composition. Many processes and treatments to which textile fibres are subjected yield materials which show very different dyeing properties from the original substance.

Dyeing processes may be classified under the following headings:—

I. Direct dyeing, using
  (1) Basic colours for animal fibres and acetate silk.
  (2) Acid colours for wool.
  (3) Direct cotton colours for both vegetable and animal fibres.

II. Dyeing with reduced colour solutions in
  (1) Sulphur colours.
  (2) Vat colours.

III. Mordanting and dyeing, using
  (1) Basic colours for cotton.
  (2) Mordanting with metallic compounds and dyeing.

IV. Producing colours on the fibre. Mainly used for vegetable fibres.
  (1) Aniline black.
  (2) Insoluble azo colours.
  (3) Mineral colours.

Direct Dyeing.— This is the simplest of all dyeing operations. It is most successful in the case of animal fibres, wool showing such a decided affinity for both acidic and basic organic compounds which possess colouring power that a very numerous selection of colouring matters is possible.

(1) Wool is dyed with basic colours directly from a neutral aqueous solution (without additions) the wool combining with the colour base to form a coloured salt or lake on the fibre. Although a neutral dyebath may be employed, an addition of 2% soap gives a brighter colour, and in some cases acid is added to the bath. Silk is dyed in a bath containing boiled off liquor; 2 to 3% on the weight of material is usually necessary.

Acetate silk has such a remarkable affinity for organic compounds of a basic character that it is capable of combining with these under a variety of circumstances. The basic colours act as direct dyes for acetate silk and some (brilliant green, for example) show better fastness on this than they do on tanned cotton. Amino azo and insoluble basic dyes converted into their carboxylic acids dye acetate silk. The compounds of insoluble organic bases with the omega sulphonic acid group ($CH_2{\cdot}OH{\cdot}SO_3H$) are soluble colours, ionamines, which dye acetate silk in the presence of formic or sulphuric acid. Some can be diazotized and developed on the fibre.

Insoluble basic compounds in a dispersed or colloidal condition with sulpho-ricinoleic acid (soluble oils) dye acetate silk direct at 80°C. (S.R.A. colours). Other colours employed in this way are amino anthraquinone derivatives (duranol, celatene and dispersol colours).

(2) The acid colours are applied to wool in this way because it is necessary to modify the composition of the fibre to render it capable of uniting with the colour acid of the dyestuff. Wool boiled with dilute sulphuric acid and then thoroughly washed with boiling water until free from acid acquires the property of dyeing with acid colours even in neutral solution. The amount of colour used is from $\frac{1}{2}$ to 6% on the weight of the wool with 2 to 5% sulphuric acid (1·84 sp. gr.) and 10% sodium sulphate (Glauber's salt). The last addition is made to produce level dyeing for it exerts a restraining action. This is also effected by the use of old dye liquors, a diminished amount of acid, the employment of weaker acids, acetic or formic acid or ammonium acetate and entering the material at a low temperature.

The woollen material is introduced and continually handled or moved about in the solution, while the temperature of the latter is gradually raised to the boiling point in the course of $\frac{3}{4}$ to 1 hour; after boiling for $\frac{1}{4}$ to $\frac{1}{2}$ hour longer, the operation is complete, and the material is washed and dried.

In the application of alkali blue the process of dyeing in an acid bath is impossible, owing to the insolubility of the colour-acid in an acid solution. Wool and silk, however, possess an affinity for the alkali salt of the colouring matter in neutral or alkaline solution, hence these fibres are dyed with the addition of about 5% borax; the material acquires only a pale colour, that of the alkali salt, in this dyebath, but by passing the washed material into a cold or tepid dilute solution of sulphuric acid a full bright blue colour is developed, due to the liberation of the colour-acid within the fibre. In the case of other acid colours, *e.g.*, chromotrope, chrome brown, chromogen, alizarin yellow, etc. the dyeing in an acid bath is followed by a treatment with a boiling solution of bichromate of potash, alum or chromium fluoride, whereby the colouring matter on the fibre is changed into insoluble oxidation products or colour lakes. This operation of developing or fixing the colour is effected either in the same bath at the completion of the dyeing operation, or in a separate bath.

When dyeing with certain acid colours, *e.g.*, eosine, phloxine and other allied bright pink colouring matters derived from resorcin, the use of sulphuric acid as an assistant must be avoided, since the colours would thereby be rendered paler and duller, and only acetic acid must be employed.

The properties of the dyes obtained with the acid colours are extremely varied. Many are fugitive to light; on the other hand, many are satisfactorily fast, some even being very fast in this respect. As a rule, they do not withstand the operations of milling and scouring very well, hence acid colours are generally unsuitable for tweed yarns or for loose wool. They are largely employed, however, in dyeing other varieties of woollen yarn, silk yarn, union fabrics, dress materials, leather, etc. Previous to the discovery of the coal-tar colours very few acid colours were known, the most important one being indigo extract. Prussian blue as applied to wool may also be regarded as belonging to this class, also the purple natural dyestuff, orchil or cudbear. Xylidine scarlet, discovered in 1879, was the first synthetic colouring matter of this class, which comprises such members as picric acid, tartrazine, orange II, fast acid violet, lissamine fast yellow and orange, alphanol, cyanol, lanacyl, kiton and neolan colours. The last compounds contain copper and chromium and are therefore mordant colours which can be dyed direct on wool from an acid bath. They are fast to milling.

(3) Direct cotton colours may be regarded as a particular type of acid colours because wool and silk dye in the presence of acetic acid, but they are characterized by the fact that cotton shows a decided affinity for them. At the same time cotton does not show that complete absorption of colour which is characteristic of wool and merely absorbs a portion of the colour from the bath, in amount depending very much upon the concentration of the dye liquor. The first colouring matter of the class was the so-called congo red, discovered in 1884. Since that time a very great number have been introduced which yield almost every variety of colour. The method of dyeing cotton consists in merely boiling the material in a solution of the dyestuff, when the cotton absorbs and retains the colouring matter by reason of a special natural affinity. The concentration of the dyebath is of the greatest importance, since the amount of colour taken up by the fibre is in an inverse ratio to the amount of dye liquor present in the bath. The addition of 1 to 3 oz. sodium sulphate and $\frac{1}{12}$ to $\frac{1}{3}$ oz. carbonate of soda per gallon gives deeper colours, since it diminishes the solubility of the colouring matter in the water and increases the affinity of the cotton for the colouring matter. An excess of sodium sulphate is to be avoided, otherwise precipitation of the colouring matter and imperfect dyeing result. With many dyestuffs, it is preferable to use $\frac{1}{6}$ to $\frac{1}{3}$ oz. soap instead of soda. On cotton the dyed colours are usually not very fast to light, and some are sensitive to alkali or to acid, but their most serious defect is that they are not fast to washing, the colour tending to run and stain neighbouring fibres. Wool and silk are dyed with the direct colours either neutral or with the addition of a little acetic acid to the dyebath. On these fibres the dyed colours are usually faster than on cotton to washing, milling and light; some are fast even to light, *e.g.*, diamine fast red, chrysophenine, hessian

yellow, etc. Many of the direct colours are very useful for dyeing plain shades on union fabrics composed of wool and cotton, silk and cotton, or wool and silk. Owing to the facility of their application, they are also very suitable for use as household dyes, especially for cotton goods. Colours of this type are benzo purpurine, benzo fast violet, chlorazol and dianoi colours. The fastness may be improved by after treatment, (a) diazotizing and developing, (b) formaldehyde treatment and (c) after treatment with metallic salts. (a) Applies to colours such as primuline which contain a free amido group and can be passed through a bath of sodium nitrite and hydrochloric acid and afterwards through a solution of an amino compound or phenol. Primuline yellow is converted into a red by this treatment. In some cases the colour change is not so marked, but the colours are distinctly improved in fastness to washing. (b) The treatment with formaldehyde applies to the benzoform colours and it improves the fastness to washing. It is carried out at about 70°C. with an aqueous solution. Treatment with boiling copper sulphate (0·5%) increases the light fastness.

Different batches of viscose silk show considerable variation in affinity for the direct cotton colours. In some cases colours appear distinctly light in shade on one batch and dark on another batch of viscose, so that defects may appear in manufactured articles which happen to contain the two types of viscose. Whittaker has shown that this trouble may be overcome by the careful selection of colours which show low capillarity, or in the case of shades composed of mixtures of colours by making these up from colours of nearly the same capillary properties. The icyl colours do not show conspicuous differences when dyed on different batches of viscose silk.

So many colours have been introduced for the direct dyeing of acetate silk that methods of treating the fibre in order to impart to it an affinity (which it does not show in the ordinary condition) for direct cotton colours have comparatively little interest. The hydrolyzing, or saponifying, action of alkali, if cautiously applied to the silk, does not reduce its lustre but may result in loss of weight and strength. This treatment and the action of ammonium thiocyanate impart to acetate silk some affinity for direct cotton colours.

Immunized cotton, that is cotton first converted into alkali cellulose and then treated with toluol sulphonic chloride or allied compounds, shows no affinity for direct colours. The process of immunizing may be applied to yarn or piece goods either wholly or locally. Esterified cotton has somewhat similar properties.

Dyeing **with** Reduced Colour Solutions. — Many insoluble coloured substances form soluble reduction products which show a definite affinity for fibres. Characteristic in this respect are (1) sulphur colours which dissolve in sodium sulphide and (2) vat colours which react with sodium hydrosulphite and other reducing agents in a somewhat similar way. These colours are most easily applied to vegetable fibres because the solution is invariably alkaline and special devices have to be employed in the case of wool. As a rule it is generally found preferable to use direct dyeing acid and mordant colours for wool, but a number of preparations have been put on the market to protect wool from the injurious action of alkali in dyeing sulphur and vat colours.

(1) Sulphur colours. The material is heated for about one hour in a solution of the colour (10 to 15%), with the addition of sodium carbonate (1 to 10%), common salt (10 to 20%) and sodium sulphide (5 to 30%); it is then washed in water and may be developed by heating in a bath containing 2 to 5% of bichromate of soda, and 3 to 6% acetic acid. A final washing with water containing a little soda to remove acidity is advisable. The sulphide colours are remarkable for their fastness to light, alkalis, acids and washing, but unless proper care is exercised the cotton is apt to be tendered on being stored for some time. This is particularly noticeable in the case of blacks and to some extent with yellow sulphur colours. The cause of tendering has been the subject of much research. Zanker (1914) considers it to be due to the oxidation of sulphur in chemical combination with the dyestuff. Most workers agree that the tendering is due to the formation of acid. Holden's method of overcoming the tendering is probably the most efficient. It consists in impregnating the cotton with tannic acid, and then passing through lime water before dyeing in the sulphur colour. The tannate of lime so formed provides an insoluble and powerful base present on the fibre and combined only with the tannic acid. Sulphur colours are suitable for dyeing goods which are intended for rubber-proofing.

Some kinds of finishing materials affect the fastness of sulphur colours very materially. Hannay (1912) has shown that castor oil preparations (soluble oil, monopol soap) very materially reduced the light-fastness of sulphur colours.

(2) Vat dyeing is one of the oldest dyeing processes, naturally occurring substances being used for the production of fermentation vats for the dyeing of indigo blue. In the early days of dyeing in England and as soon as dyers were by law permitted to use indigo in place of woad, vats were prepared from woad, bran, madder and wood ashes. These substances were used for wool dyeing long after chemical reagents had been suggested and introduced for cotton dyeing. Practically any substance or mixture of substances capable of producing hydrogen in an alkaline medium will reduce indigo. The reduction product, leuco indigo or indigo white, dissolves in the alkali with a yellow colour. In the fermentation vat, butyric acid fermentation is induced in the bran and madder by the ferment contained in woad and hydrogen is formed. Wood ashes or lime provide the alkali necessary for the solution of the indigo white. Other vats which have found application in dyeing are the copperas and lime, zinc-lime, bisulphite-zinc-lime, and the sodium hydrosulphite vats. The last is the most important; it produces a vat free from sediment and little loss of indigo. It is usual to prepare a stock vat and then to add some of this to a large volume of water (1,000 gals.) from which the dissolved oxygen has been removed by adding a little sodium hydrosulphite (9½ ozs.) and caustic soda (⅛ pint 76°Tw.). The stock vat may be made suitable for cotton by mixing 100 lb. indigo (20% paste) with 10 gals. warm water and 5½ gals. caustic soda 76°Tw., heating to 40–50°C. and adding about 20 lb. sodium hydrosulphite. Dyeing is carried out by dipping cotton in the cold vat for a few minutes, and darker shades are obtained by repeated dipping alternated with exposure to air. Washing with cold water assists the oxidation of the leuco compound. In dyeing wool, the amount of alkali in the vat must be strictly limited. Substances such as protectol or the sulphite pulp waste liquor from paper manufacture and glue are recommended for use in wool dyeing with vat colours to protect the fibre from the injurious action of alkali. In wool dyeing a temperature not lower than 70°C. is required for the dyeing of other vat colours and in all cases the time of dyeing for wool is longer than for cotton. Wool requires ½ to 2 hours for the dyeing of indigo. It is now difficult to buy suiting dyed with indigo, for the shade is generally imitated with acid chrome colours and with other acid (wool) colours.

The leuco compounds of the anthraquinone colours are usually less soluble than those of the indigoid colours and require more caustic soda to produce a vat. The amount of alkali has frequently to be double the quantity used for indigo, so they are difficult to apply to wool. Indanthrene blue is a colour of remarkable fastness, but unfortunately this cannot be said of all members of the series of colours of which this is the type. Cibanone yellow fades on exposure to light and at the same time the fibre is considerably tendered. In connection with colours of this type it has been noticed by F. Scholefield that if light is allowed to fall on the fabric during the development of colour after dyeing in the vat, the shades appear brighter than if developed in the dark but the fabric becomes tender in a few minutes and other colours that may be dyed in the same vat are destroyed.

The production of a vat is always accompanied by chemical change, which is shown by the formation of solution and frequently by colour change; but this is not so in the case of indanthrene which merely forms a vat of different shade of blue to that of the decoction of colour and water. Indanthrene yellow produces a blue vat, thio-indigo red gives a yellow vat.

The indigosols and corresponding anthraquinone products (soledon colours) are vat colours presented to the dyer in an already reduced condition. They are applied like acid dyes to wool and silk and are mixed with a solution of sodium nitrite and padded on cotton. Various acid oxidizing agents may be used for developing the colours on wool and treatment with acid to react with the sodium nitrite in the case of cotton. They may be developed in other ways, one of the most interesting being that of steaming cotton padded with chlorate of soda, vanadium chloride, neutral ammonium oxalate and indigosol O which resembles a process of producing aniline black. This renders possible the production of different colours side by side and is most valuable from the point of view of calico printing. Colours include durantherene, algol, ciba, besides those already mentioned.

Mordanting and Dyeing.— (I) Basic colours applied to cotton. Unlike the animal fibres cotton has little affinity for the basic colours. It is usual to deposit tannic acid on the fibre in the form of an insoluble tannate. For this purpose pieces are steeped in a solution containing 2 to 6 oz. per gallon tannic acid and after being evenly squeezed are passed through a warm solution of tartar emetic or other salt of antimony or tin. The tannic acid has the power of combining with the base of the colouring matter in the subsequent dyeing operation, which is generally carried out with ½–2% colour on the weight of cotton to be dyed and sufficient water, in the cold or if the temperature is raised at all it is best not higher than 70°C. The basic colours are moderately fast to soap, but most of them are very loose to light. Methylene blue is one of the best in this respect. The first coal-tar colour mauve belonged to this dyeing class, which is especially remarkable for brilliance and high colouring power. One natural colour which has long been known to dye in this way is the barberry, which contains the alkaloid berberine; but in 1918 Everest showed that the flower colours (antho-cyanines) could be dyed on tanned cotton. They are fast to light but loose to soap, and in respect to these properties are therefore quite different from the synthetic colours dyed in this way. In the dyeing of basic colours, tannic acid may be substituted by katanol (a phenolic compound containing sulphur) which can be applied in alkaline solution and in presence of salt. It does not require fixing but appears to have some affinity for cotton which is rather like that of direct colours. Direct cotton, sulphur and vat colours will act as mordants for basic colours forming lakes on the fibre.

Some important basic colours are rhodamine, brilliant green, auramine and methyl violet. A dyestuff astrafloxine has been offered as a substitute for rhodamine.

(2) Mordanting with metallic compounds and dyeing. The deposition and fixation of metallic oxides or basic salts of certain metals on vegetable and animal fibres is a necessary feature of the production of colour in the case of certain organic compounds such as alizarine and haematine which may be termed colour principles. Colour principles are the essential constituents as far as dyeing is concerned of many woods and other natural products which have found considerable application, consequently mordanting operations have been of great interest to dyers. The method provides some dyeings of great fastness. The animal fibres are very easily mordanted. For example, wool boiled for 1 to 1½ hours with 2–3% potassium bichromate absorbs chromic acid and reduces it to chromium chromate tinting the fibre a pale olive yellow. On subsequent dyeing the chromium chromate is reduced to chromium hydrate by a portion of the dyestuff and this result can with advantage be obtained previous to dyeing by the use of assistants such as sulphuric acid, cream of tartar, tartaric acid, lactic acid, etc. For special purposes chromium fluoride, chrome alum, etc., are employed. Alum or aluminium sulphate (8%), along with acid potassium tartrate (cream of tartar) (7%), is used for brighter colours—*e.g.*, reds, yellows, etc. The object of the tartar is to retard the mordanting process and ensure the penetration of the wool by the mordant, by preventing superficial precipitation through the action of ammonia liberated from the wool; it ensures the ultimate production of clear, bright, full colours. For still brighter colours, notably yellow and red, stannous chloride was at one time largely employed, but it is used less frequently; and the same may be said of copper and ferrous sulphate, which were used for dark colours. Silk may be often mordanted in the same manner as wool, but as a rule it is treated like cotton. The silk is steeped for several hours in cold neutral or basic solutions of chromium chloride, alum, ferric sulphate, etc., then rinsed in water slightly, and passed into a cold dilute solution of silicate of soda, in order to fix the mordants on the fibre as insoluble silicates. Cotton does not, like wool and silk, possess the property of decomposing metallic salts, hence the methods of mordanting this fibre are more complex and vary according to the metallic salts and colouring matters employed, as well as the particular effects to be obtained. One method is to impregnate the cotton with a solution of so-called sulphated oil or turkey-red oil; the oil-prepared material is then dried and passed into a cold solution of some metallic salt—*e.g.*, aluminium acetate, basic chromium chloride, etc. The mordant is thus fixed on the fibre as a metallic oleate, and after a passing through water containing a little chalk or silicate of soda to remove acidity, and a final rinsing, the cotton is ready for dyeing. Another method of mordanting cotton is to fix the metallic salt on the fibre as a tannate instead of an oleate. This is effected by first steeping the cotton in a cold solution of tannic acid or in a cold decoction of some tannin matter, *e.g.*, sumach, in which operation the cotton attracts a considerable amount of tannic acid; after squeezing, the material is steeped for an hour or more in a solution of the metallic salt, and finally washed. The mordants employed in this case are various—*e.g.*, basic aluminium or ferric sulphate, basic chromium chloride, stannic chloride (cotton spirits), etc. There are other methods of mordanting cotton besides those mentioned, but the main object in all cases is to fix an insoluble metallic compound on the fibre. It is interesting to note that whether the metallic oxide is united with the substance of the fibre, as in the case of wool and silk, or precipitated as a tannate, oleate, silicate, etc., as in the case of cotton or silk, it still has the power of combining with the colouring matter in the dyebath to form the coloured lake or dye on the material.

The dyeing operation consists in working the mordanted material in a decoction of the necessary colouring matter, the dyebath being gradually raised to the boiling point. With many colouring matters, *e.g.*, with alizarin, it is necessary to add a small percentage of calcium acetate to the dyebath, and also acetic acid if wool is being dyed. In wool-dyeing, also, the mordanting operation may follow that of dyeing instead of preceding it, in which case the boiling of the wool with dyestuff is termed "stuffing," and the subsequent developing of the colour by applying the mordant is termed "saddening," since this method in the past has usually been carried out with iron and copper mordants, which give dull or sad colours. The method of "stuffing and saddening" may, however, be carried out with other mordants, even for the production of bright colours, and it is now frequently employed with certain alizarin dyestuffs for the production of pale shades which require to be very even and regular in colour. There is still another method of applying mordant colours in wool-dyeing, in which the dyestuff and the mordant are applied simultaneously from the beginning; it is called the single-bath method. This process has become of greater interest; copper and chromium (chromium oxalate or "chromosul") being used in conjunction with acid azo colours. Some colouring matters which contain copper or chromium in combination are soluble in water and are applied like acid colours (Neolan colours).

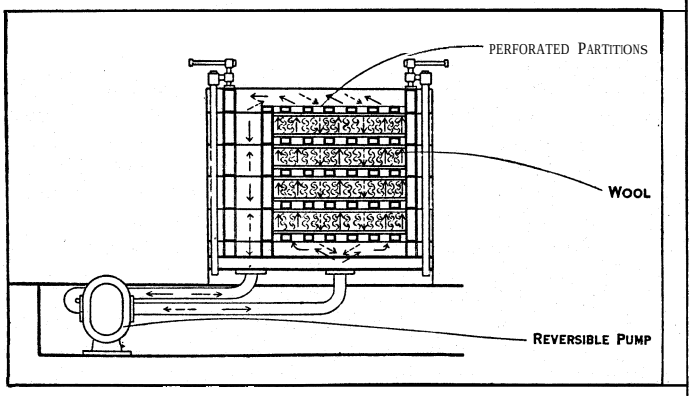
Deposition of tannate of iron on and in the fibre is the method used for the dyeing of logwood on cotton. Logwood still finds use for the production of black both on cotton and wool. In the case of wool it is dyed on chrome mordant. Acetate silk may be dyed black (Bedford's patent) by treating first with logwood extract (haematine) and afterwards adding borax and nitrate of iron.

For dyeing turkey-red, cotton is boiled but not bleached. After boiling, mordanting with red liquor (4° Tw.) and ageing, fixing with phosphate or silicate or arsenate of soda (0·5% solution) follows. Dyeing is carried out at the boil with 10% alizarine paste and the goods are afterwards soaped and cleared (using a little

stannous chloride). Steaming improves the colour.

Interest in mordant dyeing on cotton is diminishing considerably with the introduction of colours which are more readily applied and can compete well with the fastest mordant colour alizarine or turkey-red in point of fastness.

Cutch is a natural colour which is still very largely used in dyeing. Sailors believe that this colour protects the fabric of fish-



BY COURTESY OF ZITTAUER MACHINE CO

FIG 1 — WOOL DYEING IN THE BOX SYSTEM A REVERSIBLE PUMP FORCES DYE LIQUOR THROUGH THE BOX IN THE DIRECTION INDICATED

ing nets from the action of light and air. It is dyed with copper sulphate in the bath but contains in addition to the mordant colour principle (catechin), a kind of tannic acid (catechu tannic acid), consequently this colour can be topped with basic colours.

Colours Produced on the Fibre. — (I) Aniline black is produced in situ upon the fibre by the oxidation of aniline. It is chiefly used for cotton, also for silk and cotton (silk union) fabrics, but seldom or not at all for wool. Properly applied, this colour is one of the most permanent to light and other influences with which we are acquainted. One method of dyeing cotton is to work the material for about two hours in a cold solution containing aniline (10 parts), hydrochloric acid (20 parts), bichromate of potash (20 parts), sulphuric acid (20 parts), and ferrous sulphate (10 parts). The ferrous sulphate here employed is oxidized by the chromic acid to a ferric salt, which serves as a carrier of oxygen to the aniline. This method of dyeing is easily carried out, and it gives a good black; but since much of the colouring matter is precipitated on the fibre superficially as well as in the bath itself, the colour has the defect of rubbing off. Another method is to impregnate the cotton with a solution containing aniline hydrochloride (35 parts), neutralized with addition of a little aniline oil, copper sulphate (1·6 part), sodium chlorate (10 parts), ammonium chloride (1 part). Another mixture is 1·8 part aniline salt, 12 parts potassium ferrocyanide, 200 parts water, 3·5 parts of potassium chlorate dissolved in water. After squeezing, the material is passed through a special oxidation chamber, the air of which is heated to about 50°C. and also supplied with moisture. This oxidizing or ageing is continuous, the material passing into the chamber at one end in a colourless condition, after about 20 minutes passing out again with the black fully developed. A final treatment with hot potassium bichromate and soaping is necessary to complete the process. In this method probably chlorate of copper is formed and this being a very unstable compound, readily decomposes and the aniline is oxidized by the liberated chlor-oxygen compounds. The presence in the mixture of a metallic salt is very important in aiding the development of the black (Lightfoot's observation). Salts of vanadium and cerium may be substituted for copper. In the after-chroming process, chromium is fixed on the fibre and in all methods some mineral substance is fixed; chromium in the dyed black and iron in the prussiate black. The organic compound on the fibre is produced by oxidation which proceeds in four stages to nigraniline and the condensation of this substance with aniline. At the end of the ageing process there should be some unchanged aniline to condense and produce an ungreenable black in the chroming process. On the fibre, chromate of nigraniline may be formed. There is still much material for further investigation especially concerning the prussiate black. One of the serious disadvantages of aniline black is the liability to tender the cotton. It is by no means certain whether this is due to oxidation of the cellulose or to the action of acid upon it during ageing. The latter is probable, for substances which prevent drying during ageing also prevent tendering.

(2) The insoluble azo colours are produced as insoluble coloured precipitates by adding a solution of a diazo compound to an alkaline solution of a phenol, or to an acid solution of an amido compound. The necessary diazo compound is prepared by allowing a solution containing nitrous acid to act upon a solution of a primary aromatic amine. It is usually desirable to keep the solutions cool with ice, owing to the unstable nature of the diazo compounds produced. (Products can be obtained which are stable and only decompose on acidifying.) The colour obtained varies according to the particular diazo compound, as well as the amine or phenol employed, 0-naphthol being the most useful among the latter. The same coloured precipitates are produced upon the cotton fibre if the material is first impregnated with an alkaline solution of the phenol, then dried and passed into a cold solution of the diazo compound. The most important of these colours is para-nitraniline red, which is dyed in enormous quantities on cotton pieces. The pieces are first prepared by running them on a padding machine through a solution made up of 30 grms. 8-naphthol, 20 grms. caustic soda, 50 grms. turkey-red oil, and 5 grms. tartar emetic in 1,000 grms. (1 litre) water. They are then dried on the drying machine, and are passed, after being allowed to cool, into the diazo solution, which is prepared as follows: 15 grms. para-nitraniline are dissolved in 53 c.c. hydrochloric acid (34°Tw.) and a sufficiency of water. To the cold mixture a solution of 10½ grms. sodium nitrite is added while stirring. The whole is then made up to 1,200 c.c. and just before use 60 grms. sodium acetate are added. The colour is developed almost immediately, but it is well to allow the cotton to remain in contact with the solution for a few minutes. The dyed cotton is squeezed, washed, soaped slightly, and finally rinsed in water and dried. A brilliant red is then obtained which is fast to soap but not to light. If the para-nitraniline used in the foregoing process is replaced by meta-nitraniline, a yellowish-orange colour is obtained; with a naphthylamine, a claret red; with amido-azo-toluene, a brownish red; with benzidine, a dark chocolate; with dianisidine, a dark blue; and so on. The dyed colours are fast to washing and are much used in practice, particularly the para-

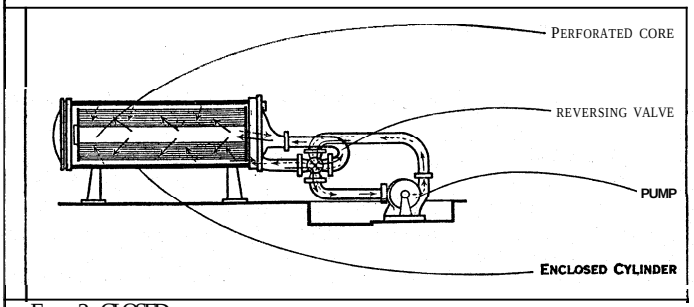


FIG. 2—CLOSED BEAM DYEING MACHINE, IN WHICH THE DYE SOLUTION IS DRAWN THROUGH THE CORE AND BEAM IN THE DIRECTION INDICATED BY THE ARROWS

nitraniline red, which has served as a substitute for turkey-red, although it is not so fast to light as the latter. Superior results can be obtained by substituting Naphthol A.S. (the anilide of -oxynaphthoic acid) and other related products for β-naphthol. The combinations of these compounds with various diazotized amines result in shades which sometimes differ from those with β-naphthol, generally giving improved appearance and almost always colours of superior fastness. Some will stand the full bleaching process. A further advantage is that the cotton shows decided direct affinity for Naphthol AS. products and there is no necessity to dry the material after padding. E. Higgins (1927) has given valuable information regarding the behaviour of insoluble azo colours.

(3) Mineral colours. These include chrome yellow, iron buff,

prussian blue, manganese brown and khaki.

Chrome yellow is only useful in cotton dyeing as a self-colour, or for conversion into chrome orange, or, formerly in conjunction with indigo, for the production of fast green colours. The cotton is first impregnated with a solution of lead acetate or nitrate, squeezed, and then passed through a solution of sodium sulphate or lime water to fix the lead on the fibre as sulphate or oxide

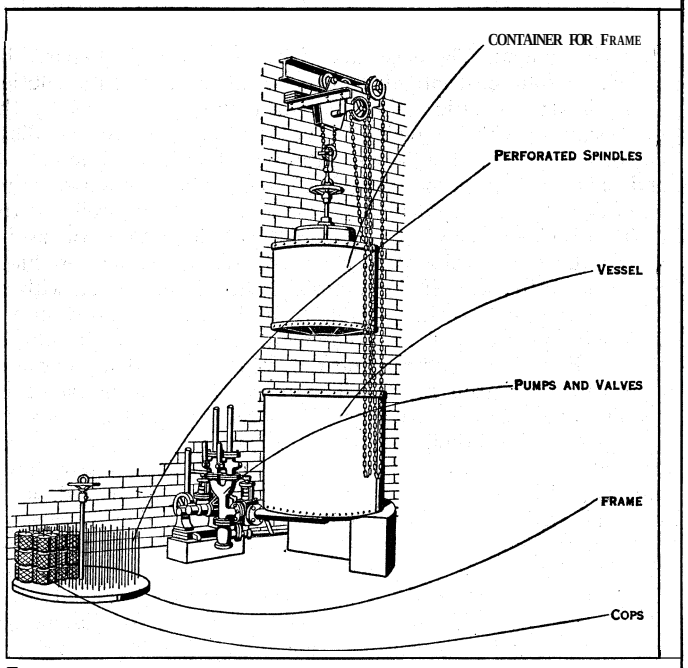


FIG. 3.— DYEING BY THE SPINDLE SYSTEM (IMPROVED FORM), IN WHICH THE CONTAINER FOR THE FRAME HOLDS THE COPS ON PERFORATED SPINDLES. IN THIS YESSEL THE CONTAINER WITH ITS CHARGE OF COPS IS CONNECTED WITH THE CIRCULATING SYSTEM FOR DYE LIQUOR

of lead. The material is then passed through a solution of bichromate of potash. The colour is changed to a rich orange by a short, rapid passage through boiling milk of lime, and at once washing with water, a basic chromate of lead being thus produced. The colour is fast to light, but has the defect of being blackened by sulphuretted hydrogen.

Iron buff is produced by impregnating the cotton with a solution of ferrous sulphate, squeezing, passing into sodium hydrate or carbonate solution, and finally exposing to air, or passing through a dilute solution of bleaching powder. The colour obtained, which is virtually oxide of iron, or iron-rust, is fast to light and washing.

Prussian blue is applicable to wool, cotton and silk, but since the introduction of coal-tar blues its employment has been very much restricted. The colour is obtained on cotton by first dyeing an iron buff, according to the method just described, and then passing the dyed cotton into an acidified solution of potassium ferrocyanide, when the blue is at once developed. A similar method is employed for silk. Wool is dyed by heating it in a solution containing potassium ferricyanide and sulphuric acid. The colour is developed gradually as the temperature rises; it may be rendered brighter by the addition of stannous chloride. On wool and silk prussian blue is very fast to light, but alkalis turn it brown (ferric oxide).

Manganese brown or bronze can be applied in wool, silk and cotton dyeing. The animal fibres are readily dyed by boiling with a solution of potassium permanganate, which, being at first absorbed by the fibre, is readily reduced to insoluble brown manganic hydrate. Since caustic potash is generated from the permanganate and is liable to act detrimentally on the fibre, it is advisable to add some magnesium sulphate to the permanganate bath in order to counteract this effect. Imitation furs are dyed in this manner on wool-plush, the tips or other parts of the fibres being bleached by the application of sulphurous acid. Cotton is dyed by first impregnating it with a solution of manganous chloride, then dyeing and passing into a hot solution of caustic soda. There is thus precipitated on the fibre manganous hydrate, which by a short passage into a cold dilute solution of bleaching powder is oxidized and converted into the brown manganic hydrate. This manganese bronze or brown colour is very susceptible to, and readily bleached by, reducing agents; hence when exposed to the action of an atmosphere in which gas is freely burnt, the colour is liable to be discharged, especially where the fabric is most exposed. In other respects manganese bronze is a very fast colour.

Khaki is a mixture of iron buff and chromium oxide. The green shades of khaki are as a rule most sought after and on this account it is necessary to secure the deposition of much chromium on the fibre. This may be done by tanning and then destroying the tannic acid with sodium bichromate; otherwise this would destroy the cotton.

Dyeing on a Large Scale.—Textile fibres may be dyed in all forms in which they appear during the course of manufacture from loose fibres to fabrics. Dyestuffs are usually applied in solution or decoction with water and this is frequently heated, while the material is immersed in it. During the process the material to be dyed or the dye liquor or both must be almost continuously moved about in order to effect uniform or even dyeing. Numerous machines are used to effect this movement for particular kinds of material and also to secure uniform heating of the vessel; devices are fitted for preventing the material from coming into contact with the steam pipes. Loose material is liable to become matted together so machines have been arranged with hooks or fingers to prevent this. It is best dealt with by circulating the liquor through the material (fig. 1). Loose dyed wool is especially useful in producing fancy fabrics with fibres dyed in different colours.

Yarn Dyeing.—Yarn is dyed in the form of hanks, warps, cops and cheeses. The hank form involves the most simple devices for obtaining even results by turning the material. Machines made to imitate the effect of turning the yarn by hand over wooden pegs, take the form of a series of reels each holding about 2 lb. of yarn which are arranged so that large batches can be lifted in and out of the liquid automatically. In other machines the yarn is arranged on rods or carriers which revolve on a central axis into half cylindrical dye vats and, during the revolution, the rods are turned so that the yarn moves to another position. Machines have been introduced for dyeing warps on the beam, the dye liquor being

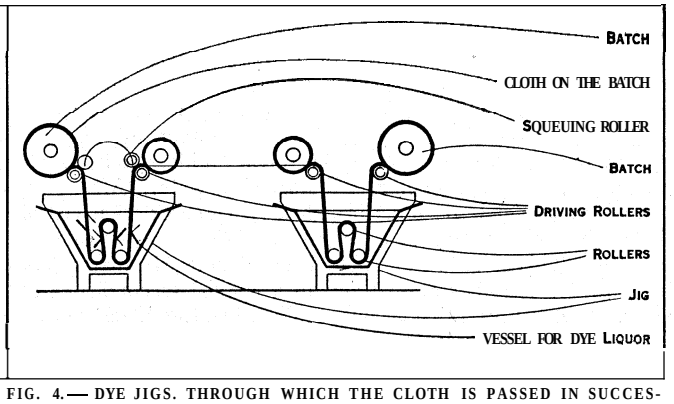


FIG. 4.— DYE JIGS. THROUGH WHICH THE CLOTH IS PASSED IN SUCCESSION OR THE JIGS CAN BE USED SEPARATELY, AFTER THE CLOTH ON THE BATCH HAS BEEN PASSED BY DRIVING ROLLERS THROUGH THE DYE LIQUOR OVER THE GUIDE ROLLERS. AND THE SQUEEZING ROLLER APPLIED

caused to circulate through the material, and the system meets with considerable success.

Large quantities of yarn, especially cotton, are dyed in the cop, for weft. The main advantage of this method is at once apparent, inasmuch as the labour, time and waste of material incurred by reeling into hanks and then winding back into compact form, so as to fit into the shuttle are avoided. A thin tapering perforated metallic tube is inserted in the hollow of each cop. The cops are then attached to a perforated disc (which constitutes the lid of a chamber or box) by inserting the protruding ends of the tubes into the perforations. The chamber is now immersed in the dye-bath

and the hot liquor is drawn through the cops by means of a centrifugal pump and returned continuously to the dye-bath. This principle is known as the skewer or spindle system.

In the so-called "compact" system of cop dyeing the cops are packed as closely as possible in a box, the top and bottom (or the two opposite sides) of which are perforated, the interstices between the cops being filled up with loose cotton, ground cork or

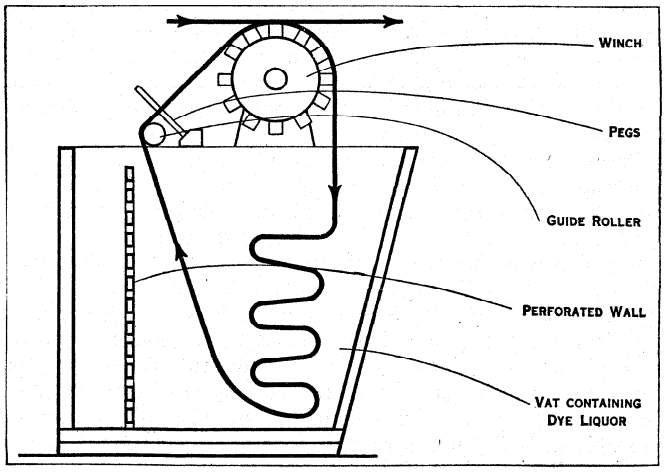


FIG 5.—THE WINCH, WHICH DRAWS THE PIECES IN ROPE FORM INTO THE VAT CONTAINING DYE LIQUOR, OVER A GUIDE ROLLER, BETWEEN PEGS Without pegs the cloth can be treated at open width, protected from the heating coil by the perforated wall

sand: The dye liquor is then drawn by suction or forced by pressure through the box, thus permeating and dyeing the cops.

Dyeing **of** Pieces.—Plain shades are usually dyed in the piece, this being the most economical and at the same time the most expeditious means of obtaining the desired effect. In the dye-jigger (fig. 4) the goods are passed backwards and forwards over guide rollers between two batching rollers. The arrangement admits of treating a large quantity of material with comparatively little dye liquor. Another machine is that shown in fig. 5. This is suitable for heavy fabrics. The pieces are stitched end to end in a band which passes over a winch. Washing off may be done on the same machine.

Except for the dyeing of light shades only the preliminary operations of bleaching (washing and scouring) are carried out before dyeing.

Theory **of** Dyeing.—The peculiar property characteristic of dye-stuffs, as distinguished from mere colouring matters, namely, that of being readily attracted by the textile fibres, notably the animal fibres, appears to be due to their more or less marked acid or basic character. Intimately connected with this is the fact that these fibres also exhibit partly basic and partly acid characters due to the presence of carboxyl and amido groups. The behaviour of magenta is typical of the basic colours. Rosaniline, the base of magenta, is colourless, and only becomes coloured by its union with an acid, and yet wool and silk can be as readily dyed with the colourless rosaniline (base) as with the magenta (salt). The explanation is that the base rosaniline has united with the fibre, which here plays the part of an acid, to form a coloured salt. It has also been proved that in dyeing the animal fibres with magenta (rosaniline hydrochloride), the fibre unites with rosaniline only, and liberates the hydrochloric acid. Further, magenta will not dye cotton unless the fibre is previously prepared, *e.g.*, with the mordant tannic acid, with which the base rosaniline unites to form an insoluble salt. In dyeing wool it is the fibre itself which acts as the mordant. In the case of the acid colours the explanation is similar. In many of these the free colour-acid has quite a different colour from that of the alkali-salt, and yet, on dyeing wool or silk with the free colour-acid, the fibre exhibits the colour of the alkali-salt and not of the colour-acid. In this case the fibre evidently plays the part of a base. Another fact in favour of the view that the union between fibre and colouring matter is of a chemical nature is that by altering the chemical constitution of the fibre its dyeing properties are also altered; oxycellulose, nitrocellulose and acetate silk for example, have a greater attraction for basic colours than cellulose. Such facts and considerations as these have helped to establish the view that in the case of dyeing animal fibres with many colouring matters the operation is a chemical process, and not merely a mechanical absorption of the dyestuff. A similar explanation does not suffice, however, in the case of dyeing cotton with the direct colours. These are attracted by cotton from their solutions as alkali salts, apparently without decomposition, the affinity existing between the fibre and colouring matter is distinctly feeble in comparison with wool. This fibre is capable of taking up as much as 20% of acid colour without appearing bronzey. Cotton absorbs under favourable conditions about 2% of actual direct colour.

The dyeing of cotton is most probably of a physical character but there are different opinions as to the nature of this. Some favour colloidal, some purely mechanical (solid solution) and some electrical theories. The latter explains phenomena which occur during dyeing and in some instances supports the chemical as well as the mechanical theory. In the case of colours which are dyed on mordants the question is merely transferred to the nature of the attraction which exists between the fibre and the mordant. G. T. Morgan finds that the co-ordination theory of valency explains and correlates known facts with regard to mordant dyeing.

The trend of advance in the industry in America, in Great Britain and on the Continent is shown by a real endeavour to meet the demands for fast dyeings and a greater value and utilization of scientific methods in the investigation of processes and the effects produced by them. Colour measuring and matching instruments have been greatly improved and may prove of value in giving a more definite expression to fastness. Products produced by the action of light on vat colours have been isolated, the first of these being the oxidation product, isatin, from indigo dyed cotton (1927). In Great Britain the Society of Dyers and Colourists has appointed a committee with F. Scholefield as chairman to consider the whole question of fastness and already contributions have been made towards elucidating some of the problems. Many of these can only be solved by steady co-operation of workers. In December 1925 the dyeing industry suffered a severe loss by the death of Edmund Knecht, who had enriched tinctorial and analytical chemistry by important researches, many of which are recorded in the pages of the *Journal* of the Society of Dyers and Colourists. "A Manual of Dyeing" by E. Knecht, C. Rawson and R. Loewenthal is a work of reference of international fame. (E. HI.)

DYER, SIR EDWARD (d. 1607), English courtier and poet, son of Sir Thomas Dyer, Kt., was born at Sharpham Park, Somersetshire. He was educated, according to Anthony à Wood, either at Balliol college or at Broadgates hall, Oxford. He left the university without taking a degree, and after some time spent abroad appeared at Queen Elizabeth's Court. His first patron was the earl of Leicester, and he is mentioned by Gabriel Harvey with Sidney as one of the ornaments of the Court. Sidney in his will desired that his books should be divided between Fulke Greville (Lord Brooke) and Dyer. He was employed by Elizabeth on a mission (1584) to the Low Countries, and in 1589 was sent to Denmark. He was knighted and made chancellor of the order of the Garter in 1596. Wood says that many esteemed him to be a Rosicrucian, and that he was a firm believer in alchemy. He had a great reputation as a poet among his contemporaries, but very little of his work has survived. Puttenham in the *Arte of English Poesie* speaks of "Maister Edward Dyar, for Elegie most sweete, solempne, and of high conceit." One of the poems universally accepted as his is "My Mynde to me a kingdome is."

See the collection of his works by *A.* B. Grosart, *Fuller Worthies Library* (vol. iv., 1876).

DYER, JOHN (c. 1700–1758), British poet, the son of a solicitor, was born in 1699 or 1700 at Aberglasney, in Carmarthenshire, and died at Coningsby on Dec. 15, 1758. In 1726 his first poem, *Grongar Hill*, appeared in a miscellany published by Richard Savage, the poet. It was an irregular ode in the so-called Pindaric style, but Dyer entirely rewrote it and printed it separately in 1727. *Grongar Hill*, as it now stands, is a short poem

of only 150 lines, describing in language of much freshness and picturesque charm the view from a hill overlooking the poet's native vale of Towy. A visit to Italy bore fruit in *The Ruins of Rome* (1740), a descriptive piece in about 600 lines of Miltonic blank verse. He was ordained priest in 1741, and held successively various Lincolnshire parishes. In 1757 he published his longest work, the didactic blank verse epic of *The Fleece*, in four books, discoursing of the tending of sheep, of the shearing and preparation of the wool, of weaving, and of trade in woollen manufactures.

His poems were collected by Dodsley in 1770 and by Mr. Edward Thomas in 1903, for the Welsh Library, vol. iv.

DYER, REGINALD EDWARD HARRY (1864–1927), British general, was born at Simla, India, Oct. 9, 1864, and educated at Middleton College, Co. Cork. He entered the army in 1885, took part in 1886–87 in the Burma campaign, in 1888 in the Hazara Expedition, in 1895 in the relief of Chitral, in 1901–2 in the Waziristan blockade and in 1908 in the operations in the Zakka Kiel country. In the World War he commanded the 45th Infantry Brigade. He was awarded the C.B. in 1916 for his success against the Sarhad raiders while in charge of the Eastern Persian cordon, and published an account of his experiences, *The Raiders of the Sarhad* (1921). In April 1919, while Dyer was Brigade Commander at Jullundur, he was called to quell a rising at Amritsar. He used military force, opening fire, without warning, on an unarmed crowd, and causing over three hundred deaths and 1,200 other casualties. His action was called in question by commission of enquiry set up under Lord Hunter. At the enquiry Dyer admitted that, although he believed that the mob could have been dispersed without firing, his attack would have been even more violent if he had not been restricted by space. He said that his avowed purpose was "to strike terror into the whole of the Punjab," and to this end he even refused succour to the wounded. In 1919 he was given command of his brigade to organize the relief of Thal from the Afghan Army, but was subsequently asked to resign by the Commander-in-Chief in India, with the approval of the Army Council. This incident roused a great deal of hostile feeling in India, and the Indian National Council bought the Jallianwala Bagh, the site of the massacre, as a "martyrs' memorial" to be used as a place of pilgrimage. The Duke of Connaught, at the inauguration of the new Indian legislature on February 2, 1921, said, "The shadow of Amritsar has lengthened over the fair face of India." In 1924 interest in the affair was again revived, by the libel action brought by Sir Michael O'Dwyer, Lieutenant General of the Punjab, against Sir Sankaran Nair. In this case Mr. Justice McCardie said in his summing-up, "General Dyer, in the grave and exceptional circumstances, acted rightly . . . and was wrongly punished by the Secretary of State for India." The Labour Government then in office protested against this statement in a letter to the Viceroy, and upheld the action of the previous government in censuring General Dyer. During the remainder of his life General Dyer devoted his time to scientific study and invented a range-finder for sighting aircraft. He died on July 23, 1927, at Long Ashton, Bristol.

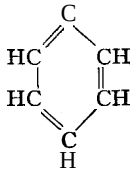
DYERSBURG, a city of north-western Tennessee, U.S.A., 15m. from the Mississippi river; the county seat of Dyer county. It is on the Jefferson Davis highway, and is served by the Gulf, Mobile and Ohio and the Illinois Central railways. The population was 8,733 in 1930 (37% negroes) and was 10,034 in 1940 by the federal census. Large crops of cotton (40,676 bales in 1940), corn. peonies and small fruits are grown in the county; dairy farming is growing in importance; and there are abundant timber resources. The city has flour and saw-mills, spoke and stave factories, a cheese factory, cotton gins and compresses, cotton-seed-oil mills and textile mills employing 1,200. Dyersburg was founded about 1826.

DYES, NATURAL. The utilization of plant products for dyeing is of ancient origin, and without doubt at the first consisted in the staining of material with the coloured juices of fruits, flowers and the like. It would be observed that certain of these effects resisted the washing process, a true fixation of the colour having occurred, and such discoveries would in course of time be extended; but on the other hand few substantive dyestuffs exist in nature, the variety of shade they yield is limited, and their effects in the main are not permanent in sunlight. Again, the observation that the leaf juice of the indigo plant develops a blue colour on keeping, and that the sea-snail, *Murex,* when crushed and exposed to light acquires a purple tint, would prepare the way for the subsequent application to fabrics of both the indigo and the purple of the ancients. The process of isolating indigo from the plant was no doubt preceded by a practice of developing this colouring matter in the leaf itself and the employment of the latter as such in the dyeing process, a method which is still adopted in remote parts of China and Africa.

The antiquity of the use of indigo is evident from the discovery at Thebes of a garment dyed therewith, of date about 3000 B.C., whilst the words "blue" and "purple" occurring in Exodus, xxv. 4, and xxxv. 25, can hardly refer to colours other than indigo and the Murex purple. The latter, also known as "Tyrian" or "royal" purple, was of much importance, and the city of Tyre where, according to legend, it was discovered, became famous for its production. The Scriptural quotation "clothed in purple and fine linen" refers not only to this dyestuff but also to its expensive character. It was only as the result of the discovery of the art of mordanting, however, which occurred (probably in India) not later than 2000 B.C., that the practice of dyeing really advanced, for as a result many natural colouring matters otherwise useless could be applied to fabrics. Thus the Biblical scarlet without doubt refers to the colour given by kermes on alum-mordanted material, whereas both madder and the lac dye of India, which have been in use from time immemorial for red dyeing, only give this colour to fabrics which have been similarly treated. Very ancient too is the use of "archil," a colour resulting from the action of ammonia as stale urine on certain lichens, and referred to by Pliny as of service in reinforcing the shade of the Tyrian purple. Early references to mordant yellow dyestuffs are meagre, though according to the same author, "cotinus" (evidently the shrub *Rhus cotinus,* that is, young fustic and weld, which was the more valuable of the two) was in use for this purpose. Again, saffron was known to both Egyptians and Greeks, and there is evidence of Egyptian use of the yellow colouring matter of safflower as a dye or stain for mummy cloths.

As a result of the discovery of Mexico and South America by the Spaniards at the end of the 11th century, many important dyes indigenous to those countries, as for instance, logwood, old fustic and the like, became available in Europe and provided the dyer with a range of effects formerly inaccessible. Kermes was soon replaced by the richer cochineal, and the employment of weld, young fustic and certain of the minor natural dyestuffs greatly decreased or was restricted to the production of special effects. (A. G. P.)

DYES, SYNTHETIC. Synthetic or artificial dye-stuffs, also known as coal-tar dye-stuffs, artificial colouring matters, aniline dyes, like those of natural origin, are complex compounds of carbon in association with other elements, more especially with hydrogen, nitrogen, oxygen or sulphur. They belong to the class of organic substances included in the aromatic division *(see* CHEMISTRY: *Organic*). Like "aromatic" compounds in general, dyes have their constituent carbon atoms arranged in the form of closed chains. They may be regarded as derived from "closed chain" or "benzenoid" hydro-carbons by the replacement of certain of the hydrogen atoms by atomic groups of other elements. Thus the hydro-carbon benzene or benzol, C_6H_6, has the structure:—

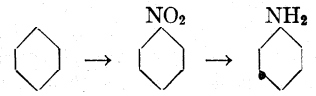


which, for the sake of simplicity, is usually abbreviated to a plain hexagon. The replacement of certain of the hydrogen atoms in this colourless benzene by suitable atomic groups gives rise to dye-stuffs; and these dye-stuffs may contain a single benzene nucleus, or more frequently are constituted of two or more such benzene nuclei united by certain of the atomic groups introduced. Furthermore, the hydro-carbon nuclei which are thus bound together to form a more complex molecule, may be those of the same or of different hydro-carbons. In other words, we may regard the dye-stuff molecule as consisting of one or more chains of carbon atoms, which form the skeleton of the system, and to which are attached various other groups of atoms. Upon the structure and position of the latter groups the character and properties of the dye-stuff (colour, fastness, etc.) mainly depend.

Raw **Materials.**—Nearly all the synthetic dyes are derived from one or other of the five hydrocarbons, benzene, toluene, xylene, naphthalene and anthracene. The most convenient source of these hydrocarbons is coal-tar, obtained in the high temperature carbonization of coal for the manufacture of illuminating gas or of metallurgical coke. The more volatile hydrocarbons, benzene and toluene, are contained also in considerable quantities in the gas produced in these operations and can be extracted therefrom by washing or "scrubbing" the gas with high-boiling solvents. In addition to the hydrocarbons mentioned above, cqal-tar contains a large number of other substances, bases, phenols, and more complex hydrocarbons, most of which find no application in dye-stuff manufacture.

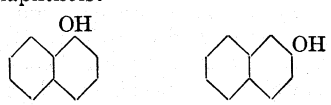
The separation of the useful hydrocarbons from the other compounds present in coal-tar and from each other, is effected by making use of the differences in their boiling-points and other physical and chemical properties. Upon submitting coal-tar to distillation, which is carried out in very large wrought-iron stills containing many tons, the first portion of the distillate contains benzene and methyl-benzenes. This is followed by a fraction rich in the hydrocarbon naphthalene, and finally a high-boiling oil containing anthracene passes over. The two latter substances being solids crystallize out from the oils upon cooling and are separated by filtration. The raw hydrocarbons thus obtained are purified by submitting them to distillation or recrystallization, and also to chemical washing with acids and alkalis. When finally purified benzene, toluene, and xylene are colourless volatile liquids whilst naphthalene and anthracene are colourless solids.

Intermediates.—With these hydrocarbons as starting materials the various dyestuffs are built up in successive stages. In the first place the hydrocarbons are converted into so-called "intermediate products." which are obtained by replacing one or more atoms of hydrogen attached to the carbon nucleus by simple atomic groups such as the amido group NH_2, the dimethylamido group $N(CH_3)_2$, the hydroxy group OH, the sulphonic group HSO_3, etc. Only a few illustrations can be given. Thus from benzene there is prepared by treatment with nitric acid, nitrobenzene, and from this by reduction (hydrogenation) aniline:—



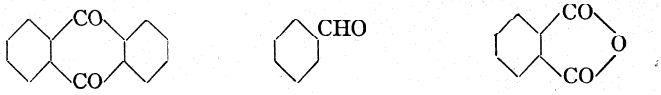
Benzene Nitrobenzene Aniline

From naphthalene there is prepared by the action of sulphuric acid the α and β-sulphonic acids, which upon fusion with caustic soda give α and β-naphthols:—



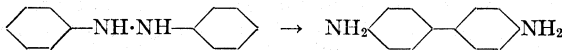
α-Naphthol β-Naphthol

By the action of nitric acid upon naphthalene, nitronaphthalene is obtained, which upon reduction gives α-naphthylamine. On the other hand β naphthylamine is obtained by heating β-naphthol with ammonia and sodium bisulphite under pressure. Again, from the hydrocarbon anthracene there is obtained by oxidation. anthraquinone. a very important intermediate for fast dyestuffs; whilst by oxidation of toluene there is produced benzaldehyde. and of naphthalene, phthalic anhydride:—



Xnthraquinone Benzaldehyde Phthalic anhydride

Rfethyl- and ethyl-anilines are obtained by heating aniline with methyl or ethyl alcohol and an acid under pressure. Diphenylamine derivatives are prepared by causing chloro compounds to react with amido compounds. The base benzidine (*q.v.*), which is an important intermediate for direct dyeing cotton colouring-matters, is obtained by a molecular transposition from hydrazobenzene under the influence of acids, this substance itself being prepared by alkaline hydrogenation of nitrobenzene:—



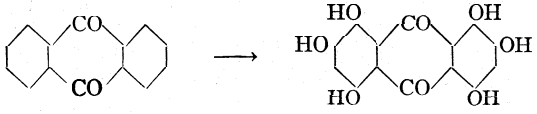
Hydrazobenzene Benzidine

By applying these and similar chemical treatments, and thus introducing two or more of such atomic groups, either of the same or of different kinds, into the hydrocarbon nucleus, there are obtained a great variety of intermediate compounds,—diamines, dihydroxy compounds, amidophenols, naphthol sulphonic acids, naphthylamine sulphonic acids, amidonaphthols, amidonaphthol sulphonic acids, etc. In these compounds isomerism plays an important rôle, since the position occupied by the respective groups in reference to the carbon skeleton is a factor of great importance in determining the properties of the colouring-matter finally resulting.

The commercial importance of some of these intermediates is illustrated by the following production figures for the year 1927 published by the Tariff Commission of the United States (the only country for which statistics are at present available):—

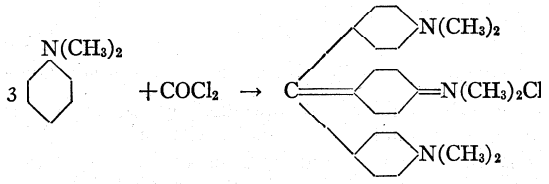
	tons
Aniline	13,542
Dimethylaniline	1,502
Ortho-toluidine	1,145
Para-toluidine	418
Meta-phenylene diamine	331
Meta-tolylene diamine	402
Dinitrochlorobenzene	4,018
Paranitraniline	800
Benzidine	306
Phthalic anhydride	2,275
Sulphanilic acid	656
Metanilic acid	270
β-naphthylamine	298
β-naphthol	2,700
β-naphtholdisulphonic 'acid' R	302
a-naphthylaminesulphonicacid	438
Amidonaphtholsulphonic acid Y	175
Amidonaphtholsulphonic acid J	84
Amidonaphthol disulphonic acid H	202

Dye Synthesis.—The above intermediate products are for the most part colourless bodies like the hydro-carbons from which they are derived. They are convertible into dye-stuffs when, by further chemical treatment, a greater complexity of molecular structure is obtained. This may be effected, (1) by the introduction of further substituent groups, or *(2)* by the linking together of the molecules of two or more intermediate compounds into a larger molecule. An example of the first kind is the formation of the yellow dye-stuff picric acid *(2*:4:6-trinitro-phenol) by the nitration of colourless phenol *(see* CARBOLIC ACID). Another case in point is the conversion of the nearly colourless anthraquinone into the dark blue hexahydroxyanthraquinone (alizarine hexacyanine) by the introduction of six hydroxyl groups:—



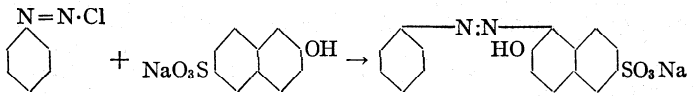
The synthesis of dye-stuffs by the linking together (chemically termed "condensation") of simpler molecules is employed in a great number of cases. Thus crystal violet is obtained by the con-

densation of three molecules of dimethyl-aniline by means of a molecule of phosgene gas:—

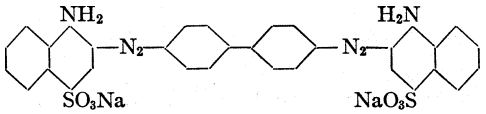


water and hydrochloric acid being also formed in the reaction. This crystal violet is a hexamethyl derivative of pararosaniline. The pentamethyl derivative comprising the chief constituent of methyl violet is made from dimethylaniline, phenol and salt in presence of cupric chloride by the oxidizing action of air.

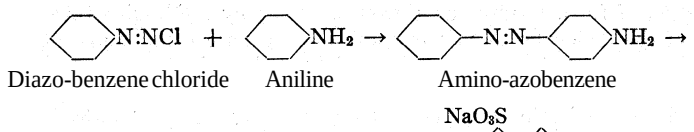
The Diazo-reaction.—The most largely used of all methods of dye-stuff synthesis is the diazo-reaction (P. Griess, 1864), by which the very large class of compounds known as azo-dyes are obtained. The procedure depends upon the fact that almost all primary amino-derivatives of aromatic hydro-carbons, when treated in acid aqueous solution with nitrous acid are converted into diazonium salts. These latter are for the most part colourless compounds of great instability and extremely reactive. When brought in contact with hydroxy or amino-derivatives of aromatic hydro-carbons they "couple" with the latter giving rise to compounds in which the two hydro-carbon residues are united by a double nitrogen group (azo group). For example, when benzene-diazonium chloride or diazo-benzene chloride, derived from aniline hydrochloride, is mixed with an alkaline solution containing, *e.g.*, the sodium salt of Schaeffer's acid (2-naphthol-6-sulphonic acid), a bright orange dye-stuff (crocein orange) is at once produced:—



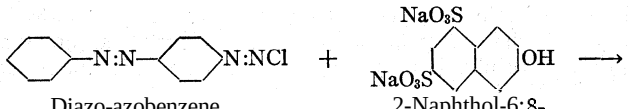
This method of dye-stuff synthesis has proved capable of wide application and is very suitable for technical employment, since it can be effected in cold aqueous solution, gives almost theoretical yields and allows of any required substituent being introduced in prearranged position into the final dye-stuff. When applied to diamino-compounds such as benzidine, it gives rise to dyes containing three hydro-carbon residues (disazo-dyes), such as Congo red:—



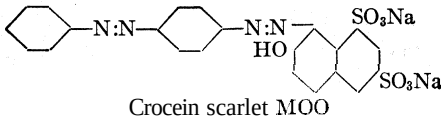
Disazo-dye-stuffs of another type are obtained by coupling diazo-compounds with primary monoamino-derivatives, again diazotizing the free amino-groups in these products and recoupling the diazo-compounds with suitable hydroxy or amino-derivatives. For example:—



Diazo-benzene chloride — Aniline — Amino-azobenzene



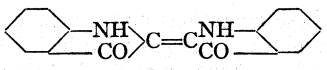
Diazo-azobenzene chloride — 2-Naphthol-6:8-disulphonic acid



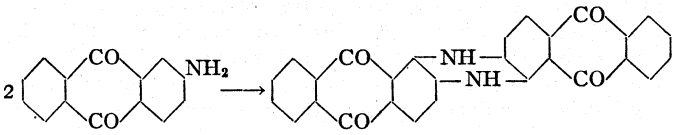
Crocein scarlet MOO

By applying a similar process to diamines, and also by making use of the fact that certain phenols and aminophenols are capable of coupling with more than one molecule of a diazo-compound, azo-dyes can be built up containing three, four or more azo-groups, and a correspondingly increased number of hydro-carbon residues. With growing molecular complexity, the colour of the dye-stuff obtained increases in depth, especially when naphthalene residues are introduced into the reaction. The diazo-reaction can be applied not only for producing dye-stuffs in substance but also for their synthesis within or upon textile fibres, whereby colours can be obtained. Thus when cotton which has been impregnated with an alkaline solution of β-naphthol is passed through a cold solution of diazotized p-nitroaniline, the bright scarlet "para red" is immediately produced and remains fixed on the cotton.

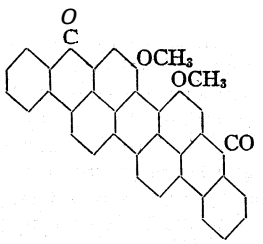
Among the many other methods of dye-stuff synthesis, dependent upon the linking together of hydro-carbon nuclei into more complex molecules, may be mentioned the production of synthetic indigo. The raw materials in this case are aniline and chloro-acetic acid, which upon condensation give phenylglycine. This, upon fusion with caustic alkali, produces indoxyl and by air oxidation indigo:—



The most complex molecular structures are those possessed by the vat dyes of the anthraquinone class. These are obtained by the linking together of two or more anthraquinone residues or by the fusion of these residues with other groups in such a way as to produce new carbon rings. The very fast indanthrene blue RS or duranthrene blue is obtained by heating β-aminoanthraquinone with caustic alkalis and subsequent oxidation by air. The change is thus represented:—



A still more complex example is the dye-stuff caledon jade green which has the structure:—



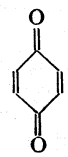
It is obtained from anthraquinone, by first condensing with glycerine, then fusing with caustic soda, oxidizing the product (dibenzanthrone), and finally introducing methyl groups in place of two hydrogen atoms. While initially all the alizarine or anthraquinone dyes were synthesized from anthracene, recently with the cheapening of phthalic anhydride, these dyes are also made by condensation of phthalic anhydride with benzene or its derivatives.

In the United States of America practically all of the anthraquinone dyes are made from phthalic anhydride, and not from anthracene. It will be seen from the examples given that it is possible for the colour chemist to build up dye-stuff molecules having almost any required structure and containing the particular atomic groupings which are known to produce the desired properties. Details of manufacture are given in the books in the bibliography appended.

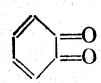
Colour and Chemical Constitution.—The cause of colour in organic compounds is still not fully explained. Most deeply coloured compounds, whether organic or inorganic, exhibit a condition which may be described as *unsaturation; i.e.*, a tendency to take up hydrogen or to pass from a higher to a lower stage of oxidation, accompanied by a disappearance of the

colour. In the compounds of carbon, colour is only present in those having a chain of atoms which are not fully saturated. In the simpler hydro-carbons of the aromatic series, in which this condition exists, colour is not apparent to the eye. Nevertheless, these substances exert a large degree of selective absorption of light in non-visible regions of the spectrum (the ultra-violet). To bring this absorption within the visible portion of the spectrum requires the introduction into the molecule of other atomic groups or the production of greater complexity of structure. It was at one time believed that hydro-carbons were invariably colourless and that only their substituted derivatives containing nitrogen or oxygen were coloured, but a number of complex hydro-carbons are now known which exhibit this property to a high degree.

Quinonoid Structure.—The manifestation of strong colour and dyeing properties amongst aromatic compounds is very frequently found associated with a quinonoid structure; *i.e.*, with a peculiar unsaturated condition of the hydro-carbon ring similar to that occurring in the quinones. Some chemists, in fact, have gone so far as to assert that all dye-stuffs have a quinonoid structure, or are capable of existence in a quinonoid state. The two quinones derived from benzene have the structure:—

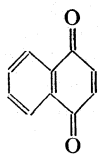


Para-benzoquinone

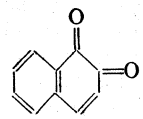


Ortho-benzoquinone

while those derived from naphthalene have the structure:—

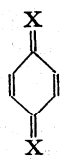


α-Naphthoquinone

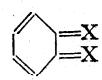


β-Naphthoquinone

Dye-stuffs having a quinonoid structure may be represented therefore upon the general types:—

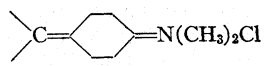


and



Para-quinonoid Ortho-quinonoid

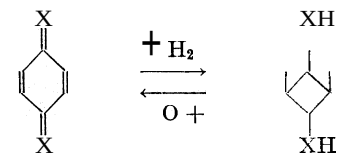
or by similar formulae derived from naphthoquinone or anthraquinone. In these formulae the symbol X may stand for various simple or complex atomic groups. Thus in the formula of crystal violet, already mentioned, the central benzene nucleus,



is quinonoid, and this, or a similar group, is regarded as the source of colour in all the dye-stuffs of the carbonium or triphenylmethane class. It may therefore be termed the chromophor (colour-giver) of this class of dye-stuffs.

Some dye-stuffs are capable of existence both in a quinonoid and a benzenoid (non-quinonoid) form, and may change from one to the other with alteration of conditions (acidity, alkalinity, temperature, solvent, etc.). This transformation is accompanied by a loss or gain of colour. A familiar example is the change of the colourless phenolphthalein (*q.v.*) to its deep red alkaline salts, and the loss of colour of the latter when rendered acid. Such changes probably have an important bearing upon the want of fastness of certain dye-stuffs to light, soap and other agencies, especially in the carbonium class.

Leuco-compounds.—It is a common property of all dye-stuffs, which is obviously associated with their colour, that they readily take up hydrogen with the production of (generally) colourless compounds. While in the case of nitro, nitroso and azo dyes, amino-compounds are thereby produced, from which the original dyes cannot be reconstituted, all other classes of colouring-matters are converted with greater or lesser ease into so-called leuco-compounds. These leuco-compounds contain two atoms of hydrogen more than the original dye from which they are formed, and are reconvertible into the latter upon oxidation. The above facts receive a ready explanation from the quinonoid hypothesis and may be represented by the general expression:—



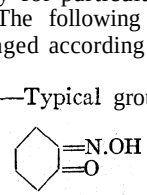
In other words, the reduction (hydrogenation) of dye-stuffs, as of their prototypes the quinones, gives rise to more saturated benzenoid compounds. In the case of the dyes of the indigo and anthraquinone groups alone, are the leuco-compounds coloured, these exceptions being probably referable to the presence in the dye of two chromophoric groups, only one of which is hydrogenated so that the leuco-compound is still quinonoid.

The facility with which the leuco-compounds derived from dye-stuffs of various classes are reoxidized to the original dye-stuffs varies with the structure, and is probably dependent upon whether the dye-stuff has an ortho-quinonoid or a para-quinonoid configuration. The leuco-compounds of indigo dyes, which must have an orthoquinonoid constitution, are readily oxidized by air, while those of the triphenylmethane, indophenol and indamine classes, to which only a paraquinonoid structure can be ascribed, are fairly stable to atmospheric oxidation and require the application of a stronger oxidizing agent, such as chromic, persulphuric, or permanganic acid, to restore their colour.

Classification of Dyes.—While the hydro-carbon framework of the dye-stuff molecule may be regarded as primarily responsible for the existence of colour, the specific properties of the dye, such as shade, affinity for particular fibres, fastness, or behaviour to reagents, depend largely upon the particular atomic groups with which this framework is clothed. These atomic groups are of two kinds, namely (a) chromophoric groups, nitro, azo, carbonium, etc., and (b) salt-forming groups, such as basic, acidic, hydroxylic, sulphide groups. While the atomic groupings of the first kind determine the chemical class to which a particular dye-stuff belongs and its behaviour when submitted to hydrogenation and reoxidation, those of the second kind are largely responsible for its dyeing properties and the resistance of the dyed material towards soap, alkalis, acids, milling, light, etc. A dye-stuff molecule of almost any class may be given basic, acidic, or mordant-fixing properties by the introduction of amino [NH_2 or $N(CH_3)_2$], sulphonic (HSO_3), or hydroxyl (OH), groups respectively in suitable positions. Dye-stuffs are therefore classified in two ways, that is *(a)* in *chemical* classes dependent on the specific chromophor present, and (b) in dyeing classes according to dyeing properties and affinity for particular fibres.

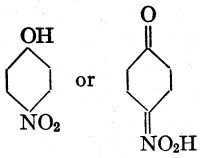
Chemical Classes.—The following are the most important classes of dye-stuffs arranged according to their constituent chromophoric groupings:

I. *Nitroso-compounds.*—Typical grouping:—

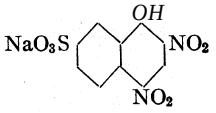


This is a very small class, obtained by the action of nitrous acid upon phenols or phenol-sulphonic acids, and mainly represented by naphthol green and fast green O. They are employed as iron lakes, the nitroso-group having the property of forming stable compounds with heavy metallic oxides.

II. Nitro-compounds.—Typical grouping:—

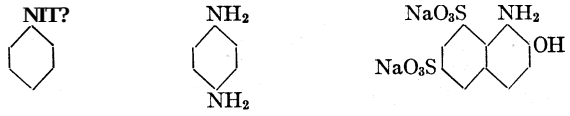


This is also a small class, consisting of yellow acidic dyes, such as martius vellow and naphthol yellow S. The latter has the constitution:—



and is obtained by the action of nitric acid upon nitroso-I-naphthol-2:7-disulphonic acid. Picric acid, no longer used as a dye but as an explosive, also belongs to this class.

III. Aso-compounds.—Typical grouping:— $R-N:N-R$, in which R stands for hydro-carbon residues of the benzene or naphthalene series. This is a very large class of dye-stuffs with over 500 members in general use. The annual production in the United States (for which country alone statistics are available) is approximately 13,500 tons, valued at over $15,000,000 (£3,000,000). The azo-compounds comprise members of nearly every shade and exhibit a great variety of properties according to structure and the auxiliary atomic groupings present. The azo (N_2) group may be present in the molecule once, twice, three or more times, the number of hydro-carbon nuclei thus linked increasing with the number of azo-groups. The simpler azo-dyes are usually yellow to red, those of more complex structure, especially when containing naphthalene nuclei, violet, blue or black. Lake formation also leads to a deepening of the colour; thus the red chromotropes, containing only one azo-group, become dark blue upon conversion into chromium lakes. Under the action of reducing agents such as sodium hydrosulphite, stannous chloride or zinc dust, the azo-dyes are split up into two or more colourless amino-compounds, each N_2 group being severed between the two nitrogen atoms. Thus crocein scarlet, MOO, the structure of which has already been given, yields upon boiling with zinc dust and ammonia the following three products:—

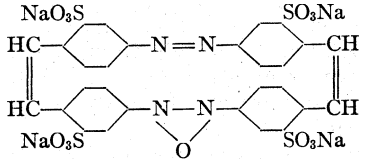


Aniline — p-phenylenediamine — 1:Amino-a-naphthol-6:8-disulphonic acid

By separating and identifying the products of reduction, the structure of the azo-dye may be inferred, and this procedure has become a valuable method of examination and analysis. When the constitution of the dye-stuff is known, the determination of the amount of hydrogen consumed during its reduction, best ascertained by titration with a standard solution of titanious chloride, serves as a convenient and accurate method for the quantitative estimation of the dye either in substance or upon textile fibres.

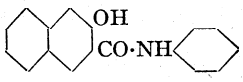
The property possessed by azo-dyestuffs of being resolved by hydrogenating agents into colourless components is also of value to the calico printer. In the production of so-called "discharge" or "foulard" styles, cotton or silk materials which have been dyed dark blue or other shades with appropriate azo-dyes, are printed with thickened reducing agents. Upon steaming the material the azo-colour is discharged leaving a white pattern upon a coloured ground. Certain azo-dyestuffs contain, in addition to the N_2 group, a second chromophore. Upon reduction, such dyes give the parent amino-compound, for example indoin blue gives safranine, while primuline red gives the yellow primuline. Oxidizing agents also effect a splitting of azo-dyes into two or more products, but in this case the division does not occur between the two nitrogen atoms, for the azo-group is left intact as a diazonium group attached to one of the hydro-carbon residues. By the action of strong nitric acid upon para red, nitro-diazobenzene nitrate and nitro-@-naphtholare obtained.

A special class of dye-stuffs containing the azo-group but obtained without the employment of the diazo-reaction, by the intra-molecular rearrangement of p-nitro-toluene-o-sulphonic acid, is the stilbene series. When p-nitro-toluene-o-sulphonic acid is submitted to the action of aqueous caustic soda, a yellow dye-stuff, direct yellow *R*, is formed, having the constitution:—



This yellow compound is the most important member of this series, over 200 tons valued at $200,000 (£40,000) being sold annually in the United States alone. Upon alkaline reduction it gives rise to other members of this group. The dye-stuffs of the stilbene series dye cotton directly and exhibit a greater fastness to light than other azo-dyes. They also behave differently with reducing agents, for instead of being at once split into colourless components they give at first hydrazo-compounds which are readily reoxidized to the stilbene dye-stuff.

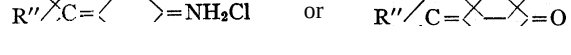
Azo-dyes which do not contain a salt-forming group, acidic or basic, are insoluble in water and therefore cannot be used in ordinary dyeing operations. They are employed as pigment colours (ground with mineral materials), and for colouring oils: waxes and varnishes. Certain of them also find a large and increasing application as colours produced on, or within, the fibre itself, and which on account of their insolubility are very resistant to washing, bleaching and light. The typical example of this class is para red, to which reference has already been made. This method of dyeing has been greatly extended by the introduction of the so-called *azoic* series, in which the cotton is impregnated with an anilide of β-oxynaphthoic acid (known commercially as a "naphthol AS" compound), such as



and subsequently passed through a bath containing the diazo-compound of a nitroaniline, nitrotoluidine, nitrochloroaniline, naphthylamine, etc. Certain of the reds obtained in this manner exhibit a very high degree of fastness, even resisting the process of cotton bleaching known as "bowking."

The group of azo-dyes may be divided according to their dyeing properties into the following subdivisions: (a) Neutral or pigment colours; (b) basic dyes: a small group represented by chrysoidine, Bismark brown, and a few other products; (c) acidic dyes: a large group to which the ordinary wool yellows, oranges, scarlets and blacks belong; (d) mordant dyes or chrome dyes: used in dyeing fast colours on wool or in cotton printing; (e) direct substantive or salt dyes: a large group of colouring-matters which have an affinity for cotton and other cellulose fibres; (f) acetate silk dyes (ionamines, S.R.A. colours, etc.): a class of recent introduction, dyeing acetyl-cellulose ("Celanese," etc.), but having no affinity for cotton, linen, or viscose silk; (g) spirit soluble dyes: employed in the colouring of stains, varnishes, waxes and gasolene (petrol).

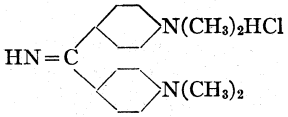
IV. *Carbonium* or *Triphenylmethane* Compounds.—Characteristic grouping:—



in which R' and R'' may both represent benzene nuclei or R' may be a benzene nucleus and R'' a naphthalene nucleus. Crystal and methyl violet, the constitutions of which have been given already, are typical members of this class. In the United States in 1926 over 1,000 tons of the carbonium dyes were sold for over $3,000,000 (£600,000).

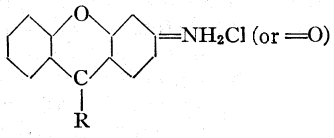
The carbonium dye-stuffs are characterized by very brilliant and intense shades of red, violet, blue and green. They have basic, acidic, or mordant fixing properties, according to the auxiliary grouping they contain. As a class they are rather deficient in fastness to light, and frequently also in fastness to washing and alkalis, by which they are partially decolourized. This loss of colour, especially noticeable in the case of the alkali and soluble blues, is attributed to a change of type from a quinonoid to a carbinol structure. It is diminished by the introduction of a chlorine atom or a sulphonic or other group into one of the benzene nuclei in a contiguous (ortho) position to the central carbon atom. Setoglaucine, patent blues, erioglaucines, xylene blues and some of the acid violets possess such a structure and exhibit a degree of fastness to washing superior to that of the other members of the class. The basic dyes of the carbonium series are represented by magenta, methyl violet, crystal violet, malachite green, brilliant green, setoglaucine, setocyanine, and the Victoria blues. The acidic members comprise acid magenta, alkali and soluble blues, acid greens, acid violets, patent blues, erioglaucines, xylene blues, etc. The mordant-fixing members are known as eriochrome azurols and eriochrome cyanines. their mordant-fixing property being due to the presence of a carboxyl group in the molecule.

The bright yellow basic dye, auramine, which has the constitution:

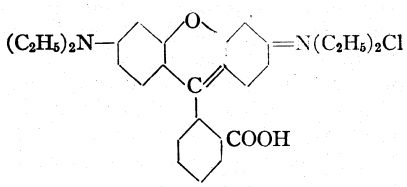


should also be classed as a carbonium compound, though it has but two benzene nuclei. The basic carbonium dyes have powerful toxic and antiseptic properties; thus auramine is employed in surgery, especially in operations upon the eye. It appears probable that derivatives of these dyes containing "labile-acidic" groups such as the sulphato-group $C_2H_4{\cdot}OSO_3H$, which can be split off in the organism, may find application in internal medicine. It has also been observed that the leuco-derivatives of the carbonium dyes, which are far less toxic than the dye-stuffs themselves, exert a powerful neutralizing effect upon certain disease toxins such as those of diphtheria and tetanus.

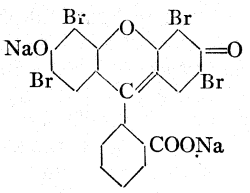
V. Xanthene, Pyrone or *Phthalein* Class. — Characteristic grouping:—



This class, consisting partly of basic and partly of acidic and a few mordant-fixing members, comprises some of the most brilliant dye-stuffs available to the colour user. In the United States the consumption during 1926 was over 250 tons valued at over $700,000. They are closely related to the carbonium class, from which they differ by the presence of an oxygen atom linking two of the benzene nuclei, and are less liable than the latter class to undergo conversion into colourless carbinol forms, and hence are faster to alkalis, soap and milling. The basic members of this class are known as rhodamines. the B brand of which has the structure:



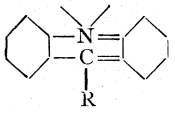
and is obtained by condensing phthalic anhydride with *m*-diethylamino-phenol. The acid rhodamines and fast acid violets are sulphonic acids of the basic dyes. The eosines are weakly acidic and have a phenolic structure, for example eosine A:—



The eosines are capable of forming unstable metallic lakes and their lead salts are employed for the preparation of bright red pigments ("vermillionettes") used in poster printing. The unbrominated compound, fluorescein (*q.v.*), has a yellow colour and in alkaline solution an intense green fluor scence, which is apparent at extreme dilutions and has led to the dye-stuff being employed for tracing the course of underground streams and the contamination of water supplies by drainage.

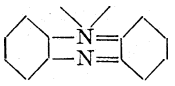
In their behaviour towards reducing agents, the xanthene colours are distinguished from the carbonium class by a greater resistance to decolourization, and a somewhat greater oxidizability of their leuco-derivatives. In this respect they occupy an intermediate position between the para- and the ortho-quinonoid classes of dye-stuffs. The eosines and rhodamines, when not containing sulphonic acid groups, are taken up from aqueous solution by ether, the former from an acid medium, the latter from an alkaline or neutral medium. The sulphonated (acidic) members of both classes are entirely insoluble in ether. The eosines, being brominated or iodinated compounds, are further characterized by the liberation of the respective halogen when heated with sulphuric acid and manganese dioxide.

VI. *Acridine* Class. — Characteristic grouping: —



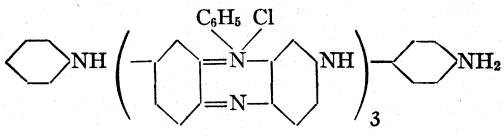
This is a small class of yellow and orange dyes containing basic members only, which find their main application in leather dyeing, calico printing and medicine. The chief representatives are phosphine, acridine yellow, acridine orange, benzoflavine and rheonine. Acriflavine (see ACRIDINE) has obtained considerable importance in surgery as a local antiseptic, but is not employed in dyeing. The Acridine dye-stuffs are somewhat resistant to reduction and are therefore not easily decolourized by hydrosulphite.

VII. *Azine* Class, — Characteristic grouping: —



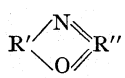
This class contains both basic and acidic dye-stuffs, ranging in shade from red to blue. While the basic members are represented by the red safranines and by the blue to black spirit-soluble indulines and spirit-soluble nigrosines, the acidic members comprise the rosindulines, water-soluble nigrosines, water-soluble indulines, indocyanines, acid cyanines, etc. Closely related to safranine is Perkin's mauve, the earliest coal-tar dye-stuff. The indulines and nigrosines find their chief application in the colouring of leathers, oils and waxes (boot polishes, printing inks and lacquers), and more than 800 tons are sold annually in the United States alone.

Aniline black is an insoluble dye, which is produced on the cotton fibre by impregnation of the latter with salts of aniline and subsequent oxidation with chlorates, dichromates, etc. It is largely employed in the dyeing of cotton cloth and in calico printing. The colouring-matter is a very complex azine containing eleven benzene nuclei and probably represented by the following formula:—.

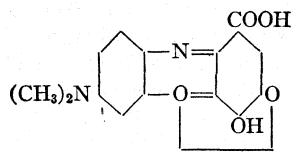


The fastness of aniline black to light and atmospheric influences depends on the completeness with which this complex structure is formed in the dyeing process. The quantity of aniline black present upon dyed cotton can be estimated by first removing all finishing materials and other dye-stuffs and then determining the nitrogen present by the Kjeldahl method, using about 5 g. of cloth. The percentage of nitrogen found, subtracting 0·1% for that normally present in the cotton fibre, gives when multiplied by the factor 6·6 the percentage of aniline black.

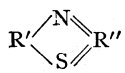
VIII. *Oxazine* Class.—Characteristic grouping:—



in which R' is a benzene nucleus and R'' a benzene or naphthalene nucleus. This class comprises the basic dyes, Meldola's blue, nile blue, capri blue, and cresyl blue; also the basic-mordant dyes, gallocyanines, gallamine blue, celestine blue, prune, delphine blue, modern violets, modern cyanines, anthracyanines, chromazurines, etc. The dyes of the latter category possess both "basic" and "mordant-fixing" properties and are employed in calico printing. Gallocyanine has the following structure:—

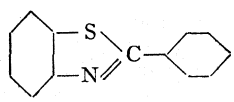


IX. *Thiazine* Class.—Characteristic grouping:—

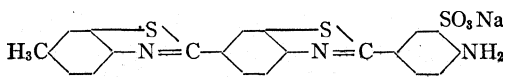


To this class belongs the important basic dye-stuff, methylene blue together with the acidic dye-stuff thiocarmine, the mordant-fixing dyes, brilliant alizarine blues and indochromine. The thiazine chromophore is probably present also in the blue and black dye-stuffs of the "sulphide" class. The leuco-compounds of this and the two preceding classes are very oxidizable, being readily reoxidized by air into the original dye-stuffs.

X. *Thiazole* Class.—Characteristic grouping:—

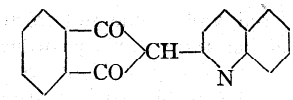


The most important dye-stuff of this class is the diazotizable dye-stuff, primuline, in which the typical thiazole group is present twice:—



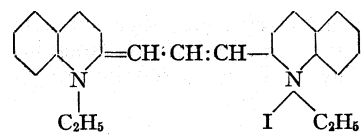
This colouring-matter dyes cotton directly in primrose-yellow shades, which, owing to the presence of an amino-group, can be diazotized and coupled on the fibre. Thus the largely used primuline red is produced by passing cotton dyed with primuline through an acidified solution of sodium nitrite and afterwards through an alkaline bath of β-naphthol. The colours thus obtained are very fast to washing. Other members of the thiazole class which dye cotton directly, though they are not diazotizable, are chlorophenine yellow, Clayton yellow and thioflavine S. Thioflavine T has basic properties and is used in calico printing, giving very pure greenish-yellow shades. In the thiazole class also belong the direct-dyeing reds, erika, geranines, titan pink and diamine rose, which contain an azo-group in addition to the thiazole chromophore. The thiazole chromophore is difficult to reduce and those dyes containing this group only are but little affected by reducing agents. When, however, as is the case with developed colours from primuline, an azo-group is also present, the latter suffers disruption and the parent thiazole remains.

XI. *Quinoline* Class.—Typical representative, quinoline yellow spirit-soluble:—



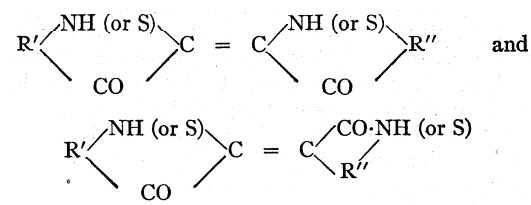
This compound is obtained from 2-methyl-quinoline and phthalic anhydride. It is insoluble in water and is only used for colouring varnishes and oils, but its disulphonic acid, quinoline yellow water-soluble, is an acidic dye-stuff giving bright greenish-yellow fast-to-light shades upon wool and silk.

Certain derivatives of the quinoline series, although too fugitive to be used for dyeing, find a very important application in photography as "sensitizers" in the manufacture of panchromatic or autochrome plates. These dyes are obtained by the action of alkalis on quaternary ammonium derivatives of quinolines and methyl-quinolines, either alone (isocyanines) or in presence of formaldehyde (carbocyanines). Examples of these products are ethyl red, pinaverdole, pinachrome, pinacyanol, kryptocyanine and dicyanine **A.** Pinacyanol, for example, has the constitution:



and is prepared by adding formaldehyde and caustic potash to a boiling solution of 2-methyl-quinoline ethyl iodide. Photographic plates treated with these dye-stuffs become exceedingly sensitive to red light, and in some cases (*e.g.*, dicyanine **A**) even to infra-red rays.

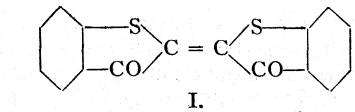
XII. *Indigoid* Class.—Characteristic groupings:—



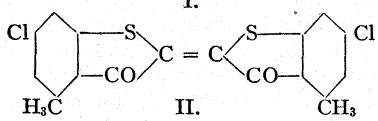
Until 1905, this class of dye-stuffs was represented only by indigo itself, its isomeride indorubin and its sulphonic acid indigo carmine. As a result of the intensive research promoted by the successful synthesis and manufacture of indigo from benzene derivatives, a large new class of analogous dye-stuffs has become known (thioindigo series, ciba series, helindone series, etc.). These possess in general the same dyeing properties as indigo itself, *i.e.*, they are insoluble in water and when reduced to their leuco-compounds they dissolve in alkalis, and from such solutions are absorbed by animal and vegetable fibres; *i.e.*, they are "vat" dyes. Originally obtained by fermentation of the expressed sap of the Indigofera *tinctoria* and other similar plants growing in India, Java, etc., indigo is now produced almost entirely artificially by chemical means. This synthesis, which has already been mentioned, ranks with that of alizarine as one of the greatest chemical achievements of the 19th century. The manufacture was commenced about 1900 and synthetic indigo has now almost entirely replaced the natural product, the production greatly exceeding that of any other individual dye-stuff and amounting for the world to about 10,000 tons of 100% product per annum with an approximate value of over £4,000,000. In the United States alone in 1926 there were sold 14,219 tons of the 20% paste (2,843 tons of 100% product) at an average price of 12·8 cents per pound, which was below the pre-war price of 1913, when all the indigo consumed there was imported from Germany and Switzerland.

Many members of the indigo class contain chlorine or bromine atoms in substitution for hydrogen in the two benzene nuclei: thus ciba blue 2B is a tetrabromo-derivative of indigo and dyes clearer and brighter shades of blue than the parent dye-stuff.

Thioindigo red has the structure **I.**, while helindone pink is represented in **II.**



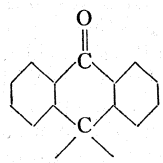
I.



II.

Indigo itself and many of its analogues exhibit the unusual property of being volatile at high temperatures and thus of giving coloured vapours on heating. Being more or less neutral in properties, the indigoid dyes can be extracted from the animal or vegetable fibre by organic solvents such as pyridine or cresol, and extraction by these solvents forms the basis of a convenient method for estimating indigo on wool or cotton materials in the presence of other dye-stuffs. Upon reduction, indigoid dyes give rise to leuco-compounds which have a yellow colour and are readily reoxidized by air to the original dye.

XIII. Anthraquinone Class.—Representative grouping:—



This important class contains acidic, mordant-fixing and vat-dyeing members, all of which are remarkable for a high degree of fastness to light. The older members, comprising the alizarines, purpurines, alizarine cyanines and alizarine blues, mostly hydroxy-derivatives of anthraquinone, are mordant-fixing colouring-matters. With aluminium, chromium, or iron hydroxides, they produce fast colours, the shades of which vary with the metallic hydroxide employed. Thus the typical dye-stuff, alizarine, yields with aluminium, a red; with chromium, a maroon; and with iron, a purple. When fixed upon a compound mordant of aluminium, calcium and a fatty acid, the celebrated Turkey red is produced. This colour was originally dyed by means of madder, the ground root of the Rubia *tinctorum,* which contains alizarine, and which up to about 1875 was grown in large quantities for this purpose. The synthesis of alizarine from the hydro-carbon anthracene by Graebe and Liebermann in 1868 laid the foundation for the artificial manufacture of this dye-stuff, and also for the great developments in anthraquinone chemistry which have followed since. In a few years the natural colouring-matter was entirely replaced by the synthetic, the manufacture of which is effected by oxidizing anthracene to anthraquinone, converting this into a sulphonic acid and fusing the latter with caustic soda.

The acidic members of the anthraquinone class are represented by alizarine red WS, alizarine acid blues, acid alizarine green, alizarine saphirol, alizarine astrol, alizarine irisol, alizarine cyaninol, alizarine rubinol, alizarine direct blue, alizarine cyanine green, cyananthrols, etc. Many of these dye wool directly from an acid bath without a mordant while others give shades which are faster to washing when a mordant is used (acid-mordant dyes). The vat dye-stuffs of the anthraquinone series are the fastest dye-stuffs known. They comprise the indanthrene (duranthrene) series, the caledon series, algol colours, cibanone colours, ponsol colours, etc., the first representative of which, indanthrene blue RS, was discovered in 1901 (vide supra). Many of these dyes have an extremely complex constitution, containing two or more anthraquinone residues united together by other groups or fused in such a way as to produce new ring structures. In these structures at least one of the two carbonyl (CO) groups of each anthraquinone residue remains intact, and it is to this group that the property of vat dyeing is to be attributed.

All the anthraquinone dye-stuffs, to whichever dyeing class they belong, exhibit the property of giving upon reduction deeply coloured leuco-compounds which usually reoxidize readily. The colour of these often differs remarkably from that of the original dye-stuff: for example, the lenco-compound of flavanthrene is blue, reoxidizing in air to yellow. The application of stronger reducing agents frequently converts the first leuco-compound into a more stable second leuco-compound from which the dye-stuff is not easily regenerated.

Dye Classes.—In the previous section the synthetic dyes were regarded from the standpoint of their chemical or chromophoric structure. It is now proposed to consider their dyeing properties and the dependence of the latter upon specific constitution or the presence in the molecular structure of particular atomic groupings. In the different categories there will frequently be found representatives of several chromophoric classes (see DYEING).

I. Basic Dyes.—The basic dyes are salts. usually hydrochlorides of coloured bases containing amino or substituted amino-groups, such as NH_2, $N(CH_3)_2$, $N(C_2H_5)_2$, etc. They dye animal materials—wool, silk, leather, feathers, etc.—directly from a neutral bath, but possess for vegetable fibres, jute excepted, only a small affinity. They are applied to cotton and linen by mordanting these fibres with tannin and a metallic salt, such as a salt of antimony, which produce insoluble compounds with the dye base. In calico printing, for which dye-stuffs of the basic class find their chief application, a thickened mixture of the dye-stuff with acetic acid and tannin is printed upon the cotton. This is then steamed to drive off acetic acid, leaving the insoluble dye tannate, the fixation of which is completed by passing through a bath of antimony potassium tartrate. The basic dyes can be applied to jute, hemp and cocoanut fibre without a mordant and are frequently used for dyeing these materials. Some are used for lake pigments for wall-paper printing, while the salts of certain dye bases with the higher fatty acids, oleic, linoleic, stearic or resin acids, are used for colouring oils, varnishes, etc.

The basic dye-stuffs appear to owe their affinity for animal fibres to a chemical combination (salt-formation) occurring between the amino or substituted amino-groups of the dye and the carboxylic acid groups (CO_2H) of the wool or silk protein. The maximum affinity for these fibres is exerted in a neutral or slightly alkaline bath, and conversely the dye-stuff can be partially removed from the dyed fibre if the latter is boiled with a dilute acid. Loss of colour on boiling with a 5% solution of acetic acid therefore forms a suitable test for distinguishing dye-stuffs of this class when dyed upon animal fibres. Before testing vegetable fibres (cotton or linen) it is necessary to remove the tannin mordant by boiling with dilute caustic soda saturated with common salt, which leaves the released dye base on the fibre, from which it can then be removed by dilute acid. The addition of caustic soda to a solution of a basic dye-stuff usually precipitates the dye base, though in a few cases (*e.g.*, safranine) the base remains in solution. The best test for distinguishing basic dye-stuffs from other classes of dyes is the production of an insoluble precipitate on the addition of a solution of tannin and sodium acetate. The most important basic dyes belong to the triphenylmethane and xanthene classes. These are magenta, methyl violet, malachite green, brilliant green, setocyanine, rhodamines, etc. They are remarkable for extreme brilliancy and tinctorial power, but unfortunately their resistance to light leaves much to be desired. Basic members of the azine, oxazine and thiazine classes are safranine, rhoduline reds, spirit-soluble induline, spirit-soluble nigrosine, Meldola's blue, nile blue, capri blue, etc. The azo-class is mainly represented by chrysoidine and Bismarck brown.

II. Acid *Dye-stuffs.*—These are salts, usually sodium salts, of coloured compounds containing acidic groups, especially the sulphonic group, SO_3H. They dye animal fibres (silk and wool) directly from an acidified solution. Certain of them (notably acid violets, wool blues and quinoline yellow) will also dye wool from a neutral bath. For cotton and other vegetable fibres they have little or no affinity, but are used to some extent in the dyeing of jute and book-binding cloths which are not required to be washed. They find their chief application in the dyeing and printing of wool and silk. In the production of lake-pigments many of the acid dye-stuffs are extensively employed (*e.g.*, naphthol yellow, azo scarlets, azo oranges, eosines, etc.), for which purpose they are precipitated as insoluble salts upon a mineral substratum by addition of barium chloride, etc. Certain acid dye-stuffs

(lithol reds, lake reds, pigment yellows, monolite reds and yellows, etc.) are manufactured especially for this purpose.

The acid dyes owe their affinity towards animal fibres to the sulphonic or other acid groups they contain, which doubtless enter into combination (salt-formation) with the amino-groups of the protein molecules. As such combinations have little stability, the dyes of this class are generally deficient in fastness to alkalis and soap, which by neutralizing the dye acid loosen its attachment to the fibre. Loss of colour upon boiling the dyed material with a 1% solution of ammonia serves as a convenient test for recognizing this class of dye-stuff. It is to be noted however that certain acid dye-stuffs (sulphone cyanines, sulphone azurines, milling reds, etc.) have a higher degree of fastness to alkalis than the normal, which is probably to be referred to the possession by these compounds of a supplementary affinity for the fibre similar to the substantive properties possessed to a greater degree by the direct dyes (see IV. below).

Acid dyes which contain carboxyl (CO_2H) groups or hydroxy (OH) groups in suitable positions frequently exhibit an affinity for metallic mordants, by the presence of which their attachment to the fibre can be increased. Such colouring-matters, which occupy an intermediate position between acid dyes and mordant-fixing dyes proper, are termed acid-mordant or chrome dyes (see III. below). A special class of the latter is supplied to the consumer in the form of already prepared copper or chromium compounds, which when dyed from an acid bath give very fast colours (fast acid red RH, fast acid purple, neolans, palatine fast colours, etc.). Naphthol green B is similarly an acid-dyeing iron compound of the nitroso-class. Most of the acid dyes are azo-compounds, *e.g.,* fast yellow, metanil yellow, orange II., acid scarlets, fast reds, carmoisine, lissamine red, naphthalene blacks, etc. The acid dyes of the carbonium class comprise acid magenta, soluble and alkali blues, patent blues, acid violets, acid greens, etc. The eosines, acid rhodamines and fast acid violets belong to the xanthene class, the water soluble nigrosines, water soluble indulines, wool fast blues, wool fast violets and indocyanines to the azine class. The acid dyes fastest to light are those of the anthraquinone class, namely alizarine saphirol, alizarine irisol, alizarine emeraldol, alizarine cyanine green, alizarine direct blues, etc.

III. Mordant and *Chrome* Dyes.—These are coloured compounds containing particular groups, usually OH or CO_2H groups, capable of forming stable coloured lakes (co-ordinative compounds) with metallic hydroxides, particularly with those of chromium, aluminium, iron and copper. The mordant dye-stuffs proper comprise many of the older natural colouring-matters, much as logwood, fustic, cutch, cochineal, Persian berries and brazilwood, but only a few synthetic dyes, which belong chiefly to the anthraquinone class (alizarine, purpurines, alizarine blue, alizarine cyanines, anthragallol, etc.). Most of the mordant-dyeing colouring-matters of synthetic origin contain acid groups (SO_3H or CO_2H, or both) and may therefore be classified as acid-mordant colours. These are mainly used on a chromium mordant and are therefore generally termed chrome colours. In wool dyeing the chromium mordant (sodium bichromate, chromium acetate or chromium fluoride) is applied to the wool either before or after dyeing, or even more frequently (metachrome or solochrome colours) both dye stuff and mordant (chromate) are added together to the dye-bath. The shades dyed with mordant and acid-mordant dye-stuffs are generally much faster to alkalis and therefore to washing and milling than those obtained with ordinary acidic dyes, whilst the resistance to light, more particularly of those belonging to the anthraquinone group, is very good. Mordant dyes are also employed in calico printing, in which case the solution of the dye-stuff suitably thickened is mixed with chromium acetate and acetic acid, printed upon the cotton cloth and steamed.

Whilst many mordant dye-stuffs are not greatly altered in shade by combination with the mordant, in some cases a complete change of colour is produced. Thus the yellow alizarine gives a red with aluminium and a purple with an iron mordant; the red chromotropes are changed to dark blue or black by chromium salts or chromic acid; and with the same mordant the red eriochrome azurol becomes blue. A special category of the mordant dye-stuffs are those which also contain basic groups. These may be termed basic-mordant dyes and belong chiefly to the oxazine class (gallocyanines, etc.). They are distinguished from acid-mordant dyes by giving a precipitate with tannin and sodium acetate. The only general method for distinguishing mordant dye stuffs on the fibre from other alkali-fast dyes, consists in seeking the metallic hydroxide. In the case of chromium this is readily accomplished by burning the dyed fibre and testing the ash. The mordant or chrome dyes of the azo-class comprise the alizarine yellows, milling yellows, palatine chrome red, diamond blacks, eriochrome blacks, solochrome browns, reds and blacks, and many others. The carbonium class is represented by the eriochrome azurols and eriochrome cyanines; the xanthene class by gallein, coeruline and ultraviridine; the thiazine class by the brilliant alizarine blues; and the anthraquinone class by alizarine, purpurine, alizarine cyanines and anthracene blues.

IV. Direct, *Substantive* or *Salt* Dyes.—These are colouring matters which dye cotton or other vegetable fibres from a neutral or alkaline solution without the application of a mordant or fixing agent. They dye animal fibres in a similar manner and also from an acid bath. They are therefore said to have a substantive affinity for these fibres. Like the acid dye-stuffs they are sodium salts of sulphonic acids, but while with the acid dyes it is the free colour acid which is taken up and combined with the fibre, in the case of the direct dyes the compound is absorbed as a whole (hence the term salt dyes). The cause of this direct affinity or substantivity is not precisely known, but it appears to be associated with long-chain structures in the dye-stuff and the presence of hydroxy-groups in the fibre itself. Acetate silk, in which the hydroxy-groups of cellulose are etherified, displays no affinity for these dye-stuffs. The direct dye-stuffs are mainly used in cotton dyeing and printing and in the dyeing of those types of artificial silk which consist of pure cellulose (viscose silk). For the latter purpose a special class of these dye-stuffs (icyl colours) has been introduced, giving more level shades than the ordinary direct cotton dyes, the affinity of which is frequently too great. Certain direct dyes are also employed in wool dyeing giving faster colours than ordinary acid dye-stuffs (diamine fast red, milling scarlet, etc.). A few contain mordant-fixing groups and can be dyed upon wool with a chrome mordant or fixed upon cotton by after treatment with a metallic salt (chromium or copper). Certain of these (sirius colours) are supplied as ready-prepared copper compounds for dyeing cotton directly in shades fast to light.

The direct dyes are a very numerous group, the principal categories of which are the following: (a) Diamine colours, consisting of azo-compounds derived from diamino-bases, such as benzidine. These include amongst others congo red, benzopurpurine, rosophenine, chrysophenine, diamine blues, diamine greens, diamine blacks and chlorazol colours. (b) J-acid colours, consisting of dye-stuffs obtained by coupling diazo-compounds with benzoyl or carbonyl derivatives of 2-amino-5-naphthol-7-sulphonic acid. They comprise the benzo fast scarlets, diamine azo scarlets, rosanthrenes and diazo brilliant scarlets. (*c*) Stilbene dyes, consisting of azo-compounds containing the group $C_6H_5{\cdot}CH{:}CH{\cdot}C_6H_5$, and comprising direct yellow, stilbene yellows and mikado oranges. (d) Thiazole dyes, comprising primuline yellow, clayton yellow, chlorophenine, erika, diamine pink, geranine and rosophenine 10B.

V. Developed *Colours.*—Many of the preceding class of dyes when containing a free amino-group, are capable of being converted on the fibre into colours of greater fastness or intensity by the process of "development." The dyed material is treated with an acidified solution of sodium nitrite, followed after washing by an alkaline bath of β-naphthol or other intermediate product. A complex azo-dye is thus built up within the fibre from a simpler one. The process, first applied in 1887 to the dye-stuff primuline, which is changed thereby from yellow to red, has since been extended to a variety of "direct-dyeing" azo colouring-matters (diazo blacks, diamine blacks, chlorazol blacks, oxamine blues, diaminogens, diazo scarlets, rosanthrenes, etc.).

In most cases the shade only becomes deeper or darker and the chief object of the process is to increase the fastness to washing.

Another method of development is termed the "coupling" process, in which the dyed material is passed through a solution containing a diazo-compound (see Diazo-reactions above), usually diazotized *p*-nitroaniline. The diazonium salt combines with the dye on the fibre, to yield a more complex compound, having a deeper shade and increased fastness to washing. This process is applicable to the benzonitrol browns, toluylene browns and diamine nitrazol colours.

VI. Sulphide Dyes.—These colouring-matters, belonging to various chromophoric classes, possess in common the property of dyeing cotton from a bath of sodium sulphide. They are produced by heating various intermediate compounds, mostly of the aminophenol class, with sodium polysulphides. The dye-stuffs themselves are insoluble in water but dissolve, probably as leuco-compounds, in an aqueous solution of sodium sulphide, from which solution vegetable fibres are dyed in shades of remarkable fastness to washing. Although their structure is not as yet fully ascertained, it seems certain that they owe their dyeing properties, which are akin to that of the "vat" dyes, to the presence in the molecule of a chain of sulphur atoms, –S–S– or –S–S–S–S, which upon reduction in an alkaline medium yields a soluble sulphydrate –SNa or –S–SNa. This is taken up by the fibre and by aerial oxidation regenerates the insoluble dye.

The sulphide dyes belong to several chemical classes: the blue and black members contain the thiazine grouping; the purple and maroon members the azine grouping; the yellow, orange and brown members, the thiazole grouping. The most important are the sulphide or sulphur blacks, which are very largely used and compete with aniline black in cotton dyeing. The blue members (thianol blues, immedial blues, pyrogene blues, etc.) are used as substitutes for indigo, while the yellows and browns (thianol yellows and browns, etc.) are employed for dyeing khaki and cutch shades. The chain of sulphur atoms to which the sulphide dyes owe their dyeing properties is somewhat unstable, and under the influence of acid reducing agents, such as stannous chloride and hydrochloric acid, a part of the sulphur is split off as hydrogen sulphide, readily detectable by lead acetate paper thus giving a convenient test for dyes of this class. Though tolerably fast to light, the sulphide dyes are readily attacked by hypochlorites (used in bleaching) even in weak solution.

VII. Vat Dyes.—This term is applied to dye-stuffs which, being insoluble in water, are applied to the fibre in the form of their alkali-soluble leuco-compounds, followed by reoxidation by air. Indigo is the typical representative and was formerly the only example of this class. During the present century, however, many new dye-stuffs have been discovered having similar dyeing properties and exhibiting a great variety of shades. These colours meet modern demands for a high degree of fastness, not only towards alkalis and washing but also for the most part to light, bleaching and other agencies. Owing to the insolubility in water of the dye-stuffs themselves, these products are usually sold in the form of pastes generally containing 20% of dry dye-stuff.

The property of dyeing "in the vat," *i.e.*, in a similar manner to indigo, may be referred to the capacity of forming leuco-compounds of weakly acid properties which possess an attraction for the fibre and are readily reoxidized by air. In the case of the vat dyes of the indigoid and anthraquinone classes this property is attributable to the presence in the molecule of $\rangle C{:}O$ groups, which by alkaline reducing agents are converted into $\rangle C\langle^{H}_{OH}$ groups and their soluble alkali salts. In the sulphide-vat colours it is doubtless due to chains of sulphur atoms, similar to those present in ordinary sulphide dyes but not so easily reducible. Attempts have recently been made to simplify the dyeing operations for vat colours by preparing soluble stable derivatives of their leuco-compounds containing "labile-acidic" groups, which derivatives can be appiied to the fibre and afterwards treated with an oxidizing agent such as ferric chloride or nitrous acid, when the labile-acidic group is eliminated and the insoluble dye becomes fixed on the fibre (indigosols and solindone colours).

The vat dye-stuffs may be subdivided into the following categories: (a) Indigoid vat colours, comprising indigo and thioindigos, ciba colours, durindones, helindone colours, etc. They are applicable to both animal and vegetable fibres. Reduction is usually effected by means of sodium hydrosulphite, though in the case of indigo itself, other reducing agents are sometimes used (fermentation vat, etc.). (b) Anthraquinone vat colours, comprizing the indanthrenes, duranthrenes, algol, cibanone, ponsol, carbanthrene and caledon series. They are employed in dyeing and printing cotton and linen, upon which materials they produce the fastest colours known. They have not yet found general application in wool and silk dyeing owing to the fact that the reduction by sodium hydrosulphite requires the presence of strong alkalis. (c) Benzoquinone and naphthoquinone vat dyes are at present only a small class comprizing certain vat browns and yellows employed in wool dyeing (helindone series). (d) Sulphide vat colours, mainly represented by the hydrone blues, derived from carbazole, probably contain the thiazine chromophor. They are closely related to the ordinary sulphide dyes, from which they only differ in their method of dyeing and greater fastness. They are employed for vegetable fibres only, upon which they are applied from an alkaline bath of sodium hydrosulphite. The hydrone blues dye cotton in indigo blue shades of great fastness, superior in some respects to indigo. They give upon reduction nearly colourless leuco-compounds, which readily reoxidize upon exposure to air. They are not sublimable upon heating and cannot be extracted from the fibre by pyridine (distinction from indigo).

VIII. Pigment *Colours.*—Under this heading may be classed synthetic colouring-matters which are insoluble in water and are not applicable for textile dyeing in the usual way. Certain azo-dyes when generated upon or within the fibre produce very fast shades (such as para red, dianisidine blue and the azoic colours). Prepared in substance certain of them are used for colouring oils, waxes, varnishes, etc. (sudans and oil colours); while other members of the class which are insoluble in oils are used for oil-colour and lithographic printing (hansa yellows, pigment red, monolite fast scarlet, typophor colours, etc.). Insoluble dye-stuffs of the indigoid and anthraquinone classes, especially prepared in a finely divided condition, may also be similarly employed.

The insolubility in water of these pigment dyes is due to the absence of strong salt-forming groups, either acid or basic. Certain soluble dye-stuffs can also be converted into insoluble compounds by precipitation as barium or aluminium salts (presence of SO_3H, CO_2H or OH groups), or as tannates, phosphates, silicates, phosphomolybdates (presence of $N(CH_3)_2$ or other basic groups). The insoluble compounds thus formed are termed lakes or lake pigments, and are also largely used in the paint, wall-paper and printing-ink industries, the dye-stuffs particularly suited for these uses being the lithol yellows and reds, monolite yellows and reds, lake scarlets and many of the ordinary acid and basic colouring-matters.

IX. Acetate Silk Dyes.—The particular kind of artificial silk which consists of acetylcellulose and is known as "Celanese," is only dyed by a few acidic dye-stuffs and by some of the basic dyes. For the majority of the acidic dyes and for the entire class of the direct dyes this fibre exerts no affinity whatever. To overcome the difficulties encountered in dyeing this material, special colouring-matters have been introduced. The first of these new classes were the ionamines, in which insoluble compounds of azo or anthraquinone series are converted into temporarily soluble derivatives by the introduction of methyl—ω—sulphonic groups, $CH_2{\cdot}SO_3Na$. These groups are split off during dyeing and the insoluble dye-stuff formed is absorbed by the fibre. Another class, the S.R.A. colours, consists of insoluble azo-dyes maintained in colloidal suspension by means of sulphonated castor oil; while in the duranol series the same principle is applied to insoluble dyes of the anthraquinone class. In addition to dyeing fast shades upon acetate silk, all these dyes have the further advantage, that they exert no affinity for cotton, linen or viscose silk, and can there-

fore be employed together with direct dyes for producing two-colour effects upon fabrics woven from these fibres together with acetate silk.

X. *Food* Dyes.—This class of dye application has been developed particularly in the United States where the Government officially "certifies" as to purity of even individual factory lots of a dozen selected dyes, in which case the lots in question can be sold as certified dyes. The selected dyes are mainly naphthol yellow S, yellow OB, poncean 3R, orange I, amaranth, tartrazine, guinea green B, erythrosine and indigo disulphonic acid. They are chosen for their harmlessness when properly made, and for their food (candy, iced drinks, confectionery) colouring ability. The amount sold in the United States in 1926 was 141 tons valued at $1,115,000 (£228,000).

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(A. G. G.)

INDUSTRIAL PRODUCTION

The genesis of the synthetic dyestuff industry is found in the discovery of aniline purple, or mauve, in 1856 by W. H. Perkin, in the course of an attempt to prepare quinine from aniline. Manufacture was commenced in the following year by Perkin and Sons, at Greenford Green, near Harrow, England, and in Dec. 1857 this colour was in commercial use for the dyeing of silk. Two years later Verguin in France, also experimenting with aniline, obtained Magenta, which was followed by Violet Imperial and Bleu de Lyon (Girard and de Laire), and in 1862 by Nicholson's Blue, the first soluble acid dye for wool, whilst in 1863 aniline yellow, the first representative of the vast group of azo colours, was introduced by Messrs. Simpson, Maule and Nicholson. At this period the manufacture of dyestuffs was mainly confined to England and France.

The possibilities of the new industry, however, were attracting attention in other countries, and it was in Germany that the most fertile soil for its development was found. In 1868 Graebe and Liebermann made the important discovery that Alizarine (madder) could be prepared from anthracene, a constituent of coal tar, and the synthesis of the first natural colouring matter was effected. Manufacturing processes were patented simultaneously by Perkin in England, and in Germany by Caro, Graebe and Liebermann, and in 1869 production commenced. The rapidity with which the natural product was driven from the market is shown by the decline of the British imports of madder from 15,300 tons, value £690,000, in 1868, to 1,650 tons in 1878, the total value of the world's madder trade in the former year being £2,000,000. Perkin and Sons produced 40 tons of Alizarine in 1870, and 435 tons in 1873. The Badische Aniline Company in Germany commenced production in 1871 with 150 tons, which during 1873 had risen to 1,000 tons.

Large profits were now being made both in Great Britain and elsewhere, and in 1874 Perkin retired from the business, which was taken over by Messrs. Brooke, Simpson and Spiller. Further important discoveries were announced from Germany with, in 1874, the Eosines, in 1876 Methylene Blue, the first basic blue soluble in water, and in 1877 Malachite Green, the first green of real dyeing value; and the supremacy of the German manufacturers was hy now definitely established. The value of the production of dyestuffs in 1878 is given at £3,150,000, participated in as follows:—

	£		£
Germany	2,000,000	France	350,000
Great Britain	450,000	Switzerland	350,000

Later landmarks in the development of the industry were the introduction (1880) by Read Holliday and Company of Para Red, the first dyestuff to be produced on the fibre, and the discovery in Germany in 1884 of Tartrazine as well as of Congo Red, the first colour having direct affinity for cotton. In 1885 only 20% of the synthetic dyestuffs consumed in Great Britain were of home manufacture.

In 1880 Von Bayer succeeded in preparing indigo by synthetic means. In 1897 after an expenditure of £900,000 had been incurred by the development work, synthetic indigo was marketed. At this time the annual value of the world's growth of indigo was about £4,000,000; in India alone 1,400,000 acres of land were devoted to this crop, but a continuous decline set in and by 1912 the Indian area had fallen to 214,000 acres. The German production of the synthetic product, which in 1900 was about 2,500 tons, had increased to 39,000 tons in 1913. Cultivated indigo thus met the fate which 40 years earlier had befallen the madder root.

The Pre-War Output.—The position of the dyestuff industry in 1913 is shown by the following statistics of production and consumption:—

Production of Dyestuffs in ~ 03r

Country	Indigo Tons	Alizarine red Tons	Other colours Tons	Total Tons	Value £	Value %
Germany	34,000	8,200	92,800	135,000	14,000,000	80·8
Switzerland	2,000	..	8,000	10,000	1,300,000	7·5
France	1,600	..	5,400	7,000	900,000	5·2
U.K.	1,400	1,800	1,800	5,000	350,000	2·0
U.S.A.	..	..	3,000	3,000	495,000	2·9
Other countries	..	..	2,000	2,000	270,000	1·6
	39,000	10,000	113,000	162,000	17,315,000	100·0

Consumption of Dyestuffs in 1913

Country	Indigo Tons	Xlizarine red Tons	Other colours Tons	Total Tons
Great Britain	2,600	3,000	17,400	23,000
Germany	1,400	1,700	16,900	20,000
France	1,650	350	7,000	9,000
Russia, Austria, Italy and Switzerland	3,150	650	21,200	25,000
U.S.A.	3,700	500	21,800	26,000
India	300	3,000	4,700	8,000
China	21,740	..	6,260	28,000
	34,540	9,200	95,260	139,000

The predominance of Germany at this time was even more pronounced than the above figures indicate, since a considerable proportion of the output shown for Switzerland, Great Britain and other countries was manufactured from "intermediates" which were of German origin. In Germany the organic chemical industry, of which dyestuffs manufacture was the mainstay, was developed on the broadest lines, supported by the banks, and directed by University trained scientists. By 1880 two German works were employing sixty scientific chemists. In 1900 six firms employed 500 chemists, 350 engineers and technologists and 18,000 workpeople. In Great Britain at the latter date the corresponding figures were 30 to 40 chemists and 1,000 workpeople. Whereas between 1886 and 1900 German firms obtained 948 patents for the manufacture of dyes, British firms took out only 86, the ratio of the number of patents closely corresponding to that of the number of chemists employed.

Modern Developments.—Such was the position in 1914 at the outbreak of War. Britain was then importing annually, at a cost of £2,000,000, dyes essential to industries producing goods valued at £200,000,000, upon which 1,500,000 workers were dependent. The United States consumed annually 26,000 tons of dyes of which 3,000 tons only were home manufacture, the total consumption being valued at £4,000,000. In all countries from

which supplies of German dyes and drugs were cut off a serious shortage rapidly supervened. Industrialists realized that although dyes were in respect of cost a minor item amongst their raw materials, they were an essential commodity to make the products saleable.

In Great Britain and the United States steps were quickly taken to stimulate production, and Government assistance was invoked. In the former country enemy patents were revoked, and the chief existing producers, Messrs. Levinstein Ltd. and Read Holliday and Co., rapidly expanded their output. The latter firm was bought out in 1915 by British Dyes Ltd., a company promoted with financial assistance by the Government and largely subscribed to by the dyestuff consumers. Processes required to be worked out, buildings and plants constructed, chemists trained. Government requirements for the war were paramount, these consisting not only of khaki and blue dyes for the army and navy, but of explosives. By 1917 the essential requirements of the country were being fully met. Alizarin had been produced in quantity for many years by the British Alizarine Co., a company formed by the Turkey Red Dyers Association in response to a German threat to increase largely the price. The British production of dyes in 1918 amounted to 13,600 tons. In 1918 an amalgamation of British Dyes Ltd. and Levinstein Ltd. was effected under the style of British Dyestuffs Corporation, Ltd. A new company, Scottish Dyes Ltd., concentrated on the production of the important fast to light vat dyes produced from anthracene. France, Japan and Italy, each formerly dependent upon German and Swiss supplies, similarly developed the industry, and by 1919 all the above countries were capable of supplying, in bulk, 80% to over 90% of their home requirements, as well as of exporting considerable quantities to the Chinese and Indian markets.

The world's annual capacity to produce dyestuffs was now at 300,000 tons, almost twice the capacity in 1914. Over production and severe competition were everywhere experienced with the return of the German colours to the market, and each of the producing countries adopted measures for protecting their hdme trade. The United States, Italy and France, created high import duties. Japan subsidized the industry and instituted a licence system of import control. Great Britain by a Proclamation in 1919 prohibited imports except under licence from the Board of Trade. A test case, however, resulted in a judgment that this procedure was illegal, and throughout 1920 there was no restriction, dyes to the value of £7,500,000 being imported. This severe blow dealt to the British industry was followed shortly by a world-wide slump in trade. The Dyestuff (Import Regulations) Act was passed, becoming operative in Jan. 1921, whereby for a period of ten years importation of dyestuffs and intermediates was only permitted under licence. Licences are granted if the corresponding product is not offered by the home producer, and also on price grounds. Initially the British manufacturer was required to supply at a price not exceeding three and a half times the established pre-war price, this factor having been since successively reduced to 3 times, $2\frac{1}{2}$ times and in 1927 to twice the pre-war figure.

In 1923 the French occupation of the Ruhr, which resulted in the shutting down of the principal German factories and the seizure and export of large stocks of dyes, was a disturbing factor in the international dyestuff situation, and the first normal years subsequent to the war were those of 1924 and 1925. The statistics for the year 1937 are given below; these represent the latest available figures of international dyestuff production.

Dyestuffs in 1937

	Production tons	Exports tons	Value of exports
Germany	63,000	42,400	£12,345,225
United States	61,122	8,350	£1,290,376
Great Britain	31,633	5,728	£1,365,544
Japan	11,769	6,683	£368,320
France	11,400	4,728	
Switzerland	7,700	7,113	£3,938,189
Other Countries	17,868		
	204,492		

The total production in bulk is 26% higher than 1913, the German production having fallen from 83% to 31%. While Germany still holds first place as an exporting country, however, dyestuff production in Great Britain and the United States increased tremendously and the range of dyes manufactured is sufficiently diversified to make these countries independent of outside sources of supply. Italy also made considerable progress in the dyestuff field producing 13,800 tons in 1937. The high value of the German exports in comparison with those of other countries excepting Switzerland is due to concentrations on the more expensive types of dye, in particular, of the vat colours, in the manufacture of which the newer producing countries were then less able to compete. (M. BA.; *X.*)

UNITED STATES

In the United States prior to 1914 about 104 dyes were manufactured almost wholly from imported intermediates, and dependence was largely upon Germany. The famine of coal-tar products which followed the outbreak of the war led to the establishment of the manufacture of intermediates and dyes on a large scale, so that by 1919, 250 and by 1925, 350 types of synthetic dyes were being manufactured. The indanthrene or vat dyes were the last to be offered by American manufacturers, the output in 1924 of such vat dyes other than indigo being 1,821,319 pounds. This increased by 43% to 2,608,361 lb. in 1925. In 1923 production had reached so satisfactory a state that 96% of domestic consumption was met in the country and there was in addition an exportable surplus of 18,000,000 lb. of dyestuffs. Since 1917, the annual progress of this branch of the chemical industry has been published in detail in the annual census issued by the United States Tariff Commission. In 1937, 43 firms were engaged in the manufacture of dyestuffs, producing more than 1.000 distinct types having a sales value of $64,613,000. Of this total vat dyes other than indigo accounted for $13,110,000 or about 20 per cent.

Early in the war it became evident that many enemy-owned American patents were being used to interfere with production incident to the successful prosecution of the war. These patents, some 4,000 in number, were taken by the alien property custodian and later sold to the Chemical Foundation, Inc., formed for the purpose of administering these patents for the public good. Any profits above 6% earned on a comparatively small capital stock are devoted to scientific research and educational activities. The Chemical Foundation, Inc., was later sued by the Government for the return of these patents, the case going to the Supreme Court, and the Chemical Foundation being sustained in the district, the appellate, and the supreme courts.

While the sales value of dyestuffs is not large when compared with many other American industries, its importance lies in the fact that others having great values are dependent upon it. It is for this reason a key industry. Textiles and textile products, paper and allied products, leather, ink, and carbon paper are among the industries dependent upon an unfailing source of dyestuff supply, for their practical existence and their products are valued at several billions of dollars annually. Furthermore, the dyestuffs group is the foundation of the entire organic chemical industry, From it has grown a large business in such products as medicinals, flavours, and perfume materials, rubber chemicals, resins, and miscellaneous coal-tar chemicals amounting in 1937 to an additional $64,123,000. The manufacture and sale of synthetic organic chemicals not of coal-tar origin in 1937 produced items to the value of $119,420,000.

At an early date the manufacturers of dyestuffs placed dependence upon scientific research, established extensive laboratories for the purpose, and encouraged the training of suitable personnel through the establishment of numerous fellowships in educational institutions. In 1934, 129 separately organized research laboratories were in operation, employing about 1,350 technically trainedpersons. Net cost of research for that year was about $8,000,000 or 4% of the sales value of all synthetic organic chemicals.

Under the "Trading with the Enemy Act" of Oct. 1917, the President of the United States on Feb. 14, 1918, issued a proclamation which excluded certain articles from import from specified

countries except by license. Dyes and chemicals were included in this proclamation. The industry rapidly developed under this embargo, which remained in force until the passage of the Tariff Act, Sept. 21, 1922. Under this act coal-tar chemicals received special protection for two years. While the industry has been required to meet severe competition under this act with its decreased protection after the first two years, it has nevertheless made great strides, offering an increased number of dyes of all classes, entirely satisfactory in quality and at prices which have been steadily lowered.

The dyestuffs industry has been well served by various bureaus and departments of the United States Government, which have furnished statistics as to imports by classes of dyes and by origin and which have published the census of dyestuffs at stated intervals to guide those developing the domestic dyestuffs industry. In 1921 the Synthetic Organic Chemical Manufacturers Association of the United States was formed for the purpose of furthering the interests of the organic chemical industry and presenting through the association the united efforts of many manufacturers. The achievements of the industry since 1917 have had a far-reaching effect. The products and processes developed have enabled manufacturers of consumer goods to make great improvements, to evolve new products, and to produce them at lower cost. In addition to so largely satisfying domestic demands, the American dyestuffs manufacturers have given a good account of themselves in foreign markets, where they have had to win a share of the business on the quality of the products offered in the face of long-established preferences and prejudices. (H. E. H.)

DYETSKOYE SELO (Detskoe Selo), a town in north Russia, formerly Tsarskoye Selo, 1 j m. south of Leningrad in lat. 59° 43' N., long 30° 24′ E., on the Duderhof Hills. Pop. (1926) 19,284. When Peter the Great took the mouth of the Neva river, a Finnish village, Saarimois, stood on the site now occupied by the town and its Russified name, Sarskaya, was changed into Tsarskoye Selo (The Tsar's Village) when Peter presented it to his wife, Catherine. It was later arranged as a summer abode by the Tsaritsas Elizabeth and Catherine II. and was subsequently used as such by the Imperial family. As a court residence, the town was the earliest Russian town to be supplied with the conveniences of modern civilization. The first Russian railway, built in 1837–8, connected it with Leningrad, and in 1887, it was lighted by electricity, the first town on the European continent to be so lighted. It also has the best system of water supply and sanitation in Russia, and on account of its cleanness, its good sanitation and dry climate, it is a health resort. In 1917 the Tsar Nicholas II. and his family were imprisoned here from March to August, when they were transferred to Tobolsk. Under the Soviet government the former palaces and villas have been turned into museums, schools, hospitals and sanatoria for children. Its present name means Children's Village and has been given to it because in summer it is practically a children's colony. The cathedral of St. Catherine, built by Thon in 1840, is a miniature copy of that at Constantinople. The former imperial park, now the Dyetskoye Selo park, covers 1,680 acres. In it is the "old palace," built in 1724 by Rastrelli, and gorgeously decorated with mother-of-pearl, marble, amber, lapis lazuli, silver and gold, the gallery of Cameron, adorned with fine statues and entrance gates, numerous pavilions and kiosks, and a bronze statue of the poet Pushkin, who was a scholar at the Lyceum. A second palace, the Alexander, was built by Catherine II. 1792–96, and designed by Guarenghi. The Chinese village, bridge and theatre were designed as a result of the interest in China taken by Catherine II. Behind the north wall of the park is the Federovsky Gorodok (Fedor town), built for the Tsar's family 1914–17 by the architect Prestchinsky in old Russian style, and now controlled by the Institute of Agronomy. The Fedor Cathedral was built by Pokrovsky in 1912 in the Pskov-Novgorod style. For a full description of the town, see "Guide to the Soviet Union" (Moscow, 1925; in *English*). The town is now named Pushkin.

DYEWORKS AND CHEMICAL INDUSTRIES, AMALGAMATION OF. The company known as I. G. Farbenindustrie Aktiengesellschaft, founded Dec. 2, 1925, embodies the amalgamation of the German tar dye factories (Badische Anilin- & Soda-Fabrik, Ludwigshafen, Farbenfabriken vorm. Friedr. Bayer & Co., Leverkusen, Farbwerke vormals Meister Lucius & Briining, Hoechst, Aktiengesellschaft für Anilinfabrikation Berlin, Chemische Fabrik Griesheim-Elektron, Frankfort-on-Main, and Chemische Fabriken vorm. Weilerter Meer, Uerdingen Rhine). It is the largest German chemical industry undertaking and has absorbed other concerns. The company's object is the production and sale of dye-stuffs, pharmaceutical and photographic articles, artificial silks, rich materials, metals, nitrogen compounds, benzine and products from the liquefaction of coal and chemical products of all kinds, also the working of other industrial undertakings. It is qualified to establish branches at home and abroad, to participate in other companies and undertakings and to take over wholly or partly their working. A working together in the United States of America was agreed to with the Standard Oil Company of New Jersey with regard to the negotiation of the mutual patents and processes in the territory of the refining of crude oil. The company works with the Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Oslo in the manufacture of nitrogen. At the end of 1927 a regulation of production and sale of dyes in accordance with standardised viewpoints was agreed with the French dye industry. In 1928 the company was amalgamated with the Ansco Photoproducts Inc., New York. The share capital of the I. G. Farbenindustrie Aktiengesellschaft amounts to 1,100 million Marks. Furthermore it has issued convertible Bonds up to an amount of 250 million Marks. (W. J.)

DYKE: *see* DIKE.

DYMOKE, the name of an English family holding the office of king's champion. The functions of the champion were to ride into Westminster Hall at the coronation banquet, and challenge all comers to impugn the king's title. (See CHAMPION.) The earliest record of the ceremony at the coronation of an English king dates from the accession of Richard II. On this occasion the champion was Sir John Dymoke (d. 1381), who held the manor of Scrivelsby, Lincolnshire, in right of his wife Margaret, granddaughter of Joan Ludlow, who was the daughter and co-heiress of Philip Marmion, last Baron Marmion. The Marmions claimed descent from the lords of Fontenay, hereditary champions of the dukes of Normandy, and held the castle of Tamworth, Leicestershire, and the manor of Scrivelsby, Lincolnshire. The right to the championship was disputed with the Dymoke family by Sir Baldwin de Freville, lord of Tamworth, who was descended from an elder daughter of Philip Marmion. The court of claims eventually decided in favour of the owners of Scrivelsby on the ground that Scrivelsby was held in grand serjeanty.

Sir Thomas Dymoke (1428?–1471) joined a Lancastrian rising in 1469, and, with his brother-in-law Richard, Lord Willoughby and Welles, was beheaded in 1471 by order of Edward IV. after he had been induced to leave sanctuary on a promise of personal safety. The estates were restored to his son Sir Robert Dymoke (d. 1546), champion at the coronations of Richard III., Henry VII. and Henry VIII., who distinguished himself at the siege of Tournai and became treasurer of the kingdom. His descendants acted as champions at successive coronations. Lewis Dymoke (d. 1820) put in an unsuccessful claim before the House of Lords for the barony of Marmion. His nephew, Henry (1801–65) was champion at the coronation of George IV. He was accompanied on that occasion by the duke of Wellington and Lord Howard of Effingham. Henry Dymoke was created a baronet; he was succeeded by his brother John, rector of Scrivelsby (1804–73), whose son, Henry Lionel, died without issue in 1875, when the baronetcy became extinct, the estate passing to a collateral branch of the family. After the coronation of George IV. the ceremony was allowed to lapse, but at the coronation of King Edward VII. H. S. Dymoke bore the standard of England in Westminster Abbey.

DYNAMICS, a branch of mechanics. The term is usually applied (as here) to the study of the motion of matter, but sometimes it includes statics, which is concerned with matter at rest.

The Fundamental Equation. — If we were to consider a material system isolated in space it would theoretically be

possible (though perhaps not practicable) to describe the motion merely as related to the configuration. We more frequently consider, however, some arbitrary and not necessarily isolated portion of matter — a "dynamical system." The motion of such a system depends not merely on its configuration but also upon matter external to the system. The effect of this external matter is most simply comprehended in the notion of force. And although we could perhaps study the behaviour of a self-contained system without the aid of this notion, yet when once it has been introduced there is no good reason for restricting its use.

The measurement of mass and of force, Newton's "Laws of Motion," the idea of work, and the theory of the simplest systems — such as a single particle or rigid body under given forces, or two particles mutually attracting — are dealt with in the article MECHANICS. One particular case of two particles subject only to their mutual attraction is of special interest and importance, namely, when the attraction varies inversely as the square of the distance between the particles. This is the famous "problem of two bodies." The methods developed in the study of this particular problem have had a profound effect on the history of the whole subject.

In the present article we consider the general theory of systems of particles and rigid bodies. A rigid body is conceived of, for our present purpose, as an aggregate of particles, finite in number, set in a rigid imponderable frame. (It is hardly necessary to remind the reader that this conception, adequate for the purpose of dynamics, is totally inadequate in other connections.) Thus the whole system consists of a number (perhaps large, but essentially finite) of particles, each subject to forces, including the reactions of other particles of the system; and these reactions must so adjust themselves that the necessary geometrical relations imposed by the constitution of the system are fulfilled. It is easy to see of what form these relations are. For if we denote by $\xi_1, \xi_2, \ldots, \xi_{3N}$ the $3N$ co-ordinates of the N particles of the system referred to fixed rectangular axes, then we shall have m relations of the type

$$\sum_{s=1}^{3N} a_{rs}\,d\xi_s + a_r dt = 0, \qquad r = 1, 2, \cdots, m \tag{1}$$

where $m < 3N$. The coefficients a_{rs}, a_r depend upon the configuration and the time. Thus for a single particle constrained to move without friction on a variable surface $f(x, y, z, t) = 0$ we have

$$\frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy + \frac{\partial f}{\partial z}dz + \frac{\partial f}{\partial t}dt = 0.$$

In the systems usually considered we have often an important simplification, namely, that in the equations (1) there are no terms in dt, and the coefficients a_{rs} are independent of t.

The motion of a typical particle of the system is controlled by the equations

$$\begin{aligned} m\ddot{x} &= X + X', \\ m\ddot{y} &= Y + Y', \\ m\ddot{z} &= Z + Z', \end{aligned} \tag{2}$$

where m denotes the mass of the particle, x, y, z, its co-ordinates with respect to fixed rectangular axes, and $X+X'$, $Y+Y'$, $Z+Z'$ the components parallel to these axes of the resultant force acting on the particle. The notation implies the division of the forces into two groups, and the division is to be effected thus: The "internal" forces X', Y', Z' are such that altogether they do no work in any infinitesimal displacement of the system compatible with the constraints as they exist at the instant considered. We will call such displacements "admissible." It is important to observe that if the constraints are variable the admissible displacements are those appropriate to the system as constituted at the given instant. Thus in the case of the particle constrained to move on the variable surface $f(x, y, z, t) = 0$ the admissible displacements are in the tangent plane to the surface as it is at the given instant. Explicitly the increments $\delta x, \delta y, \delta z$ must satisfy the single condition

$$\frac{\partial f}{\partial x}\delta x + \frac{\partial f}{\partial y}\delta y + \frac{\partial f}{\partial z}\delta z = 0.$$

And generally the admissible displacements are subject to the equations obtained from (1) by writing $\delta\xi_s$ for $d\xi_s$ and omitting the terms in dt.

We have then

$$S(X'\delta x + Y'\delta y + Z'\delta z) = 0, \tag{3}$$

where S denotes here, and throughout the present article, a summation over the particles of the system, and the equation holds for all sets of values of $\delta x, \delta y, \delta z$ corresponding to admissible displacements. The forces which fall into this category are familiar from the theory of virtual work in statics. The most important are (i.) the mutual reactions between pairs of particles whose distance apart is invariable, (ii.) the reactions between perfectly smooth surfaces, and (iii.) the reactions between perfectly rough surfaces; in the last case the admissible displacements include only a relative motion of pure rolling. From (2) and (3) we derive at once

$$S\{(X - m\ddot{x})\delta x + (Y - m\ddot{y})\delta y + (Z - m\ddot{z})\delta z\} = 0. \tag{4}$$

This is the fundamental equation of dynamics. It expresses the fact that the work of the "kineta" (mx, my, mz) for any admissible displacement is equal to the work of the "external" forces, X, Y, Z. It is the immediate analogue for a dynamical system of d'Alembert's principle for a single rigid body.

First Deductions from the Fundamental Equation. — It may happen that among the admissible displacements is included the displacement that the system actually suffers in a small time succeeding the instant considered. This will be the case, for example, if a particle is constrained to move on a *fixed* smooth surface, but not if the particle moves on a variable surface as in the example considered above. Suppose that this does hold, and consequently that we may write $\dot{x}, \dot{y}, \dot{z}$ for $\delta x, \delta y, \delta z$ in the equation (4). We have then

$$S(X\dot{x} + Y\dot{y} + Z\dot{z}) = \frac{dT}{dt},$$

where $T = \frac{1}{2}Sm(\dot{x}^2 + \dot{y}^2 + \dot{z}^2)$, the "kinetic energy." The rate of working of the external forces is equal to the rate of increase of the kinetic energy. This is the famous "equation of energy."

Again, it may happen that among the admissible displacements is included a displacement of the whole system without distortion as if rigid, in the direction of x. Then we may write $\delta x = \text{constant}$, $\delta y, \delta z = 0$ in the equation (4), whence

$$SX = Sm\ddot{x}.$$

In particular if $SX = 0$ we have

$$Sm\ddot{x} = 0, \qquad Sm\dot{x} = \text{constant}.$$

This is the equation of the "conservation of linear momentum." And in the same way, if a rotation without distortion of the system about the axis of x is admissible, and if further

$$S(yZ - zY) = 0,$$

then

$$Sm(y\dot{z} - z\dot{y}) = \text{constant},$$

the "conservation of angular momentum."

Transformation of the Fundamental Equation. — The equation (4) is the starting point for a number of lines of development. Thus (a) for systems of a suitably restricted type we can derive from it a new variational equation (see equation [8] below), the variables whose differentials appear being new generalized co-ordinates and their derivatives. The compact and elegant form of such variational equations — equivalent, of course, to a set of differential equations — is of peculiar value in dynamics. Or (b) we can exhibit the equation as the condition that some function is to be stationary under given conditions. In Gauss's principle we have to minimize an algebraic function of the accelerations (the co-ordinates and velocities, which appear in the function, being treated as mere constants while the equa-

tions are being formed). In Hamilton's principle and in the "Principle of Least Action" of Maupertuis it is an integral that has to be minimized by the usual methods of the calculus of variations. Or (c) we can transform to differential equations—equations associated with the names of Appell, Lagrange, Hamilton, Routh. The various lines of development are of course intimately connected. Thus the minimizing equations for Gauss' function are Appell's equations, and the minimizing equations obtained from Hamilton's principle are Lagrange's equations.

The methods just enumerated are not applicable over identical ranges. Thus Appell's equations of motion have the advantage that they may be applied at once to systems containing rolling surfaces, *e.g.*, a rough sphere, to which given forces are applied, rolling on a fixed or moving surface. Lagrange's equations may not be applied directly to such problems—though it is easy to modify them (by the introduction of multipliers associated with the reaction at the point of rolling contact) to include problems of this type. Again, Hamilton's principle has a wide range of applicability. It may be applied, by a natural extension, even to continuous systems, such as a vibrating string or membrane; though in practice the differential equations can usually be obtained more simply in other ways—either by considering the motion of a small element treated as a particle, or directly from a suitably modified form of the fundamental equation.

In a short article it is of course impossible to consider all these methods in detail. We shall therefore restrict our further enquiry to systems of a particular type—the type with which we are in fact most often concerned—leaving the reader to consult the books mentioned at the end of this article for information as to systems of more general types. To begin with, we suppose that the co-ordinates x, y, z, of every particle of the system can be expressed as functions, not involving t, of n generalized co-ordinates $q_1, q_2, \ldots, q_n$ capable of continuous variation in a certain domain; and that the admissible displacements of the system are represented by arbitrary infinitesimal increments $\delta q_1, \delta q_2, \ldots, \delta q_n$. This is a very sweeping simplification. The class of admissible displacements is identical with the class of possible displacements (there are no dt terms in the equations [1]), and these displacements are represented in a particularly simple way—by arbitrary increments in the q's. The restriction excludes the possibility of a motion inexorably imposed on the system from without. It also excludes the possibility of rolling surfaces; for although in this case all possible displacements may be admissible, it is not possible, in general, to represent the displacements by arbitrary increments of a set of parameters. Thus, as a simple concrete example, for a rough sphere rolling on a plane we can express the co-ordinates of any particle as functions of five parameters; but the increments of these parameters representing the displacements are subject to two non-integrable relations.

We suppose further that the external forces are "conservative," *i.e.*, that the sum $S(X\delta x+Y\delta y+Z\delta z)$ is the perfect differential of a function, $-V$, of the q's. The outstanding example of conservative forces is the mutual attraction F between a pair of particles, when F depends only on the distance r: for these forces $V=\int F\,dr$.

With these limitations the equation (4) takes a very simple form. Consider separately the term $\ddot{x}\delta x$ appropriate to one particular particle. We have

$$\frac{\partial \dot{x}}{\partial \dot{q}_r}=\frac{\partial x}{\partial q_r}, \qquad \frac{\partial \dot{x}}{\partial q_r}=\frac{d}{dt}\left(\frac{\partial x}{\partial q_r}\right),$$

so that

$$\begin{aligned}\ddot{x}\delta x &= \ddot{x}\frac{\partial x}{\partial q_r}\delta q_r \\ &= \left\{\frac{d}{dt}\left(\dot{x}\frac{\partial x}{\partial q_r}\right)-\dot{x}\frac{d}{dt}\left(\frac{\partial x}{\partial q_r}\right)\right\}\delta q_r \\ &= \left\{\frac{d}{dt}\left(\dot{x}\frac{\partial \dot{x}}{\partial \dot{q}_r}\right)-\dot{x}\frac{\partial \dot{x}}{\partial q_r}\right\}\delta q_r, \qquad (5)\end{aligned}$$

where repeated suffixes imply summation (this convention is to be understood throughout), and the three similar terms for each particle can be transformed in the same way. The kinetic energy T is now a quadratic form in the $\dot{q}$'s with coefficients depending on the q's. We write

$$L=T-V, \qquad (6)$$

$$p_r=\frac{\partial L}{\partial \dot{q}_r}, \qquad (7)$$

so that $$p_r=\frac{\partial T}{\partial \dot{q}_r}=Sm\left(\dot{x}\frac{\partial \dot{x}}{\partial \dot{q}_r}+\dot{y}\frac{\partial \dot{y}}{\partial \dot{q}_r}+\dot{z}\frac{\partial \dot{z}}{\partial \dot{q}_r}\right).$$

From (4) and (5) we have

$$\left(\dot{p}_r-\frac{\partial L}{\partial q_r}\right)\delta q_r=0,$$

or

$$\dot{p}_r\delta q_r+p_r\delta\dot{q}_r=\delta L, \qquad (8)$$

where

$$\delta L=\frac{\partial L}{\partial q_r}\delta q_r+\frac{\partial L}{\partial \dot{q}_r}\delta\dot{q}_r.$$

If we write $\frac{d}{dt}\delta q_r=\delta\dot{q}_r$ the equation (8) may be written compactly in the form

$$\frac{d}{dt}(p_r\delta q_r)=\delta L, \qquad (9)$$

where 6 denotes a contemporaneous variation, and δq_r, $\delta\dot{q}_r$ are arbitrary.

Equations of Motion.—If L be expressed in its natural form as a function of q's and $\dot{q}$'s we have from (8) or (9)

$$p_r=\frac{\partial L}{\partial \dot{q}_r}, \qquad \dot{p}_r=\frac{\partial L}{\partial q_r}. \qquad (10)$$

If we eliminate p_r between these equations we get at once

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_r}\right)=\frac{\partial L}{\partial q_r}. \qquad (11)$$

This is the form of the equations of motion given by Joseph Louis Lagrange, the author of the great *Mécanique Analytique* (1788). It is usually the most convenient form to apply to concrete problems.

As a simple example, consider a particle moving in a plane under given conservative forces, the position of the particle at any time being given by polar co-ordinates (r, θ). Here

$$T=\tfrac{1}{2}m(\dot{r}^2+r^2\dot{\theta}^2), \qquad (12)$$

and Lagrange's equations are

$$m(\ddot{r}-r\dot{\theta}^2)=-\frac{\partial V}{\partial r}, \qquad (13)$$

$$m(r\ddot{\theta}+2\dot{r}\dot{\theta})=-\frac{1}{r}\frac{\partial V}{\partial \theta} \qquad (14)$$

In particular for a central attraction for which V is a function only of r we have from (14)

$$r\ddot{\theta}+2\dot{r}\dot{\theta}=0,$$

whence

$$r^2\dot{\theta}=\text{constant}. \qquad (15)$$

This is the equation of angular momentum already mentioned.

Next we introduce the function

$$H=p_r\dot{q}_r-L=T+V, \qquad (16)$$

and express H as a function of q's and p's, suppressing the $\dot{q}$'s in favour of the p's by means of the equations (7). Then (9) may be written

$$\dot{p}_r\delta q_r-\dot{q}_r\delta p_r=-\delta H,$$

the δq_r, δp_r being arbitrary variations; so that

$$\dot{q}_r = \frac{\partial H}{\partial p_r}, \quad \dot{p}_r = -\frac{\partial H}{\partial q_r}. \tag{17}$$

These are the equations of motion given by Sir William Ronan Hamilton in 1834. We have here $2n$ equations of the first order as contrasted with the n equations of the second order of Lagrange. Hamilton's equations, though usually less convenient than Lagrange's for concrete problems, are of great importance in theoretical work.

In connection with Lagrange's equations we can picture the motion of the system as the motion of a representative point $(q_1, q_2, \ldots, q_n)$ in an n-dimensional manifold, the q-space. The co-ordinates and velocities of the representative point at a given instant suffice to determine the motion. In the same way, in connection with Hamilton's equations, we can consider the motion of a representative point $(q_1, q_2, \ldots, q_n, p_1, p_2, \ldots, p_n)$ in a an-dimensional manifold, the (q, p) space. The co-ordinates alone of the representative point at a given instant suffice to determine the motion. The path of the representative point, either in the q-space or the (q, p) space, is called an "orbit" of the system.

In the q-space, but not in the (q, p) space, any path is geometrically possible. When, as in Hamilton's principle, we consider variations to neighbouring paths which are not necessarily natural orbits of the system, we think in terms of the q-space. But when we consider variations to neighbouring natural orbits, *i.e.*, orbits satisfying the equations of motion, we may use either representation.

It is possible to produce a function which plays the part of a Lagrangian function for some freedoms, and of a Hamiltonian function for the rest. For the equation (9) may be written

$$\sum_1^m (\dot{p}_r \delta q_r - \dot{q}_r \delta p_r) + \sum_{m+1}^n (p_r \delta \dot{q}_r + \dot{p}_r \delta q_r) = \delta(L - \sum_1^m p_r \dot{q}_r);$$

if therefore we express

$$R = L - \sum^m p_r \dot{q}_r$$

in terms of $p_1, p_2, \ldots, p_n, \dot{q}_{m+1}, \dot{q}_{m+2}, \ldots, \dot{q}_n$ and the q's we have as the equations of motion

$$\begin{aligned} \dot{q}_r &= -\frac{\partial R}{\partial p_r}, \quad \dot{p}_r = \frac{\partial R}{\partial q_r} \qquad r = 1, 2, \cdots, m \\ p_r &= \frac{\partial R}{\partial \dot{q}_r}, \quad \dot{p}_r = \frac{\partial R}{\partial q_r} \qquad r = m+1, m+2, \cdots, n. \end{aligned} \tag{18}$$

Thus the equations corresponding to the first m co-ordinates are of the form (17), and the rest of the form (10). The method was devised by Edward John Routh (1876) for the special case in which $q_1, q_2, \ldots, q_m$ do not appear in L, nor, consequently, in R; so that $p_1, p_2, \ldots, p_m$ remain constant during the motion. Such co-ordinates appear conspicuously in the study of gyroscopes, and Routh's method is commonly applied to such problems.

Hamilton's Principle.—So far we have supposed the equation (9) to refer to a given instant. It will, however, remain true for all time if we consider variations to contemporaneous points on a neighbouring orbit in the q-space, and this will still hold whether the neighbouring orbit is one of the natural orbits of the system—satisfying the equations of motion—or not. Suppose first that we do not restrict the neighbouring orbit to be a natural orbit of the system. Let the original orbit start from (q_{r0}) at the zero of time, and reach (q_r) at time t: and let the neighbouring orbit pass through $(q_{r0} + \delta q_{r0})$, $(q_r + \delta q_r)$ at these same times. Then we derive at once from (9)

$$p_r \delta q_r - p_{r0} \delta q_{r0} = \delta \int_0^t L dt \tag{19}$$

where 6 denotes, as before, a contemporaneous variation. In particular if $\delta q_r, \delta q_{r0} = 0$ we have $\delta \int_0^t L dt = 0$. The integral $\int L dt$ is stationary along a *natural* orbit as compared with *any* neighbouring orbit having the same termini and the same times of departure and arrival. This is Hamilton's principle.

As we have already hinted above the principle holds under less restricted conditions than those imposed in the proof just given. But in some cases (*e.g.*, that of the rolling sphere) there is a new feature which must be carefully borne in mind. The variation to the contemporaneous point on the neighbouring orbit must always be an admissible variation; but the neighbouring orbit itself may be, not only not a natural orbit, but not even an orbit which is geometrically possible. (In the case of the sphere rolling on a rough plane the motion in the varied orbit would, in general, involve sliding as well as rolling on the plane.)

The Equation of Energy.—Consider now variations to contemporaneous points on a neighbouring orbit which is a natural orbit for the system. And suppose first that the neighbouring orbit is the same as the original orbit, but not quite synchronized with it; so that the system passes through the same sequence of configurations, but reaches any configuration a small time τ earlier than it did in the original orbit. Then

$$\delta q_r = \dot{q}_r \tau, \qquad \delta L = \frac{dL}{dt} \tau,$$

and the equation (9) leads to

$$\tau \frac{d}{dt}(p_r \dot{q}_r) = \tau \frac{dL}{dt}.$$

Hence

$$p_r \dot{q}_r - L = H = \text{constant}. \tag{20}$$

This is the equation of energy already established otherwise, in a different form and under less restricted conditions, above.

As an example of the use of this equation, consider again the problem of a particle moving in a plane under a central attraction derived from a potential function $V = V(r)$. The equation of energy is

$$\tfrac{1}{2}m(\dot{r}^2 + r^2\dot{\theta}^2) + V = \text{constant} = E, \text{ say}. \tag{21}$$

We have also the equation (15) of angular momentum

$$mr^2\dot{\theta} = A. \tag{22}$$

From (21) and (22) we have at once

$$m\dot{r} = \sqrt{[2m(E - V) - A^2/r^2]} = \sqrt{\rho}, \text{ say}, \tag{23}$$

where the positive value of the radical is to be taken so long as r increases with t. If r lies originally between two consecutive real positive zeros r_1, r_2, of ρ, then r lies always in the range (r_1, r_2). From (23) we have

$$t - t_0 = \int_{r_1}^{r} \frac{m dr}{\sqrt{\rho}} \tag{24}$$

Also from (22) and (23) we have

$$\frac{d\theta}{dr} = \frac{A/r^2}{\sqrt{\rho}}, \qquad \theta - \theta_0 = \int_{r_1}^{r} \frac{A/r^2}{\sqrt{\rho}} dr. \tag{25}$$

This completes the solution; $t = t_0$ and $\theta = \theta_0$ when $r = r_1$. (25) is the equation of the orbit, and (24) gives the position of the particle in its orbit at any time.

If the attraction at distance r is $\gamma Mm/r^2$ we have $V = -\gamma Mm/r$. For $E < 0$ the orbit (23) is an ellipse having the centre of attraction in one focus.

The Integral-invariant $\oint p_r \delta q_r$.—Returning to the equation (9), consider now variations to contemporaneous points on any neighbouring natural orbit. Consider the orbits starting at $t = 0$ from points on a closed curve in the (q, p) space. Denote by $\oint$ an integral round the curve traced out in the (q, p) space by the contemporaneous points on these orbits at any time. From the equation (9) we have

$$\frac{d}{dt} \oint p_r \delta q_r = \oint \delta L, \tag{26}$$

which vanishes for a closed curve. Hence the integral $\oint p_r \delta q_r$ is constant for all time; the integral is a relative integral-invariant of the Hamiltonian equations.

Transformation Theory.—Consider again variations to any neighbouring natural orbit, and denote by S the integral $\int L dt$ taken along a natural orbit, and expressed in terms of (q_r, q_{r0}, t). We have then, as before,

$$p_r \delta q_r - p_{r0} \delta q_{r0} = \delta S, \tag{27}$$

so that

$$\frac{\partial S}{\partial q_r} = p_r, \qquad \frac{\partial S}{\partial q_{r0}} = -p_{r0}. \tag{28}$$

We have further

$$L = \frac{dS}{dt} = \frac{\partial S}{\partial t} + \frac{\partial S}{\partial q_r} \dot{q}_r = \frac{\partial S}{\partial t} + p_r \dot{q}_r,$$

whence

$$\frac{\partial S}{\partial t} = -(p_r \dot{q}_r - L) = -H. \tag{29}$$

Thus, denoting by d a completely general variation, we have

$$d\delta = p_r dq_r - p_{r0} dq_{r0} - H dt. \tag{30}$$

The equation (30) retains the same form if we replace the constants (q_{r0}, p_{r0}) defining the orbit by new constants (A_r, μ_r), provided

$$p_{r0} dq_{r0} = \lambda_r d\mu_r + dM, \tag{31}$$

where dM is a perfect differential; then

$$p_r dq_r = \mu_r d\lambda_r + H dt + dN. \tag{32}$$

This equation (32) is precisely equivalent to the equations of motion. We have derived it from the equation (9), and it can be shown that the equations of motion (17) are equally implied in it.

A transformation from (q_r, p_r) to (a_r, β_r), where (a_r, β_r) are functions of $(q_1, q_2, \ldots, q_n, p_1, p_2, \ldots, p_n, t)$ is called a contact transformation if

$$\beta_r d\alpha_r = p_r dq_r + R dt + dW, \tag{33}$$

where R, W can be expressed at will in various forms—for example, as functions of the q's and p's and t, or as functions of the a's and β's and t. In particular the equation (32) is of the form (33); the solution of a dynamical problem—the transformation from (A_r, μ_r) to (q_r, p_r)—is a contact transformation.

Suppose now we have a dynamical problem for which the variables are (q_r, p_r)—satisfying the equation (32)—and we transform to new variables (a_r, β_r) by means of a contact transformation satisfying (33). We have then

$$\beta_r d\alpha_r = \mu_r d\lambda_r + (H+R) dt + d(N+W), \tag{34}$$

so that (a_r, β_r) *satisfy* new *Hamiltonian* equations, the new *Hamiltonian function* being $(H+R)$. This important theorem is due in substance to Carl Gustav Jacob Jacobi (1837).

The Hamilton-Jacobi Theorem.—In particular if $R = -H$ the solution of the dynamical problem is given by

$$\alpha_r = \text{constant}, \qquad \beta_r = \text{constant}. \tag{35}$$

To find such a transformation we proceed as follows:

Consider the equation

$$\frac{\partial S}{\partial t} + H\left(q_r, \frac{\partial S}{\partial q_r}\right) = 0, \tag{36}$$

where the second term in the first member is obtained from H by substituting $\frac{\partial S}{\partial q_r}$ for p_r. This (the Hamilton-Jacobi equation) is a partial differential equation of the first order with $(n+1)$ independent variables $q_1, q_2, \ldots, q_n, t$. Let

$$S = S(q_1, q_2 \ldots, q_n, \alpha_1, \alpha_2, \ldots, \alpha_n, t)$$

be a complete integral of the equation, the a's being arbitrary constants, none of which is merely additive. Write the equations

$$p_r = \frac{\partial S}{\partial q_r}, \tag{37}$$

$$\beta_r = -\frac{\partial S}{\partial \alpha_r}, \tag{38}$$

and let these equations be solved to express the a's and β's in terms of the q's and p's and t. Then the transformation from (q_r, p_r) to (a_r, β_r) is a contact transformation having the property we require. For we have

$$\begin{aligned} \beta_r d\alpha_r &= -\frac{\partial S}{\partial \alpha_r} da, \\ &= \frac{\partial S}{\partial q_r} dq_r + \frac{\partial S}{\partial t} dt - dS \\ &= p_r dq_r - H dt - dS, \end{aligned} \tag{39}$$

which is of the required form. For this transformation, appropriate to the particular system characterized by H, the *integrals of the new equations of motion* are the *equations* (35). This is the Hamilton-Jacobi theorem, one of the most famous and beautiful theorems of mathematical physics. It was discovered independently by Hamilton (1834) and Jacobi (1837).

As a simple example of the use of this theorem consider again the problem of a particle moving in a plane under a central attraction derived from a potential function $V = V(r)$. The equation (36) is

$$\frac{\partial S}{\partial t} + \tfrac{1}{2} m \left\{ \left(\frac{\partial S}{\partial r}\right)^2 + \frac{1}{r^2} \left(\frac{\partial S}{\partial \theta}\right)^2 \right\} + V = 0, \tag{40}$$

and a complete integral is

$$S = -\alpha_1 t + \alpha_2 \theta + \int_{r_1}^{r} \sqrt{\rho}\, dr \tag{41}$$

where

$$\rho = 2m(\alpha_1 - V) - \alpha_2^2 / r^2,$$

and r_1 is a zero of ρ. The equations (38) are

$$t - \beta_1 = \int_{r_1}^{r} \frac{m dr}{\sqrt{\rho}}, \tag{42}$$

$$\theta + \beta_2 = \int_{r_1}^{r} \frac{\alpha_2 / r^2}{\sqrt{\rho}}\, dr. \tag{43}$$

These are the integrals of the equations of motion, obtained previously by another method. The compactness of the present method is very striking.

Perturbations.—Returning to the general theory, consider the problem modified by the substitution of a new function $(H+K)$ for H. We may call the new term K a "perturbation function." Let us apply to the new problem the contact transformation defined by the equations (37) and (38), appropriate to the original system. In virtue of the theorem proved above we see, from the equation (39), that the new variables (a_r, β_r) satisfy the equations

$$\dot{\alpha}_r = \frac{\partial K}{\partial \beta_r}, \qquad \dot{p}_r = -\frac{\partial K}{\partial \alpha_r}. \tag{44}$$

If K is zero, then the a's and β's remain constant during the motion; but if K is not zero, then they vary in accordance with the equations (44). This exhibits the perturbed orbit as the gradual modification of an orbit within the group of orbits appropriate to the unperturbed system. This form of solution is particularly important when K is small in comparison with H.

BIBLIOGRAPHY.—For further information, and for an account of those branches of the subject—*e.g.*, the theory of impulses—not treated of here, the reader may consult Lord Kelvin and P. G. Tait, Natural Philosophy (Cambridge, 1912); E. J. Routh, Advanced Rigid Dynamics (London, 1905); E. T. Whittaker, Analytical Dynamics (Cambridge, 1927); P. E. Appell, *Mécanique Rationelle*, tome ii. (Paris, 1924). The last two contain extensive references to original sources.

(L. A. P.)

DYNAMISM (Gr. *δύναμις*, power), is the name coined by **A.** Van Gennep for that attitude of the primitive mind towards the sacred or occult which involves a prevailing sense of its peculiar power or *mana.* He is careful not to impute to the savage a theology in which any clear distinction is drawn between the impersonal and the personal aspects of the divine—as contrasted with advanced religion, which, as may be seen in Buddhism and Christianity respectively, may emphasize the one aspect almost to the exclusion of the other—but suggests dynamism as a term that may be used for classifying any phase of primitive religion in which *mana,* rather than soul or moral personality, receives emphasis as the leading attribute of that which is worshipped.

BIBLIOGRAPHY.—A. Van Gennep, ***Les*** *Rites de Passage* (1909); Rev. E. W. Smith and Capt. *A.* M. Dale, *The Zla-speaking Peoples of Northern Rhodesia* (1920). *(See* also MANA; ANIMATISM; ANIMISM.)
(R. R. M.)

DYNAMITE, a high explosive consisting essentially of nitroglycerine absorbed in an inert solid material in order to'reduce its sensitivity to shock. The most frequently used absorbent is kieselguhr (an infusorial earth), and an average composition is nitroglycerine 75%, kieselguhr 25%. Gelatine dynamite consists of nitroglycerine 75%, nitro-cellulose 6%, potassium nitrate 16%, and small quantities of wood-meal and chalk. (See EXPLOSIVES.)

DYNAMO-ELECTRIC MACHINES: see ELECTRIC GENERATOR, MOTOR, ELECTRIC, and ELECTRICAL ARTICLES.

DYNAMOMETER, an instrument for measuring force exerted by men, animals and machines. (Gr. *δύναμις*, strength, and *μέτρον*, a measure). The name has been applied generally to all kinds of instruments used in the measurement of a force, as for example electric dynamometers, but the term specially denotes apparatus used in connection with the measurement of work, or in the measurement of the horse-power of engines and motors. If P represent the average value of the component of a force in the direction of the displacement, s, of its point of application, the product Ps measures the work done during the displacement. When the force acts on a body free to turn about a fixed axis only, it is convenient to express the work done by the transformed product $T\theta$, where T is the average turning moment or torque acting to produce the displacement θ radians. The apparatus used to measure P or T is the dynamometer. The factors s or θ are observed independently. Apparatus is added to some dynamometers by means of which a curve showing the variations of P on a distance base is drawn automatically, the area of the diagram representing the work done; with others, integrating apparatus is combined, from which the work done during a given interval may be read off directly. It is convenient to distinguish between absorption and transmission dynamometers. In the first kind the work done is converted into heat; in the second it is transmitted, after measurement, for use.

Absorption Dynamometers.— Baron Prony's dynamometer *(Ann. Chim. Phys.* 1821, vol. 19), which has been modified in various ways, consists in its original form of two symmetrically shaped timber beams clamped to the engine-shaft. When these are held from turning, their frictional resistance may be adjusted by means of nuts on the screwed bolts which hold them together until the shaft revolves at a given speed. To promote smoothness of action, the rubbing surfaces are lubricated. A weight is moved along the arm of one of the beams until it just keeps the brake steady midway between the stops which must be provided to hold it when the weight fails to do so. The general theory of this kind of brake is as follows:—Let F be the whole frictional resistance, r the common radius of the rubbing surfaces, W the force which holds the brake from turning and whose line of action is at a perpendicular distance R from the axis of the shaft, N the revolutions of the shaft per minute, ω its angular velocity in radians per second; then, assuming that the adjustments are made so that the engine runs steadily at a uniform speed, and that the brake is held still, clear of the stops and without oscillation, by W, the torque T exerted by the engine is equal to the frictional torque Fr acting at the brake surfaces, and this is measured by the statical moment of the weight W about the axis of revolution; that is—

$$T=Fr=WR. \qquad (1)$$

Hence WR measures the torque T.

If more than one force be applied to hold the brake from turning, Fr. and therefore T, are measured by the algebraical sum of their individual moments with respect to the axis. If the brake is not balanced, its moment about the axis must be included. Therefore, quite generally,

$$T=\Sigma WR. \qquad (2)$$

The factor θ of the product $T\theta$ is found by means of a revolution counter. The power of a motor is measured by the rate at which it works, and this is expressed by $T\omega=\frac{T2\pi N}{60}$ in foot-pounds per second, or $\frac{T2\pi N}{33{,}000}$ in horse-power units. The latter is commonly referred to as the "brake horse-power." The maintenance of the conditions of steadiness implied in equation (1) depends upon the constancy of F, and therefore of the coefficient of friction μ between the rubbing surfaces. The heating at the surfaces, the variations in their smoothness, and the variations of the lubrication make μ continuously variable, and necessitate frequent adjustment of W or of the nuts. J. V. Poncelet (1788–1867) invented a form of Prony brake which automatically adjusted its grip as μ changed, thereby maintaining F constant.

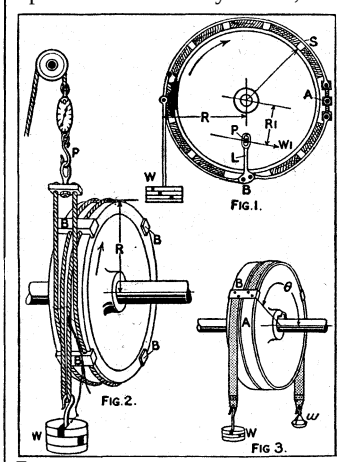

FIG. 1.—APPOLD COMPENSATING BRAKE
FIG. 2.—KELVIN ROPE BRAKE
FIG. 3.—THOMSON SELF-ADJUSTING BRAKE

The principle of the compensating brake devised by J. G. Appold (1800–1865) is shown in fig. 1. **A** flexible steel band, lined with wood blocks, is gripped on the motor fly-wheel or pulley by a screw **A,** which, together with W, is adjusted to hold the brake steady. Compensation is effected by the lever L inserted at B. This has a slotted end, engaged by a pin P fixed to the framing, and it will be seen that its action is to slacken the band if the load tends to rise and to tighten it in the contrary case. The external forces holding the brake from turning are W, distant R from the axis, and the reaction, W_1, say, of the lever against the fixed pin P, distant R from the axis. The moment of W_1 may be positive or negative. The torque T at any instant of steady running is therefore $\{WR \pm W_1R_1\}$.

Lord Kelvin patented a brake in 1858 (fig. 2) consisting of a rope or cord wrapped round the circumference of a rotating wheel, to one end of which is applied a regulated force, the other end being fixed to a spring balance. The ropes are spaced laterally by the blocks B, B, B, B, which also serve to prevent them from slipping sideways. When the wheel is turning in the direction indicated, the forces holding the band still are TY, and P, the observed pull on the spring balance. Both these forces usually act at the same radius R, the distance from the axis to the centre line of the rope, in which case the torque T is $(W-P)R$, and consequently the brake horse-power is $\frac{(W-P)R\times 2\pi N}{33{,}000}$ When μ changes the weight W rises or falls against the action of the spring balance until a stable condition of running is obtained. The ratio $\frac{W}{P}$ is given by $e^{\mu\theta}$, where $e=2{\cdot}718$; μ is the coefficient of friction and θ the angle, measured in radians, subtended by the arc of contact between the rope and the wheel. In fig. 2 $P,\theta=2\pi$. The ratio W/P increases very rapidly as θ is increased, and therefore, by making θ sufficiently large, P may conveniently be made a small fraction of W, thereby rendering errors of observation

of the spring balance negligible. Thus this kind of brake, though cheap to make, is, when θ is large enough, an exceedingly accurate measuring instrument, readily applied and easily controlled.

It is sometimes necessary to use water to keep the brake wheel cool. Engines specially designed for testing are usually provided nith a brake wheel having a trough-shaped rim. Water trickles continuously into the trough, and the centrifugal action holds it as an inside lining against the rim, where it slowly evaporates.

Fig. 3 shows a band-brake invented by Professor James Thomson, suitable for testing motors exerting a constant torque (see *Engineering*, 22nd October 1880). To maintain $e^{\mu\theta}$ constant, compensation for variation of μ is made by inversely varying θ. A and *B* are fast and loose pulleys, and the brake band is placed partly over the one and partly over the other. Weights W and w are adjusted to the torque. The band turns with the fast pulley if μ increasc, thereby slightly turning the loose pulley, otherwise at rest, until θ is adjusted to the new value of μ. This form of brake was also invented independently by J. A. M. L. Carpentier, and the principle has been used in the Raffard brake. A self-compensating brake of another kind, by Marcel Deprez, was described with Carpentier's in 1880 (*Bulletin de la société d'encouragement*, Paris). W. E. Ayrton and J. Perry used a band or rope brake in which compensation is effected by the pulley drawing in or letting out a part of the band or rope which has been roughened or in which a knot has been tied.

In an effective water-brake invented by W. Froude (see Proc. *Inst.* M. E. 1877), two similar castings, A and B, each consisting of a boss and circumferential annular channel, are placed face to face on a shaft, to which B is keyed, A being free (fig. 4). A ring tube of elliptical section is thus formed. Each channel is divided into a series of pockets by equally spaced vanes inclined at 45°. When A is held still, and B rotated, centrifugal action sets up vortex currents in the water in the pockets; thus a continuous circulation is caused between B and **A,** and the consequent changes *of* momentum give rise to oblique reactions. The moments of the components of these actions and reactions in a plane to which the axis of rotation is at right angles are the two aspects of the torque acting, and therefore the torque acting on B through the shaft is measured by the torque required to hold A still. Froude constructed a brake to take up 2,000 H.P. at go revs. per min. by duplicating this apparatus. This replaced the propeller of the ship whose engines were to be tested, and the outer casing was held from turning by a suitable arrangement of levers carried to weighing apparatus conveniently disposed on the wharf. The torque

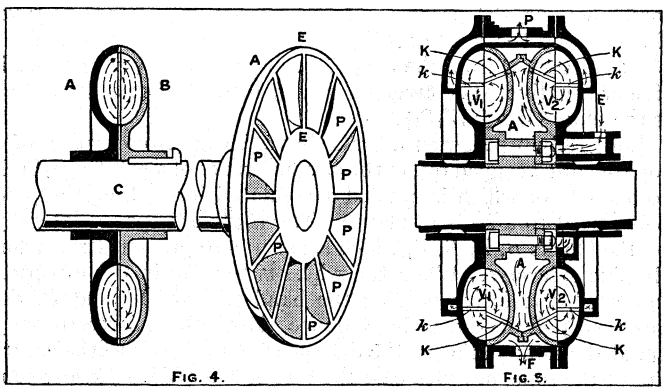

FIG. 4. FIG. 5.

FIG. 4.— DIAGRAMMATIC ILLUSTRATION OF THE HYDRAULIC BRAKE
FIG. 5.— FROUDE-REYNOLDSHYDRAULIC BRAKE

corresponding to 2,000 H P. at go revs. per min. is 116,772 foot-pounds, and a brake 5 ft. in diameter gave this resistance. Thin metal sluices were arranged to slide between the wheel and casing, and by their means the range of action could be varied from 300 H P. at 120 revs. per min. to the maximum. The form of the Froude Brake developed by Messrs. Heenan and Froude is widely used. It is specially convenient for measuring the torque of high speed engines.

Professor Osborne Reynolds in 1887 patented a water-brake (see Proc, *Inst C* E 99, p 167), using Froude's turbine to obtain the highly resisting spiral vortices, and arranging passages in the casing for the entry of water at the hub of the wheel and its exit at the circumference. Water enters at E (fig. 5), and finds its way into the interior of the wheel, **A,** driving the air in front of it through the air-passages K, K. Then following into the pocketed chambers V_1, V_2, it is caught into the vortex, and finally escapes at the circumference, flowing away at F. The air-ways k, k, in the fixed vanes establish communication between the cores of the vortices and the atmosphere. From $\frac{1}{5}$ to 30 H.P. may be measured at 100 revs. per min. by a brake-wheel of this kind 18 in. in diameter. For other speeds the power varies as the cube of the speed. The casing is held from turning by weights hanging on an attached arm. The cocks regulating the water are connected to the casing, so that any tilting automatically regulates the flow, and therefore the thickness of the film in the vortex. In this way the brake may be arranged to maintain a constant torque, notwithstanding variation of the speed. In G. I. Alden's brake (see Trans. Amer. *Soc. Eng.* vol. xi.) the resistance is obtained by turning a cast iron disk against the frictional resistance of two thin copper plates, which are held in a casing free to turn upon the shaft, and are so arranged that the pressure between the rubbing surfaces is controlled, and the heat developed by friction carried away, by the regulated flow of water through the casing. The torque required to hold the casing still against the action of the disk measures the torque exerted by the shaft to which the disk is keyed.

Transmission Dynamometers.—The essential part of many transmission dynamometers is a spring whose deformation indirectly measures the magnitude of the force transmitted through it. For many kinds of spring the change of form is practically proportional to the force, but the relation should always be determined experimentally. General A. J. Morin (see *Notice sur divers appareils dynamométriques*, Paris, 1841), in his classical experiments on traction, arranged his apparatus so that the change in form of the spring was continuously recorded on a sheet of paper drawn under a style. For longer experiments he used a "Compteur" or mechanical integrator, suggested by J. V. Poncelet, from which the work done during a given displacement could be read off directly. This device consists of a roller of radius r, pressed into contact with a disk. The two are carried on a common frame, so arranged that a change in form of the spring causes a relative displacement of the disk and roller, the point of contact moving radially from or towards the centre of the disk. The radial distance x is at any instant proportional to the force acting through the spring. The angular displacement, θ, of the disk is made proportioaal to the displacement, s, of the point of application of the force by suitable driving gear. If $d\phi$ is the angular displacement of the roller corresponding to displacements, $d\theta$ of the disk, and ds of the point of application of P, a, and C constants, then $d\phi = \frac{x\,d\theta}{\gamma} = \frac{a}{\gamma}\,\mathrm{P}ds = C \cdot Pds$, and therefore $\phi = C\int_{s_1}^{s_2} Pds$; that is, the angular displacement of the roller measures the work done during the displacement from s_1 to s_2. The shaft carrying the roller is connected to a counter so that ϕ may be observed. The angular velocity of the shaft is proportional to the rate of working. Morin's dynamometer is shown in fig. 6. The transmitting spring is made up of two flat bars linked at their ends. Their centres s_1, s_2, are held respectively by the pieces A, B, which together form a sliding pair. The block A carries the disk D, B carries the roller R and counting gear. The pulley E is driven from an axle of the carriage. The dynamometer car used by railway engineers to measure the tractive resistance of trains is essentially a development of the Morin apparatus. The pull exerted by the engine on the train passes through a spring. The deflection of the spring is carried through a mechanism to a pencil working on a drum driven continuously from the axle of the car itself. The curve drawn by the pencil then shows the tractive force in terms of the distance. A second pencil electrically connected to a clock traces a time line on the diagram with a kick at definite intervals of time. A third pencil traces an observation line in which a kick can be made at will by pressing any one of the electrical pushes

placed about the car, and a fourth draws a datum line. Other lines are also traced recording events of interest. The spring of the dynamometer car is usually made up of flat plates, spaced by distance pieces nibbed into the plates at the centre and by rollers at the ends. The draw-bar is connected to the buckle, which is carried on rollers, the ends of the spring resting on plates fixed to the under-frame. The gear operating the paper roll is driven from the axle of an independent wheel which is let down into contact with the rail when required. This wheel serves also to measure the distance travelled. A Morin disk and roller integrator is usually connected with the apparatus, so that the work done during a journey may be read off. A detailed account of a railway dynamometer car will be found in the "Railway Engineer," Dec. 1923.

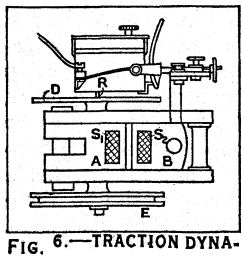

FIG. 6.—TRACTION DYNAMOMETER

In spring dynamometers designed to measure a transmitted torque, the mechanical problem of ascertaining the change of form of the spring is complicated by the fact that the spring and the whole apparatus are rotating together. In the Ayrton and Perry transmission dynamometer or spring coupling of this type, the relative angular displacement is proportional to the radius of the circle described by the end of a light lever operated by mechanism between the spring-connected parts. By a device used by W. E. Dalby (Proc. *Inst.* C.E. 1897–1898, p. 132) the change in form of the spring is shown on a fixed indicator, which may be placed in any convenient position. Two equal sprocket wheels, Q_1,Q_2, are fastened, the one to the spring pulley, the other to the shaft. An endless band is placed over them to form two loops, which during rotation remain at the same distance apart, unless relative angular displacement occurs between Q_1 and Q_2 (fig. 7) due to a change in form of the spring. The change in the distance d is proportional to the change in the torque transmitted from the shaft to the pulley. To measure this, guide pulleys are placed in the loops guided by a geometric slide, the one pulley carrying a scale, and the other an index. A recording drum or integrating apparatus may be arranged on the pulley frames.

Every part of a machine transmitting force suffers elastic deformation, and the force may be measured indirectly by measuring the deformation. The relation between the two should in all cases be found experimentally. G. A. Hirn (see Les *Pandynamomètres,* Paris, 1876) employed this principle to measure the torque transmitted by a shaft. Signor Rosio used a telephonic method to effect the same end, and mechanical, optical and telephonic devices have been utilized by the Rev. F. J. Jervis-Smith. (See Phil, Mag. February 1898.) H. Frahm (Zeitschrift des *Vereins* deutscher, *Ingenieure,* 31st May 1902), during an important investigation on the torsional vibration of propeller shafts, measured the relative angular displacement of two flanges on a propeller shaft, selected as far apart as possible, by means of an electrical device (Engineering, 6th of February 1903). These measurements were utilized in combination with appropriate elastic coefficients of the material to find the horse-power transmitted from the engines along the shaft to the propeller. In this way the effective horse-power and also the mechanical efficiency of a number of large marine engines, each of several thousand horse-power, have been determined.

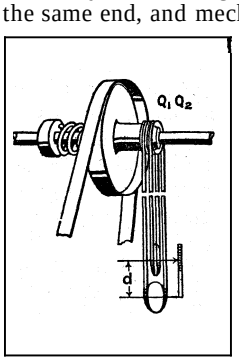

FIG. 7.—DALBY TRANSMISSION DYNAMOMETER

The method of deducing the power transmitted from observations based on the elastic deformation of the parts is specially useful in turbine driven engines because the steam engine indicator from which the indicated horse power is calculated cannot be used with a turbine.

In the Thring-Hopkinson Torsion Meter, the twist between points on a short length of the propeller is observed. A cylindrical sleeve is gripped to the shaft at one end and is free from the shaft at the other end so that there is relative motion of twist between the free end of the sleeve and the shaft. This relative motion is utilized to give angular displacement to a mirror which reflects light from a fixed source to a fixed scale and flashes an image to the scale once per revolution. At moderate speeds the intermittent images appear continuous to the eye and so a continuous indication is given on the scale of the relative twist of the ends of a length of shaft equal in length to the sleeve. As the torque increases the twist increases and the angular displacement of the mirror increases and the indication on the scale shows the instantaneous amount of twist. From the twist the torque on the shaft can be calculated.

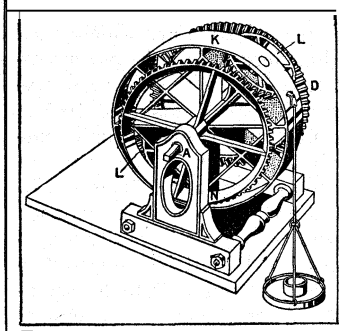

FIG. 8.— TRANSMISSION DYNAMOMETER

In the Moullin Torsion meter the relative twist of a defined length of the shaft is made to alter the self induction of a coil mounted upon and rotating with the shaft. An alternating current is supplied to the coil through brushes and slip-rings, and the variation of this current depends upon the variation of the self induction of the coil so that current variation is thereby related to twist of shaft. Meters placed in series with the coil are calibrated to read torque directly. A description of this instrument will be found in the first Report of the Marine Oil Engine Trials Committee together with some records taken on the shaft of the "Sycamore" when under trial.

In the Ford Torsion meter the relative twist of a definite length of shaft alters the air gap on a transformer mounted on the shaft, with the result that there is a variation of the e.m.f. of the secondary circuit. This variation is related to the twist and therefore to the torque on the shaft.

The difference in the tensions in the driving and slack sides of a driving belt has been made the basis of transmission dynamometers. For examples, reference may be made to the W. Froude belt-dynamometer (Proc. *Inst. M.E.* 1858) and to the Hefner-Alteneck dynamometer (see Electrotechnischen *Zeitschrift,* 1881, 7).

When a shaft is driven by means of gearing the driving torque is measured by the product of the resultant pressure P acting between the wheel teeth and the radius of the pitch circle of the wheel fixed to the shaft. Fig. 8, which has been reproduced from

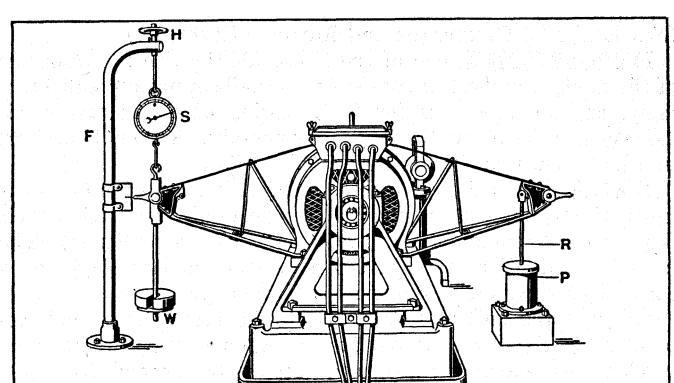

FIG. 9.—ELECTRIC CRADLE DYNAMOMETER

J. White's *A New Century* of Inventions (Manchester, 1822), illustrates possibly the earliest application of this principle to dynamometry. The wheel D, keyed to the shaft overcoming the resistance to be measured, is driven from wheel N by two bevel wheels L, L, carried in a loose pulley K. The two shafts, though in a line, are independent. A torque applied to the shaft A can be transmitted to D, neglecting friction, without change only if the central pulley K is held from turning; the torque required to do this is twice the torque transmitted.

The torque acting on the armature of an electric motor is neces-

sarily accompanied by an equal and opposite torque acting on the frame. If, therefore, the motor frame is mounted so that it is free to turn, and it is prevented from turning by the application of a torque, this applied torque T, measures the armature torque. The rate at which the motor is transmitting work is then $\frac{T2\pi n}{550}$ H.P., where n is the revolutions per second of the armature.

Electric dynamometers based on this principle are widely used to measure the power of high speed engines. Fig. 9 is an illustration of the electric dynamometer coupled to the Ricardo Experimental Petrol Engine. The engine shaft is coupled to the armature of the dynamo. The dynamo frame is held in ball bearings only and is thus free to turn about the axis of the armature shaft. Attached to the dynamo frame are light arms. The arm to the left carries a scale pan W and is hooked to a spring balance suspended from a fixed support F and adjustable in position vertically by the handwheel H. The arm to the left is connected to the piston of a dash pot P by the vertical rod R. Small oscillations are controlled by the dash pot. When the engine is running under load, weights are added to W and the hand wheel H is adjusted to keep the pointed end of the arm at the centre of the scale on the fixed support. The load, derived from W and the spring balance reading multiplied by the perpendicular distance of its line of action from the axis of revolution, measures the reaction T against which the armature is turned. A machine designed by F. W. Lanchester to test the efficiency of worm gears may be classed as a dynamometer since frictional loss in a worm and wheel is measured directly by weighing the reaction the friction produces. A description of this interesting machine, set up in the National Physical Laboratory will be found in Appendix Q of a paper entitled "Worm Gear," read before the Institution of Automobile Engineers, Proceedings Session 1912–13.

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DYNAMOTOR, an electrical machine which when set in motion by mechanical means generates electricity, and which, without any alteration, is capable of doing mechanical work when supplied with an electric current. Its action is thus reversible. (See ELECTRIC GENERATOR and MOTORS, ELECTRIC.)

DYNAPHONE, one of the latest additions to the resources of the modern orchestral composer. Described, not too enlighteningly, as "an apparatus for the emission of sound waves," it has been utilized by the French composer, Arthur Honegger, in a ballet entitled "Roses en métal."

DYNASTY, a family or line of rulers, a succession of sovereigns of a country belonging to a single family or tracing their descent to a common ancestor (Gr. δυναδεία, sovereignty). The term is particularly used in the history of ancient Egypt as a convenient means of arranging the chronology.

DYNE, the unit of force in the centimetre-gram-second system. It is the force which, acting on one gram, produces an acceleration of one centimetre per second per second: It is $1/g$ the gravitational unit of force which is the weight of one gram, g being the acceleration due to gravity. (See MECHANICS and PHYSICAL UNITS.)

DYRRACHIUM, CAMPAIGN OF (48 B.C.). Having destroyed Pompey's power in Spain, Julius Caesar returned to Italy, and on Nov. 28, 49 B.C., set sail from Brundisium with seven legions for Palaeste on the Epirotic coast. Landing on the 29th, on Dec. 2 he headed for Dyrrachium, which, however, he failed to capture. Though numerically weaker than Pompey he succeeded in cutting him off from this city, and then to safeguard his convoys he drew a circle of trenches some 16 miles in length round Pompey's army. Two deserters from Caesar's camp informed Pompey of the weak position in his defences, and acting on this information Pompey determined to attack his enemy's left flank, which rested on the coast.

Caesar had built round Pompey's right flank a line of contravallation and one of circumvallation, between which was posted the IX. legion. Pompey's attack was made at dawn. He landed a number of archers and slingers in rear of Caesar's men, and whilst these broke into the unfinished works he attacked them in front with 60 cohorts. The IX. legion, taken in front, flank and rear, broke in confusion and spread panic amongst the reinforcements which had been sent out by Marcellinus, near whose camp Antony checked the Pompeians by a bold counter-attack. Caesar, hearing of the disaster, moved rapidly with such cohorts as he could collect towards the scene of action, only to find that Pompey had established a new camp on his own original left flank. Nothing daunted, Caesar entrenched his men opposite to Pompey, and attempted to turn Pompey's left flank, but his forces, taking panic fell back, and the attack failed. In this battle Caesar suffered a severe defeat, and not only were his losses considerable, but his loss of prestige almost disastrous to his cause. Caesar's operations throughout this campaign, though daring in the extreme, were essentially faulty. By attempting to enclose a numerically superior adversary he was strong nowhere, and had Pompey known how to win victory as well as fight a battle Caesar must have been decisively defeated. (See PHARSALUS.)

DYSART, royal burgh and seaport, Fifeshire, Scotland, on the shore of the Firth of Forth, 2 m. N.E. of Kirkcaldy by the L.N.E.R. Pop. (1921) 4,598. Many ancient houses in High street bear inscriptions and dates. Scarcely anything is left of the old chapel dedicated to St. Dennis, which for a time was used as a smithy; and of the chapel of St. Serf, the patron saint of the burgh, only the tower remains. The chief industries are the manufacture of bed and table linen, towelling and woollen cloth, flax-spinning; there are power-loom factories and coal is exported. In smuggling days the "canty carles" of Dysart were professed "free traders." In the 15th and 16th centuries the town was a seat of the salt industry, but the salt-pans have been abandoned. During the time of the alliance between Scotland and Holland, which was closer in Fifeshire than in other counties, Dysart became known as Little Holland. To the west of the town is Dysart House, the residence of the earl of Rosslyn. With Burntisland, Kinghorn, Buckhaven, Methil and Inverleven Dysart forms one of the Kirkcaldy district group of parliamentary burghs. The town is mentioned as early as 874 in connection with a Danish invasion. Its name is said to be a corruption of the Latin *desertum,* "a desert," which was applied to a cave on the seashore occupied by St. Serf. From James V. the town received the rights of a royal burgh. In 1559 it was the headquarters of the Lords of the Congregation, and in 1607 the scene of the meetings of the synod of Fife known as the Three Synods of Dysart. Ravenscraig Castle, on the shore to the west of the town, is the Ravensheugh of Sir Walter Scott's ballad of "Rosabelle." William Murray, a native of the place, was made earl of Dysart in 1643. This borough was added to Kirkcaldy in 1930.

DYSENTERY. A disease which in man is characterized by the passage of blood and mucus, the bloody flux of former times. It results from the superficial and deep ulcerative action of certain protozoal and bacterial micro-organisms, primarily upon the large bowel and particularly its lower part. As dysentery may be due to diverse micro-organisms, the causal one or its family or generic name is employed to specify the type of infection, thus—amoebic, bacillary, spirochaetic, ciliar and helminthic dysentery, the first two being the most prevalent and of world-wide incidence.

Pseudo-dysentery. — The term has been given to passage of blood and mucus arising from ulceration of the lower bowel in diseases in which the activity of the causal micro-organism is not specifically selective for the lower bowel, but may occur in other parts, as in tubercle, syphilis, typhoid or paratyphoid. Again, passage of blood and mucus may be associated with a pathological state of the kidney, heart or liver or with carcinoma of the bowel, the impaction of a foreign body or mechanical irritation.

Clinical Dysentery. — The term clinical dysentery is applied

to a mild form of dysentery of short duration, seen especially in natives in the tropics, the aetiology of which is not yet known. In all forms of dysentery frequently there is abdominal pain and tenesmus, but one or both may be absent, for they depend on the site or extent of the ulceration.

Casual **Organisms.**—The casual micro-organisms have been grouped. Protozoa and bacteria found in the intestine of man have been classified into pathogenic and non-pathogenic, and the varieties of form certain protozoal organisms undergo in their life histories in the intestines, or when, as some helminths do, they pass through a phase of existence in an invertebrate host, have been studied and made known.

The findings of Walker and Sellards in Manila from experiments on condemned prisoners show that of the five amoebae found in man only one, *Entamoeba histolytica,* is pathogenic to him. Later Darling, James and others at Panama, differentiated it from the non-pathogenic E-coli. Recently Cutler, Boeek and Dr. Bohlar have cultivated E. *histolytica* in artificial media. In the Philippine Islands Vedder studied the specific action on amoebae of emetine, an alkaloid from ipecacuanha, and its application with beneficial results to man was first made by Sir Leonard Rogers in India. **A** new species of bacillus dysenteriae, B. dys. *Schmitz,* was first found in Rumania in 1916.

Improvements in Technique.—Mechanical aids have been improved to obtain more precise clinical knowledge. The sigmoidoscope, by which one can see 20cm. up the bowel, is now employed to look for any ulceration and its character in this region and, if present, specimens for laboratory examination can be taken direct therefrom. Skiagrams taken after a barium mixture, given by mouth or injected per anum, indicate the movements and the nature of the bowel condition, and presence of any ulceration, filling defects, strictures or diverticula in its wall in subacute or chronic cases *(see* X-RAY).

In England and France the existence of bacteriophage has been determined. Regarding dysentery d'Hérelle found that if a few drops of the filtrate from a broth culture of the faeces of a convalescent case of B. *dys. Shiga* be placed in a broth culture of this bacillus, the micro-organisms are dissolved *(see* BACTERIA AND DISEASE).

AMOEBIC DYSENTERY

This is also called amoebiasis, loeschiasis or tropical dysentery, the latter because of its early endemicity and greater incidence in the tropical areas.

The causal organism *E. histolytica* (Loesch 1871) affects man alone in nature, though the dog, cat, guinea-pig and rat have been infected experimentally. The *E. histolytica* in its life-cycle in man passes through three stages—a large vegetative stage when living within the tissues, giving rise to ulceration and passage of blood and mucus; a pre-cystic stage found in convalescents and carriers, when the amoebae are much smaller and live on the mucous membrane within the bowel, from which they may pass into the membrane and assume the larger vegetative form; and a cystic stage. The amoebae increase in numbers by division of the parent into two. In the pre-cystic stage they contract into smaller, rounded or ovoid forms, develop a firm outer wall and become transformed into cysts with one to four characteristic nuclei and chromatoid rods which possibly act as food stores. It is by swallowing these cysts that man is infected. They do not resist drying, but retain their vitality for two weeks if kept moist in the faeces or in water. They can therefore be transmitted by direct contamination with faeces, through handling soiled linen, by flies carrying them to food, by soil or by drinking contaminated water; and prophylaxis must be directed accordingly. The cysts pass through the stomach unchanged; in the small intestines they germinate, and amoebulae are set free. These grow, divide and penetrate into the submucous layer of the large bowel where they continue to proliferate and destroy the tissue, thus leading to haemorrhage and outpouring of mucus. Locally, a flask-shaped ulcer is formed, with roughened undermined edges at the orifice, and such ulcers are frequently joined by submucous tunnels.

Symptoms.—Clinically the disease is characterized by its chronicity and tendency to recrudescence. The onset is insidious, the sufferer first noticing debility and lassitude with an increase of stools, soft and mixed with blood and mucus. These may clear up after a few days and be the only signs noticed, or may recur months later. Most often the initial stage is followed by an acute exacerbation of symptoms, dependent in their degree upon the extent of the ulceration in the large bowel, the most markedly affected sites being the entire colon, the caecum, flexures and appendix, sigmoid and rectum. Stools become still more frequent, even up to 40 or 50 in 24 hours, and the ulceration gives rise to abdominal pain and, if at the rectum, to severe tenesmus. In uncomplicated cases there is but slight rise of temperature or other symptoms of toxaemia as the entamoeba produces no toxin. Diagnosis is quickly made by microscopical examination of the stools.

Occasionally infection with other bowel organisms supervenes, and gangrene may follow, or the amoebae may perforate the large bowel, giving rise to peritonitis, or, penetrating a blood-vessel and being conveyed by the blood stream they may cause an abscess in the liver, or, most exceptionally, in the brain or lung. Healing is brought about by the development of fibrous tissue at the sites of the ulcers.

Treatment.- he specific treatment is ipecacuanha, or its alkaloid, emetine. Combined hypodermic injections of emetine hydrochloride with oral administration of ipecacuanha (Brazilian), or of bismuth subnitrate in large doses, to attack the amoebae from within and without have given striking results. The toxic action of emetine on the heart must be watched. Added to the specific treatment in acute cases there is the general and symptomatic, which may include an early free flushing of the bowel by a dose of castor oil with tinct. opii. added; later followed by magnesium (or sodium) sulphate in hourly or two-hourly half or drachm doses for 12 or **24** hours. Morphia may be necessary to relieve the abdominal pain and straining. The diet must be light and easily assimilated, and raw food should be withheld.

The symptoms subside in one to three weeks, the patient regains his general health after suitable convalescence and no further trouble may follow. However, not infrequently the scar tissue formed in healing leads to thickening of the bowel wall, partial loss of peristalsis or constriction producing chronic constipation; or again the entamoeba may persist in the lumen of the bowel, ready to enter its wall and renew symptoms when conditions so favour.

Therapy Notes.—Treatment to eliminate the entamoeba in its pre-cystic form from within the lumen of the bowel of the carrier is not yet on an equally satisfactory basis. Emetine hydrochloride injections have no effect upon it. An important measure to avoid recrudescence is to maintain the general health and avoid indiscretions in diet. Intravenous injections and colonic lavage with neosalvarsan have been much used to supplement oral treatment by the French. Amoebic hepatitis and small abscess of the liver respond well to injections of emetine hydrochloride, but a large abscess needs surgical intervention. **A** carrier should, if possible, live in the temperate zone.

BACILLARY DYSENTERY

While sharing with the amoebic the clinical dysenteric syndrome above described, it differs therefrom by the shortness of the incubation period, generally **24** to 72 hours, its acute onset with fever that may persist several days or more, and other symptoms of toxaemia; extreme contagiousness; seasonal prevalence (midsummer and autumn); epidemic character and incidence in temperate regions, where the amoebic type is practically limited to sporadic cases; higher death-rate. It also differs in the complications that may follow infection more especially with B. *dys. Shiga,* namely: arthritis, fibrositis, conjunctivitis, muscular paralysis and myocarditis. Clinically it may vary from mild to severe, and occasionally be hypertoxic, typhoidal or ulcero-gangrenous. Outbreaks of dysentery in asylums, prisons, concentration camps and ships are generally bacillary in type.

The bacillary dysentery group comprises:—

1. B. *dys. Shiga,* containing endotoxins pathogenic to man and experimental animals.

2. *B. dys. Schmitz,* containing endotoxins acting severely on rabbits but much less pathogenic to man. Its incidence is rare.

3. *B. dys. Flexner-Hiss,* heterogeneous group fermenting mannite and producing indol from peptone. It contains many species recently distinguished by agglutination and absorption reactions.

4. A further group rarely found and having specific agglutination and absorption properties and power to ferment certain sugars; *e.g., Bacillus* of *Strong, Castellani, Gay, d'Hérelle* and others, each capable of producing a mild, clinically dysenteric syndrome in man.

Symptoms. — Clinical symptoms vary, as do the degree of the intestinal lesions and the toxicity of the causal bacillus. Infections with B. *dys. Shiga* are the most severe. The ulcerative lesions are not confined to the large bowel but extend one to two feet up into the small intestine. The bacilli pass through the stomach, multiply in the small intestine and produce at least two toxins which are absorbed into the blood, one acting on the nervous system and the other excreted into the large bowel, causing inflammation with coagulation of lymph, thrombosis of vessels and necrosis of the submucous layer and superimposed mucous membrane. The bacilli proliferate on the bowel wall, diphtheritic-like membrane, forms and separates off, leaving superficial ulcers with raised, red, oedematous edges. These may deepen by continued microbic action and even perforate, leading to peritonitis, or gangrene may set up in the damaged necrosed tissue, and in either case death follows unless surgical intervention is early. Repair proceeds along the same lines as in amoebic cases, but, the ulcers being generally more superficial, the permanent damage is not so great.

The stools have a characteristic microscopic appearance, as numerous pus and epithelia1 cells and large, macrophage cells are present in the mucus. Microscopically the stool most often consists of mucus, like cloudy-grey jelly streaked or stained by bright red blood, or the mucus may be bile-stained in a diarrhoea-like stool, or, in very severe cases, there are shreds of necrosed mucosa.

Treatment. — In bacillary dysentery the patient is much more ill than in amoebic, and treatment is directed to neutralizing the toxins which act strongly on the heart and other vital organs, and elimination of the micro-organism from the intestines. Infections with *B. dys. Shiga* are outstandingly the most severe, and it is the anti-Shiga serum which is the most efficacious. It has also been used in severe cases due to B. *dys. Flexner-Hiss* with some success. A serum prepared by inoculating strains of both these groups of micro-organisms has been extensively used in cases of either infection. The injections should be given as early in the disease as possible and in large doses, *e.g.,* 60c.c., 40c.c., 20c.c., on successive days in a severe case; saline aperients until the stools become faecal should be given frequently. Heart stimulants may be needed. Diet as above. Thereby amelioration is rapid, sequelae rare, the bacillus early eliminated and convalescent carriers much more rare than after amoebic dysentery, and the bowel wall is not so often permanently damaged. After an attack careful dieting is needed.

Prophylaxis. — The general prophylactic measures are the same as those against infections with E. *histolytica.* Dependent on several factors, bacillary is more contagious than amoebic dysentery. Inoculations with a vaccine of *B. dys. Shiga* were made in epidemic areas in the World War. Its contained toxins give rise to acute local reactions unless modified prior to inoculation by special methods. These series of inoculations made by various workers gave encouraging results. Vaccine-therapy employed to rid the convalescent carrier of *B. dys. Shiga* has not been successful. In striking contrast with B. *dys. Shiga* the killed and untreated emulsions of the *B. dys. Flexner-Hiss* group give rise to no reaction, even in high doses.

Spirochaetic Dysentery. — This is due to *Spirochaeta eurygyrata* (Le Dantec 1900, Werner 1910). Evidence is increasing that this spirochaeta is capable of giving rise to an acute condition with passage of blood and mucus or, more frequently, of maintaining a chronic or intermittent mild form of dysentery. It is never found free in faecal matter but only in mucous shreds excreted, in the detached crypts and occasionally within the lining epithelial cells of the mucous membrane. Many observers consider that it proliferates and gains a footing on a bowel damaged by the entamoeba. It is a rare form of dysentery but has a wide endemic distribution in tropical and subtropical countries. Treatment of the very rare acute condition is by frequent saline aperients. In its chronic form best results have followed enemata containing oil of eucalyptus, or by calomel followed by a saline aperient or by Slovarsol.

Helminthic Dysentery. — The chief helminths which give rise to dysentery are the bilharzia worms, *Schistosoma mansoni,* in Africa, South America, West Indies and *Schistosoma japonicum* in the Far East. Another trematode which may cause dysenteric symptoms is *Fasciolopsis buski,* found in China, Assam and India. Thymol or beta-naphthol are used in treatment of this latter.

Infections with hookworm *(see* HOOKWORM), *Ankylostoma duodenale,* are widely distributed in tropical lands and extend to subtropical regions. In such infections blood and mucus are sometimes passed in large quantities and these cases may be mistaken for true dysentery.

Ciliar dysentery due to *Balantidium coli* is a form of dysentery that has been found in Europe, Japan and the Philippine Is., but rarely elsewhere. An investigation of a number of habitants of Utuado, Porto Rico, led to the detection of many carriers without symptoms. The ciliar form of dysentery is rarely seen outside endemic regions.

Carriers. — A certain number of cases of dysentery become convalescent carriers, harbouring the parasite in the intestine with or without obvious activities on the host. The contact or healthy carrier may have no signs past or present. Neither type of carrier is common in the bacillary form, but both are not very uncommon in amoebic dysentery.

GENERAL CONCLUSION

Epidemiology. — Dysentery is markedly more frequent in hotter countries and tends to arise in subjects of lowered body resistance. The disease appears in its most devastating epidemic form in armies, fugitives, refugees and pioneers, and vanishes before the comfort and prosperity of a well-fed and settled people, especially when living under favoured climatic and sanitary conditions. During the World War, its incidence was great in all armies, especially those fighting in tropical countries where the conditions favoured it, and in parts of eastern Europe where sanitary control was not scrupulously exercised. On the Gallipoli Peninsula, nearly every soldier who landed suffered from dysentery or diarrhoea, and few escaped the former disease. Severity of the climatic conditions, difficulties of obtaining adequate food and sterilized water, fly pests, fatigue, hastily improvised resting places and sanitary arrangements, prolonged periods in trenches, were the important factors conducive to infection. The comparatively small death roll was due to the knowledge that dysentery may be due to diverse organisms, each having a specific line of treatment. Most deaths were due to *B. dys. Shiga* infections.

Incidence. — In most temperate zones the incidence of dysentery is practically limited to occasional small outbreaks of the bacillary form, to sporadic cases of this or of the amoebic form due to infection from a patient or carrier, and to cases that have been infected in tropical or subtropical lands or under war and such like conditions of life; but in hot climates these forms of dysentery normally claim a very high incidence and death rate, approximating to that of malaria.

To show the benefit arising from applied research it suffices to mention that amoebic dysentery, once so prevalent in the Panama Canal Zone, is now uncommon there, while in the Malay States, where bacillary dysentery is the more frequent form, there has been an increasing fall in the number of cases and death rate.

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DYSON, SIR FRANK WATSON (1868–1939), British astronomer, was born at Ashby-de-la-Zouch, Leicestershire, on Jan. 8, 1868, and was educated at Bradford Grammar School and Trinity College, Cambridge, where he was second wrangler and Smith's Prizeman. In 1894 he became chief assistant at the Royal Observatory, Greenwich, and in 1905 was made astronomer royal of Scotland, a position which he held until his return to Greenwich as astronomer royal of England (1910–33). From 1899 to 1905 he was secretary of the Royal Astronomical Society. He was elected F.R.S. in 1901, subsequently serving on the council, and was in 1921 awarded the royal medal for his numerous contributions to astronomy, and especially for his important investigations of the distribution and movements of stars and the bearing of these upon the structure of the stellar universe. His observations of the spectrum of the corona and chromosphere during eclipses of the sun were published in Determination of Wave Length from Spectra Obtained at the Total Solar Eclipses of *1900, 1901 and 1905* (1906). Knighted in 1915, he was created R.B.E. in 1926. He also wrote Astronomy, *a* handy *manual* for *students* and others (1912), and many valuable contributions to the *Quarterly Journal* of Mathematics, etc.

DYSPEPSIA or **INDIGESTION,** a term vaguely given to a group of pathological symptoms. Dyspepsia may occur in almost any organic disease of moment, particularly if it involves the alimentary canal, but here the term is used to describe derangement of the natural process of digestion, without obvious change in the organs concerned in the act.

The condition may depend on (a) the food, and (b) the organism. In respect of food common causes are indigestible articles of diet, over-eating, irregular and over-hasty meals, insufficient mastication especially of smoked or salted meat, whether from haste or poor dentition. Drinks are a common source of dyspepsia, particularly new beer, vinegar, acid wines and tea. Even too much water at mealtimes may cause indigestion, since the food in the mouth is softened by water instead of saliva, and, the gastric juice being diluted, digestion in the stomach is too slow and prolonged. Mention must also be made of chronic alcoholism and excessive tobacco smoking.

Of the causes which concern the organism, nervous influences come first. Crises in the money market are a fertile source of dyspepsia among financiers. Bad news, worry or mental trouble may take away all power of digestion and even provoke vomiting. General weakness and atony affect the stomach also, and, if the muscles of the abdominal wall be much wasted, they fail to support the abdominal viscera. Hence results a general tendency for these organs to fall (visceroptosis), when an obstinate dyspepsia is a very marked feature. Again, dyspepsia is often one of the early symptoms of renal disease, or, in young people, of pulmonary tuberculosis. In fact, any condition which lessens the general well-being of the organism as a whole, apart from its producing a permanent morbid condition in the stomach, may yet interfere with the normal digestive processes and so give rise to dyspepsia.

Symptoms.—A furred tongue, foul breath, disturbance of appetite, nausea and vomiting, oppression in the chest, pain, flatulence and distension, acidity, pyrosis and constipation or diarrhoea are the commonest symptoms.

When the attack is acute, *e.g.*, a few hours after a heavy meal following severe exertion, there is often pain with sickness and vomiting, after which the patient soon regains his former healthy state. In chronic cases the symptoms are somewhat different. A sensation of discomfort comes on shortly after a meal, and is more of the nature of weight and distension in the stomach than of actual pain, although this too may be present. These feelings may follow each meal, or only certain meals, and they may arise irrespective of the kind of food taken, or only after certain articles of diet. The stomach is dilated and lactic acid fermentation of the contained food leads to accumulation of gases which causes flatulence and eructations of an acid or foul character. Occasionally quantities of hot, sour, tasteless or bitter fluid—pyrosis—or mouthfuls of half-digested food, regurgitate from the stomach. Temporary relief may be obtained when another meal is taken, but soon the discomfort returns as before. The appetite may be craving or deficient, or desirous of abnormal kinds of food. Constipation is more common in the chronic forms of dyspepsia, diarrhoea in the acute.

Symptoms in other parts are often more distressing than the merely gastric symptoms. Pains in the chest, shortness of breathing, palpitation, headache, giddiness, affections of vision, coldness of the extremities, and general languor are common accompaniments of dyspepsia; the nervous phenomena include sleeplessness, irritability, despondency and hypochondriasis.

Treatment.—Experience has shown that no particular kind of food or avoidance of food is absolutely to be relied on; in general the best diet is one of a mixed animal and vegetable kind, simply but well cooked. Highly-seasoned or salted meats, raw vegetables, newly-baked bread, pastry and confectionery are all well-known common causes of dyspepsia, and should be avoided. When even a simple diet is found to disagree it may be necessary to change it temporarily for a milk diet, and that even in very moderate quantity. Alcohol in small doses is usually beneficial in atonic dyspepsia of the aged, but in the young, and particularly in acute gastric conditions, it is injurious.

The medicinal treatment of dyspepsia can only be undertaken by a physician, but the following is a very brief résumé of the drugs he depends on. Bicarbonate of soda with some bitter, as quassia, gentian or columba, is much in vogue as a direct gastric stimulant. In irritable dyspepsia some form of bismuth in solution or powder; and, to assist digestion through the nervous system, nux vomica and strychnine can be relied on. Hydrochloric acid, pepsin and rennet are prescribed in many forms, but where there is much vomiting ingluvin is more efficacious than pepsin. When starchy food is badly borne, diastase is helpful, given either before or with the meal. To prevent fermentation, phenol, creosote and sulpho-carbolate of soda are all extremely useful in skilled hands; and for intestinal decomposition and flatulent distension, bismuth salicylate with salol or β-naphthol is much used.

See also DIGESTIVE ORGANS; NUTRITION; DIET ASD DIETETICS.

DYSPROSIUM is a metallic element belonging to the rare-earth group. In 1886 de Boisbaudran deposited a sealed paper with the Académie des Sciences; this was opened at a later date and read at the writer's request. It contained the statement that a new element possessing a characteristic absorption spectrum had been separated from crude holmia. The oxide was obtained pure for the first time in 1906 by G. Urbain. This element occurs along with erbium, holmium, etc., in the minerals gadolinite, euxenite, xenotime, etc. Its symbol is Dy, atomic number 66, and atomic weight 162.5. It is best obtained free from its congeners by the fractional crystallization of the bromates. The white oxide dissolves in many acids forming yellowish-green solutions which show a strong absorption spectrum. The salts of this metal possess the highest magnetic susceptibility of all salts. See RARE EARTHS. (C. J.)

DYSTELEOLOGY, a modern word invented by Haeckel (*Evolution* of Man) for the doctrine of purposelessness, as opposed to the philosophical doctrine of design (Teleology).

DYVEKE: see *s.v.* CHRISTIAN II., KING OF DENMARK.

DZERZHINSKY, FELIX EDMUNDOVICH (1877–1926), Russian politician of Polish descent, was born at Vilna. He joined the Social Democratic Party of Lithuania in 1895, and two years later was arrested and banished to Siberia for political agitation. In 1899 he escaped, was rearrested in the following year and in 1902 again escaped. After he had taken part in the revolution of 1905 there followed further years of banishment until 1912, when he returned to Warsaw, was arrested again and sentenced to nine years hard labour. After the revolution of March 1917, he was released and became a member of the military revolutionary committee which organized the Bolshevik revolution. In Dec. 1917 he organized and became chairman of the Cheka, or secret police, afterwards the Ogpu. He was appointed commissar of the home department in 1919. The organization of the Cheka was found to be so complete that it was possible to dispense with Dzerzhinsky's supervision and in 1921 he was transferred to the commissariat of transport, where

he carried out an exhaustive reform of the railways. In 1924, after the party dispute on policy at the time of Lenin's death, Dzerzhinsky was placed at the head of the supreme economic council. He died in July, 1926.

DZUNGARIA, DSONGARIA or JUNGARIA, a former Mongolian kingdom of central Asia, raised to its highest pitch by Kaldan or Bushtu Khan in the latter half of the 17th century, but completely destroyed by Chinese invasion about 1757–59. It derived its name from the Dsongars, or Songars, who were so called because they formed the left wing (dson, left; gar, hand) of the Mongolian army. Its widest limit included Kashgar, Yarkand. Khotan, the whole region of the T'ien Shan (or Tian-shan) mountains, and the greater proportion of that part of central Asia which extends from 35° to 50°N. and from 72° to 97°E. The name, however, is more properly applied only to the later Chinese province of T'ien-Shan-pei-lu and the country watered by the Ili. As a political or geographical term it has practically disappeared from the map.

E the fifth letter of the alphabet, answers to Semitic 𐤄, Greek Ε or Ε, Latin E. Forms in use at Corinth were Ε or Β. The Lydian form was 𐤄 and there was an alternative form 𐤄 in use in the Faliscan and Latin alphabets. The uncial form was from the 4th century A.D. rounded Ε and the cursive form was also round, ℯ. From these developed the Carolingian e from which the modern minuscule *e* is derived.

The sound represented by the letter was a low front vowel corresponding, though inexactly, to the sound of English *a* in *take*. The latter is a diphthong, whereas *e* represented an unmixed vowel sound, such as that heard in French *tête* or *été*. In Greek

NAME OF FORM	APPROX-IMATE DATE	FORM OF LETTER
PHOENICIAN	B.C. 1.200	𐤄
CRETAN	1,100-900	𐤄 𐤄
THERAEAN	700600	4
ARCHAIC LATIN	700-500	(Ε)
ATTIC	600	𐤄
CORINTHIAN	600	𐤄 𐤄 𐤄
CHALCIDIAN	600	Ε
IONIC	403	𐤄
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	Ε WITH 𐤄
URBAN ROMAN		E
FALISCAN		𐤄 Ε
OSCAN		𐤄 Ε
UMBRIAN		Ε 𐤄
CLASSICAL LATIN AND ONWARDS		E

THE DEVELOPMENT OF THE LETTER "E" FROM THE PHOENICIAN THROUGH CLASSICAL LATIN TO THE PRESENT FORM

ε stood for a short, close vowel as opposed to η whose sound was long and open, although in all local alphabets, especially in early times, this distinction was not exactly observed. In Attic Greek the long, close sound was expressed by EI. In the Latin alphabet the letter E did duty for all shades of the sound, long or short, close or open.

In English an extensive change has taken place in the sound of the long vowel during and since the later Middle English period (probably between the 11th and 17th centuries). Just as the sound represented by *a* moved forward till it now covers the ground of that formerly represented by *e*, so the latter moved upward, encroaching upon and occupying the territory of the sound of *i*, which became a diphthong. The sound of English long e is now a close high palatal vowel, as in *be*, that of short *e* a more open and less high front vowel, as in *bed*, that has not to any great extent shifted from what may be called its original position (cf. the sounds of French *été* and English *bed*). When followed by *r* the sound is modified and is less high, as in *here*. In the word *there* the vowel has the same sound as that of a in *hare*. In many English words a mute final *e* is employed as a device to mark the fact that the preceding vowel is long, e.g., *take*, *wine*, *stone*. This occurs only when the final *e* is separated from the long vowel by a single consonant. Again, in words such as *added*, *rotten*, the letter represents little more than a voice glide.

In music, E is the fifth note of the musical alphabet and the third degree of the "natural scale" of C. Its syllabic name, employed in France and Italy, is mi.

EA (written by means of two signs signifying "house" and "water"), in the Babylonian religion, was the god of wisdom and patron deity of Eridu, situated in ancient times at the head of the Persian Gulf but now at some distance from the gulf. Eridu, "the good city," was one of the oldest settlements in the Euphrates valley, and is now represented by the mounds known as Abu Shahrein. Whether Ea (or A-e) represents the real pronunciation of his name we do not know. The name is rendered by Ἀός in the theogonies of Damascius, and by Ὡάννης in the fragments of Berossus. All attempts to connect Ea with Yah and Yahweh are idle conjectures without any substantial basis. The original Sumerian name of this god is En-Ki, "Lord of the earth," referring to his abode in the *Apsu*, or nether sea, from which springs and rivers were supposed to flow. He is never connected with the salt water seas. Ea is not found earlier than the 22nd century. He is figured as a man covered with the body of a fish, and this representation, as likewise the name of his temple E-apsu, "house of the watery deep," points decidedly to his character as a god of the waters (*see* OANNES). Of his cult at Eridu, which reverts to the oldest period of Babylonian history, nothing definite is known. Incantations, involving ceremonial rites, in which water as a sacred element played a prominent part, formed a feature of his worship. Eridu never played an important political rôle. The prominence of the Ea cult led to the survival of Eridu as a sacred city, long after it had ceased to have any significance as a political centre, *c.* 2200 B.C. Myths in which Ea figures prominently indicate that Ea was regarded as the protector and teacher of mankind. He is essentially a god of civilization, the creator of man and of the world in general. Traces of this view appear in the Marduk epic celebrating the achievements of this god, and the Ea cult at Eridu is connected with that of Marduk, since Marduk is generally termed the son of Ea who derives his powers from the voluntary abdication of the father in favour of his son.

Ea acquires his permanent place in the pantheon as the third figure in the triad, the two other members of which were Anu (*q.v.*) and Enlil (Bêl). To him was assigned the control of the watery element, and in this capacity he becomes the *shar*

apsi, i.e., king of the Apsu or "the deep," an ocean beneath the earth. Since the gathering place of the dead, known as Arālu, was situated near the confines of the Apsu, he was also designated as En-Ki, *i.e.,* "lord of that which is below," in contrast to Anu, who was the lord of the "above" or the heavens. The cult of Ea extended throughout Babylonia and Assyria. Temples and shrines were erected in his honour, *e.g.,* at Nippur, Girsu, Ur, Babylon, Sippar and Nineveh, and the numerous epithets given to him, as well as the various forms under which the god appears, alike bear witness to the popularity which he enjoyed from the earliest to the latest period of Babylonian-Assyrian history. The consort of Ea, known as Damkina, "lady of that which is below," or Nip-Ki, having the same meaning, or Damgal-nunna, "great lady of the prince," plays a part merely in association with her lord.

BIBLIOGRAPHY.—Tentative excavations were made at Eridu in 1919 by H. *R.* Hall, *see* "Ur and Eridu," *Journal of Egyptian Archaeology,* IX. (1923), and in 1918 by R. Campbell Thompson, *The British Museum Excavations at Abu Shahrein, Archaeologia LXX.* (1920).

EACHARD, JOHN (1636?–1697), English divine, was born in Suffolk, and was educated at Catharine Hall, Cambridge, of which he became master in 1675 in succession to John Lightfoot. He was twice *(1679* and *1695)* vice-chancellor of the university. He died on July *7, 1697.* In 1670 he had published anonymously a humorous satire entitled *The Ground and Occasions of the Contempt of the Clergy enquired into in a letter to R. L.* He attacked the philosophy of Hobbes in his *Mr. Hobb's State of Nature considered in a dialogue between Philautus and Timothy* (1672), and in his *Some Opinions* of *Mr. Hobbs considered in a second dialogue (1673).*

See his *Works* (3 vols., 1774). The *Contempt of the Clergy* was reprinted in E. Arber's *English Garner.*

EADBALD (ĕd'bawld) (d. 640), king of Kent, succeeded on the death of his father Aethelbert in *616.* He had not been influenced by the teaching of the Christian missionaries, and on his accession he followed the heathen custom and married his father's widow. After his subsequent conversion by Laurentius, archbishop of Canterbury, he recalled the bishops Mellitus and Justus, who had fled from his persecution, and built a church dedicated to the Virgin at Canterbury. He arranged a marriage between his sister Aethelburh and Edwin of Northumbria, on whose defeat and death in *633* he received his sister and Paulinus, whom he had sent with her, and offered the latter the bishopric of Rochester. After his conversion Eadbald ceased to live with his first wife, and married Emma, a Frankish princess. He died on Jan *20, 640.*

See Bede, *Historia ecclesiastica* (ed. *C.* Plummer, *1896);* *Saxon Chronicle* (ed. *J.* Earle and C. Plummer, *1899).*

EADMER or **EDMER** *(c.* 1060–1124), English historian and ecclesiastic, was probably of English parentage. At the monastery of Christ Church, Canterbury, he met Anselm, to whom he served as assistant when Anselm became archbishop of Canterbury in 1093. In 1120 he was nominated archbishop of St. Andrew's, but the Scots refused to recognize the authority of Canterbury. He died probably in 1124. His most important work is the *Historiae Novorum,* dealing with the history of England, mainly ecclesiastical, between 1066 and *1122.* It was first edited by John Selden in *1623.* Together with his *Vita Anselmi* (first printed in Antwerp in 1551) it was edited by M. Rule for the Rolls Series (London, *1884).* He also wrote lives of St. Dunstan and St. Oswald which are printed in Henry Wharton's *Anglia Sacra* part *2,* (1691), which has also a list of his works. Most of his mss. are in the library of Corpus Christi college, Cambridge.

See M. Rule, *On Eadmer's Elaboration of the first four Books of "Historiae novorum" (1886);* and Père Ragey, *Eadmer (1892).*

EADS, JAMES BUCHANAN (1820–1887), American engineer, was born at Lawrenceburg (Ind.), on May 23, *1820.* His first engineering work of any importance was in raising sunken steamers. In *1845* he established glass works in St. Louis. During the Civil War he constructed ironclad steamers and mortar boats for the Federal Government. His next important engineering achievement was the construction of the great steel arch bridge across the Mississippi at St. Louis upon which he was engaged from *1867* till *1874.* The work, however, upon which his reputation principally rests was his deepening and fixing the channel at the mouths of the Mississippi by means of jetties, whereby the narrowed stream was made to scour out its own channel and carry the sediment out to sea. Shortly before his death he projected a scheme for a ship railway across the isthmus of Tehuantepec, in lieu of an isthmian canal. He died at Nassau, in the Bahamas, on March *8, 1887.*

EAGLE, the name given to the larger diurnal birds of prey which are not vultures and which form the sub-family *Aquilinae.* They inhabit all regions of the world. Some seven or eight species inhabit Europe, of which only one is now resident in Britain.

BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

AMERICAN EAGLE, THE NATIONAL EMBLEM OF THE UNITED STATES In the adult of this "bald" sea eagle, the head, neck and tail are white

The golden eagle *(Aquila chrysaetus)* inhabits the palaearctic and most of the nearctic regions. The plumage is dark brown, with the neck-feathers light tawny and the tail marbled with grey and lighter brown. It nests on cliffs, building a huge eyrie of sticks in which the female lays from two to four white eggs, mottled with red and purple. The same nest may be used year after year. The young are clad in white down. The Kirghiz Tartars use the golden eagle to capture antelopes. Allied species include the imperial eagle *(A. heliaca)* of Asia and south-east Europe; and *A. pennata* of southern Europe, Africa and India, which is the smallest of all eagles.

A second British species was the erne, sea-eagle or white-tailed eagle (*Haliaeetus albicilla*), which inhabits the whole of the northern part of the Old World, but has recently ceased to breed in Britain. The plumage is greyish-brown with a pale head, yellow beak and white tail. The nest resembles that of the golden eagle, but is more usually near water, for in addition to the hares, rabbits, grouse and other prey of *A. chrysaetus,* the erne eats fish and the refuse thrown up by the tide. Larger than either is *H. pelagicus* of eastern Asia, recognized by its white thighs and upper wing-coverts. Other species occur in south-east Europe, India, Malay, Australia, South Africa and Madagascar. All may be distinguished from the *Aquila* group by the bare, sealy tarsi.

In America the golden eagle is found from Labrador and interior Alaska to central Mexico, breeding in suitable localities throughout its range. The bald eagle (H. *leucocephalus*), the national emblem of the United States, is distributed from Maine to the coast of Alaska to northern Mexico, breeding throughout its range. Young birds in the first winter are streaked with brown and gray, much darker above. Later stages show heavy streaking of black and white on the under parts. Probably three years are required to attain adult plumage. Bald eagles are common in the lower Hudson valley when the river is frozen.

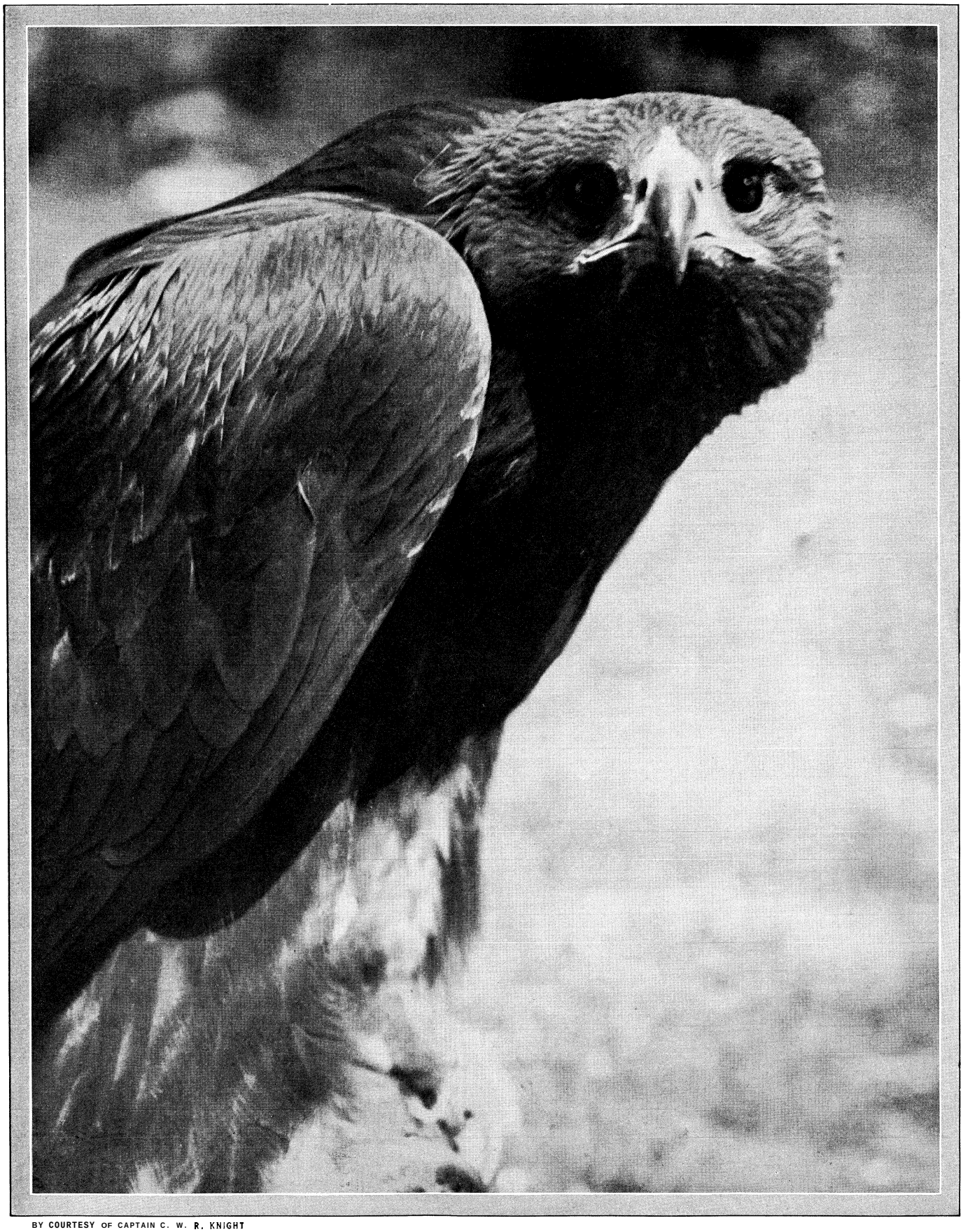
Local races of the bald eagle are *H. l. hypoleucus,* a paler subspecies found on Bering island, and the Alaskan H. *l. alascanus.*

The monkey-eating eagle (*Pithecophaga jefferyi*) is the largest of all eagles; it is related to the harpy (*q.v.*). It inhabits the Philippine Islands.

All eagles are remarkable for the power and stateliness of their flight, which is largely "soaring" in type, *i.e.,* the wings are not flapped, but kept stretched out, and the bird appears to float through the air.

See C. W. R. Knight, *The Golden Eagle (1927);* *F.* H. Herrick, *American Eagle* (1934).

EAGLE GROVE, a city of Wright county, Iowa, U.S.A., near the Boone river, 92 mi. N. by W. of Des Moines. It is served by the Chicago and North Western and the Chicago Great Western railways. The population in 1940 federal census was 4,024 It is



BY COURTESY OF CAPTAIN C. W. R. KNIGHT

THE GOLDEN EAGLE

The golden eagle (*Aquila chrysaëtus*), found over a large portion of the northern hemisphere. It is the largest of the birds of prey trained for falconry, and has been used in Asia, especially in India, for taking bustards. antelopes, hares, foxes and, it is said, even larger animals, such as wild goats and wolves

EAGLE

BY COURTESY OF CAPTAIN C. W. R. KNIGHT

GOLDEN EAGLE WITH PREY

1 and **2.** A female golden eagle, trained for falconry, shown here killing a rabbit. Training an eagle is a formidable task. Owing to its extreme ferocity when deprived of its prey, and to its slowness in turning in the air, the attempt is seldom made to train the eagle for falconry

a railroad division point, and has car shops, cement works and butter and ice-cream factories.

EAGLEHAWK, a mining township of Bendigo county, Victoria, Australia, 105 mi. by rail N.N.W. of Melbourne and 4 mi. from Bendigo. Pop. (1933) 3,789. It stands on the Bendigo gold-bearing reef, and its mines are important. It has also spinning mills, a brewery, cordial works and a plaster sheet factory.

EAGLE OWL (Bubo bubo), a big owl inhabiting Europe and Asia, though only a straggler in most of Great Britain, and characterized by its large size and the two tufts of feathers on the head. It is allied to the great-horned owl (B. virginianus) of North America, but is larger. On the northwest coast of the United States the latter is represented by the dusky-horned owl (B. *v. saturatus*), a very dark-coloured race. The Arctic horned owl (B. v. subarcticus) is lighter coloured In Lower California there is a small, light-coloured race, the dwarf-horned owl (B. v. elachistus).

EAGLE PASS, a city of southwestern Texas, U.S.A., on the Rio Grande, opposite Piedras Negras, Mexico; a port of entry and the county seat of Maverick county. It is served by the Southern Pacific railway.

The population in 1920 was 5,765, of whom 2,711 were foreign-born white; in 1940 it was 6,459. Stock, feed and vegetables (notably spinach and onions) are raised in the surrounding country, and coal and gas are mined near by. The city was settled about 1846 and incorporated in 1908.

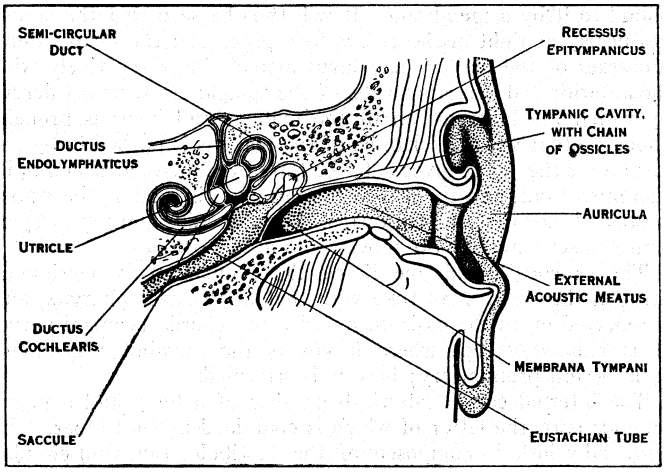
EAGRE: see BORE.

EAKINS, THOMAS (1844–1916), American portrait and figure painter, was born at Philadelphia, Pa., on July 25, 1844. A pupil of J. L. Gérôme, in the École des Beaux-Arts, Paris, and also of Léon Bonnat, besides working in the studio of the sculptor Dumont, he became a prolific portrait painter. He also painted genre pictures, sending to the Centennial exhibition at Philadelphia, in 1876, the "Chess Players," now in the Metropolitan Museum of Art, New York. A large canvas, "The Surgical Clinic of Professor Gross," owned by Jefferson Medical college, Philadelphia, contains life-sized figures. Eakins, with his pupil Samuel Murray (1870–1941), modelled the heroic "Prophets" for the Witherspoon building, Philadelphia, and his work in painting has a decided sculptural quality. He was for some years professor of anatomy at the schools of the Pennsylvania academy of fine arts in Philadelphia. A man of great inventiveness, he experimented in many directions, depicting on canvas modern athletic sports, the Negro, and early American life, but he is best known by his portraits. He died in Philadelphia on June 25, 1916.

EALPNG, a municipal and parliamentary borough of Middlesex, England, suburban to London, 9 mi. W. of St. Paul's cathedral, on the highroad to Uxbridge, served by the G.W.R. and the London Passenger Transport board. Pop. (est. 1938) 161,000. Area 13 98 sq.mi.

The borough was considerably enlarged in 1926 by the addition of the urban districts of Hanwell and Greenford, and further additions in 1928 made it one of the largest non-county boroughs. The parish church of St. Mary (rebuilt c. 1870) contains many interesting tombs. The church of All Saints (1905) commemorates Spencer Perceval, prime minister, who was assassinated in the house of commons in 1812 and who lived in Ealing. It was erected under the will of his daughter Frederica, a resident of Ealing. The tower of Holy Cross, Greenford, has a timber structure of the 12th century. Ealing has 979 ac. of parks, recreation grounds and open spaces under its control, including the ancient common (47 ac.), Walpole park (30 ac.), Pitshanger park (26 ac.) and others. Gunnersbury park (186 ac.), with two large mansions, was purchased in 1925 from the Rothschild family by the Ealing and Acton borough councils, with whom it is also shared by the borough of Brentford and Chiswick. Among former owners of the property was Princess Amelia, daughter of George II, who lived there from 1761 till her death in 1786. The name of Gunnersbury is said to be traceable to the residence here of Gunilda, niece of King Canute. The manor of Ealing early belonged to the see of London. Ealing, which was incorporated in 1901, has a technical institute and art school, It returns one member to parliament

EAR, ANATOMY OF. The human ear is divided into three parts—external, middle and internal. The external ear consists of the pinna and the external auditory meatus (fig. 1). The pinna is composed of yellow fibro-cartilage covered by skin. Round the margin in its upper three-quarters is a rim called the helix, in which is often seen a little prominence known as Darwin's tubercle, representing the folded-over apex of a prick-eared ancestor. Concentric with the helix and nearer the meatus is the antihelix which, above, divides into two limbs. In front of the antihelix is the deep fossa known as the concha, and from the anterior part of this the meatus passes inward into the skull. Overlapping the meatus from in front is a flap called the tragus, and below and behind this is another smaller flap, the antitragus. The lower part of the pinna is the lobule, which contains no cartilage. The pinna can be slightly moved by the anterior, superior and posterior auricular muscles. The external auditory meatus (fig. 1) is a tube about an inch long, its outer third being cartilaginous and its inner two-thirds bony. It is lined by skin in its whole length, the sweat glands of which are modified to secrete the wax or cerumen Internally it is closed by the tympanic membrane.



FROM CUNNINGHAM, "TEXT-BOOK OF ANATOMY," PERMISSION THE OXFORD MEDICAL PUBLICATIONS

FIG. 1.— DIAGRAMMATIC VIEW OF THE ORGAN OF HEARING, SHOWING THE RELATIONS OF THE EXTERNAL, THE MIDDLE AND THE INTERNAL EAR

The middle ear or tympanum (fig. 1) is a small cavity in the temporal bone. The Eustachian tube runs thence forward, inward and downward, to open into the nasopharynx, and so admits air into the tympanum. From the upper part of the posterior wall of the tympanum, an opening leads backward into the mastoid antrum and so into the air-cells of the mastoid process. Lower down is a little pyramid which transmits the stapedius muscle, and at the base of this is a small opening for the chorda tympani to come through from the facial nerve. The roof is formed by a very thin plate of bone, which separates the cavity from the middle fossa of the skull. Below the roof the upper part of the tympanum is somewhat constricted off from the rest, and to this part the term "attic" is often applied. The floor is a mere groove formed by the meeting of the external and internal walls. The outer wall is largely occupied by the tympanic membrane (fig. 1), which entirely separates the middle ear from the external auditory meatus; it is circular, and so placed that it slopes from above, downward and inward, and from behind, forward and inward. Externally it is lined by skin, internally by mucous membrane. while between the two is a firm fibrous membrane, convex inward about its centre to form the umbo.

The inner wall shows a promontory caused by the cochlea and grooved by the tympanic plexus of nerves; above and behind it is the fenestra ovalis, while below and behind the fenestra rotunda is seen, closed by a membrane. Curving round, above and behind the promontory and fenestrae, is a ridge caused by the aqueductus Fallopii or canal for the facial nerve. The whole tympanum is about half an inch from before backward, and half an inch high, and is spanned from side to side by three small bones, of which

the malleus is external. This is attached by its handle to the umbo of the tympanic membrane, while its head lies in the attic and articulates posteriorly with the upper part of the next bone or incus. The long process of the incus runs downward and ends in a little knob, the os orbiculare, jointed on to the stapes or stirrup bone. The two branches of the stapes are anterior and posterior, while the footplate fits into the fenestra ovalis and is bound to it by a membrane. It will thus be seen that the stapes lies nearly at right angles to the long process of the incus. Bony processes of the malleus and incus articulating respectively with the anterior and posterior walls of the tympanum form a fulcrum by which the lever action of the malleus and incus is brought about, so that when the handle of the malleus is pushed in by the membrane the head moves out; the top of the incus, attached to it, also moves out, and the os orbiculare moves in, and so the stapes is pressed into the fenestra ovalis. The stapedius and tensor tympanic muscles modify the movements of the ossicles.

The mucous membrane lining the tympanum is continuous through the Eustachian tube with that of the naso-pharynx, and is reflected on to the ossicles, muscles and chorda tympani nerve. It is ciliated except where it covers the membrana tympani, ossicles and promontory; here it is stratified.

The internal ear or labyrinth consists of a bony and a membranous part, the latter of which is contained in the former. The bony labyrinth is composed of the vestibule, the semi-circular canals and the cochlea. The vestibule lies just internal to the posterior part of the tympanum, and there would be a communication between the two, through the fenestra ovalis, were it not that the foot-plate of the stapes blocks the way. The inner wall of the vestibule is separated from the bottom of the internal auditory meatus by a plate of bone pierced by many foramina for branches of the auditory nerve (fig. 1), while at the lower part is the opening of the aqueductus vestibuli, by means of which a communication is established with the posterior cranial fossa. Posteriorly the three semicircular canals open into the vestibule; of these the external has two independent openings, but the superior and posterior join together at one end, while at their other ends they open separately. One end of each canal is dilated to form its ampulla. The superior semicircular canal is vertical, and the two pillars of its arch are nearly external and internal; the external canal is horizontal, its two pillars being anterior and posterior, while the convexity of the arch of the posterior canal is backward and its two pillars are superior and inferior. Anteriorly the vestibule leads into the cochlea (fig. 1, 4) which is

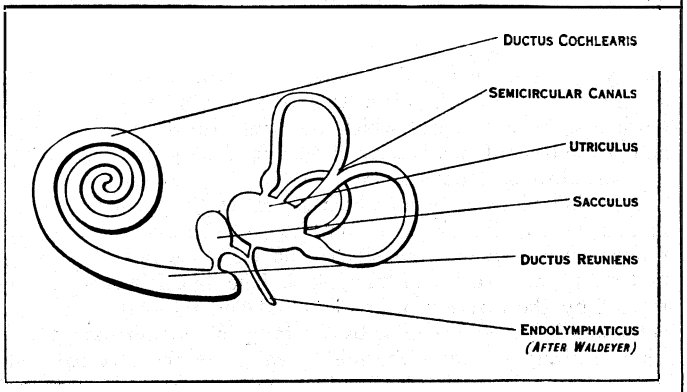


FIG. 2.— DIAGRAM OF THE DIFFERENT PARTS OF THE MEMBRANOUS LABYRINTH

twisted two and half times round a central pillar called the modiolus, the whole cochlea forming a rounded cone something like the shell of a snail though it is only about 5mm. from base to apex. Projecting from the modiolus is a horizontal plate (lamina spiralis) which runs round it from base to apex like a spiral staircase; it stretches nearly half-way across the canal of the cochlea and carries branches of the auditory nerve.

The membranous labyrinth lies in the bony labyrinth, but does not fill it; between the two is the fluid called perilymph, while inside the membranous labyrinth is the endolymph. In the bony vestibule lie two membranous bags, one of which, the saccule (fig. 2), is in front, and the other, the utricle, behind; each has a special patch or macula to which twigs of the auditory nerve are supplied, and in the mucous membrane of which are specialized hair cells (fig. 3).

Attached to the maculae are crystals of carbonate of lime called otoconia. The membranous semicircular canals are very much smaller in section than the bony; in the ampulla of each is a ridge, the crista acustica, which is covered by a mucous membrane containing sensory hair cells like those in the maculae. All the canals open into the utricle. From the lower part of the saccule runs a small canal called the ductus endolymphaticus (fig. 2). Anteriorly the saccule communicates with the membranous cochlea or scala media by a short ductus reuniens. A section obtained through each turn of the cochlea shows the bony lamina spiralis, already noticed, which is continued right across the canal by the basilar membrane (fig. 4), thereby cutting the canal into an upper and lower half, and connected with the outer wall by the strong spiral ligament. Near the free end of the lamina spiralis the membrane of Reissner is attached, and runs outward and upward to the outer wall, taking a triangular slice out of the upper half. There are now three canals seen in section; the upper is the scala vestibuli, the middle and outer scala media, ductus cochlearis or true membranous cochlea and the lower, the scala tympani. The scala vestibuli and scala tympani communicate at the apex of the cochlea, so that the perilymph can here pass from one canal to the other. At the base of the cochlea the perilymph in the scala vestibuli is continuous with that in the vestibule, but that in the scala tympani bathes the inner surface of the membrane stretched across the fenestra rotunda, and also communicates with the subarachnoid space through the aqueductus cochlea, which opens into the posterior cranial fossa. The scala media containing endolymph communicates with the saccule through the canalis reuniens, while, at the apex of the cochlea, it ends in a blind extremity of considerable morphological interest which is called the lagena.

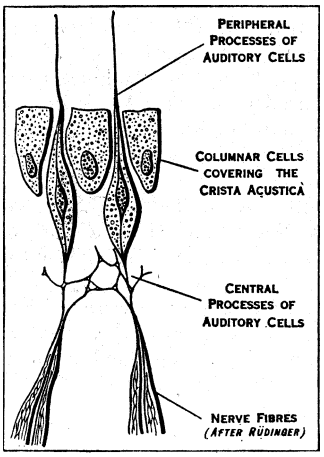
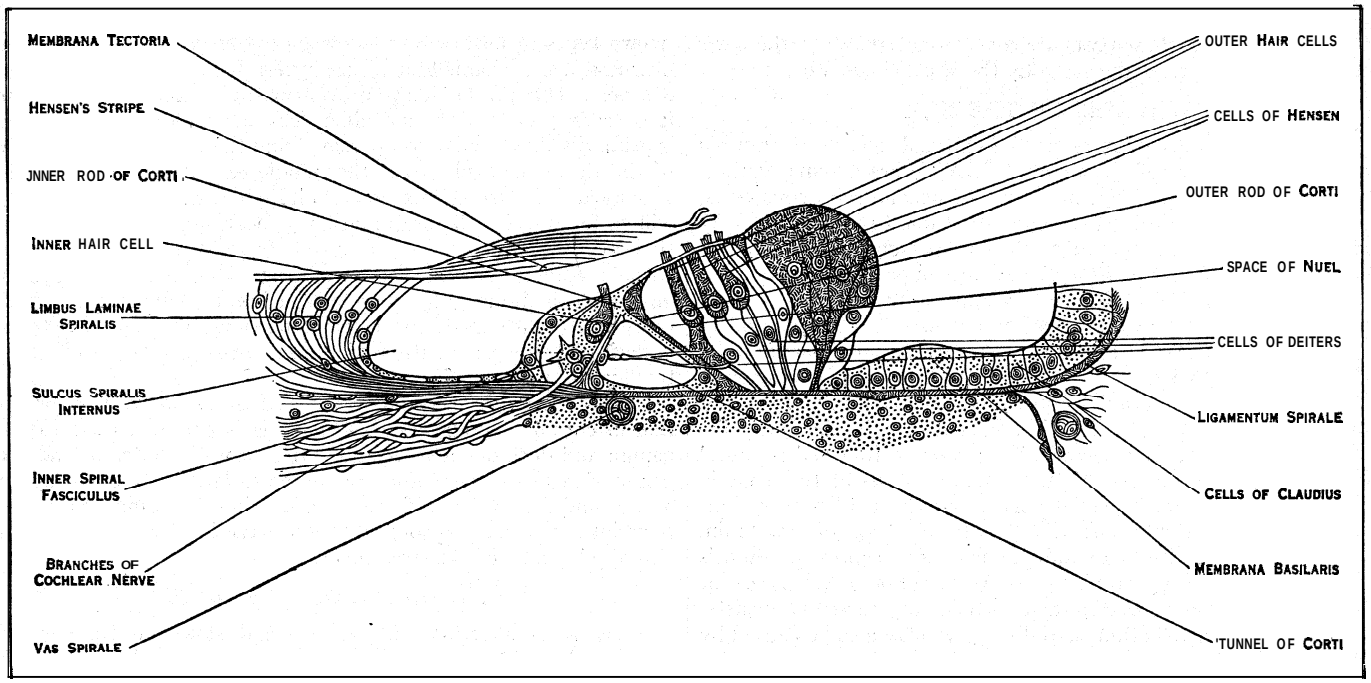


FIG. 3.— DIAGRAM OF AUDITORY NERVE CELLS AND PROCESSES

The scala media contains the essential organ of hearing or organ of Corti (fig. 4), which lies upon the inner part of the basilar membrane; it consists of a tunnel bounded on each side of the inner and outer rods of Corti; on each side of these are the inner and outer hair cells, between the latter of which are found the supporting cells of Deiters. Most externally are the large cells of Hensen. A delicate membrane called the lamina reticularis covers the top of all these, and is pierced by the hairs of the hair cells, while above this is the loose membrana tectoria attached to the periosteum of the lamina spiralis, near its tip, internally, and possibly to some of Deiters' cells externally. The cochlear branch of the auditory nerve enters the lamina spiralis, where a spiral ganglion (fig. 4) is developed on it; after this it is distributed to the inner and outer hair cells.

Embryology. — The pinna is formed from six tubercles which appear round the dorsal end of the hyomandibular cleft. Those for the tragus and anterior part of the helix belong to the first or mandibular arch, while those for the antitragus, antihelix and lobule come from the second or hyoid arch. The tubercle for the helix is dorsal to the end of the cleft where the two arches join. The external auditory meatus, tympanum and Eustachian tube are remains of the hyomandibular cleft, the membrana tympani being a remnant of the cleft membrane and therefore lined by ectoderm outside and entoderm inside. The origin of the ossicles is doubtful. H. Gadow's view is that all three are derived from the hyomandibular plate. The internal ear first appears as a pit from



FROM CUNNINGHAK, "TEXT-BOOK OF ANATOMY;" PERMISSION THE OXFORD MEDICAL PUBLICATIONS

FIG. 5. — TRANSVERSE SECTION OF CORTI'S ORGAN FROM THE CENTRAL COIL OF COCHLEA. SHOWING RODS AND HAIR CELLS

the cephalic ectoderm, the mouth of which in mammals closes up, to leave a pear-shaped cavity. The lower part of the vesicle grows forward and becomes the cochlea, while from the upper part three hollow circular plates grow out, the central parts of which disappear, leaving the margin as the semicircular canals. Subsequently constrictions appear in the vesicle marking off the saccule and utricle. From the surrounding mesoderm the petrous bone is formed by a process of chondrification and ossification.

Comparative Anatomy. — The ectodermal inpushing of the internal ear has probably a common origin with the organs of the

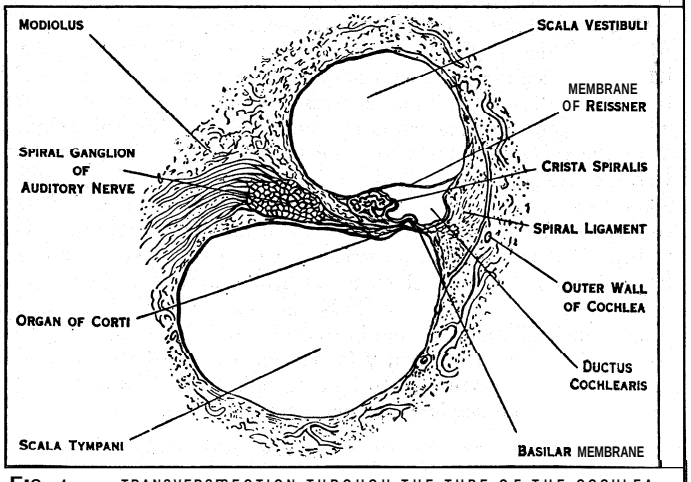


FIG. 4. — TRANSVERSE SECTION THROUGH THE TUBE OF THE COCHLEA, SHOWING PARTS

lateral line of fish. In the lower forms the ductus endolymphaticus retains its communication with the exterior on the dorsum of the head, and in some elasmobranchs the opening is wide enough to allow the passage of particles of sand into the saccule. In certain teleostean fishes the swim bladder forms a secondary communication with the internal ear by means of special ossicles. Among the Cyclostomata the external semicircular canals are wanting; *Petromyzon* has the superior and posterior only, while in *Myxine* these two appear to be fused. In higher types the three canals are constant. Concretions of carbonate of lime are present in the internal ears of almost all vertebrates; when these are very small they are called otoconia, but when, as in most of the teleostean fishes, they form huge concretions, they are spoken of as otoliths. One shark ***Squatina,*** has sand instead of otoconia. The utricle, saccule, semicircular canals, ductus endolymphaticus and a short lagena are the only parts of the ear present in fish.

The Amphibia (*q.v.*) have an important sensory area at the base of the lagena; it is probably the first rudiment of a true cochlea. The ductus endolymphaticus has lost its communication with the skin, but it is frequently prolonged into the skull and along the spinal canal, from which it protrudes, through the intervertebral foramina, bulging into the coelom. This is the case in the common frog. In this class the tympanum and Eustachian tube are first developed; the membrana tympani lies flush with the skin of the side of the head, and the sound-waves are transmitted from it to the internal ear by a single bony rod—the columella.

In the Reptilia the internal ear passes through a great range of development. In the Chelonia and Ophidia the cochlea is as rudimentary as in the Amphibia, but in the higher forms (Crocodilia) there is a lengthened and slightly twisted cochlea, at the end of which the lagena forms a minute terminal appendage. At the same time indications of the scalae tympani and vestibuli appear. As in the Amphibia the ductus endolymphaticus sometimes extends into the cranial cavity and on into other parts of the body. Snakes have no tympanic membrane. In the birds the cochlea resembles that of the crocodiles, but the posterior semicircular canal is above the superior where they join. In certain lizards and birds (owls) a small fold of skin represents an external ear. In monotremes the internal ear is reptilian, but above them the mammals always have a spirally twisted cochlea, the number of turns varying from one and a half in the Cetacea to nearly five in the rodent *Coelogenys.* The lagena is reduced to a mere vestige. The organ of Corti is peculiar to mammals, and the single columella of the middle ear is replaced by the three ossicles already described in man. In some mammals, especially Carnivora, the middle ear is enlarged to form the tympanic bulla, but the mastoid cells are peculiar to man.

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(F. G P.)

EAR, NOSE AND THROAT, DISEASES OF THE. Though diseases of these parts are considered separately, the parts themselves are closely connected by the Eustachian tube.

I. DISEASES OF THE EAR

Diseases of the ear may affect the external, middle or internal ear. The commoner affections of the *auricle* are eczema, various tumours (simple and malignant), and serous and sebaceous cysts. Effusion of blood into the auricle is often due to injury, but may occur spontaneously, especially in insane persons. The chief diseases of the *external auditory canal* are impacted cerumen (or wax), boils, strictures due to inflammatory affections, bony growths, malignant disease, caries and necrosis, and foreign bodies.

Diseases of the *middle ear* are suppurative and non-suppurative, The former is either acute or chronic, and is accompanied by perforation of the drum-head and discharge from the ear. The chief importance of these affections, in addition to pain, deafness, discharge, etc., is that, if neglected, they may be followed by aural polypi, caries and necrosis of the bone, affections of the mastoid process, paralysis of the facial nerve, and the still more serious intracranial and vascular infective diseases of abscess in the brain, meningitis, subdural and extradural abscesses, septic thrombosis of the venous sinuses, and pyaemia. Acute suppurative disease of the middle ear is often due to the exanthemata, scarlatina, measles and smallpox, and to bathing and diving. It may also be caused by influenza, diphtheria and pulmonary tuberculosis.

Non-suppurative disease of the middle ear may be acute or chronic. In the acute form the inflammation is rarely accompanied by perforation. Chronic non-suppurative inflammations are moist, in which the symptoms are improved by inflation of the tympanum through the Eustachian tube, and dry (including sclerosis), which is intractable and not amenable to inflation. Diseases of the *internal ear* may be primary or secondary to an affection of the tympanum or to intracranial disease.

Injuries to any part of the ear may occur, among the commoner being injuries to the auricle, rupture of the drum head (from explosions, blows on the ear or the introduction of sharp bodies into the ear canal), and injuries from fractured skull.

Symptoms. — The chief symptoms of ear diseases are deafness, noises in the ear (tinnitus aurium), giddiness, pain and discharge. Deafness (or other disturbance of hearing) and noises may occur from disease in almost any part of the ear. Purulent discharge usually comes from the middle ear. Giddiness is more commonly associated with affections of the internal ear.

The researches of Arthur Cheatle have shown that in 80% of cases the mastoid process is composed very largely of air cells, that in the remaining 20% it is dense or acellular as in infants, that mastoid cells may develop in regions other than the mastoid process, and that persistence or excessive development of certain small veins in the inner wall of the mastoid antrum may favour the spread of infection leading to intracranial complications. These anatomical features may determine the symptoms and line of treatment to be adopted when disease attacks the temporal bone, particularly in inflammatory disease of the middle ear.

Of late the attention of otologists has been more than ever concentrated on the labyrinth, and particularly on its vestibular component. The internal ear or labyrinth comprises two essential structures, the cochlea which is to the ear what the retina is to the eye; the vestibular apparatus which subserves two important functions: (a) static (saccule and utricle) which has to do with the maintenance of equilibrium, (*b*) kinetic (saccule, utricle and semicircular canals) for the recognition and analysis of motion.

In health certain tests give results indicating a normal condition of the vestibular apparatus, *e.g.*, the pointing tests, nystagmic movements of the eyes after rotation of the patient and the employment of the caloric and electrical tests. These reactions are modified or absent when the vestibule is diseased. Hence the aural surgeon can explore the labyrinth and its immediate neighbourhood with minuteness. Consequently, certain types of vertigo, acute and chronic suppuration of the labyrinth with threatening symptoms of meningitis, and tumours of the auditory nerve, are often benefited by operation.

While little advance has occurred in the treatment of well-known types of insidious and slowly progressive forms of chronic deafness, it is probable that future generations will suffer less from deafness. This will be due to prevention rather than cure, because it is recognized that the so-called "chronic middle-ear deafness" is primarily due to infection passing from the nasopharynx by way of the Eustachian tubes into the middle ear cleft and its adnexa. Prophylactic measures in school clinics, child welfare centres, etc., will go far towards the preservation of hearing and in the prevention of complications apt to result from neglected acute and chronic suppuration of the middle-ear cleft, *e.g.*, meningitis, abscess of the brain and certain types of septicaemia. In the diagnosis and treatment of the latter conditions, valuable assistance is derived from examination of the cerebro-spinal fluid obtained by "lumbar puncture."

Finally, **A.** R. Friel has demonstrated the value of zinc ionization in chronic suppuration where sepsis is confined to the tympanum and does not involve the "attic" nor the antrum, and the perforation in the tympanic membrane is large enough to admit of the middle ear being filled with the ionizing fluid. Suppurations intractable and of long duration, have been cured by one or two applications of this treatment.

II. DISEASES OF THE NOSE

Apart from affections of the external skin and tumour-like overgrowth of the mucous membrane (polypi), deflection of the septum and plastic operations for correction of deformities, diseases of the nose are important from coincident infection of the air cells or sinuses.

In this connection also no organ or tissue of the body appears to be exempt from possible sub-infection by the organisms or their toxins if and when these are located in the antral, ethmoidal, frontal or sphenoidal sinuses. They gain entry into the system by inhalation or swallowing, or by the lymphatics or blood-vessels. This important subject was dealt with in the "Semon Lecture," University of London (1925), by Dr. Watson-Williams.

Treatment. — Formerly chronic suppuration involving the frontal sinus was treated by external operation; at present free and permanent drainage is attained through the nasal cavity and the result is much better.

One of the most intractable diseases of the nose is Foetid Atrophic Rhinitis (Ozaena). It is characterized by gradual wasting of the nasal mucous membranes and the bony structures which they cover. These atrophic changes are accompanied by the formation of foul-smelling crusts and not infrequently with a sinking in of the bony frame-work of the nose. Its cause has not been fully ascertained. Very similar effects are produced by syphilitic and tuberculous affections involving the bones of the nose. Hitherto surgeons have depended chiefly on local antiseptic applications and the daily use of cleansing washes. Recently better results have been obtained by surgical measures which aim at narrowing the nasal cavities by forcing inwards the inner walls of the antral sinuses and maintaining them in that position. Many cases appear to have been cured or greatly benefited. Lupus of the nasal mucous membrane has proved to be amenable to radium therapy.

(For hay fever, *see* **HAY** FEVER; ANAPHYLAXIS.)

III. DISEASES OF THE THROAT

The Tonsils. — This term is popularly applied to compact masses of lymphatic tissue situated between the anterior and posterior faucial pillars. Similar collections of lymphoid tissue are present in the nasopharynx and in the base of the tongue. The complete circle of this tissue is known as Waldeyer's Ring. It is present in all children and while it tends to undergo atrophy at puberty, this change often fails to take place.

Adenoids. — The term adenoids implies an overgrowth of the lymphoid mass in the nasopharynx which is sufficient in degree to produce symptoms. In health the collections of lymphoid tissue comprising Waldeyer's Ring are supposed to act as a first line of defence against invasion of the body by pathogenic micro-organisms. At the same time they offer an easy and open portal for infection. It is only necessary to mention the initial inflammation

of the tonsils and their immediate regions which herald an attack of scarlet fever, measles, diphtheria, influenza (frequently) and acute rheumatic fever. But when the components of the lymphoid ring become the seat of a chronic infection, or act as foci of sepsis, their potency for evil is equal to or even greater than that of the paranasal sinuses already referred to.

In respect of mental disease at the New Jersey State Hospital (Trenton) the number of discharged patients increased from 37 to 85% after removal of oral and tonsillar infections (H. A. Cotton, 1923). It is often forgotten that a small septic tonsil—especially in adults—frequently causes more definite symptoms in distant organs or tissues than large and prominent tonsils which are often only a cause of local discomfort. The modern practice of "enucleation" or complete rather than partial removal of the tonsils is based on the facts which are briefly outlined above.

Malignant Disease.—Both sarcomata and carcinomata are commonly met with. If left untreated they prove fatal, but if recognized and dealt with in their earlier stages they may be cured or afforded long periods of immunity from recurrence. Radiotherapy alone or combined with less radical surgery than formerly, has produced equally good if not better results than extensive surgical procedures by themselves *(see* RADIUM THERAPY).

Diathermy.—Under diathermy *(see* ELECTROTHERAPY) the operation is practically bloodless, the patient suffers no shock, scarring is slight and healing rapid. The coagulation by heat prevents dissemination of the cancer cells into the surrounding tissues which ordinary surgical manipulations may not be able to avoid. A dissection of the glands in the neck can be made before or after destruction of the primary growth.

Treatment by diathermy can only be carried out successfully when the growth is situated in readily accessible regions such as the mouth, soft palate, tonsillar regions, posterior wall of the pharynx and the epiglottis of the larynx. It is contra-indicated in the immediate neighbourhood of large blood-vessels, bone and cartilage. Hitherto "deep" X-ray therapy has not been successful for malignant disease in the throat or larynx.

Diseases of the Larynx.—Tuberculosis of the larynx is practically always secondary to a primary infection of the lungs, and its treatment has improved *pari passu* with that of the pulmonary lesion. Frequent inspection of the larynx, and the recognition of the earliest signs and symptoms of tuberculous laryngitis, followed by prolonged functional rest of the voice, have cured many patients whose general health and resistance have been maintained or improved by sanatorium treatment. In these circumstances and if prolonged functional rest of the vocal cords fails to cure small or limited tuberculous lesions in the larynx, application of the galvano-cautery will often produce rapid healing. Severe surgical measures for the removal of infected laryngeal tissues are rarely called for. The value of tuberculin in the treatment of laryngeal tuberculosis is still a matter of opinion. For fuller information on this subject *see* "the Mitchell Lecture" by Sir St. Clair Thomson *(Brit. Med. Journ.* Nov. *8,* 1924).

Malignant Disease.—Here again the essential for successful treatment is early diagnosis. Any adult suffering from an alteration of the normal speaking voice of more than a few weeks' duration should be examined by an expert laryngologist. The treatment of the disease in its early stages is surgical and aims at its complete removal. The records of cure or many years of freedom from recurrence are probably better than those in any other region of the body.

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EARL, a title and rank of nobility (corresponding to Lat. *comes;* Fr. *comte),* now the third in order of the British peerage, between marquess and viscount. Earl is the oldest title and rank of English nobles, and was the highest until 1337, when the Black Prince was created duke of Cornwall by Edward III.

The nature of a modern earldom is readily understood, since it is a rank and dignity of nobility which, while it confers no official power or authority, is inalienable, indivisible, and descends in regular succession to all the heirs under the limitation in the grant until, on their failure, it becomes extinct.

The title is of Scandinavian origin, and first appears in England under Canute as *jarl,* which was englished as *eorl.* Like the *ealdorman,* whose place he took, the *eorl* was a great royal officer, who might be set over several counties, but who presided separately in the county court of each with the bishop of the diocese. Although there were counts in Normandy before the Norman Conquest, they differed in character from the English earls, and the earl's position appears to have been but slightly modified by the Conquest. He was still generally entitled to the "third penny" of the county, but his office tended, under Norman influence, to become an hereditary dignity and his sphere was restricted by the Conqueror to a single county. The right to the "third penny" is a question of some obscurity, but its possession seems to have been deemed the distinctive mark of an earl, while the girding with "the sword of the county" formed the essential feature in his creation or investiture, as it continued to do for centuries later. The fact that every earl was the earl of a particular county has been much obscured by the loose usage of early times, when the style adopted was sometimes that of the noble's surname (*e.g.,* the Earls Ferrers), sometimes that of his chief seat (*e.g.,* the Earls of Arundel), and sometimes that of the county. Palatine earldoms, or palatinates, were those which possessed *regalia, i.e.,* special privileges delegated by the Crown. The two great examples, which dated from Norman times, were Chester and Durham, where the earl and the bishop respectively had their own courts and jurisdiction, and were almost petty sovereigns.

The earliest known charter creating an earl is that by which Stephen bestowed on Geoffrey de Mandeville, in or about 1140, the earldom of Essex as an hereditary dignity. Several other creations by Stephen and the empress Maud followed in quick succession. From at least the time of the Norman Conquest the earl had a double character; he was one of the "barons," or tenants in chief, in virtue of the fief he held of the Crown, as well as an earl in virtue of his "belting" (with the sword) and his "third penny" of the county. His fief would descend to the heirs of his body; and the earliest charters creating earldoms were granted with the same "limitation." The dignity might thus descend to a woman, and, in that case, like the territorial fief, it would be held by her husband, who might be summoned to parliament in right of it. The earldom of Warwick thus passed through several families till it was finally obtained, in 1449, by the Kingmaker, who had married the heiress of the former earls. But in the case of "co-heiresses" (more daughters than one), the king determined which, if any, should inherit the dignity.

The 14th century saw some changes introduced. The earldom of March, created in 1328, was the first that was not named from a county or its capital town. Under Edward III. also an idea appears to have arisen that earldoms were connected with the tenure of lands, and in 1337 several fresh ones were created and large grants of lands made for their support. The first earldom granted with limitation to the male heirs of the grantee's body was that of Nottingham in 1383. Another innovation was the grant of the first earldom for life only in 1377. The girding with the sword was the only observance at a creation till the first year of Edward VI., when the imposition of the cap of dignity and a circlet of gold was added. Under James I. the patent of creation was declared to be sufficient without any ceremony. An earl's robe of estate has three bars of ermine, but possibly it had originally four.

Something should be said of anomalous earldoms with Norman or Scottish styles. The Norman styles originated either under the Norman kings or at the time of the conquest of Normandy by the house of Lancaster. To the former period belonged that of Aumale, which successive fresh creations, under the Latinized form "Albemarle" have perpetuated to the present day *(see* ALBEMARLE, EARLS AND DUKES OF). The so-called earls of Eu and of Mortain, in that period, were really holders of Norman *comtés.* Henry V. and his son created five or six, it is said, but really seven at least, Norman countships or earl-

doms, of which Harcourt (1418), Perche (1419), Dreux (1427) and Mortain (1430) were bestowed on English nobles, Eu (1419) and Tankerville (1419) on English commoners, and Longueville (1419) on a foreigner, Gaston de Foix. Of these the earldom of "Eu" was assumed by the earls of Essex till the death of Robert, the parliament's general (1646), while the title of Tankerville still survives under a modern creation (1714). An anomalous royal licence of 1661 permitted the earl of Bath to use the title of earl of Corbeil by alleged hereditary right. Of Scottish earldoms recognized in the English parliament the most remarkable case is that of the Lords Umfraville, who were summoned for three generations (1297–1380), as earls of Angus; Henry, Lord Beaumont, also was summoned as earl of Buchan from 1334 to 1339.

The earldom of Chester is granted to the princes of Wales on their creation, and the Scottish earldom of Carrick is held by the eldest son of the sovereign under act of parliament.

The premier earldom is that of Arundel (*q.v.*), but as this is at present united with the dukedom of Norfolk, the oldest earldom not merged in a higher title is that of Shrewsbury (1442), the next in seniority being Derby (1485), and Huntingdon (1529). These three have been known as "the catskin earls," a term of uncertain origin. The ancient earldom of Wiltshire (1397) was unsuccessfully claimed in 1869 by Mr. Scrope of Danby, and that of Norfolk (1312), in 1906, by Lord Mowbray and Stourton.

The premier earldom of Scotland as recognized by the Union Roll (1707), is that of Crawford, held by the Lindsays since its creation in 1398; but it is not one of the ancient "seven earldoms." The Decreet of Ranking (1606) appears to have recognized the earldom of Sutherland as the most ancient in virtue of a charter of 1347, but the House of Lords' decision of 1771 recognized it as having descended from at least the year 1275, and it may be as old as 1228. It is at present united with the dukedom of Sutherland. The original "seven earldoms" (of which it was one) represented seven provinces, each of which was under a mormaer. This Celtic title was rendered *jarl* by the Norsemen, and under Alexander I. (c. 1115) began to be replaced by earl (comes), owing to Anglo-Norman influence, which also tended to make these earldoms less official and more feudal.

In Ireland the duke of Leinster is, as earl of Kildare, premier earl as well as premier duke.

An earl is "Right Honourable," and is styled "My Lord." His eldest son bears his father's "second title," and therefore, that second title being in most cases a viscounty, he generally is styled "Viscount"; where, as with Devon and Huntingdon, there is no second title, one may be assumed for convenience; under all circumstances, however, the eldest son of an earl takes precedence immediately after the viscounts. The younger sons of earls are "Honourable," but all the daughters are "Ladies." In formal documents and instruments, the sovereign, when addressing or making mention of any peer of the degree of an earl, usually designates him "trusty and well-beloved cousin"—a form of appellation first adopted by Henry IV., who either by descent or alliance was actually related to every earl and duke in the realm. The wife of an earl is a countess; she is "Right Honourable," and is styled "My Lady." For the earl's coronet see CROWN AND CORONET.

See Lord's *Reports on the Dignity of a Peer;* Pike's *Constitutional History of the House of Lords;* Selden's *Titles of Honour;* G. E. C(okayne)'s *Complete Peerage;* J. H. Round's *Geoffrey de Mandeville* (1892). (J. H. R.)

EARLE, JOHN (*c.* 1601–1665), English divine, was born at York about 1601. He matriculated at Christ Church, Oxford, but migrated to Merton, where he obtained a fellowship. In 1631 he was proctor and also chaplain to Philip, earl of Pembroke, then chancellor of the university, who presented him to the rectory of Bishopston in Wiltshire; and in 1641 he was appointed chaplain and tutor to Prince Charles. Early in 1643 he was chosen chancellor of the cathedral of Salisbury, but was soon deprived as a "malignant," and in the same year was elected one of the Assembly of Divines at Westminster, but declined to sit. After Cromwell's victory at Worcester, Earle went abroad, and was named clerk of the closet and chaplain to Charles II., being appointed dean of Westminster at the Restoration and in 1661 one of the commissioners for revising the liturgy. In November 1662 he was consecrated bishop of Worcester, and was translated, ten months later, to the see of Salisbury, where he conciliated the nonconformists. He was on friendly terms with Richard Baxter and was strongly opposed to the Conventicle and Five Mile Acts. During the great plague Earle attended the king and queen at Oxford, and there he died on Nov. 17, 1665.

Earle wrote the witty work entitled Microcosmographie, or a Peece of the World *discovered,* in Essayes and Characters (1628), which ran through ten editions in the author's lifetime. He was employed by Charles II. to make the Latin translation of the Eikon Basilike, published in 1649; a similar translation of Hooker's Ecclesiastical Polity was accidentally destroyed.

See Philip Bliss's edition of the *Microcosmographie* (1811 and 1868).

EARL MARSHAL, in England, ranks as the eighth of the great officers of State, is the head of the college of arms, and appoints the kings-of-arms, heralds, and pursuivants. He attends the sovereign in opening and closing the session of parliament, walking at his or her right hand. He arranges State processions and ceremonials, especially coronations, royal marriages and funerals, and with the lord great chamberlain he assists in introducing newly-created peers in the House of Lords.

He exercised joint and co-ordinate jurisdiction with the constable in the court of chivalry, and afterwards became the sole judge of that tribunal till its obsolescence in 1737. The marshalship of England was formerly believed to have been inherited from the Clares by the Marshal family, who had only been marshals of the household. It was held, however, by the latter family as early as the days of Henry I., and passed to the Bigods. In 1306 it fell by inheritance to Edward I., and in 1316 was granted by Edward II. to his own younger brother, Thomas "of Brotherton," earl of Norfolk. As yet the style of the office was only "marshal." The office, having reverted to the Crown, was granted out anew by Richard II. in 1385 to Thomas Mowbray, earl of Nottingham, the representative of Thomas "of Brotherton." In 1386 the style of "earl marshal" was formally granted to him in addition. After several attainders and partial restorations in the reigns of the Tudors and the Stuarts, the earl marshalship was granted anew to the Howards by Charles II. in 1672 and entailed on their male line, under which settlement it has regularly descended to the present duke of Norfolk. Its holders, however, could not execute the office until the Roman Catholic emancipation, and were forced to appoint deputies. His Grace appends the letters "E.M." to his signature, and bears behind his shield two batons crossed in saltire, the marshal's rod (*virga*) having been the badge of the office from Norman times. There appear to have been hereditary marshals of Ireland, but their history is not well ascertained. The Keiths were Great Marischals of Scotland from at least the days of Robert Bruce, and were created earls marischal in or about 1458, but lost both earldom and office by the attainder of George, the 10th earl, in 1716. (See also MARSHAL; STATE, GREAT OFFICERS OF.)

See "The Marshalship of England," in J. H. Round, *Commune of London and Other Studies* (1899); G. E. C(okayne)'s *Complete Peerage.* (J. H. R.)

EARLOM, RICHARD (1742–1822), English mezzotint engraver, was born and died in London. In 1765 he was employed by Alderman Boydell, then one of the most liberal promoters of the fine arts, to make a series of drawings from the pictures at Houghton Hall; and these he afterwards engraved in mezzotint. His most perfect works as engraver are perhaps the fruit and flower pieces after the Dutch artists Van Os and Van Huysum. Earlom executed a series of 200 facsimiles of the drawings and sketches of Claude Lorraine, which was published in three vols., under the title of Liber veritatis (1777–1819).

EARLSTON (formerly ERCILDOUNE, of which it is a corruption), parish and market town, Bermickshire, Scotland. Pop. (1931) 1,689. It is on Leader Water in Lauderdale, 72½ m. S.E. of Edinburgh by the L.N.E.R. branch line from Reston Junction to St. Boswells, and about 4 m. N.E. of Melrose. Originally it was

called Arcioldun or "Prospect Fort," an ancient earthwork on Black Hill. In the 12th and 13th centuries the Lindsays and the earls of March and Dunbar were the chief baronial families The ivy-clad ruin of the ancient tower, "The Rhymer's Castle," is the traditional residence of Thomas Learmont, commonly called Thomas of Ercildoune, or Thomas the Rhymer, poet and prophet, and friend of the Fairies, who was born here about 1225. The Edinburgh Border Counties Association acquired this relic and surrounding lands in 1895. The leading manufactures are ginghams and tweeds, and the town is also an agricultural centre, stock and corn sales taking place at regular intervals and cattle and horse fairs being held every year. Some 3 m. away is Bemersyde, said to have been in the possession of the Haigs for 1,000 years, and presented to Field Marshal Earl Haig by the nation in 1921. The prospect from Bemersyde Hill was Sir Walter Scott's favourite view. The castle at Bemersyde was erected in 1535 to secure the peace of the Border.

EARLY, JUBAL ANDERSON (1816–1894), American soldier and lawyer, was born in Franklin county (Va), on Nov. 3, 1816, and graduated at West Point in 1837. He served in the Seminole War of 1837–38, after which he resigned in order to practise law in Franklin county, Virginia. He also engaged in State politics, and served in the Mexican War as a major of Virginia volunteers. He was strongly opposed to secession, but thought it his duty to conform to the action of his State. As a colonel in the Confederate army, he rendered conspicuous service at the first battle of Bull Run (*q.v.*). Promoted brigadier-general, and later major-general, Early served throughout the Virginian campaigns of 1862–63, and defended the lines of Fredericksburg during the battle of Chancellorsville. At Gettysburg he commanded a division of Ewell's corps. In the campaign of 1864 Early, who had now reached the rank of lieutenant-general, commanded the Confederate forces in the Shenandoah valley. After several successful actions in the Shenandoah and Potomac valleys (on July 11 he threatened the city of Washington), Gen. Sheridan arrived with Union reinforcements, forced Early to retreat, and defeated him at Winchester and Fisher's Hill. Finally, on Oct. 19, after inflicting at first a severe blow upon the Federal army in its camp at Cedar creek, he was decisively beaten by Sheridan. (See SHENANDOAH VALLEY.) Waynesboro (March 1865) was his last fight, after which he was relieved of his command.

Gen. Early was regarded by many as one of the ablest soldiers in the Confederate army.

After the declaration of peace he went to Canada; but in 1867 returned to resume the practice of law. For a time he managed the Louisiana lottery in conjunction with Gen. Beauregard. He died at Lynchburg (Va.), on March 2, 1894. Gen. Early was for a time president of the Southern Historical Society, and wrote, besides various essays and historical papers, *A Memoir of the Last* Year of *the War, etc.* (1867).

See *Lieutenant General Jubal Anderson* ***Early;*** *an Autobiographical Sketch and Narrative of the War Between the States* (1912).

EARLY CLOSING MOVEMENT. The Early Closing Association came into existence in Great Britain following a meeting of drapers' assistants held at the Commercial tavern, Holborn, in Oct. 1842. A resolution was then passed "that the present hours of business are longer than either the convenience or the necessities of the public require and that a judicious curtailment thereof may be effected, without injury to any of the principals concerned, which would be productive of the most beneficial results." In the period after 1842 great progress was made, including (1) the establishment of the Saturday half-holiday culminating in the Shops act, 1912, legalizing a weekly half-holiday for every shop assistant, (2) the Shops Seat act (1899), which stipulated for one seat to every three female assistants in shops, (3) the Shops act (1920), which provided compulsory closing of shops at eight o'clock weekday nights and nine o'clock Saturdays, in addition to the weekly half-holiday, and (4) improved shop conditions.

The Saturday half-holiday became a British national institution, and was adopted by almost every other country in the world. (A. LK.)

United States.—Laws limiting working hours of mercantile employees had been passed in most states prior to World War II, but actual openings and closings were determined by employers. Traditionally, Saturday became the chief shopping day of the week, with most stores remaining open later on that day, particularly in farm communities. After 1942, ho ever, the changed buying habits of the public, resulting from increased income and population shifts into war industry areas, caused merchants to experiment radically with store hours.

The department stores in some of the large cities eliminated the late Saturday closing and substituted instead certain weekdays.

Chain grocery stores and butcher shops in many of the bigger cities also eliminated the late Saturday closing. In the food trade the early closing policy was initiated by the meat cutters' trade union in San Francisco before 1920, and thereafter was generally adopted in other western cities. Labour's desire for improved working conditions became an increasingly important factor during the seven years previous to 1940 which saw the passage of the National Industrial Recovery act, the Wagner act and the Fair Labor Standards act.

Early closing hours for department stores were first demanded by the Working Women's society in 1891. This group enlisted the support of women consumers to secure better conditions for store employees by constructive legislation.

After its inception in 1891, the Consumers' league of New York helped bring about a shortened week for women employees, improved working conditions in retail stores, the closing of stores in the evening, half-holidays on Saturday, and advocated early Christmas shopping.

(R. GL.)

EARLY ENGLISH PERIOD, in architecture, the first of the three divisions into which the English Gothic style is usually divided. Although originally the term was applied to English Gothic up to the beginning of the 14th century (as by Rickman and R. P. Spiers), it is now more customarily limited to the first half of the 13th century. In the last quarter of the 12th century, partly through the influence of the Cistercian order and partly through that of the French design of the early Gothic parts of Canterbury cathedral (choir, c. 1175–78), pointed arches and other Gothic ideas became more and more common, so that by the end of the century the transitional period was over and the architecture of England completely Gothic. It is this earliest developed Gothic which is known as Early English. The chief characteristics of the style are: frequent use of high, slim openings, capped with steeply-pointed arches, known as lancets, often grouped in threes, fives (the "five sisters" in the transept of York cathedral) or even in sevens; simple four part church vaulting (see VAULT), often with a ridge rib in addition to groin, cross and wall ribs; arch mouldings, consisting of complex combinations of convex projections with deep, rounded hollows; nave and chapter house piers of a central core of stone surrounded by a number of black Purbeck marble shafts, tied together by occasional moulded bands; capitals, almost always consisting of a circular abacus with rich mouldings below, or sometimes with conventionalized foliage with many rounded lobes; frequent use of ball-flower (*q.v.*) and dog-tooth (*q.v.*) ornament. Toward the end of the period the use of tracery became general, lavishness of ornament increased, as in the diaper patterns in the arch spandrils of Westminster Abbey, and naturalism in the carving grew. Outstanding examples of the style are Salisbury cathedral, begun 1220; the nave and transept of Wells cathedral, end of the 12th century to 1242; parts of York cathedral transepts, 1230–60. (See GOTHIC ARCHITECTURE)

(T. F. H.)

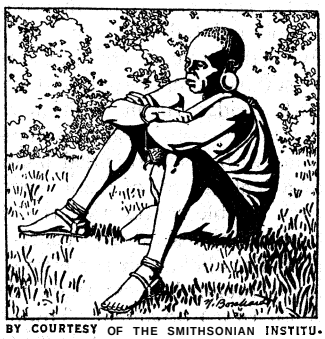
EARN, a loch and river, Perthshire, Scotland. The loch is 6½ m. long east to west and ⅘ m. in maximum breadth. It discharges by the river Earn. On its shores are Lochearnhead (at the southern extremity of Glen Ogle), which has a station on the railway from Perth to Balquhidder, and the ruins of St. Blane's chapel; Edinample Castle, an old turreted mansion belonging to the marquess of Breadalbane, situated in well-wooded grounds near the pretty falls of the Ample; Ardvorlich House, the original of Dar-

linvarach in Scott's Legend of Montrose, and the village of St. Fillans at the foot of the loch. The river, a notable fishing stream, flows out of Loch Earn eastwards with a gentle inclination towards the south, and reaches the Firth of Tay, 63 m. below Perth. The principal places of interest on the banks of the Earn are Dunira House; the village of Comrie; the town of Crieff; the ruined castle of Innerpeffray, founded in 1610 by the 1st Lord Maderty, close to which is the library founded in 1691 by the 3rd Lord Maderty, containing some rare black-letter books and the Bible that belonged to the marquess of Montrose; Gascon Hall, now in ruins, but with traditions reaching back to the days of Wallace; Dupplin Castle, a fine mansion in Tudor style; Forgandenny, and Bridge of Earn, a health resort situated amidst picturesque surroundings. Strathearn, as the valley of the Earn is called, extending from the loch to the Firth of Tay, is a beautiful and, on the whole, fertile tract, though liable at times to heavy floods. The earl of Perth is hereditary steward of Strathearn.

EARNEST, the payment of a sum of money by the buyer of goods to the seller on the conclusion of a bargain as a pledge for its due performance. It is almost similar to the *arrha* of the Roman law. Apart from its survival as a custom, its chief importance in English law is its recognition by the Statute of Frauds as giving validity to contracts for the sale of goods of a value exceeding £10. (See SALE OF GOODS.) It is in that statute clearly distinguished from part payment, consequently any sum, however small, would be sufficient as earnest, being given as a token that the contract is binding and should be expressly stated so by the giver. (See DEPOSIT)

EAR-RING, an ornament worn pendent from the ear, and generally suspended (especially among the more civilized races) by means of a ring or hook passing through the pendulous lobe of the ear. Among savage races the impulse to decorate, or at any rate to modify the appearance of the ear, is almost universal. The Berawan people of Borneo use plugs through the lobe of the ear $3\frac{3}{4}$ in. in diameter. More extraordinary still is an example of a stone ear-plug worn by a Masai, $4\frac{1}{2}$ in. in diameter and weighing 2 lb. 14 ounces. Among the superior races, though ear ornaments of extravagant size and elaboration are not unknown, moderation in size is commonly observed, and greater attention is paid to workmanship and fineness of material.

The general usage appears to have been to have ear-rings worn in pairs, the two ornaments in all respects resembling each other; in ancient times, or more recently among Oriental races, a single ear-ring has sometimes been worn. The use of this kind of ornament, which constantly was of great value, dates from the remotest historical antiquity, the earliest mention of ear-rings occurring in the book of Genesis. It appears probable that the ear-rings of Jacob's family, which he buried with his strange idols at Bethel, were regarded as amulets or talismans, such unquestionably being the estimation in which some ornaments of this class have been held from a very early period, as they still are held in the East. Thus in New Zealand ear-rings are decorated with the teeth of enemies, and with talismanic sharks' teeth. Among all the Oriental races of whom we have any accurate knowledge, the Hebrews and Egyptians excepted, ear-rings always have been in general use by both sexes; while in the West, as well as by the Hebrews and Egyptians, as a general rule they have been considered exclusively female ornaments. By the Greeks and Romans also ear-rings were worn only by women, and the wearing of them by a man is often spoken of as distinctively oriental.



BY COURTESY OF THE SMITHSONIAN INSTITUTION

A BANTU NEGROID

Among certain African tribes, ear-rings are worn not so much for ornament as for pulling the ear into a fashionable size and shape

In archaic art, ear-rings are frequently represented or their traces are left in the perforated ear lobes of early statues. After the 4th century such perforations occur seldom. In one instance, a Greek inscription records the weight of the detachable gold ornaments on a statue, among which a pair of ear-rings is included. Ear-rings of characteristic form are frequently discovered by excavation. In Egypt, a system of pendent chains is found hanging from a disc. In Assyria the decoration consists of pendants or knobs attached to a rigid ring. In the Mycenaean period, ear-rings are infrequent in Greece, but have been found in abundance in the Mycenaean finds of Enkomi (Cyprus) in the form of pendent bulls' heads, or of decorative forms based on the bull's head. In the tombs of the Greek settlers in the Crimea (4th century B.C.), ear-rings are found of marvellous complexity and beauty. The lexicographer Pollux, speaking of the names given to ear-rings, derived from their forms, mentions caryatids, hippocamps and centauresses. Jewels of the same class, of exquisite beauty and of workmanship that is truly wonderful, have been rescued from the sepulchres of ancient Etruria. Ear-rings of comparatively simple forms, but set with pearls and other stones, were the mode in Rome. Researches among the burial places of Anglo-Saxon Britain have led to the discovery of jewels in considerable numbers, which among their varieties include ear-rings.

These ornaments, which have never fallen into disuse, showed a considerable decline in Europe and America during the 19th century, but have been revived again in the 20th century to the extent that they are not uncommonly worn on the street or with evening dress. The more recent ones do not pierce the ear and are considerably smaller. (See also JEWELLERY.)

EAR-SHELL: see ABALONE.

EARTH. In the present article we shall treat the subject matter of the earth as a planet under the following headings:—(1) size, mass, density and form, (2) movements, (3) constitution, (4) age of the earth, and (5) earth's thermal history.

SIZE, MASS, DENSITY AND FORM

To primitive man the earth was a flat disk with its surface diversified by mountains, rivers and seas. The spherical form was asserted by Pythagoras, and Aristotle used arguments in its favour similar to those used to-day, viz., the ship gradually dis-

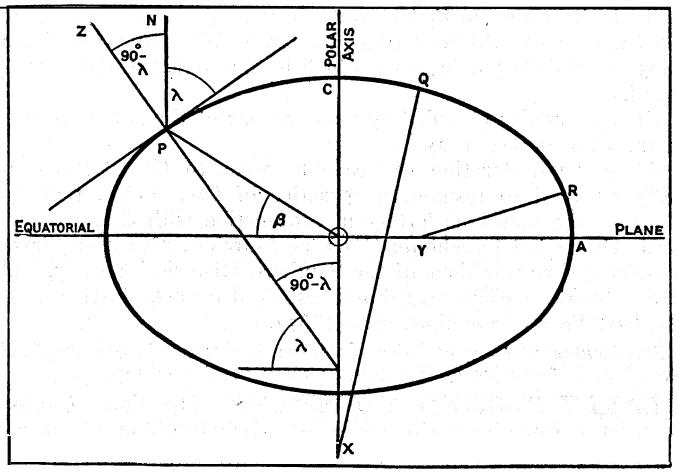


FIG. 1.— DIAGRAMMATIC SECTION OF EARTH THROUGH POLAR AXIS TO ILLUSTRATE LATITUDE

The latitude of a point P is the angle λ between PN parallel to the polar axis and a horizontal plane through P. The zenith distance of the pole is the angle NPZ=90°−λ. QX and RY are normals to the polar axis and the difference between CQ and RA represents the difference in length of a degree of latitude near the pole and near the equator

appearing, hull first, masts later, as it recedes beyond the horizon; the circular shadow cast on the moon during an eclipse; and the alteration in the appearance of the heavens as one passes from place to place on the surface. With regard to the last point, we may notice that if the earth were flat any star above it would be visible from every point of it. This is not true: many of the stars visible in England are never visible in South Africa or Australia, and conversely. On the other hand, an observer on the surface of a spherical earth would see every star that is above the tangent plane to the sphere at the point where he is. The direc-

tion of this plane varies with his position, and therefore the stars visible also depend on his position. The mean altitude (angular elevation above the horizon) of the Pole star is equal to the latitude of the place, for observers in the northern hemisphere.

The spherical form did not, however, become generally believed until after explorers had actually sailed around the earth; though this argument is not intrinsically so conclusive as any of the three first given. The distance a traveller has to proceed northwards to make the mean altitude of the Pole star increase by 1° is a "degree of latitude." Eratosthenes, in 250 B.C., was the first to measure this, by determining the difference of latitude between Alexandria and Syene, but there is some doubt about his measurement of the distance between these places. Picard, in 1671, obtained the first useful estimate. From the length of the degree of latitude the size of the earth can be calculated.

Actually, the length of the degree of latitude is found to vary slightly with latitude. This is because the earth is not exactly a sphere, a better approximation to its shape being an oblate spheroid (the surface swept out by an ellipse rotated about its shortest diameter). Such a surface is flatter near the pole than near the equator, and the degree of latitude is therefore longer in high latitudes than in low ones. Thus observation of the length of the degree in both high and low latitudes determines both the size of the earth and its polar flattening. The best determination yet made is that of J. F. Hayford, from observations in the United States, published in 1910. He gives:

$$a = \text{equatorial semi-axis} = 6{,}378{\cdot}388\text{km.}$$
$$b = \text{polar semi-axis} = 6{,}356{\cdot}909\text{km.}$$
$$a - b = 0{\cdot}18\text{km.}$$
$$\frac{a-b}{} = \text{ellipticity} = \frac{1}{297{\cdot}0 \pm 0{\cdot}5}$$

The distance from pole to equator, measured along the surface, is very nearly 10,000 kilometres.

The mass of the earth is found by comparing its gravitational attraction on a small sphere at its surface with that of a large sphere of known mass on the same small sphere. The attractive force satisfies the law of gravitation, namely, that the force produced on a given small body is proportional to $\frac{m}{r^2}$, where m is the mass of the attracting body and r the distance of its centre. If then the forces produced and the distances are known, we can find the ratio of the masses. Boys and Braun independently found the mass to be $5{\cdot}98 \times 10^{21}$ metric tons (1 metric ton $= 10^6$ grams $=$ 0·9842 British ton). This is the mass of a body with a volume equal to that of the earth, and with a density equal to 5·527 times that of water. The mean density of the earth is therefore 5·527 gm. per cubic centimetre.

MOVEMENTS

The motion of the earth is known if we know three things, which are independent or nearly so: first, the motion of its centre; second, its rotation about its centre; third, any variations of shape that may be taking place. These three types of motion may be described separately.

Movement of the **Earth** as **a** Whole.—The most important part of the movement of the centre is the revolution about the sun. The centre of mass (*i.e.,* centre of gravity) of the earth and moon together describes in the course of a year an elliptic path, with the centre of the sun at one focus. The mean distance from the sun is 149·4 million km., or 92.82 million miles. The eccentricity of the orbit is 0·016751 (eccentricity = difference of greatest and least distances ÷ sum of greatest and least distances).

The centre of the sun, however, is not fixed, but shares in the general motion of the solar system relative to the stars. The latter is a steady motion of the centre of mass of the whole system with a velocity of about 20km. per sec. towards a point in the constellation Hercules. It is found by statistical discussion of the apparent motions of stars. The sun's centre is close to the centre of mass of the solar system, but moves with regard to it on account of the attractive forces of the planets on the sun. The planets also attract the earth and moon. These forces introduce very complicated minor disturbances called perturbations.

The centre of mass of the earth and moon is about 4,800 km. from the centre of the earth; the latter moves about the former in the course of a month on account of the attraction of the moon for the earth, and on this account the earth gets alternately in front of and behind its mean position. This monthly inequality provides a means of determining the moon's mass.

Rotation.—The rotation of the earth about its polar axis is nearly uniform, the period being the sidereal day, which is 23h. 56m. 4·095s. of solar time. The revolution about the sun and the rotation were both established by Copernicus in 1543. In his great work De *orbium coelestium revolutionibus* it was shown that the common astronomical phenomena, such as the rising and setting of stars and the sun, the difference between the lengths of the sidereal and solar days, and the seasons, could be explained most simply by regarding the earth as revolving annually about a fixed sun, while rotating about an axis in itself. Later, the explanation of the revolutions of the planets was the greatest triumph of Newton's law of gravitation.

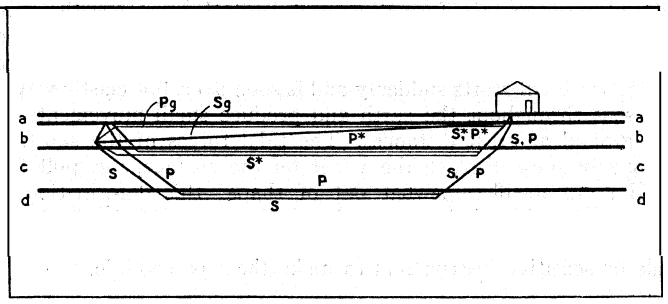


FIG. 2 — PATHS OF THE SIX PULSES OBSERVED IN NEAR EARTHQUAKES
aa, sedimentary layer; bb, granitic layer; cc, intermediate layer; dd, dunite base

The position of the axis, however, varies. The disturbances are known as precession, nutation and the variation of latitude. Precession (often called precession of the equinoxes) is a motion of the earth's axis in a cone whose axis is perpendicular to the plane of the earth's orbit, so that the celestial pole appears to move in a circle about the pole of the ecliptic. The time taken for the complete revolution is about 25,800 years. The phenomenon was discovered by Hipparchus (120 B.C.), and was first explained by Newton. The attraction of the sun and moon on the earth's equatorial protuberance tends to make it move so as to bring the equator into the plane of the orbit of the earth or the moon respectively. But the earth's rotation introduces a gyroscopic control, and the ultimate result is that each point of the earth's axis moves parallel to the plane of its orbit. The explanation is similar to that of the motion of the axis of a spinning top. Gravity tends to make the axis move downwards, but the spin of the top converts the disturbance into a revolution of the axis about the vertical. One effect of precession is that the equinoxes move around the ecliptic so as to be always moving to meet the sun. The rate is 50″·26 per year, enough to displace the equinoxes by 30° in 2,150 years. The vernal equinox, the point where the sun crosses the equator on its way north, was known in astronomy as the "first point of Aries"; but on account of precession it is now in Pisces. Also 4,000 years ago the star nearest the pole was **a** Draconis; but since the pole has moved it is now **a** Ursae Minoris; in 12,000 years it will be Vega.

The force tending to alter the tilt of the axis is not constant; when the sun or moon is crossing the equator, for instance, it has no effect. The path of the pole is therefore not described with uniform velocity, and is not quite a circle. The departures from the uniform circular motion are called "nutations." The largest of them, discovered by Bradley, is the lunar nutation, with a period of 18.6 years and an amplitude of 9″·2 in latitude. This arises because the plane of the moon's orbit revolves on the plane of the ecliptic in 18·6 years, so that the motion of the pole caused by the moon is not always about quite the same point of the sky. The variation of latitude consists of two small movements, one with a period of about 14 months, the other of a year. Both have amplitudes of about 0″·1. The existence of the former was predicted on dynamical grounds by Euler; it is a circular oscillation of the axis akin to the wobbling of a badly thrown quoit.

If the earth were quite rigid its period would be 306 days; actually it is about 428 days, the difference being due to the earth's elastic yielding. The annual movement is due to seasonal displacements of matter over the earth's surface. Both were discovered by Chandler in 1891; the qualitative explanation is due to Newcomb.

Deformations. — In addition to the above general movements, the earth is continually altering its shape. The movements involved in mountain formation and isostatic compensation are large but slow, taking millions of years for completion. The movement in a large earthquake may reach several metres close to the origin; it starts suddenly and is soon over, but elastic waves are sent throughout the earth and produce small movements of the ground at great distances. The tidal forces of the sun and moon not only displace the water on the surface, but pull the solid earth itself somewhat out of shape; this deformation is associated with an indirect one due to the weight of the displaced oceanic waters. All of these movements require either long intervals or sensitive instruments to make them perceptible.

CONSTITUTION

There are several different sources of information which are available concerning the constitution of the earth. Starting with the geological evidence, we know that most of the land surface is covered with a layer of sedimentary rocks. The chief of these are sandstones and shales, produced mainly by the weathering of granite and related rocks and redeposition of the resulting sediments in shallow water. In addition, large areas within the continents are covered with ancient rocks akin to granite, and granite is also a common intrusive rock. For all these reasons geologists (following Suess) have come to believe in a widespread granitic layer under all the continents. Another very common intrusive rock is basalt, which exists in several different forms, such as dolerite, gabbro, eclogite and tachylite. It is denser, in its commonest forms, than granite (3.0 against 2·7), and therefore has probably come from a greater depth. But the mean density of the earth is 5.5, nearly twice the density of basalt, and it has been shown that the high pressures in the interior of the earth are quite insufficient to compress basalt to such an extent. There must be much denser matter within the earth, and its density must be much greater than 5·5 to make up for the lighter stuff on the outside. This indicates an interior composed of heavy metals, especially iron, since this is the commonest heavy metal in the crust.

Upper Layers. — More detailed information is provided by seismology. As has just been mentioned, earthquakes send out elastic waves through the body of the earth, and the arrival of these at distant stations is recorded by instruments. Two types of bodily waves exist in a solid: first, a compressional wave like a sound wave, such that, as the wave passes, a particle vibrates *in* the direction of travel of the wave; and, second, a distortional wave, where the vibrating particle moves *at* right *angles to* the direction of travel of the wave. The two types are referred to, for brevity, as P and S. The letters stand for "primary" and "secondary" because the compressional wave travels faster. The velocities depend on the elastic properties of the material (incompressibility and rigidity, or resistance to change of shape) and on its density. When the substance is not uniform the energy of each wave behaves very much like that of light: that is, it travels in rays, which are curved in such a way that the wave travels from one end of the ray to the other in a shorter time than it would take if it travelled by any slightly different path. As in the case of light, again, if there is a sharp boundary between two different materials, a wave reaching the boundary is partly transmitted and partly reflected. A complication arises, however; in elastic waves, in a solid, four waves arise at a boundary, a compressional one and a distortional one in each medium. The distortional wave is entirely characteristic of solids: it does not exist in a liquid.

It is actually found, when the times of arrival of the waves from a near earthquake at different distances are compared, that a pair of waves can be traced, travelling with velocities of 5·4km. per sec. and 3·3km. per sec. respectively. The former velocity agrees with that found by L. H. Adams and E. D. Williamson, of the Geophysical laboratory at Washington, for the velocity of compressional waves in granite. This wave is consequently denoted by P_g and the other, which appears to be the corresponding distortional wave, by S_g. They travel wholly in the granitic layer from the origin to the observing station, apart from their short passage upwards through the sedimentary layer. These waves were first observed by A. Mohorovičić of Zagreb, Yugoslavia, in 1909.

If, however, a basalt layer underlies the granitic one it would be expected that some part of the waves sent out would be transmitted into this layer, travel through it, and be refracted up again when they return to the boundary. Now actually not one, but two other pairs of waves can be traced; they have been given specific symbols, and their velocities are: P*, 6·3km. per sec.; S*, 3·7km. per sec.; P_n (or simply P) 7·8km. per sec.; S_n (or simply S), 4·3km. per second. The curious fact is that none of these velocities fits that for compressional waves in crystalline basalt, as found in the laboratory, which is 6·9km. per second. The inference is that there is no widespread layer of crystalline basalt. The velocity of P* fits either tachylite, which is basalt in a vitreous, or glassy, condition, or diorite, a crystalline rock intermediate in composition between granite and basalt. P_n has a very high velocity; the only rock that transmits waves with so high a velocity is dunite, a rare rock at the surface, but consisting almost entirely of the mineral olivine (Mg_2SiO_4 and Fe_2SiO_4), which is fairly common as a constituent of mixed rocks. Eclogite, which has a similar composition to basalt, but a density of 3.3, may give a similar velocity, though it has not yet been examined for this purpose in the laboratory. There are thus two possible successions with increasing depth, both consistent with the seismological data, namely, granite-tachylite-dunite and granite-diorite-eclogite-dunite. The former was suggested by H. Jeffreys, the latter by Professor A. Holmes, and both views have arguments in their favour.

The six waves all appear to travel with uniform velocity, so long as the distance does not exceed about 900 kilometres. But their times of arrival are related as if they had started at times differing by a few seconds. If Δ is the distance of an observing station from the "epicentre" (the point of the surface vertically above the origin), T the time of arrival at the station, and v the velocity of travel of the wave, we have

$$T = T_o + \frac{\Delta}{v},$$

where T_o is the same for all stations for the same wave, so that the wave appears to have started at time T_o and travelled out with velocity v. But every wave has its own T_o, on account of the delay of the indirect waves in travelling down to the intermediate and lower layers, whereas the waves S_g and P_g come practically directly; just as walking to the next village may be quicker than travelling by train if one does not live near the station. These apparent delays in starting provide means of estimating the thicknesses of the granitic and intermediate layers, which are found to be about 10km. and 20km. respectively, under average continental conditions.

Below the ocean the structure must be somewhat different. Granitic rocks appear not to exist there, and basalt may come right up to the ocean bottom. On the other hand Holmes has suggested that there may be a thin upper layer of syenite, a rock resembling granite except that it contains no quartz. Direct seismological evidence is lacking, except that P_n and S_n seem to have the same velocities as under the continents. The chief difference between continents and oceans is, then, that under the oceans the granitic layer is absent or very thin.

Deeper Portions. — At distances over 900km. the four waves P_g, P*, S_g, S* have all disappeared or at least become unrecognizable. But P_n and S_n still exist. Their observed times of transmission give a means of finding their velocities of propagation at great depths, which has been employed by E. Wiechert, B. Gutenberg, S Mohorovičić and C. G. Knott. The velocities increase with depth, somewhat irregularly, to a depth of 0·45 of the radius, or 2,900km.; that of P varies within this range from 7.8 to 13km.

per sec.; the corresponding values for S are 4·35km. per sec. and 7km. per second. The increase is to be attributed mainly to an effect of the high pressure in increasing the stiffness of the material. There is no sudden change of velocity within this range of depth and the material is therefore probably of uniform composition, or at least its composition varies only continuously.

P waves just reaching a depth of 2,900km. emerge at an angular distance of 103° from the epicentre; that is, the line joining the epicentre to the point of emergence subtends an angle of 103° at the centre of the earth. At greater distances P and S cannot be detected. P reappears at a distance of 144°, and can be traced from there to the antipodes, but S never reappears at all. This is what would be expected if the earth had a liquid central core, for the fundamental property of a liquid is its inability to transmit distortional waves. But other alternatives are just possible, and we cannot decide that the central core is liquid without discussing other evidence.

P waves travel more slowly in the central core than just outside it, their velocity being about 9km. per second. These waves were first identified by R. D. Oldham in 1906, and further work on them has been done by Gutenberg and H. H. Turner. They emerge at minimum deviation at an angular distance of about 144°, and consequently have large amplitudes there. Between 103° and 144° only very small diffracted waves are recognizable. In addition, P and S waves incident on the central core are partly reflected and partly transmitted into the core as P waves. The reflected ones are spread out so much that they give rise to only small movements at the outer surface, but they have been identified by V. Conrad, the discoverer of P*. The transmitted waves are more conspicuous. That derived from S is again broken up when it returns to the boundary, giving three parts, denoted briefly by S_cP_cS, S_cP_cP and (S,P_c) (P_cS). The first two re-enter the outer shell when the wave has passed through the core; the three letters in each symbol indicate the type of the wave in the three parts of its path. The third wave is reflected on the inside of the core, and emerges after describing another path in the core as P and being transmitted into the shell as S. The existence of all these waves was predicted by Gutenberg, who calculated their theoretical times of transmission from the known velocities of P and S at various depths; and they have all been found by observation at the predicted times by Gutenberg himself and other workers, especially Prof. H. H. Turner. The wave reflected at the inside of the core is interesting because reflexion would not occur if the transition was gradual; it points to a sharp boundary between two quite different materials.

Density at Various Depths.—We have already seen that the high mean density of the earth also points to a difference of density between the interior and the exterior, comparable with that between metallic iron and ordinary rocks. There is reason to believe that the earth was once fluid, and in this state iron and silicates would not mix; thus a metallic core, sharply separated from a rocky shell, would be expected to exist. A correspondingly sharp change in properties with depth has been inferred, on entirely different evidence, from seismology. Seismology also indicates that there is no other sudden change. Hence we naturally infer that the two sudden transitions are identical, and that the thick outer shell, down to a depth of 2,900km., is composed of a silicate rock resembling olivine in composition, while the central core below that depth is made of metallic iron, probably in the liquid state.

The theory of the figure of the earth leads to another datum, involving the earth's "moments of inertia." The moment of inertia of a body about a line is obtained by multiplying the mass of every particle of the body by the square of its distance from the line, and adding up for all the particles. The moment of inertia of the earth about the polar axis is denoted by C, and that about any diameter in the plane of the equator is denoted by A. C is greater than A because the earth is spheroidal; particles, on an average, are farther from the polar axis than from one in the equatorial plane. Now the rate of precession contains as a factor the ratio $\frac{(C-A)}{C}$, which is therefore sometimes called the "precessional constant" or the "dynamical ellipticity." This rate being observed, and every other factor in the formula for it being known, we can therefore find the precessional constant, which is $\frac{1}{305\cdot6}$. But C—A can also be found absolutely, because it is the only unknown in the formula for the variation of gravity over the surface of the earth. Hence C can be found by simple division. It is conveniently expressed by the equation

$$\frac{C}{Ma^2} = 0\cdot334$$

where M is the earth's mass and a its equatorial radius. If the earth was a uniform sphere this ratio would have been 0·400; the difference gives new evidence that the earth is much denser near the centre.

The next step is to assume the earth to consist of a rocky shell and a metallic core, both of uniform density, and with the radius of the core equal to what seismology has revealed—0.55 of the outer radius. The densities of the shell and core are our unknowns, and can be found because we have two data, the mass and moment of inertia of the earth. The densities are found to be 4·5 and 12·0. They are much greater than those of dunite and iron at the earth's surface. But in the earth every layer is compressed by the weight of the matter above it, and if we allow for this we find that the average densities would be very close to those found for the uniform shell and core.

The Bodily Tide.—The density and the velocities of propagation of the P and S waves at any depth being by this time fairly accurately known, the elastic constants (the incompressibility and the rigidity) of the matter can be found. Hence it becomes, theoretically, possible to calculate how the earth as a whole would yield under known forces. The 14-monthly variation of latitude and the tides both provide data capable of being compared with theory. If the earth were perfectly rigid, the period of the variation of latitude would be 306 days; if it were a fluid, the variation

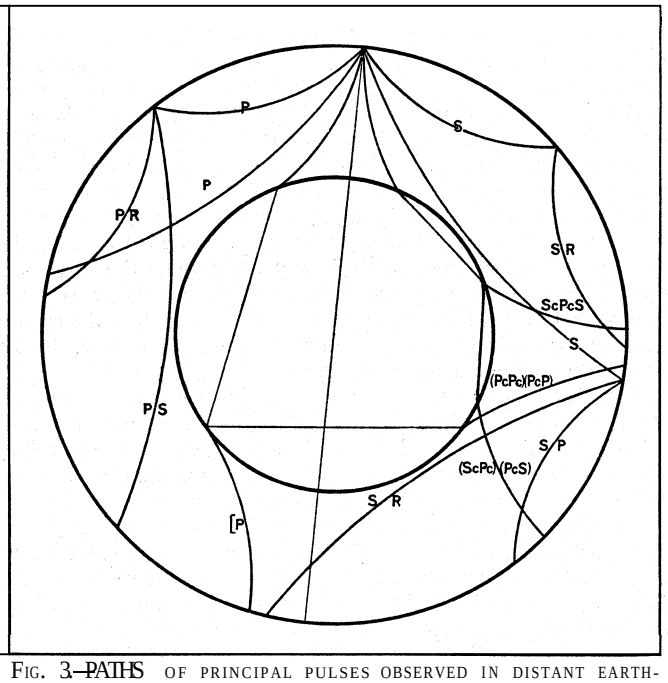


FIG. 3.—PATHS OF PRINCIPAL PULSES OBSERVED IN DISTANT EARTHQUAKES. THOSE STARTING AS P ARE SHOWN ON THE LEFT, THOSE STARTING AS S ON THE RIGHT

of latitude would not exist. If, again, the earth were fluid, the interior would yield so much to tidal force's that the ocean could yield no more, and there would be no visible tides. The actual tides are about 0·7 as high as they would be on a rigid earth. The two sources of information are closely related, but do actually give distinct checks on any theory. Lord Kelvin showed that the tidal yielding of the solid earth was no more than that of a globe of steel of the same size. We know now, however, that the dunite at a depth of 30–40km. is about two-thirds as stiff as steel, and the matter 2,900km. down is fully twice as stiff as steel. If the central

core were equally stiff, it can be shown that the earth as a whole would yield less than tides and the variation of latitude show it does. It has not yet been definitely shown that a liquid central core would give complete agreement, but it would certainly fit the facts much better than any reasonable hypothesis consistent with the solidity of the core.

Summary. — The structure of the earth, along a radius emerging at a typical point within a continent, would be as follows: —

	Thickness (km.)	Density
Sedimentary layer	0–5 (?)	a – 2.7
Granitic layer	10	2·7
Tachylite or diorite layer	20	2·9
Dunite shell (possibly with eclogite near the top)	2,900	3.3 (top) 5·0 (bottom)
Liquid iron core	3,500	11–11a

In oceanic regions the granitic layer may be absent, the sedimentary one thin and formed of deep-sea deposits, and the tachylite one replaced by matter of similar composition, but crystalline. The thicker shell and the central core are much the same below sea as below land.

THE AGE OF THE EARTH

The only theory of the origin of the earth that has hitherto survived quantitative test is the tidal theory. *(See* COSMOGONY.*)* This implies that the earth condensed from a filament, newly ejected from the sun under the gravitational attraction of a large star passing close to the sun's surface. The primitive earth would liquefy partly through loss of heat by radiation from the outside and partly by adiabatic expansion. The latter leads to the formation of liquid drops as in a liquid air machine, and the drops would gradually collect towards the centre. The formation of a liquid earth, probably with an atmosphere of some of its more volatile constituents, would be a matter of centuries. Further cooling would lead to solidification; the time needed for this would be longer on account of the reduced temperature and distension, but in a few thousand years at most the earth would have a thick solid shell on the outside. The further time taken for the outer surface to cool down, till its temperature was maintained almost wholly by the sun's radiation, would be only a few years. The temperature would then be near the present temperature, since the sun was in nearly its present state. The moon, if it originated in the same way as most of the other satellites, was formed a few years after the earth; if it was formed according to Sir G. H. Darwin's resonance theory, it still separated while the earth was liquid. Thus the intervals that have elapsed since the earth separated from the sun, since the moon was formed, or since the earth's outer surface became approximately as cool as it is now, do not differ by more than a few thousand years.

Denudation. — As soon as the outer surface became cool, an ocean could form — though possibly only a small one at first — and rain and rivers, denudation and sedimentary rocks came into existence. Several methods are available for estimating the age of the earth, but they are not all of equal accuracy, or reliability. The simplest, apparently, is that based bn denudation. If we know the total mass of sedimentary rocks over the earth's surface, and the annual amount of sediments carried to the sea by rivers, a simple division gives an estimate of how long the process has been going on. The transport of sodium to the sea in rivers, together with the present total amount of salt in the sea, gives another estimate. Both methods suggest ages of about 300 million years. But it is important to notice that many factors can vitiate both. In particular, purely geological evidence makes it clear that the present rate of denudation is considerably in excess of the average of the past, owing to the existence of many high and comparatively new mountain ranges and the large amount of easily denuded matter left by the last glacial period. These methods can, therefore, at most suggest an order of magnitude.

Kelvin's Arguments. — Two methods were given by Lord Kelvin, one based on the rate of supply of energy from the sun, and the other on the cooling of the earth's crust by conduction. In the former he supposed, following Helmholtz, that the sun's energy was maintained by contraction, and found that the whole energy liberated by the sun, in contracting from an infinite distension to its present size, would maintain radiation, at the present rate, for only about 20 million years. In the latter he considered the cooling of the earth from the state just after solidification, and found how the rate of increase of temperature with depth in the crust depended on the time the earth has been cooling This increase of temperature with depth is known by observation. The method, with modern data, gives about 27 million years for the age of the earth.

There is now an overwhelming amount of evidence that the earth and the sun are both very much older than Kelvin's numerical results would indicate. Yet the value of his attempts has not disappeared, though some current references might lead one to suppose that it had. Numerous astronomical sources of information have shown that the sun has been radiating as vigorously as now for hundreds of thousands of millions of years, and not merely for tens of millions, and we must infer that stars can draw on some source of energy much more provident than contraction under gravity. But Kelvin's argument will not be completely answered until this source can be definitely located and we can say under what conditions, and how fast, it gives up its energy; and although astrophysicists are making progress in studying it, its nature still remains largely a matter of speculation. At present we can only assert its existence.

Radioactivity. — The argument from the earth's thermal state was shown to require modification by the discovery of radioactivity. It was found that all surface rocks contained minute quantities of radioactive elements, but they were enough to indicate the probability that a large fraction of the heat being conducted out of the earth is of radioactive origin and does not arise from the original heat. But if so the original heat accounts for a smaller rate of increase of temperature with depth than was previously thought; in other words, cooling has proceeded to a greater depth and the time taken has been longer than Kelvin's theory indicates. Nevertheless, his theory is not done with. The earth is not so old that original heat has ceased to be important, and Kelvin's work shows how to estimate its importance. Its geophysical interest will not disappear till after the hot central core freezes.

Radioactivity not only showed the need of supplementing the old theory, but provided a new means of determining geological time; and this method is the best that is known. Radioactivity consists in the breaking up of elements with high atomic weights; in all known cases the disruption takes place by the loss of an a-particle, which is a charged helium atom, or by the loss of a β-particle, which is a free electron. In each case a certain amount

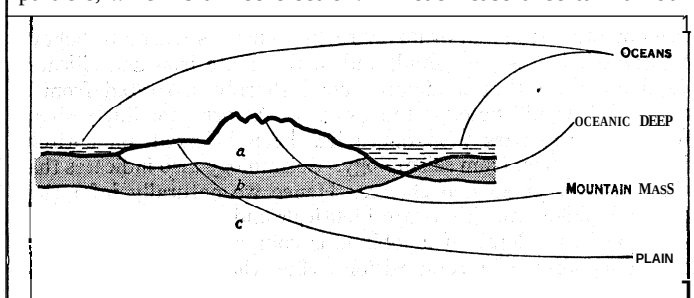


FIG. 4. — DIAGRAM ILLUSTRATING THEORY OF ISOSTASY. ACCORDING TO WHICH EQUILIBRIUM IN THE EARTH'S CRUST IS MAINTAINED BY FLOW OF ROCK MATERIAL BENEATH THE SURFACE UNDER GRAVITATIVE STRESS
a, granitic layer; b, intermediate layer; c, lower layer

of radiative energy is also liberated. The atomic weight of uranium is 238, that of helium is 4, and that of an electron, on the same scale, would be $\frac{1}{1800}$. Thus when an a-particle is lost the atomic weight decreases by 4; when a β-particle is lost it decreases by an insignificant amount. The products of the decay of uranium have therefore atomic weights of 234, 230, 226, 222, 218, 214, 210 and 206; but several may have nearly the same atomic weight owing to loss of β-particles. The most interesting

of the products, for our purpose, are those with atomic weights 226 and 206, namely, radium and lead. Radium breaks up at a known rate; in a given sample of radium 1 part in 2,280 breaks up every year. But in spite of its short life, radium is present in all uranium minerals, in a constant proportion corresponding to 36 atoms of radium per hundred million of uranium. The explanation is that uranium itself breaks up at such a rate as to replenish the radium as fast as this in its turn breaks up. For this to be possible one atom of uranium in 6,400 million must break up every year.

The final product is a kind of lead; that is to say, no chemical test will distinguish it from ordinary lead, but its atomic weight is 206 instead of 207·2. Lead is always found in uranium minerals, and when it was isolated it was actually found to have atomic weight 206. The different kinds of lead were the first examples discovered of isotopes, elements identical in chemical behaviour but differing in atomic weight; but numerous others are now known through the work of Aston.

Now, this lead is being produced from uranium at a known rate: for every 6,400 million atoms of uranium 1 atom of lead is produced every year, or, if we allow for the difference in atomic weights, 7,400 million parts by weight of uranium produce 1 part by weight of lead every year. Hence if a mineral contained no lead to begin with, and now contains x parts of lead to 1 of uranium, the age of the mineral is $7{,}400x$ million years, Petrologists can recognize when original lead must have been absent, and the method is therefore applicable to the determination of the ages of minerals, and hence to the absolute measurement of geological time. The element thorium behaves somewhat similarly to uranium, its final product being a lead of atomic weight 208. When uranium and lead are both present in a mineral the age can be calculated by the formula of Holmes and Lawson:—

$$\text{Age} = \frac{\text{Pb}}{\text{U}+0{\cdot}38\text{Th}} \times 7{,}400 \text{ million years.}$$

Holmes and Lawson give also a slightly more accurate formula, allowing for the variation of the amounts of uranium and thorium with time. The oldest known minerals to which this method is applicable have been found to have ages of about 1,500 million years. The coal measures were laid down about 250 million years ago. The former estimate is therefore a minimum estimate of the age of the earth.

The radioactive elements can be applied in another way, due to H. N. Russell, to find an upper limit to the age of the earth. The above method is based on the analysis of minerals specially rich in uranium and thorium. But these elements are present in all rocks, and the method could be applied to the earth's crust as a whole. A caution necessary is that some of the lead may have always been lead and not have been produced by radioactivity during the geological time. Consequently the method gives an upper limit. The amounts of the relevant elements, in parts by weight, shown by averages of analyses of rocks, are U, 6 parts per million; Th, 15 parts per million; Pb, 7·5 parts per million. The quantity of lead is too small to be consistent with the existence of the earth for more than about 3,000 million years, according to Holmes's latest revision. Thus radioactivity leads to the conclusion that the age of the earth is between 1,500 and 3,000 million years.

Evidence from Cosmogony: The Orbit of Mercury.—Two arguments from cosmogony also give evidence concerning the age of the earth. The first is based on the fact that planets formed by ejection from the sun would move originally in very elongated orbits, which must have been altered to their present circular form by some later influence. The only cause known that could produce such an effect is the resistance of the gaseous medium surrounding the sun, formed of the parts of the primitive filament that failed to condense into planets. The medium would meanwhile degenerate gradually on account of viscosity and diffusion. The time such a medium would take to reduce the eccentricity of the orbit of Mercury to its present value is inversely proportional to its density; the time it would take to become destroyed by viscosity and diffusion is directly proportional to its density. These times must be somewhere near equal, because, if the medium was not dense enough to begin with, it would have disappeared before it had produced its actual effect, while if it was too dense a large amount of it would still remain and would be visible. From a comparison of the two intervals of time it is found that the age must be of the order of magnitude of 3,000 million years. Great accuracy is not possible.

Tidal Friction.—An alternative method depends on the history of the earth and moon. The rotation of the earth is not absolutely uniform; the day is becoming longer by about one second in 120,000 years. The change affects the observed times of ancient eclipses to a measurable extent, and it is from these that the amount is determined. The explanation depends on the tides produced by the sun and moon. The tidal currents in shallow seas are resisted by friction over the bottom, and this leads to a certain amount of dissipation of energy and to a reaction on the tides in mid-ocean, giving a systematic disturbance of the times of high water. If no friction took place the attraction of either the sun or the moon on the tides raised by itself would act exactly through the centre of the earth, and would have no tendency to turn it; but the displacement of the times of high water causes the attraction to act along a line passing a little to one side of the centre, and consequently to alter the rotation of the earth. A reaction on the moon makes the moon go farther off, and explains how the moon can have receded to its present distance from its probable original close proximity to the earth's surface. The rate of change of the earth's speed of rotation due to lunar tidal friction varies inversely as the sixth power of the moon's distance, and must therefore have been much greater in the past. An estimate of the time needed to bring the moon to its present distance, based on the supposition that the phase lag of the oceanic tides has always been as at present, indicates an age of the order of 4,000 million years.

These two methods are much less accurate than those based on radioactivity. Their utility is that they both depend on theories that explain a large number of other facts, and that the agreement of their conclusions in order of magnitude with those drawn from radioactivity gives independent reason to believe that the latter are not vitiated by some fundamental error of principle.

THE EARTH'S THERMAL HISTORY

The primitive earth was presumably very thoroughly stirred up. But the heavy metallic constituents refused to mix with the rocky ones and quickly settled to the centre to form the core. At some stage during the solidification the granitic and basaltic layers separated from the dunite one, and, by some process so far very imperfectly understood, the granitic matter became collected into large patches, which we know now as the continents. In a few thousand years a thick solid crust formed, and subsequent cooling took place by conduction through it.

The later history is substantially modified by radioactivity. The amount of heat being conducted out of the earth per unit surface per unit time is the product of the thermal conductivity of the surface rocks, say 0·01 c.g.s., and the increase of temperature per unit depth, which is about 0·00032° C. per centimetre. Thus $3{\cdot}2\times10^{-6}$ calories per sq.cm. per sec. are being conducted out of the earth. But the experimental work of the present Lord Rayleigh, J. Joly, J. H. J. Poole and others has shown that average granite contains enough radioactive matter for 1 cu.cm. to produce $1{\cdot}4\times10^{-12}$ calories per second. Hence about $2{\cdot}3\times10^{6}$cm., or 23 km., of average granite would supply all the heat leaking out at the surface. The actual thickness of the granitic layer, as we have seen, is about 10km.; but other rocks are also radioactive. We are forced to suppose that unless the radioactivity is practically confined to a surface layer with a thickness comparable with 20km., the heat coming out of the earth would exceed its actual amount.

The temperature at any depth in the crust may be regarded as made up of two parts, one due to the original heat, the other to that developed by radioactivity since solidification. The age of the earth and the other relevant physical data being roughly known, the former part can be evaluated. Subtracting from the

rate of conduction out of the earth the portion due to original heat, we are left with the part due to radioactivity. This is found to be equivalent to the rate of generation of heat by about 15km. of granite, or by 10km. of granite with 20km. of basalt under it;—in excellent agreement, so far as we can tell, with the results of seismology. If we adopt the latter view, the present temperature at the base of the intermediate layer should be about 560° Centigrade. At a depth of about 300km. the rocks should have cooled by about 280° since solidification; below 600km. the present temperature in the rocky shell is nearly the melting point. We can now easily see why the central core is liquid. The melting point of dunite at ordinary pressures is 1,400°–1,600°; that of pure iron is about 1,500, but that of the material of the central core might be lower by some hundreds of degrees on account of impurities. In addition, the melting point of dunite is raised by pressure; that of iron, at any rate at low pressures, is lowered by pressure. Accordingly we should expect that the central core would be more fusible than the surrounding rock; and if the latter is near its melting point the iron must be liquid.

The foregoing discussion concerns mainly continental conditions. Radioactivity beneath the oceans must be less, and the cooling at great depths there may be up to 30% more. The upward concentration of radioactive matter requires an explanation. It is perfectly genuine, for, without it, it would be impossible to reconcile the radioactivity of the surface rocks with the rate of increase of temperature inwards. Also it can be shown easily that if the radioactive layers were twice as deep, or even if the total amount of radioactive matter were the same, but were uniformly distributed to a depth of 100km., the steady temperature at the base of the radioactive layer would be so high that the interior could never have become solid. A difficulty sometimes expressed about the concentration near the surface is that the elements concerned are heavy, and might have been expected to collect near the centre of the earth. But when the total amount of a substance is too small to affect the density of its solvent appreciably, the density is often of much less importance than solubility or volatility in determining the distribution.

Actually it is found that the radioactive generation of heat in basalt is under a third of what it is in granite, and in denser rocks such as dunite the amount is much lower again. This points directly to a strong upward concentration, especially as the dunites analysed are, of course, surface samples, and have probably been enriched by contact with the more radioactive rocks that surround them. Further, Holmes has called attention to the fact that in successive igneous outpours, even of material of similar composition, the material from the higher levels seems to have been enriched in radioactive materials at the expense of that lower down. The evidence that these substances actually do tend to collect upwards is very strong. The explanation is probably connected with the facts that they form volatile compounds, and that an important fraction of the water on the earth's surface has probably been extruded during geological time. The ascent of the water from rock magmas would carry the volatile constituents upwards. But it is to be noticed that the effect of radioactivity on deep-seated temperatures is proportional not only to the total amount of radioactive matter present, but also to its mean depth. The upward concentration of this matter would continue until it became too near the surface to prevent any farther solidification down below. Later denudation would tend to transfer the radioactive substances to the ocean bottom, as Joly has pointed out.

A further complication is the influence of change of state. If a liquid gradually solidifies by cooling from the top a solid crust forms and steadily thickens. The rate of thickening is largely controlled by the latent heat of fusion, which has to be conducted away before new matter can solidify. With a latent heat of 100 calories per gm., which is about correct for the few silicate rocks yet tested, it can be shown that solidification could not have reached a greater depth than 300km. during geological time. Yet the seismological evidence is clear that the earth is solid to nearly ten times this depth. It seems to follow that no change of state involving so great a latent heat has taken place at great depths; the change has possibly been from a liquid state to a glassy one, and not to a crystalline one.

The Effects of Cooling at Great Depths.—The fall of temperature since the solidification of the crust would be associated with a contraction in volume. But we have seen that, since the solid crust formed, the outer surface and the central regions have scarcely cooled at all; the greatest rate of cooling is at an intermediate depth, which is at present somewhere about 200 kilometres. The spherical shell of cooling matter becomes too small to fit the interior, but being plastic it stretches and becomes thinner. This makes its outer boundary move towards the centre, tending to leave the uncooled outermost regions unsupported. But they are not strong enough to support themselves, and collapse under their own weight. They have to accommodate themselves to too small a surface, and consequently crumple, fold and fracture. This is the thermal contraction theory of mountain formation. It is found that the total amount of reduction of surface to be expected is at least 2,000,000 square kilometres. The compression required to explain all known mountains is not accurately known, only a few great ranges having been fully surveyed geologically, but it appears to be of the same order of magnitude. The chief strength of the thermal contraction theory, however, is that it certainly accounts for a large fraction of the mountains of the globe, and as no other suggested theory has been proved so capable the presumption is that thermal contraction is the chief cause of mountain formation.

Further, the rocks beneath the oceans are more basic, and therefore are probably less radioactive and have cooled more than subcontinental rocks. Even at the same temperature basalt seems to be stronger than granite and when it is cooler it will be stronger still. Hence when an ocean floor is compressed against a continent, the latter will be the first to yield. This is the probable explanation of the Pacific type of mountains—the long series of the Rockies and Andes with the smaller ranges running nearly parallel to them and to the neighbouring coast.

Mountain formation, on almost any mechanical theory, would be expected to be intermittent in time and localized in position. The upper rocks are elastic solids, which have to be under a considerable stress before they give way, and when they do so the yield is at a definite place and becomes complete almost instantaneously. If then the stress is one that grows very slowly and gradually, there will be long quiescent periods when the stresses are accumulating, separated by short intervals when they are relieved by folding and fracture, with mountain formation as a result. This corresponds with the facts as known to geology.

The theory has, however, still to meet several difficulties in points of detail; while the phenomena of igneous activity, shown in volcanoes and intrusions, seem at present to stand right outside it. The temperatures that seem most probable within, the intermediate (basaltic) layer are enough to make a hard glass readier to flow than the basaltic layer actually is; nevertheless, basalt driven up to the surface seems to be much more completely fluid and, to judge by its effects on neighbouring rocks, at a much higher temperature. A curious fact noticed by Aston provides what looks like a promising clue. The "inert gases" (helium, neon, argon, krypton and xenon) are far scarcer on the earth than one might expect from comparison with the abundance of other elements of neighbouring atomic weights in the crust: the ratio is in all cases somewhere about a millionth. A very natural explanation is that when the primitive earth was highly heated and probably distended its gravitation was insufficient to control the freely-moving molecules of a gaseous atmosphere; consequently the truly gaseous constituents were mostly lost from the earth and transferred to the resisting medium. The present earth consists of the constituents, such as iron, that liquefied readily, and of the materials that formed liquid or solid compounds at the high temperature concerned. From this point of view it is interesting to note that the amount of oxygen in the earth's crust is within 1% of that needed to combine with all the other elements; and the rarity of the inert gases is to be attributed precisely to the fact that they are inert gases, and could not find even a temporary place of safety in the earth's interior. But if we adopt this explanation we must suppose that most of the water and carbon com-

pounds on the earth's surface at present have been expelled from the interior since the earth shrank to its present size. Now there is ample independent evidence that chemically active gases and water vapour are continually being expelled from volcanoes, and T. A. Jaggar and A. L. Day have given reason to believe that their reactions with one another and with the oxygen of the air are the principal factors in maintaining volcanic temperatures.

Continuous heating in the deeper crust would produce expansion and hence tension in the upper crust. This would lead to vertical cracks and violent igneous outpourings. On the views just given concerning the way radioactive materials become concentrated near the surface, the earth's crust must have had such a history in its earliest days, but denudation and other factors have obliterated all traces of it. On the moon, however, there has been no denudation, and an extensive system of fissures and craters is the moon's most prominent feature. Lunar vulcanism is then to be referred to the moon's earliest days and the upward movement of radioactive matter produced by it provides the reason why the internal heating ceased and there is no vulcanism on the moon to-day.

Isostasy. — It is clear from the geological evidence that the transport of large quantities of matter horizontally, so as to thicken or thin the crust locally by several kilometres, is a common feature of the earth's history. Now, all matter produces a gravitational field, and this redistribution would therefore be expected to produce disturbances of the direction and intensity of gravity. Numerical calculations of the amount of these disturbances can be made; but when they are compared with the actual local direction and intensity of gravity, as shown by the slope of the plumb-line and the period of a standard pendulum, they are always found to be wrong. It would actually be nearer the truth to say that additional matter does not appear to attract the plummet or the pendulum bob at all, and that matter removed appears not to have attracted them. The law of gravitation cannot be wrong; the only possibility is that there is really no excess or deficiency of mass in these places, addition or removal of matter on top being compensated by the outflow or inflow of an equal mass below. This result would follow physically if the earth's upper crust was an elastic solid, but so thin as to be readily flexible, and rested everywhere on a fluid interior.

This theory was actually suggested as an explanation by Sir G. B. Airy when attention was called to the facts by Archdeacon J. H. Pratt. Extra mass on top would force the crust down, the fluid below would flow out, and the process would continue until just enough had flowed out to restore the balance; in the "isostatic" state every vertical column of the same section would have the same mass inside it. Pratt did not accept this explanation, and proposed as an alternative the idea of a "depth of compensation"; according to him the extra mass of a mountain is compensated by a uniform reduction in density of all the matter below it, down to a fixed depth. This hypothesis requires that the matter should diminish in density when an extra pressure is placed on top of it, and therefore is physically unplausible; and there are also weighty geological arguments against it. But most geodesists, especially J. F. Hayford and W. Bowie in the United States, have adopted Pratt's view and found it to correspond well with the facts. It is only recently that W. Heiskanen has shown that the Airy theory fits the facts at least as well, and that H. Jeffreys has shown that this result was inevitable from the nature of the law of gravitation. The only modification needed in the Airy theory is that the substratum is not a fluid, but a very stiff solid, capable of transmitting distortional waves, but not of enduring great stresses for a long time. The weakness is, of course, to be attributed to its high temperature.

The variation of gravity over the outer surface depends somewhat on the thickness of the elastic outer layer, for this affects the depth where the outflow takes place. A horizontal displacement of a given mass at the surface would clearly affect gravity in a different way from a similar displacement at the centre of the earth. Heiskanen, on the hypothesis that the outflow was always vertically below the added matter, found that the thickness of the upper layer should be 40–80km. in different great mountain ranges. Actually the elastic bending of the upper layer will spread the compensation horizontally a little, and, when allowance is made for this, the most probable thickness is only about 30 kilometres. Thus the strong region extends at most to the bottom of the intermediate layer; all matter below that has a strength less than about a fiftieth of that of granite or basalt under surface conditions.

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(H. J.)

EARTH, FIGURE OF THE: *see* GEODESY.

EARTH CURRENTS. Our knowledge of earth currents dates from the introduction of telegraphy. Ordinary telegraph lines are traversed by natural electric currents which occasionally interfere seriously with their use. It is these currents which we shall mainly consider here. There are, however, electric currents arising from electro-chemical action in mineral deposits, electric waves due to natural causes such as thunderstorms or to wireless, and widely distributed artificial currents due to electric traction and lighting. The pioneers of our subject in England included W. H. Barlow and C. V. Walker, in charge, respectively, of the Midland and South-eastern telegraph systems. Barlow noticed the existence of a more or less regular diurnal variation, and the fact that earth currents proper occur in a line only when both ends are earthed. Walker collected statistics of large earth currents. His and Barlow's results indicated that the lines which suffer most from earth currents in England have the general direction north-east to south-west.

As Walker pointed out, it is the direction of the terminal plates relative to one another that is the essential thing. Thus in France, in 1883–84, E. E. Blavier, comparing continuous records from two lines, one aerial, the other underground, connecting Paris and Nancy by different routes, found an exact parallelism between the currents. The difference of electro-motive force between the two terminal plates is the cause of the current, but the intensity varies inversely as the total resistance of the wire. The currents in the ground must depend on the resistance of the soil, which will vary with the depth and the geological conditions. Observations on experimental lines can convey only a general idea as to the currents in the earth itself, but they may be expected to show their variations.

Our present knowledge owes much to practical men, but the fact that telegraph systems are primarily commercial undertakings is a serious obstacle to their employment for research. Some valuable observations have, however, been made on long telegraph lines. In addition to the French observations already referred to, mention may be made of important observations made from 1884 to 1888 in the case of two German lines, Berlin to Thorn and Berlin to Dresden, discussed by B. Weinstein, also of observations during 1921 and subsequent years on several Swedish lines, discussed by D. Stenquist.

Experimental Lines. — Amongst the earliest experimental lines were those instituted at Greenwich in 1865, one going to Dartford, distant about 10 m., in a direction somewhat south of east, the other going to Croydon, distant about 8 m., in a direction west of south. Perhaps the earliest of what may be considered modern installations was that set up by T. Moureaux at Parc St. Maur, near Paris, in 1892. There were three lines, one having terminal earth plates 14.8 km. apart in the geographical meridian, a second having earth plates due east and west of one another, also 14.8 km. apart, and the third, which did not measure earth currents, forming a closed circuit wholly insulated from the ground. In each of the three lines was a Deprez d'Arsonval galvanometer, and a continuous photographic record was devised.

TABLE I. *Diurnal Variation*

	N–S		N′–S′		W–E		W′–E′	N–S		N′–S′	W–E		W′–E′		Dists.
	Ebro Q 1926	Ebro 6 years	Ebro Q 1926	Ebro D 1926	Ebro Q 1926	Ebro 6 years	Ebro Q 1926	Ebro Q 1926	Berlin	Greenwich 65-67	Ebro Q 1926	Berlin	Greensicka 65-67	Ben Nevis 1885	Ebro
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hour	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	%	%	%	%	%	%	%	%
1	+ 1·8	+ 1·6	+ 2	+ 9	+1·5	+0·9	+0·7	+ 32	− 10	− 82	+ 64	+ 11	+ 61	+ 59	+ 65
2	+ 4.6	..	+ 5	+16	+2·6	..	+0·5	+ 82	− 4	− 59	+110	+ 12	+ 35	+115	+ 39
3	+ 0·9	+ 0·5	+ 1	+ 7	+1·0	+0·4	+0·6	+ 16	0	− 38	+ 42	+ 1	+ 10	− 36	+ 30
4	0·0	..	0	+ 8	+0·5	..	+0·5	0	− 8	− 16	+ 21	− 18	− 16	− 65	+ 12
5	− 2.7	− 3·4	− 3	+ 2	−0·7	−1·2	+0·6	− 48	− 36	− 26	− 30	− 35	− 1	−154	− 34
6	− 3'7	..	− 4	+ 7	−1.1	..	+0·6	− 66	− 66	− 55	− 47	− 28	+ 49	+ 8	− 74
7	− 1·7	− 2·0	− 3	+ 4	−0·7	−0·6	+0·6	− 30	− 70	−105	− 30	+ 15	+121	− 70	−118
8	− 0·8	..	− 1	+ 4	− 0.2	..	+0·2	− 14	− 14	−152	− 8	+100	+188	+ 90	−107
9	+ 5'7	+ 7·8	+ 6	+ 5	+2·5	+3·2	−0·1	+101	+103	−136	+106	+200	+209	+166	−116
10	+14·2	..	+15	+16	+5·6	..	−0·8	+253	+240	− 38	+237	+276	+117	+174	−118
11	+17·0	+17·4	+19	+14	+7·0	+6·6	−1·1	+303	+330	+ 71	+297	+285	− 4	+129	−110
12	+13·4	..	+14	+11	+5·0	..	−1·0	+238	+312	+180	+212	+217	−104	− 17	−114
13	+ 6·0	+ 6·7	+ 6	+16	+1·9	+2·3	−0·7	+107	+192	+213	+ 80	+ 86	−147	− 67	−125
14	− 0·6	..	− 1	− 3	−0·5	..	−0·1	− 11	+ 22	+179	− 21	− 51	−177	− 51	−123
15	− 7'0	− 7·1	− 8	− 8	−3·3	−3·0	0·0	−125	−115	+133	−140	−143	−152	−323	− 99
16	−10·7	..	−12	−24	−4·8	..	+0·2	−190	−179	+139	−204	−181	−169	− 51	− 61
17	−18·0	−11·4	−14	−24	−5·6	−4·8	+0·2	−320	−176	+146	−237	−174	−184	−211	+ 25
18	−11·7	..	−13	−13	−5·3	..	+0·2	−208	−140	+109	−225	−149	−149	+ 14	+ 76
19	− 7'0	− 8·7	− 8	−13	−3·3	−3·6	0·0	−125	−105	+ 38	−140	−125	− 87	−140	+101
20	− 3'3	..	− 4	−13	−2·0	..	0·0	− 59	− 84	− 19	− 85	−106	− 8	+ 25	+191
21	+ 0·3	− 2·8	0	−18	0'0	−1·3	−0·1	+ 5	− 74	−100	0	− 88	+ 73	+157	+220
22	+ 1·3	..	+ 1	− 3	−0·8	..	−0·3	+ 23	− 61	−120	− 34	− 63	+112	+104	+194
23	+ 1·3	+ 0·6	+ 1	+ 3	+0·3	−0·5	−0·2	+ 23	− 38	−118	+ 13	− 32	+106	+ 79	+121
24	+ 1.2	..	+ 1	− 3	+0·4	..	−0·1	+ 21	− 21	−128	+ 17	− 4	+121	+ 95	+127
Range	35·0	28·8	33	40	12·6	11·4	1·8	..	..	..	..	..	..	..	..
A.D.	5·6	5·8	5·9	10·2	2·4	2·4	0·4	100	100	100	100	100	100	100	100
Mean value	256	..	285	303	126	..	6·9	..	..	..	..	..	..	..	..

Each galvanometer had a resistance of about 200 ohms, shunted by a resistance of only 2 ohms. The total effective resistances in the north-south and east-west lines were 225 and 348 ohms respectively. What is really measured by such apparatus is the voltage between the two earth plates. This voltage between the two earth plates as measured is usually stated in mv./km.: millivolts per kilometre.

Industrial currents put an end to the usefulness of the earlier installations. Of those still functioning the best known is that of the Ebro observatory, Tortosa, dating from 1910. One line, which we may call the N.′–S.′ line, has earth plates 1·28 km. apart, and the straight line joining them is inclined at 25°16′ to the geographical meridian, thus running roughly from north-north-west to south-south-east. The other, or W.′–E.′ line, has plates 1·415 km. apart, and is nearly perpendicular to the N.′–S.′ line, being inclined at 24°46′ to the geographical west-east line. The method of recording is similar to that described at Parc St. Maur. Other more recent installations are those of the Carnegie institution at Watheroo (Western Australia) and Huancayo (Peru).. The two lines at Watheroo run exactly north-south and east-west, each being about a mile long.

A source of uncertainty, especially in short lines, is the probable existence of polarization currents from the electrodes. These can be largely, if not entirely, avoided in temporary installations by the use of special non-polarizable electrodes. But difficulties still remain in permanent installations. For many purposes a constant polarization current is immaterial, but varying polarization effects might cause serious confusion. Provision for the detection of spurious electrode effects is thus desirable, and is included in the installation at the Carnegie institution which is situated at Watheroo (Western Australia).

Diurnal Variation. — The diurnal variation data in Table I. are all given as inequalities, *i.e.*, as algebraic departures from the mean value for the day. The inequality may be regarded as superposed on a "constant" value, which, in general, was so large that the direction of the total current was invariable. In cases like the Ebro, where the absolute difference of potential between the earth plates was known, the entries in Table I. represent millivolts per kilometre. In cases where the unit was arbitrary, the units employed in Table I. were such as to make the A.D., *i.e.*, the average numerical departure of the hourly values from the mean value for the day, equal 100. A few explanatory remarks will be found useful. The Greenwich data are based on a discussion by Sir G. B. Airy of results from 1865 to 1867. The Greenwich observations were among the earliest experimental studies made of the subject. Airy resolved the observed currents from the two lines in two directions, one N.′–S.′ in the magnetic meridian, the other W.′–E.′ perpendicular to it. Magnetic declination at the time was about 21° W. In every month the mean of the 24 hourly values represented a current from north to south in the magnetic meridian, and from east to west in the perpendicular direction. Col. 10 represents the inequality in the former current, + signifying increase in the current from north to south. Col. 13 represents the inequality in the latter current, but + signifies algebraic increase in the direction west to east, and so a numerical fall.

Col. 14 is based on a discussion by H. N. Dickson of hourly readings during a fortnight in Sept.–Oct. 1885 of the current in the telegraph cable between Ft. William and the Ben Nevis observatory. The "constant" part of this current was directed up the hill, nearly west to east. Thus in this case + represents numerical as well as algebraic increase.

Cols. 9 and 12 are based on Weinstein's discussion of the results from the German lines, Berlin to Thorn, 262 km. away, and Berlin to Dresden, 120 km. away. Relative to Berlin the geographical co-ordinates of the two other terminals were Thorn 0° 29′ N. lat., 5° 12′ E. long., and Dresden 1° 28′ S. lat., 0° 21′ E. long. The directions taken as + in Table I. are in each case the opposite of Weinstein's. His units being arbitrary, such (different) units were employed in cols. 9 and 12 as to make the A.D. in each case 100. But if we used the same absolute unit for the two directions, we should reduce the figures in col. 12 in the proportion roughly of 45 to 100.

Cols. 1 and 5, which refer to true geographical directions, are derived from the official Ebro publication for the year 1926, and are based on five days a month, mainly the international magnetically quiet (or Q) days selected at De Bilt; when the Ebro record was incomplete another quiet day was substituted. Cols. 2 and 6 also refer to the Ebro; they were calculated by D. Stenquist from all the available days, quiet or disturbed, of the six

TABLE II. *Annual Variation*

	Ebro N-S' line					Ebro W'-E' line					Daily range			
	Daily range				Mean monthly values	Daily range				Mean monthly values	Berlin inequ resultant	Ebro N'-S' line Absolute range		Distd. in Norway
	Inequ	Absolute				Inequ	Absolute							
	Quiet	Quiet	All	Distd.		Quiet	Quiet	All	Distd.			1910–20	1926	
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	mv/km	%	%	%	%
January	30	60	155	356	407	1·5	4·2	8·3	25·3	7·5	60	89	141	62
February	45	59	139	343	424	2·3	4·5	7·2	13·0	8·9	83	89	127	121
March	52	83	155	282	376	3·0	4·8	8·4	14·8	9·8	116	110	141	143
April	39	65	135	270	491	2·8	3·3	8·2	17·1	7·9	129	102	123	124
May	47	60	114	203	579	3·7	6·6	7·1	9·3	4·7	124	92	104	85
June	53	74	99	238	567	3·7	6·2	9·2	17·8	6·1	124	96	90	68
July	35	61	75	147	120	2·7	5·4	7·0	10·1	8·0	133	96	68	65
August	31	51	68	117	41	2·9	6·2	6·9	8·7	10·4	118	106	62	60
September	35	47	122	291	85	2·8	4·7	6·3	8·0	13·0	102	106	111	93
October	41	54	110	289	65	1·5	2·8	12·9	43·4	4·9	94	120	100	138
November	19	25	49	76	29	1·4	2·4	3·6	11·8	−0·5	65	102	45	150
December	20	49	96	143	237	1·1	1·9	3·9	6·6	2·4	52	92	88	91
Year	37	57	110	230	285	2·5	4·4	7·4	15·5	6·9	100	100	100	100
Winter	28	48	110	230	274	1·6	3·3	5·8	14·2	4·6	65	93	100	106
Equinox	42	62	131	283	254	2·5	3·9	8·9	20·4	8·9	110	110	119	124
Summer	42	61	89	176	327	3·3	6·1	7·5	11·5	7·3	125	97	81	70

years 1910, 1912, 1913, 1916, 1917 and 1918. Cols. 8 and 11, applying to the Ebro, reproduce the results in cols. 1 and 5 respectively, multiplied by the factors necessary to make the A.D.=100 in each case. In addition to the inequalities in cols. 1 and 5, obtained by combining results from the Ebro N.'–S.' and W.'–E.' lines, we have in cols. 3, 4 and 7 inequalities for the two lines separately, going only to the nearest mv./km. in the NS line. Cols. 3 and 7 are based like cols. 1 and 5 on the quiet day results of 1926 in the official publication. Col. 4 refers also to 1926, but is derived from the international magnetic disturbed (or D) days. Of the 60 disturbed days eight were omitted, as the trace was incomplete. No substitutes were used, and equal weight was given to each month.

Double Daily Oscillation. — A general feature in Table I. is a well marked double daily oscillation, best seen in the comparatively smooth data from Berlin and the Ebro. A key to the Ebro phenomena is supplied by cols. 3 and 7. The amplitude of the diurnal variation is some 15 times larger in the N.'–S.' line than in the W.'–E.' The phase of the W.'–E.' variation seems rather opposite than similar to that of the N.'–S.' variation, but the latter is so dominant as to decide the phase even in the west-east inequality, cf. cols. 8 and 11. The peculiarity of the phenomena may raise doubts respecting all the Ebro inequalities. But it will be seen that the results for the Ebro, in cols. 8 and 11, are remarkably similar to the corresponding results from the long German lines in cols, 9 and 12. The German data also agree in showing at least a close approach to agreement in the phase of the north-south and west-east diurnal inequalities. It was largely with a view to emphasizing this agreement in phase that W. to E. has been taken as the + direction in Table I.; this departs from the procedure adopted in the 11th edition.

The agreement between the Ebro results in cols. 1 and 2, and again in cols. 5 and 6, is good. The closeness of the amplitudes in the two cases must, however, be regarded as largely accidental. The amplitude really varies with the amount of disturbance and with the sunspot frequency. The six years on which cols. 2 and 6 depend had a mean sunspot frequency of only 44·2, as against 63.9 for 1926. The effect of disturbance on the regular diurnal variation at the Ebro can best be inferred from the corresponding quiet and disturbed day results in cols. 3 and 4 of Table I. Disturbance does not seem to have much influence on the type of the diurnal variation, but it largely increases the amplitude.

In view of the irregularities natural in inequalities from a single year, the A D. is probably a better measure of the amplitude than is the range in most cases in Table I. If we take the A.D as our measure, the ratio borne by the amplitude of the diurnal inequality in the west-east line to that in the north-south line is 0·43 at the Ebro (1926) and 0.45 at Berlin. According to observations by D. Stenquist, extending over several months of 1924 and 1925, the ratio was 0·54 at Lund (56° N.) and 1.84 at Lulea (66° N.). This tendency to a rise in the relative importance of the diurnal changes in the west-east direction as we go to higher latitudes in Europe was pointed out by Stenquist.

Irregular Changes. — Col. 15, Table I., stands by itself. It is based on an enumeration by Stenquist of the number of irregular changes exceeding a certain amplitude recorded in the Ebro N.'–S.' line during 1916, 1917 and 1918. The results are shown as an inequality representative of disturbance, the unit being selected to bring the A.D. up to 100. The changes really numbered 1645, the hourly totals varying from 12 to 168. We have here little if any trace of a double oscillation. The hour 9 P.M. of most frequent disturbance accords closely with the hour of greatest frequency of large magnetic disturbance in Britain; and, as is true of magnetic disturbance in Europe generally, the night is much more disturbed than the day. Stenquist also investigated the disturbances in the Ebro W.'–E.' line. They showed a decided double oscillation, but were relatively insignificant.

The fact that the amplitude of the regular diurnal inequality increases with sunspot frequency was first demonstrated by Weinstein for the German lines. Stenquist found a similarly large effect at the Ebro. L. A. Bauer also dealt with the matter in a discussion of Ebro data from 1910 to 1920. Employing all days with the exception of the highly disturbed, he found that the absolute daily range, *i.e.*, the excess of the absolute maximum over the absolute minimum of the day, in the N.'–S.' line was 53% larger in 1917, the year of sunspot maximum, than in 1913, the year of minimum.

Annual Variation. — Table II. illustrates the annual variation. Cols. 1 to 5 relate to the N.'–S.' line, cols. 6 to 10 to the W.'–E.' line at the Ebro. These data all refer to 1926, and are in mv./km. Cols. 1 and 6 give the ranges of the regular diurnal inequalities derived from five quiet days a month. Cols. 2 and 7 give the absolute daily ranges from the same quiet days. Cols. 3 and 8 give the absolute daily ranges from all available days, while cols 4 and 9 give the absolute daily ranges from the international magnetically disturbed days. Winter includes January, February. November and December; equinox includes March, April, September and October; and summer includes May to August. In all cases the yearly and seasonal results are arithmetic means from the included months. There is invariably a marked increase in amplitude as we pass from the inequality range to the absolute range, from the quiet day to the average day, and from the

average day to the magnetically, highly disturbed day.

The data in cols. 11, 12 and 13 are expressed in terms of units such that the mean from the 12 months is in each case 100. Col. 11 refers to Weinstein's value of the resultant current as derived from the diurnal inequalities in the German lines. Cols. 12 and 13 are derived from the all day absolute ranges in the Ebro N.′–S.′ line. Col. 12 is based on data given by Bauer for the 11 years 1910 to 1920. Col. 13 merely repeats the data in col. 3, but in a shape comparable with col. 12. Col. 14 is based on a table given by Stenquist of the number of disturbances from 1881 to 1884 in telegraph lines at four Norwegian stations, varying from 60° N. lat. to 70° N. The occurrences at the four stations, summed up as if independent, numbered 904. Each monthly sum was multiplied by —, so as to bring the monthly mean up to 100.

Cols. 11 and 14 may be regarded as representing respectively the regular and irregular daily changes. In col. 11 the maximum of activity occurs in the summer months, the minimum in the winter.

In col. 14, on the other hand, the maximum activity is in the equinoctial months, and the more conspicuous minimum occurs in summer. Cols. 12 and 13 agree with col. 14 in placing the maximum of activity in the equinoctial season. Cols. 3, 4, 8 and 9 agree with cols. 12 to 14 in making equinox the season of greatest activity. Cols. 1, 2, 6 and 7 agree with col. 11 in showing a tendency for the regular diurnal changes to be larger in summer than in winter.

Cols. 5 and 10 of Table II. represent the mean monthly values of the "constant" part of the current in the two Ebro lines. The difference between the results in the N.′–S.′ line from January to June and from August to November is extraordinary. A rapid fall occurred in July and a rapid rise in December. The phenomenon is almost equally prominent in the results given by Bauer for the resultant currents at the Ebro from 1914 to 1918, the chief difference being that in Bauer's average year the decline did not set in until August. His July values varied between 329 and 611, his September values between 13 and 33. The phenomenon is probably of local origin and might be a consequence of variable plate polarization. But there is nothing in the run of the figures in cols. 1 to 4 and 6 to 9 which suggests that the diurnal changes are affected.

Relations to Terrestrial Magnetism. — At the Ebro during 1926 the highest voltage recorded in the N.′–S.′ line was 0·754 v./km., but in one magnetically disturbed day the range exceeded 0·7 j v./km. Much larger voltages are sometimes encountered. In May 1921, during an outstanding magnetic storm, Stenquist calculated from the fusing of some copper wires and the non-fusing of others that the largest earth current voltage in Sweden lay between 6.3 and 20 volts per kilometre. In several cases the currents produced in telegraph wires exceeded 2·5 amperes. Under such circumstances potentials differing from that of the earth by several hundred volts may exist in a long line. Potentials of 700 or 800 volts are, in fact, said to have been met with in English lines during the autumn of 1859.

In dealing with the Ebro it has been assumed that quietness or disturbance in earth current phenomena can be safely inferred from the magnetic conditions. A striking confirmation is afforded by a table of Stenquist's which enumerates the days, 53 in number, between Nov. 1, 1906, and Oct. 31, 1909, when a current exceeding 15 milliamperes was recorded at the Stockholm Central Telegraph office, this representing the lower limit at which serious trouble was experienced. The magnetic character figure — the international measure of disturbance-exceeded 1·5 on 30 of the 53 days, and fell short of 1·0 on only two of them, the character on the average day being under 0·7. The three equinoctial months, March, September and October, supplied 28 of the 53 days, while June and July supplied none.

Close parallelism with magnetic phenomena is also shown in an investigation by W. J. Peters and C. C. Ennis of the 27 day recurrence interval. This is a well known magnetic phenomenon, conditions, whether specially disturbed or specially quiet, tending to recur after 27 days. Peters and Ennis employed the absolute daily ranges in the Ebro N.′–S.′ line from 1910 to 1924. Primary pulses were formed from selected disturbed and quiet days — usually five of each per month — and the adjacent days, in a similar way to that employed by Chree for terrestrial magnetism, and exactly as in the case of magnetism these were found to have associated pulses of disturbance or quietness, with their crests falling 27 days subsequent to those of the primary pulses.

All the phenomena mentioned here point to an intimate connection between earth currents and terrestrial magnetism. Many authorities have supposed it a case of cause and effect, differing, however, as to which is the cause and which the effect. So far as the limited data available enable us to judge, neither hypothesis suffices to explain the facts. It is practically certain that at least a substantial part of the regular diurnal changes in terrestrial magnetism is due to overhead electric currents, and the association of earth current with magnetic disturbances, and of both with aurora, points to the upper atmosphere as the ultimate seat of at least disturbance phenomena. The 27 day recurrence phenomenon supports the view, now generally held, that aurora and magnetic disturbance are due to electrical discharges from the sun. The exact nature of the discharge is still, however, a matter of speculation.

If the main cause of the daily magnetic variations is situated above the earth, this varying external field must necessarily induce electric currents within the earth. From consideration of the records of the diurnal variation of magnetic force at numerous observatories, Schuster showed that about two-thirds of the diurnally varying field is of external origin, the remainder coming from within. This implies that the induced currents in the earth are less than the primary currents in the atmosphere. According to Chapman the earth must be much more conducting below a depth of about 250 km. than in the layer above this. The specific resistance found for the core is 2,700 ohms per cm. cube. The core is about 1,000 times as conducting as dry earth, but only about $\frac{1}{100}$ as conducting as the salt water of the oceans.

Chapman and Whitehead have compared the diurnal variation of the horizontal potential gradient at Ebro with calculations based on the computation of the magnetic field. The agreement in phase is close enough to indicate that the theory is substantially correct; the observed variations are more than five times as great as the computed ones; but this is probably due to the local distribution of resistance in the rocks of the Ebro valley.

The movements of a magnetic needle being governed by the electric currents in the upper atmosphere as well as those under ground it is not to be supposed that magnetograms and records of the horizontal electric force will be very simply related. In general it is true that an increase in the flow of electricity under ground from north to south is accompanied by a movement of the compass needle to the west and a flow from east to west is accompanied by an increase in horizontal force. The ratio of the scales on which the variations of electric and magnetic force occur is much greater for rapid oscillations than for the regular diurnal changes. This may be due to the fact that the earth currents taking part in the rapid oscillations do not extend to any great depth.

In the case of Ben Nevis, as already remarked, the "constant" part of the potential difference indicated a current flowing up the mountain. A similar tendency has been described in other cases, but more evidence is needed to justify the conclusion that there is a general tendency for earth currents to flow up mountains.

Certain mineral deposits, e g., pyrites, especially when the surrounding material is damp, give rise to local earth currents of perceptible amount. This property may be utilized by prospectors, as is described by J. Bartels in the *Lehrbuch* der *Geophysik*, p. 575.

Uses of Artificial Earth Currents. — Artificial earth currents have been used in various ways by prospectors. To get a general idea of the problem, suppose a long 3 in. plank of wood, backed by 1 in. copper plating, and suppose holes drilled to a depth of 0·5 in. along the median line of the opposite face of the plank, to serve as points for the insertion of a pair of terminals, in a circuit furnished with a battery, and electrical measuring apparatus. Suppose measurements made of the electrical resistance of the wood between the terminals. So long as the distance between the termi-

nals is only 1 in. or 2 in., the presence of the copper backing is of little account, but as the distance between the terminals increases, so does the influence of the copper, until it becomes very large indeed. The presence of underground material differing much in electrical conductivity from the surrounding soil can be inferred in this way from judicious measurements of resistance, made with two terminals inserted in the ground at various distances apart. Other electrical methods have been tried, involving the use of alternating currents of high voltage, with periods such as 0·002 second, led into the earth. Equipotential surfaces may be mapped out with the aid of a telephone, and their shape supplies a key to the situation (cf. Bartels, l.c.).

As a specific example, reference may be made to investigations carried out by W. J. Rooney and O. H. Gish in the immediate neighbourhood of the observatories of Watheroo and the Ebro. Suppose four terminals sunk in the earth along a straight line, the distance between adjacent pairs being in each case a. The extreme pair of terminals are in a circuit containing a source of current. If I is the measured current in the circuit and V the potential difference found with a potentiometer between the inner pair of terminals, the resistivity of the earth ρ, assumed uniform, is given by $\rho = 2\pi a V/I$.

As regards the applications, in Rooney and Gish's words "The value of resistivity thus found must, however, in general be considered an average, in which the resistivity of the earth near the line of terminals is the more heavily weighted." They assume that material whose distance from the line of electrodes exceeds a may practically be left out of account.

The mean values calculated for ρ at Watheroo, from a series of sections and in different months, in ohms per cm.^{3}, varied from 580,000 when a was 2·5 metres, to 700 when a was 60 or 100 metres, and then increased to 5,000 when a was 600 metres. It was inferred that the sandy soil at the surface had a very high resistivity when dry, but beneath it at a comparatively small depth was a layer of low resistivity. This was confirmed. From the increase in the values obtained for ρ when a exceeded 100 metres it was inferred that below 100 metres there was a stratum of much higher resistivity.

At the Ebro the resistivity with $a = 2{\cdot}5$ metre, *i.e.*, near the surface, was much less than at Watheroo, in one case as low as 1,300; but with a as large as 60 or 100 metres it rose to 10,000, being then and for greater values of a much larger than at Watheroo. Rooney and Gish point out that the higher resistance of the deeper strata in the Ebro valley is accompanied by higher values of the potential gradient, so that the currents in the earth in the two localities are comparable.

Disturbances Due to Artificial Earth **Currents.**—Practically every kind of artificial use of electricity, traction, lighting, telegraphy, telephony and wireless, may set up earth currents of one kind or another.

The most important case is that of the disturbance caused by the use of direct current for electric traction. The currents are large, and even if there were a perfectly insulated return there would be a considerable resultant magnetic force at distances from the track which were not largely in excess of the distance apart of the direct and return currents. At a distance of $\frac{1}{2}$ m. or more from an ordinary electric railway the disturbance is usually much the largest in magnetographic records of changes in the vertical component of the earth's field. At Washington (D.C.), U S.A., sensitive instruments have shown disturbance effects at a distance of 12 miles. Practically all the magnetic observatories once functioning near large towns—including of late years Kew and Greenwich—have been put out of action.

As regards damage from electrolysis caused by the so-called "vagabond" currents to underground gas and water pipes, numerous observations have been made, especially in Germany and the United States. Owing, perhaps, to the conflicting interests involved, the extent of the damage has been variously estimated. However this may be, the prosecution of research into natural earth currents has difficulties to contend with which did not exist 100 years ago.

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EARTHENWARE, a term generally associated with a coarser type of domestic pottery, although such cups and saucers and other table ware of thin pottery, are often called china (*q.v.*) in error. Earthenware can be made almost as thin as china, but it lacks translucency; it is opaque. Its chief feature is that it will absorb moisture *under* the glaze, whereas china will not. A test adopted by the British customs officials is the application of red ink to the ware at a point where the glaze has been removed. If the ink is absorbed then it is classed as earthenware.

Earthenware embraces a wide range of pottery known under a variety of names, which usually indicate the place where the ware was first introduced. William Burton, a well-known authority (*see* CERAMICS), writes: "The word earthenware in its widest sense might be used to cover all varieties of pottery, as they are all made from some form of earthen or mineral substance taken out of the ground. In this broad sense a brick, a drainpipe and a Chinese vase might be equally described as earthenware, but though the chemical differences between them are slighter than would be supposed, they are so far apart in technique and final result that the names earthenware, stoneware and porcelain are very conveniently used to differentiate between them. In this restricted sense, the title 'earthenware' covers all articles made from a single natural clay, or from mixtures of clay and other mineral substances which, *when sufficiently fired* for practical use, *still* remain porous, and need, therefore, if they are to be used for culinary, domestic, or decorative purposes, to be completed by the addition of an outer skin of glaze or glass melted on them. . . ." A handbook compiled by British experts in conjunction with the educational committee of the Pottery and Glass Trades' Benevolent Institution, gives the following definition of earthenware:—

"All ware may be termed earthenware which is porous in the material itself, and requires to be glazed before it can be applied to domestic use. Earthenware is opaque; it will not transmit light."

The porosity of the "body" (the pottery itself without a glaze) may give a wrong impression to those who are not familiar with the ceramic industry. For instance, Bourry, a noted authority on the industry, points out that terra-cotta and stoneware are quite distinct in their properties. One of the chief characteristics of stoneware is its impermeability, whereas terra-cotta has a porous body. If the distribution of the temperature of the kiln is irregular, some of the ware, says Bourry, will be impervious and rightly termed "stoneware," whilst other ware, in the same kiln, will have a porosity between that of terra-cotta and stoneware. Judged on the basis of porosity, an article, Bourry points out, might be defined as "stoneware" if viewed from one side and as "terra-cotta" if viewed from another! Therefore it will be seen that earthenware and other types are not easily defined; but for general purposes the term "earthenware" may be applied to pottery which is absorbent under the glaze.

Types of Earthenware.— Earthenware can, however, appear under several names, each chosen to distinguish a special type of ware. These are sometimes distinguished in the trade as agate ware, onyx ware, marbled ware, porphyry ware, that is, earthenware made to imitate these various natural stones by mixing different coloured clays and glazing with a rich soft glaze.

Delft ware is a general term applied to earthenware covered by an opaque tin enamel. It takes its name from Delft in Holland, where it was already largely made about 1600. Afterwards it was imitated at Lambeth, Bristol and Liverpool (England).

Faience ware is an earthenware with a soft rich glaze, generally decorated under the glaze; named after the place of its origin, "Fayence."

Majolica ware is the name given to an earthenware which is glazed with soft-coloured glazes. It takes its name from "Majorca."

Queensware is a yellow or cream-coloured English earthenware first made about 1750 by Josiah Wedgwood of Etruria (England). Many imitations of it have been made, which vary much in character, colour, hardness and quality.

Semi-porcelain and ironstone china are only trade names given to a harder form of earthenware. They are not in reality either porcelain or china.

The above descriptions cover in the main table ware and decorative pottery; but earthenware is also used for more prosaic purposes, such as sanitary utensils, and containers for food and drink. Earthenware is also produced in almost every civilized country of the world, but the quality varies considerably. In this respect Great Britain has an enviable reputation for its earthenware, just as it has for china.

Not only will the ware itself differin its quality, according to the country of origin, but the decorations also are in most cases characteristic of the nation that produces the earthenware, unless it is made specially for export. For instance, an eastern country like Japan expresses its artistic character in its pottery decorations, but to capture the trade in western countries forsakes its national decorative schemes and adopts those common in the Western Hemisphere.

The principal raw materials used in the manufacture of earthenware are: china clay, ball clay, flint and china stone.

China-Clay.—This mineral is found in many parts of the world, but the English mines at Cornwall and Devon are considered to produce the best clay for china-making. The clay is, of course, consumed largely by the British potters, but large quantities are exported, particularly to the United States, which have not a clay of the English quality, although quite good clays are found in Georgia.

The British trade returns do not show the exports of china-clay separately, but group them with china-stone. Of these two minerals 651,990 tons were sent abroad during 1926, more than half the quantity (361,797 tons) going to the United States. Belgium follows with 64,891 tons, and the Netherlands ranks third with 40,421 tons.

According to the last census of production, published in a series of preliminary reports during 1926, the output of British china-clay was 805,000 tons, valued at £1,448,000. The previous census taken in 1907 gave the production of china-clay and china-stone together, the total being 726,000 tons, valued at £542,000.

Perhaps the next most important deposits of china-clay are to be found in Czechoslovakia, where an output of 40,000 tons per year is obtained.' The best clay in Czechoslovakia is mined at Sedlice and Karlovy Vary. Czechoslovak clay is also exported to the extent of about 20,000 tons per year, a large part of this being sent to Germany.

China-clay is said to have resulted from the decomposition of granite through many centuries. Its main constituents are silica and alumina, and may be described generally as a white, amorphous powder. The clay is not usually mined in the ordinary way, but is washed down from the sides of the mine by huge jets of water thrown out of hosepipes at a high pressure. The water brings down the fine clay to the bottom of the mine, where any sand is allowed to settle out. The watery mixture of clay is then pumped up to the ground level, and run through a series of troughs, known as "micas," where it undergoes a process of levigation, which consists of running the mixture into a trough from which the clay and water overflow into another trough, and so on throughout the series. While the mixture is passing through the "micas," the heavier materials—the impurities such as mica --gradually settle out and are left behind. On emerging from the "micas" the clay, now pure, is run into settling pits. From here it will pass to storage tanks and then to drying kilns. Finally it travels, in the form of lumps, to the storage room or "linhay," from which it will be loaded into railway trucks or conveyed to ships. It is the china-clay that gives plasticity to the mixture of materials used by the potter.

Ball Clay.—This is found principally in Devon and in Dorsetshire, and is sometimes known as blue clay, owing to its greyish-blue colour, which is due to organic matter. When fired at a moderate temperature it becomes white and remains absorbent; but some clays, if subjected to intense heat, are, according to Sandeman, rendered so hard that they are not easily scratched with a knife. Under such conditions these clays turn a yellowish colour and become non-absorbent.

The clays vary, and the producer grades his clays into several qualities. Deposits will in some instances be found quite near the surface, while in other cases shafts will be sunk and the clay mined in branching "lanes," which vary in height according to the thickness of the vein of clay. It is necessary to "weather" the clay before sending it to the potter. To do this it is piled in heaps and exposed to the weather, and to the sun, rain and frost. probably for years, the whole being turned over at least once, so that all the clay may benefit from the exposure. This weathering is said to increase the plasticity of the clay, an important matter to the potter.

The production of ball clay in the United Kingdom according to the census published in 1926 was 146,000 tons, which had a selling value of £128,000. The United States bought 17,870 tons in 1926, more than half the quantity exported that year, Italy and Belgium following with 4,669 and 2,167 tons respectively.

Flint.—Almost everyone is familiar with the pebbles or pieces of flint which are washed smooth by the waves on the sea-shore. These find their way into the body of earthenware. Not all flints are equally suitable; the best are found in France, although there are many other sources of supply. To reduce the flints to a powdery mass so that they can be incorporated into the clay, the pebbles are heated (or calcined), a process which not only turns them white, but makes them more amenable to grinding. They are first of all crushed and then ground into very small particles in water, so that a white, or greyish, thin liquid paste is produced.

The flint can withstand very high temperatures and therefore makes what might be termed a framework for the clay and other materials in the earthenware. The census of production for the United Kingdom published in 1926 gives a total of 188,000 tons for flints (including crushed and broken flints).

China-Stone.—This is an important ingredient in pottery, and there are deposits of a high quality in Cornwall, England, where the stone is mined by inserting explosive charges in holes drilled by compressed air boring machines. The stone has four recognized qualities or grades: hard purple (a white, hard rock with a purple tinge); mild purple (similar but softer); dry white or soft (a soft white rock); buff (similar to dry white, but with a slight yellow tinge).

Silica is the principal constituent, amounting to about 74% in the dry white and over 80% in the three other varieties. Oxide of alumina is the next important ingredient, amounting to about 18% in the dry white and from 7 to 10% in the other varieties, The British output, according to the preliminary census reports published in 1926, was 51,000 tons, valued at £82,000. China-stone gives the china "body" its translucency.

Manufacture of Earthenware.—Earthenware may be "thrown" on the potter's wheel or made under semi-mechanical conditions. In the case of the potter's wheel the prepared ball or lump of clay, revolving at the will of the potter on a small circular platform, is moulded by hand into whatever shape is aimed at. But for commercial production on a large scale, the thrower may form the ware in a mould, which shapes the exterior, the clay being pressed inside until the desired thickness is attained; or the clay and other materials may be introduced in the form of "slip" (a mixture of the materials with water) into a plaster of paris mould.

A further method is that of "jolleying." In this process a mould forms one side of the article. If "flat" ware, such as saucers, plates, etc., is being made, the mould shapes the top or inside, and the under-side of the ware, which is on top in this process,

is fashioned by cutting away the clay, as it revolves, by means of a tool which is cut to represent the profile of article to be made. The lathe also plays a part in finishing raw, or "green," clay articles. These processes are described and illustrated under CHINAWARE (*q.v.*).

Unlike china, earthenware, has little beauty of its own; also, as already stated, it is necessary to cover it with a hard glaze before it can be used for domestic or most ornamental purposes. Its decoration may be applied by painting or printing designs under or over the glaze; or the decoration may consist of coloured glaze, in one colour or a variety of shades. A glaze is really a glass, and this may be coloured with various metallic oxides. The oxides produce different colours according to the temperature of the kiln and the method of heating. A variety of colour schemes is possible, but it is a speculative method of decoration for it is difficult accurately to predict what the colours will be when they emerge from the kiln. This element of chance is made use of by some potters, for it truthfully can be said that no two pots decorated in such a manner will be identical.

To perfect the decoration of pottery by the fusing of metallic oxides and a flus on the ware the potter needs to have a scientific knowledge; that is, he must understand the chemical and physical properties of the metallic compounds so that he may judge what their behaviour will probably be when subjected to heat in the kiln. With such knowledge some beautiful effects may be produced; but many glorious combinations of coloured glazes have been the result not of predetermined efforts, but of unforeseen happenings in the kiln.

When the "green" or raw clay article has been made, it is fired or heated in an "oven." The glaze is then applied and the ware is fired again.

These processes are illustrated under CHINAWARE.

Statistics.— The quantity of general earthenware, semi-porcelain and majolica produced in the United Kingdom, according to the census published in 1926, was 997,000 cwt., with a selling value of £2,691,000. These figures include only the returns in which weight was stated; other returns gave selling value only, and the total in this case was £3,288,000, making a selling value of £5,979,000 for the year. Sanitary earthenware had a selling value of £1,252,000. Returns regarding the weight of the ware produced were only partially made and gave a total of 360,000 cwt., with a selling value of £854,000. Imports of general earthenware (except high-grade earthenware resembling china), semi-porcelain and majolica into the United Kingdom during 1926 amounted to 291,232 cwt., the largest consignments coming from Germany (195,158 cwt.), Czechoslovakia ranking second with 53,744 cwt. and France, third, with 15,748 cwt. Exports for the same year amounted to 716,724 cwt., as compared with 825,513 cwt. in 1925. The United States is by far the best customer for British earthenware and china; for although earthenware is produced in America, English pottery is eagerly bought. Canada is not far behind the United States, the next most important market being Australia, while other countries in the British empire and South America take substantial proportions of the output of the British factories.

Czechoslovakia produces large quantities of pottery for export. China has been dealt with under CHINAWARE. Italy is well known for its majolica, and there is a moderate export trade; but of earthenware generally, Italy's imports are greater than her exports. Like other countries, France imports pottery as well as sending its own products overseas. Of faience and majolica the exports of French manufacture are considerable.

Classifications of pottery vary in almost every country. In the United States stoneware is grouped with earthenware and we get the record of imports in the table above.

The above countries are the principal sources of American import supply: smaller centres of production make up the grand totals.

See also CHINAWARE.

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Imports into the United States (1926)
Earthen, crockery and stoneware

	Table, toilet and kitchenware		
	[illegible]	(Decorated)	Other
	Dozens	—	Dozens
Total	598,440	4,006,688	1,311,510
From Austria	[illegible]	8,111	..
,, Czechoslovakia	36,603	340,245	
,, France	..	161,533	
,, Germany	301,903	788,970	.
,, Netherlands	26,264	196,610	.
,, United Kingdom	185,005	1,905,756	..
,, Japan	20,284	476,839	

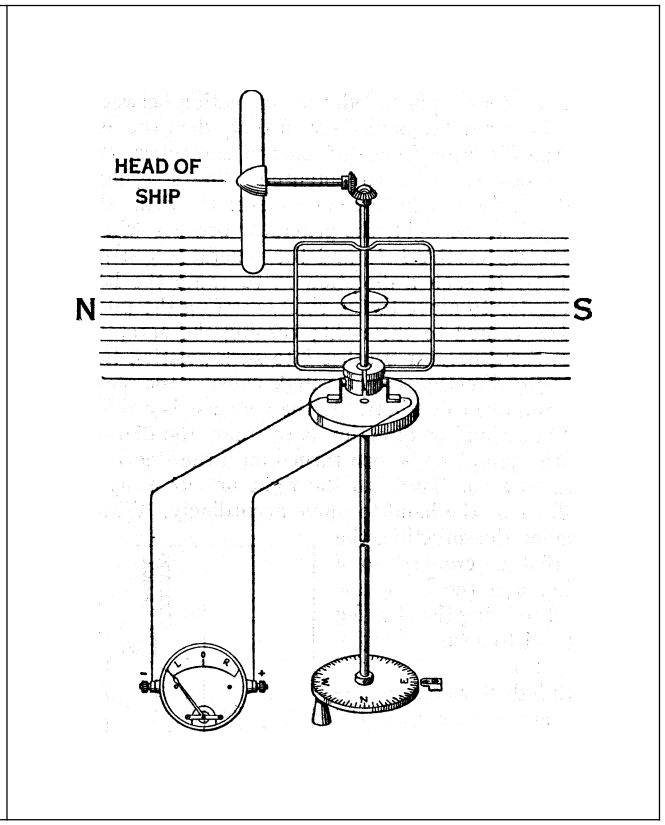

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FIG. I.— SCHEMATIC DRAWING OF EARTH INDUCTOR COMPASS, SHOWING THE THREE PRINCIPAL UNITS WHICH COMPOSE IT
For use on aircraft, this type is preferred to the ordinary magnetic compass. Its great advantage lies in the separation of the generator from the steering indicator, making it possible for the latter to be installed far enough from the engine to ensure freedom from magnetic disturbance

EARTH INDUCTOR COMPASS, THE, is related to the ordinary magnetic compass (*q.v.*) only in its use of the earth's magnetic lines as the directive force. There is no physical similarity between the two types of compass. The earth inductor compass comprises three principal units. That which reacts with the earth's field and therefore corresponds to the magnets of an ordinary compass is designated the *inductor generator.* This resembles an ordinary electric generator. except that it has no arti-

ficial field. It has an armature, commutator and brushes, and produces electromotive force by reaction with the earth's magnetic field. As in the case of any electric generator, the electromotive force depends upon the angle between the brushes and the field. In the earth inductor generator the brushes may be oriented about a vertical axis so that they may be set in any angular relation to the fore-and-aft line of the aeroplane. They may therefore be turned in relation to the earth's field, either independently or with the aeroplane. As the turning of the brushes in relation to the field discloses two positions of maximum potential and two positions of zero potential. In the earth inductor compass, use is made of one of these positions of no potential. The second unit is known as the *direction controller*. This carries a dial similar to an ordinary compass card and has a crank by which this dial may be turned to any position. There is a mechanical connection between the controller dial and the brushes of the generator, so that the angular position of the brushes is indicated upon the controller dial. The third unit of the compass, the *steering indicator* constitutes a sensitive zero-centre galvanometer, the dial of which is marked *left* and *right*. The indicator is electrically connected to the brushes. (*See* fig. 1.)

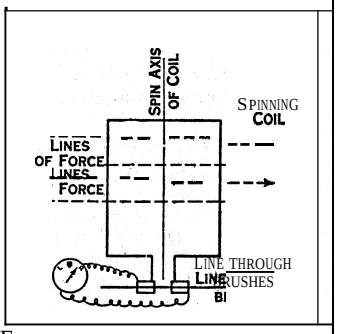


FIG. 2.—IF LINE THROUGH BRUSHES IS PARALLEL TO LINES OF EARTH'S MAGNETIC FIELD. GALVANOMETER SHOWS MAXIMUM DEFLECTION

When the compass is installed, the connection between the controller and the generator is made such that when the aeroplane is headed in the direction indicated on the controller, the brushes will be in a position of zero potential. The steering indicator hand will therefore remain in the centre of the dial. If the aeroplane is turned to the right, the generator brushes will be turned in relation to the earth's field and the generator will produce an electric current in such a direction as to cause the hand of the steering indicator to move to the right, showing the pilot that the aeroplane has turned to the right; turning the aeroplane to the left will put the generator brushes into such position that current in the opposite direction is generated, causing the steering indicator hand to move to the left. As the compass is ordinarily used, the desired "bearing" or direction is set upon the dial of the controller and the aeroplane is then turned until the steering-indicator hand comes to zero. Turns to the right or left away from this heading will cause the hand to move accordingly. When it is desired to change the direction, the controller dial is cranked to a new position and the aeroplane again turned to bring the steering indicator hand to zero. (*See* fig. 2 and fig. 3.)

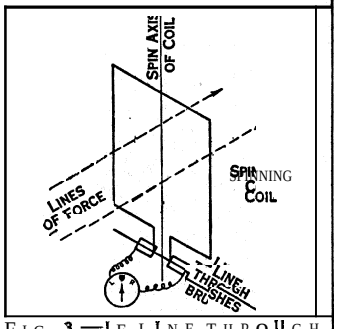


FIG. 3.—IF LINE THROUGH BRUSHES IS AT RIGHT ANGLES TO LINES OF EARTH'S MAGNETIC FIELD, GALVANOMETER READS ZERO

The earth inductor compass offers many advantages over the ordinary magnetic compass, particularly for use on aircraft (*see* AERIAL NAVIGATION). It is much easier to follow the hand of the steering indicator than it is to keep a certain mark on a swaying compass card opposite the lubber-line (*see* COMPASS). The outstanding advantage, however, is the dissociation of the direction-responsive element and the direction-indicating units. In the ordinary magnetic compass these cannot be separated, and in order that the pilot may see his compass it is frequently necessary to place it in a position where it is subject to strong local magnetic fields. With the inductor compass, on the other hand, the generator may be placed in a position which is practically free from magnetic disturbance, while the steering indicator is placed in the best position for observation by the pilot. The controller may be operated by the pilot or by a navigator. One form of the earth induction compass, the "Pioneer," is the invention of M. M. Titterington, and was used by the United States army fliers on their round-the-world and Pan-American flights, on Commander Rodgers's Hawaiian flight, Commander Byrd's North Pole flight, on the trans-Atlantic flights of Lindbergh, Chamberlin and Byrd, and on the flight of Brock and Schlee from New York to Tokyo.

(C. H. **C.**)

EARTH-NUT, the English name for *Conopodium denudatum,* a member of the family Umbelliferae, which has a brown, tuber-like root-stock the size of a chestnut. It grows in woods and fields, has a slender, flexuous, smooth stem 2 to 3 ft. high, much-divided leaves, and small white flowers in many-rayed, terminal, compound umbels. Though really excellent in taste and unobjectionable as food, it is disregarded in England by all but pigs and children. In Holland and elsewhere on the continent of Europe the rootstocks are generally eaten.

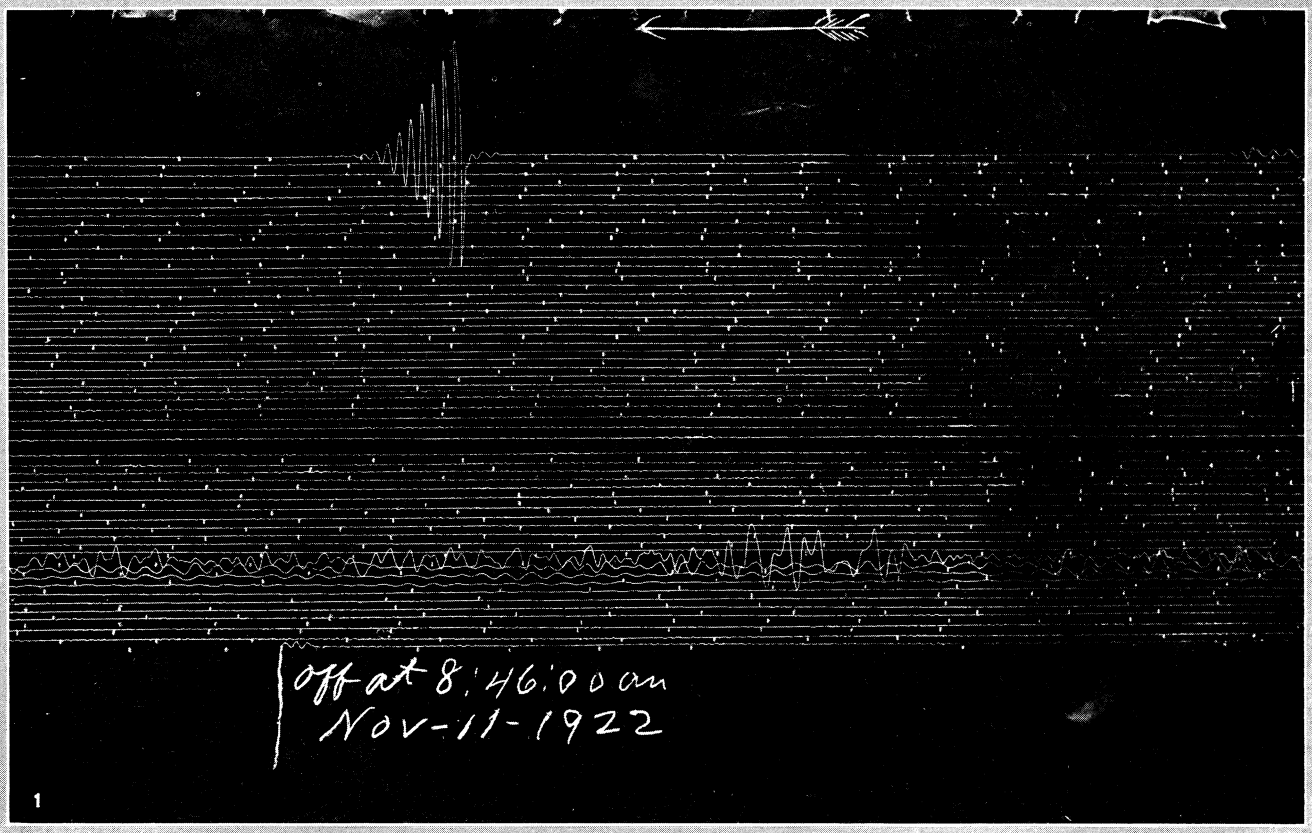
The name is applied also to the fruit of *Arachis hypogaea* (family Leguminosae) which is also known as the peanut, groundnut (*qq.v.*) or monkey-nut.

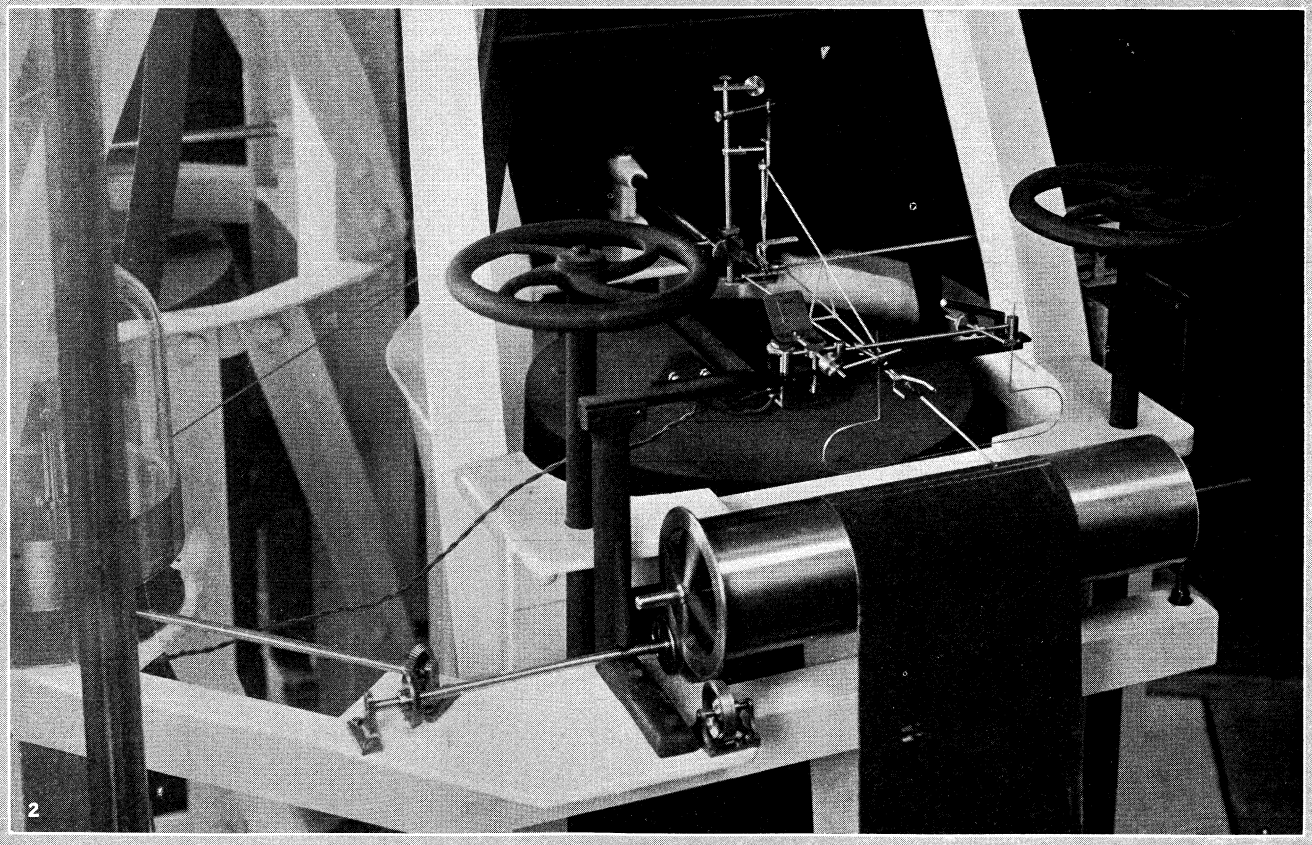
EARTH PILLAR, a column of soft rock, or earth, which has not a homogeneous structure throughout, but contains large blocks embedded in much finer material. By exposure to conditions of denudation, especially rain action, the large blocks protect the material beneath and so, by differential action, the earth pillars are produced. Glacial drift and morainic deposits are ideal substances in which earth pillars can be formed and these structures are therefore found in regions of recent glaciation.

Earth pillars are most likely to be found where the climate is semi-arid with precipitation concentrated. The "bad lands" of western North America furnish excellent examples, and there are specimens in Tirol and other parts of the Alps, in Scotland and in the Dead sea region.

EARTHQUAKE. Though, from very early times, the chief phenomena of earthquakes have been well-known, it was not until the middle of the 19th century that the science dealing with them received a name. In 1858, the term *Seismology* was introduced by Robert Mallet. "The observation of the facts of earthquakes and the establishment of their theory," he says, "constitute *Seismology* (from *σεισμός,* an earthquake, a movement like the shaking of a sieve)."

History.—Over the conceptions of the ancient writers, we need not linger. It was natural that the early Greek and Roman writers should be interested in earthquakes, for those phenomena are more frequent and more violent in Italy and Greece than in any other European countries. Earthquakes therefore find a place in many early works, especially those of Aristotle, Seneca and Pliny, but although these writers attempted to offer a rational explanation of earthquake phenomena, the hypotheses which their explanations involved are, as a rule, too fanciful to be worth reproducing. On the facts as described by them, however, most writers relied until the middle of the 18th century, and it was only when they had freed themselves from their authority and trusted to their more complete knowledge of (then) recent earthquakes, that seismology can be said to have existed as a science. For this release, we are indebted, more than to anyone else, to John Michell, for some years Woodwardian professor of geology at Cambridge. His well-known memoir on earthquakes, suggested by the Lisbon earthquake of 1755, was read five years later before the Royal Society. Except from an historical point of view, Michell's theory of the origin of earthquakes is now of little interest. It is otherwise with his direct contributions to science. He was the first to attribute the vibratory movement in earthquakes to elastic waves traversing the crust. He realized that the position of the origin could be determined by the directions of the shock at two or more places and also by observations of the time or of intervals of time. Its depth, in the case of the Lisbon earthquake, he supposed to be not less than 1 or 1½m. and probably not more than 3 miles. The Lisbon earthquake was succeeded in 1783 by a series of destructive earthquakes in southern Calabria. These were the first great earthquakes to be carefully studied, and the reports on them,





BY COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

A SEISMOGRAPH, AND ITS RECORD OF AN EARTHQUAKE

1. Section of a seismograph record of the earthquake in Chile, 1922. 2. A seismograph. The horizontal pendulum, carrying a steady mass weighing 220 lb., registers earthquake motion (magnification: 80–100) on smoked paper, which rolls upon a drum, the paper being marked in convenient units of time. One such instrument is set in N–S direction to record E–W motion, and a second E–W to record N–S

by G. Vivenzio and by the committee appointed by the Neapolitan Academy are the earliest of a long series of important earthquake monographs. A succession of great earthquakes drew attention to many points of interest, and to none more significant than the changes of level that occurred during the New Madrid earthquake of 1811, the Kutch earthquake of 1819, and the Chilian earthquakes of 1822 and 1835.

In the first half of the 19th century, our knowledge of earthquakes received many additions. K. E. A. von Hoff, for instance, compiled a catalogue of earthquakes for the whole world. He also issued annual lists of earthquakes from 1821 to 1832. Von Hoff and others thus prepared the way for the general interest shown in the subject about the middle of the century. With this revival, the names of Alexis Perrey in France and Robert Mallet in England are chiefly associated. Perrey's work lay mainly in three directions. He published annual lists of earthquakes from 1843 to 1871, as well as a valuable series of regional memoirs, in which the greater part of the world was covered; but the subject to which he always turned with unfailing interest was the periodicity of earthquakes. He is now, perhaps, best known by the three laws in which he asserted that earthquakes are most numerous about the times of new and full moon, when the moon is nearest the earth, and when it crosses the meridian of the place of observation. The laws have been much criticized. It is possible that the third has no foundation; the others have not yet been definitely proved or disproved.

The impress left by Robert Mallet on the science has been much more lasting. In his first memoir (1846), he applied the laws of wave-motion in solids to the explanation of earthquake-phenomena and treated the subject "in a more determinate manner and in more detail than any preceding writer." He followed it up by his four reports to the British Association (1850–58). The third consists of his great catalogue of 6,831 earthquakes. In the fourth, he discussed this catalogue and published his valuable seismic map of the world. Mallet's last and most important work was his investigation of the Neapolitan earthquake of 1857, in which he applied several new methods of investigation. He determined the position of the epicentre and found the mean depth of the focus to be about 6½ miles. Mallet also advanced several terms still in use, such as seismic focus, angle of emergence, isoseismal line and meizoseismal area.

Development of Seismology.— While Mallet's work was drawing to a close, the study of earthquakes was continued in other countries. In Italy, L. Palmieri constructed his electro-magnetic seismograph in 1855, and installed it in the new observatory on Vesuvius. From 1869 to 1878, T. Bertelli observed and measured earth-tremors with unfailing diligence. In 1874, M. S. De Rossi founded the *Bollettino del Vulcanismo Italiano,* the first journal devoted solely to earthquakes and volcanoes. He also devised his scale of seismic intensity, to be combined a few years later with one proposed by F. A. Forel. In 1878, A. Heim and Forel founded the Swiss Seismological Commission, by which Swiss earthquakes were studied for more than 30 years. It was then merged in the existing Government department of the Swiss earthquake service.

Far more important was John Milne's foundation, in 1880, of the Seismological Society of Japan. It is not too much to say that. during its 12 years' existence, seismology became an exact science. Accurately recording seismographs were invented by J. A. Ewing, T. Gray and Milne, and, for the first time, revealed the real nature of the movements of the ground during an earthquake. Most of the society's work was done by Milne, who organized a system of observers throughout a large part of the country, catalogued the great earthquakes of Japan and studied their distribution in space. Shortly before the Seismological Society ceased its useful work, the provinces of Mino and Owari were visited by the destructive earthquake of Oct. 28, 1891. A few months later the Imperial Earthquake Investigation Committee was founded. The objects set before it were to discover means of predicting earthquakes and to fix the design of earthquake-proof buildings. The committee, however, wisely took all seismology for their province, extended the system of observers begun by Milne, even studying the volcanoes of the country, and accomplished valuable work.

Somewhat briefer references must be made to some other committees founded for the study of earthquakes. After the Ischian earthquake of 1883, the Italian meteorological office was extended so as to include a special section of geodynamics. In 1895, the Italian Seismological Society started its *Bollettino,* one of the most useful of seismological journals. The Laibach earthquake of 1895 led to the creation of the Austrian earthquake service. The Seismological committee of the British Association was appointed in 1895. The services of the International Association of Seismology, founded in 1903, were unfortunately ended in 1914. After the Californian earthquake of 1906, the Seismological Society of America began its promising career. In its *Bulletin,* many valuable memoirs have already been published.

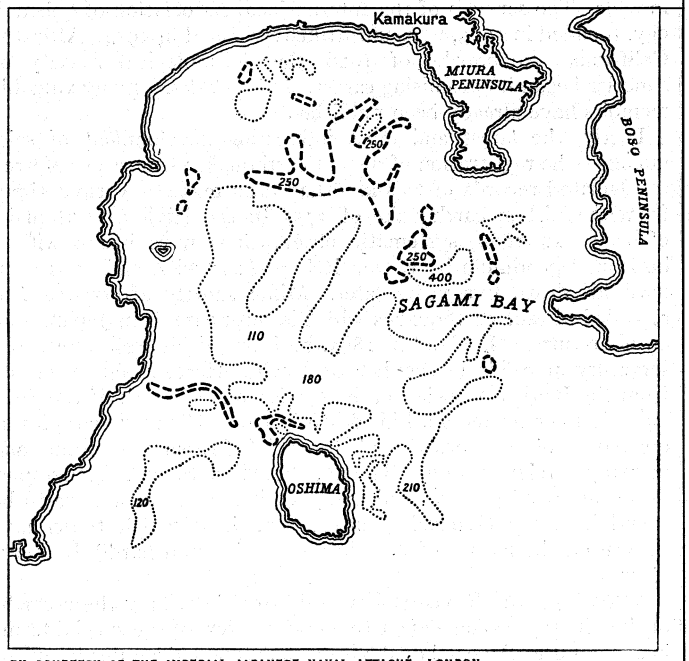
Lastly, the latest and most interesting development of seismology — the registration of distant earthquakes — must be referred to. Isolated records of this kind had been made at various times from the Lisbon earthquake of 1755 to the Riviera earthquake of 1887. In 1889, systematic observations were begun with a horizontal pendulum by E. von Rebeur-Paschwitz, and carried on until his death five years later. Milne shortly afterwards had recorded distant earthquakes with his seismograph in Japan, and, on his return to England in 1895, he founded his well known observatory at Shide in the Isle of Wight. Here, aided by grants from the British Association, he carried on the work of the Seismological committee until his death in 1913. His seismograph was erected at observatories in all the chief British possessions and st many foreign stations. To-day, the Milne-Shaw seismographs, of an improved pattern, and many similar instruments, are to be found in every civilized country. The light which these have thrown on the nature of the earth's interior, can hardly be overestimated.

Some Typical Earthquakes.— Before describing these earthquakes, it may be convenient to mention a few of the special terms in general use. An earthquake is due to some sudden displacement within the earth. The region within which this occurs is usually called the *seismic focus*, or simply the focus, sometimes also the origin, centre or hypocentre. The point on the surface vertically above the centre of the focus is the *epicentre.* A line drawn through all places at which the intensity of the shock is the same is termed an *isoseismal line.* The area within which the shock is strongest, say, that bounded by the innermost isoseismal line, is known as the *meizoseismal area,* and that within which the shock is perceptible without instrumental aid as the *disturbed area.* When earthquakes occur in series, the most important member is the *principal shock.* The others are divided into *fore-shocks* and *after-shocks* according as they occur before or after the principal shock.

Lisbon, 1755.—One of the greatest of all known earthquakes mas that which ruined Lisbon on Nov. 1, 1755. The epicentre was submarine and some distance to the west of Lisbon. How far the shock was actually felt is uncertain, for many observations, such as those reported in England, cannot refer to the earthquake. It seems, however, to have been felt all over Portugal and Spain, and in the south of France and the north of Africa, so that the disturbed area was probably more than a million sq. miles. The earthquake came without warning. Three great shocks in succession threw down all the houses in the lower part of Lisbon. Observers near the coast noticed that the sea retired, laying bare the bar, and then rolled in, it is said, to a height of qcft. above the ordinary level. For the whole of that day and the next night the sea continued to ebb and flow. Similar waves were observed along the coast of Spain, at Tangier and Funchal, along the coast of Holland, the south and east coasts of the British Isles, and even across the Atlantic to Antigua, Martinique and Barbadoes. Such waves occur with every great submarine earthquake. The feature of the Lisbon earthquake that is unique, or almost unique, among known earthquakes, is the agitation of inland waters far beyond the limits of the disturbed area. In Italy and Switzerland, lakes were set in oscillation, pools, rivers and lakes in Great Britain, as far as Loch Ness. 1,320m. from the epicentre, and even the lakes of Sweden and Norway, at a distance of 1,750m. In Loch Lomond (1,220m.), the water rose to a height of zft. 4in., then

subsided, and continued to rise and fall every ten minutes for an hour and a half.

Southern Calabria, 1783.—Less than 30 years later, in 1783, southern Calabria was desolated by a series of violent shocks. From Feb. 5 to March 28 there were six great earthquakes, and, up to Oct. 1, 1786, there were besides at Monteleone 38 very strong shocks, 198 strong, 303 of moderate strength and 642 slight shocks, a total of 1,187 earthquakes. The first great shock



BY COURTESY OF THE IMPERIAL JAPANESE NAVAL ATTACHÉ, LONDON

FIG. 1.—CENTRAL AREA OF JAPANESE EARTHQUAKE OF 1923. SHOWING MAIN ZONES; THE BOSO PENINSULA AND THE NORTH-WEST PORTION OF SAGAMI BAY. WHERE EARTHQUAKES WERE FREQUENT BETWEEN 1914 AND 1921

on Feb. 5 occurred without any warning, except for occasional slight shocks from 1780 onwards. Lasting about two minutes, with undulations vertically upwards and from every direction, all houses on the plain were destroyed within a few seconds, while those built on the firm ground of the hills escaped serious damage. The meizoseismal areas of the six great earthquakes were all of small size, and the intensity declined so rapidly outside them that one town might be entirely ruined while another only 1m. away suffered little. The disturbed areas were small, not one of them exceeding 100,000sq.m. From this, it is clear that the foci were situated close to the surface. The most interesting feature about these earthquakes was the rapid migrations of the foci. The first occurred on Feb. 5 near Palmi; the second on Feb. 6 near Scilla, 10m. to the S.W.; the third on Feb. 7, at 8.20 P.M., near Monteleone, 35m. N.N.E. of Scilla; the fourth, at 10 P.M. on the same day, near Messina and Scilla; the fifth, on March 1, near Monteleone again; and the sixth, which was as strong as the first, on March 28, near Girifalco, about 20m. E.N.E. of Monteleone. Thus the movements took place over a length of 65 miles.

Since 1783, many earthquakes of great interest have occurred, some of which have revealed to us new phenomena. It will be sufficient to refer here to the Assam earthquake of June 12, 1897, and the Japanese earthquake of Sept. 1, 1923, and to the slight shocks of Great Britain.

Assam, 1897.—On the Assam earthquake, we have an admirable report by R. D. Oldham. It was an earthquake remarkable for the vast extent of its meizoseismal area and the distortions of the crust within it. The shock itself was felt over about one and three-quarter millions sq.m., or nearly half the size of Europe. Serious damage to buildings occurred in a district containing about 160,000sq.m., or more than twice the size of Great Britain. The meizoseismal area, lying about 250m. N.E. of Calcutta, covered more than 6,000sq.m., *i.e.*, about the size of Yorkshire. From such figures, we can only conclude that, unlike the Calabrian earthquakes, the Assam earthquake originated at an unusually great depth. At Shillong, the ground vibrated visibly like a storm-tossed sea, only with more rapid undulations. At several places in the meizoseismal area, stones were projected from the ground, showing the maximum acceleration there must have been greater than 9,600mm. per sec. per sec. Within the meizoseismal area, distant places became clearly visible that before were hidden by intervening ridges. Changes in the slope of stream-beds led to the formation of pools. Fractures without superficial displacement occurred in the solid rock, one 7m. in length. Close to it, trees were snapped in two, and large blocks of stone were rent or dislodged. Besides these fractures, fault-scarps were formed, one 12m. long with a maximum throw of 35 feet. In many parts of the meizoseismal area, there were isolated centres of after-shocks, all, with the distortions described above, being evidently the results of some vast deeply-seated movement.

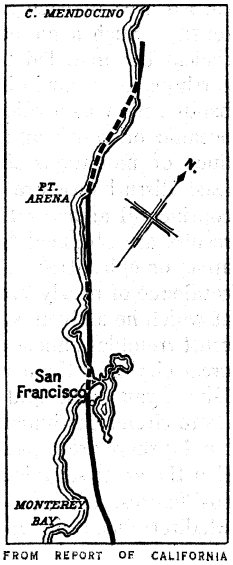
Japan, 1923.—In the present century, one of the greatest disasters known to us was the Japanese earthquake of 1923, though most of the loss to life and property was due, not to the earthquake, but to the great fires that followed it. From seismographic records at Tokyo and elsewhere, it was found that the epicentre lay beneath Sagami bay, a short distance to the north of Oshima (fig. 1), and that the mean depth of the focus was 30 miles. Soon after the earthquake, re-surveys were begun, both of the sea-bed and of the coastal regions of Sagami bay. The most remarkable changes were those in the bed of the bay. The broken lines in fig. 1 represent curves of elevation of 50 fathoms, and the dotted lines curves of equal depression. The figures within the curves give the greatest changes in fathoms. They reveal an uplift of more than 250 fathoms in one place, and, about a mile away, a depression of more than 400 fathoms, a difference of three-quarters of a mile. Clearly, a change of this magnitude could hardly occur without faulting. On land, the changes of elevation were much less marked. The main areas of uplift occurred along and beyond the north shore of Sagami bay and in the southern half of the Boso peninsula. In both, the greatest uplift measured was six and a half feet. Elsewhere, the change was usually one of subsidence, as a rule less than 16in., and only in one place reaching 5ft. 4in. In addition to the changes of level on land, the new survey revealed some horizontal movements. The island of Oshima was shifted 12ft. 5in. a little east of north, while the north shore of Sagami bay moved about 9ft. E.S.E. The displacements at these and other places show that the whole district made a clockwise twist about a vertical axis in Sagami bay.

British Earthquakes.—From 974 to 1916, the total number of earthquakes known in Great Britain is 1,190, of which 310 occurred in England, 822 in Scotland and 54 in Wales. Not more than 22 of them attained destructive intensity, 13 in England, seven in Scotland and two in Wales, the strongest known being that which occurred near Colchester on April 22, 1884. In Scotland, nearly all the earthquakes are connected with well known faults. Close to Inverness, four strong earthquakes have occurred from 1816 to 1901, probably through slips of the great fault that crosses Scotland along the line of the Caledonian canal. The most celebrated earthquake district in the country is the village of Comrie in Perthshire, which lies close to the Highland border fault. Here, from 1788 to 1921, 421 earthquakes were felt or heard, three-fourths of them between 1839 and 1846. A third region lies on the south side of the Ochil Hills. From Bridge of Allan to Alva, nearly 200 earthquakes have been observed during the present century. In England and Wales, there are many earthquake-centres, the most important being near-Hereford, in the midland counties of England, and in the southern counties of Wales. Some of the strongest earthquakes in England and Wales are those known as twin-earthquakes. In these, the shock consists of two distinct parts separated by an interval of two or three seconds. The impulses which cause them originate at some depth, in two detached foci from about 8m. to 20m. apart, and in many of them so closely together that the second focus is in action before the vibrations from the first have time to cross the intervening space.

Nature of Earthquake Motion.—In slight earthquakes, a low rumbling sound is usually heard, in a second or two, the sound becomes louder and with it a weak tremor is felt, the tremor rapidly merges into a few distinct vibrations and then movement and sound die away, the whole lasting from five to ten seconds. In great earthquakes, the order is the same, but the vibrations are strong oscillations, each of which may last a second or more, and the total duration may amount to four or five minutes. In the greatest of all, the ground may suddenly move as a whole and with such violence that no work of human hands can withstand the motion.

Seismographic records of earthquakes also reveal three stages of motion. In the preliminary tremor the vibrations are small in amplitude and short in period, from five to 12 occurring every second. It is succeeded by the *principal* portion, in which the vibrations are of much greater amplitude and from half to one or even two and a half seconds in period. In the end portion, the vibrations are of small amplitude but remain of long period. In most earthquakes, the range or double amplitude of the vibrations is less than 1mm.; in a semi-destructive earthquake, it may reach 73mm., and, in a destructive earthquake, 223mm. (about 9in.) or more. The intensity is usually measured by the maximum acceleration of the vibrations. In an earthquake that is just sensible, this is about 17mm. per sec. per sec. In destructive earthquakes, the maximum acceleration must exceed 300mm. per sec. per sec., but it often reaches much higher figures, such as 2,000mm. per sec. per sec. in the Californian earthquake of 1906 and the Messina earthquake of 1908, about 3,840mm. per sec. per sec. in the Japanese earthquake of 1923 and more than 9,600mm. per sec. per sec. in the Assam earthquake of 1897. These figures represent the intensity in the central areas of the earthquakes. To show how the intensity declines as the distance from the epicentre increases, series of isoseismal lines are drawn, the intensity along each depending on the degrees of some arbitrary scale, such as the Rossi-Forel or the Mercalli scale. The outermost isoseismal line bounds the disturbed area. In Great Britain, the largest disturbed areas known are about 100,000sq. miles. In destructive earthquakes the area may amount to as much as one and three-quarters or two million sq.m., as in the Assam earthquake and the Kangra earthquake of 1905.

The sound that accompanies an earthquake is a very deep rumbling noise, so deep that it may pass unheard by many observers. When it is heard, some of the vibrations may be inaudible, and thus the sound may be referred to different types, such as a lorry or train passing, thunder, wind or a chimney on fire, loads of stones falling, the fall of a heavy body, an explosion, etc. The variation in audibility throughout the disturbed area may be represented by a series of isacoustic lines, along each of which the same percentage of observers hear the sound. In great earthquakes, the sound-area occupies a rather small region surrounding the epicentre; in slight ones, it may extend beyond the disturbed area on one or all sides. Occasionally, the sound alone is heard, and series of such earth-sounds have been observed in the island of Meleda in the Adriatic sea, East Haddam in Connecticut and Guanajuato in Mexico.



FROM REPORT OF CALIFORNIA COMMISSION ON THE EARTHQUAKE OF 1906

FIG. 2.—MAP OF SAN ANDREAS RIFT AFTER EARTHQUAKE OF APRIL 18, 1906. HEAVY LINE INDICATES WHERE DISPLACEMENT OCCURRED

Dislocations **of the** Crust.—In some of the greatest earthquakes, there are no features more remarkable than the dislocations of the crust, the renewal of movement along the fault that may follow one general direction for many miles. The displacement along the fault may be mainly horizontal, as in the Californian earthquake of 1906, vertical as in the Assam earthquake of 1897, or partly vertical and partly horizontal, as in the Mino-Owari (Japan) earthquake of 1891. In a few earthquakes, such as the Messina earthquake of 1908, the movement takes the form of a warping of the crust, no actual fault being visible on the surface.

When the movement is horizontal, the fault may appear as a crack or fissure or may be revealed by the severing of roads, fences, etc., the ends of which may be separated by several feet. The Californian earthquake of 1906 was due in part to a movement along a remarkable fault, the San Andreas rift (fig. 2). The portion of the rift displaced runs close to the coast, and its total length is about 270 miles. The rift has been traced still farther to the south for another 300m. into the desert region of southern California. Here, the features of the rift retained their sharpness for many years, and there are clear signs of horizontal displacement in the past. For instance, in one place four deep ravines that descend the mountain slopes on the east side of the rift are displaced abruptly at the fault-line and reappear on the west side of the fault about 50yd. farther to the north-west. Such movements are no doubt the sum of many displacements. In 1906, the total horizontal shift varied as a rule from six to 15ft., in one place reaching 21 feet. From the shifting of fences, etc., it was unknown which side had moved, but a new survey of the; district proved that the rock on both sides had been displaced, that on the south-west side to the north-west, and that on the north-east side to the south-east. The movements decreased with increasing distance from the rift, ceasing at about 4m. on the north-east side, but at not less than 23m. on the other.

Much more remarkable in appearance, but less persistent in range, are the vertical displacements of the ground. When the throw is small, the result may be a mere slope of the surface; but, if it should exceed two or three feet, it appears as a low scarp or cliff. While the elevation is usually in one direction only, its amount is subject to wide and rapid variations. One of the faults of the Assam earthquake of 1897, the Chedrang fault, was about 12m. long. The movement was everywhere vertical, and the east side was invariably left the higher, except in two places where there was no throw. In the three portions into which the fault was thus divided, the maximum uplift was 25ft. in the southern portion, 35ft. in the middle and 32ft. in the northern. In this fault, it is unknown whether the east side was raised or the west lowered. In the Alaskan earthquakes of 1899, the measurements were all made with reference to the sea-level. Six years later, dead barnacles still clinging to the rocks showed that, on the west side of Disenchantment bay, there had been an uplift (the greatest known to us) of 47ft. 4in. Here again, there were rapid variations, from 42ft. on the same coast to 30ft. a mile to the west, and to 9ft. a quarter of a mile farther.

The displacements that are partly horizontal and partly vertical are more common than either of the others. One of the most remarkable examples is that which occurred with the Mino-Owari earthquake of 1891. This fault, which almost crosses the main island of Japan in a general north-westerly direction, was traced for a distance of 40m., and there can be little doubt that its total length was 70 miles. Its course is independent of the slope of the ground, for it cuts across hill and valley alike. Throughout its whole length, the ground on the north-east side of the fault **was** shifted to the north-west relatively to the other, usually 3ft. or 4ft., sometimes as much as 13ft. In some places, there has been no uplift, but, when it is perceptible, it is always a depression of the north-east side by from 3ft. to 20ft., except in one place, where the north-east side was left 20ft. above the other.

In a few earthquakes, a new series of levels has revealed a general bulging or subsidence of the crust without superficial fracturing. In the Kangra (India) earthquake of 1905, a slight rise of not more than 5in. was measured. In the Messina earthquake of 1908, there appears to have been a general subsidence, of as much as aft. at Reggio and 2ft. 4in. at Messina.

Sea-Waves.—When the origin of an earthquake is submarine, the shock along the coastal region may be followed by the inrush of a sea-wave, often, but erroneously, called a tidal wave. Estimates of the height of the wave are usually excessive, but, in the Messina earthquake of 1908, the height was certainly 28ft. on the

Sicilian coast and 35ft. on the other. In the Sanriku (Japan) earthquake of 1896, the height mas not less than 93 feet. So strong are the waves that vessels may be driven inland 200yd., trees may be uprooted, or a mass of concrete, 10cu.yd. in volume, may be torn from a pier and drifted 20yd. away. The sea-waves sometimes travel to great distances. The sea-waves of the Sanriku earthquake were registered at San Francisco (4,787m.), and those of South American earthquakes have been recorded in Japan after travelling distances of about 10,000 miles. After such journeys the water slowly sweeps up a beach and back again, like tides of short period, of 20 or 30m., the total rise and fall being as much as eight feet. There can be little doubt that the sea-waves are caused by some displacement of the ocean-bed, like that which occurs on land when fault-scarps are formed, for changes of level have occurred on land with many earthquakes followed by sea-waves. On the other hand, in the Californian earthquake of 1906, the fault was in part submarine, but the crust displacements were horizontal and no sea-waves were observed.

After-Shocks of Earthquakes. — After a great earthquake, the ground near the epicentre may remain for days in almost incessant motion. So frequent are the after-shocks, sometimes so continuous, that it may be impossible to count them without instrumental aid. After the Mino-Owari earthquake of Oct. 28, 1891, a seismograph at Gifu recorded 3,365 shocks by the end of 1893. Other Japanese earthquakes have been similarly followed, the earthquake of 1830 by 681 shocks in six months, that of 1847 by 930 in 31 days, and that of 1923 by 1,256 at Tokyo in the first month. Even in Great Britain, the Inverness earthquake of 1901 was succeeded by 16 shocks in less than two months. On the other hand, with the Californian earthquake of 1906, there were comparatively few after-shocks, the greatest number observed at any place in 14 months being 153. As there were vertical displacements of the crust in the Assam and Mino-Owari earthquakes, and none of any consequence in the Californian earthquake, it would seem that the number of after-shocks depends on the direction of the crust displacement. Usually, after-shocks are of slight intensity, but they sometimes reach destructive strength and are then followed by their own trains of after-shocks. After the first few days, they decline rapidly in frequency. At Gifu during the first week after the Mino-Owari earthquake, the daily numbers were 318, 173, 126, 99, 92, 81 and 78. Omori has shown that, if small variations are neglected, the decline in frequency may be represented by the formula $y = \frac{k}{x+h}$, where h and k are constants and y is the number of after-shocks within a given interval at time x after the earthquake. Their epicentres lay along all parts of the fault described above, they were frequent for some time near the terminal regions and finally were almost confined to the central district. A similar law governed the distribution of the after-shocks of the Inverness earthquake of 1901, and these were also marked by a continual approach of the foci towards the surface of the earth.

Secondary Effects of Earthquakes. — Whenever strong earthquakes occur in hilly districts, they may give rise to avalanches so large and so numerous that hillsides previously covered with forest are left bare. Avalanches along one side of a valley may divert a river-course, from both sides they may pond back the river into lakes. When the earthquakes occur among snow-covered mountains, as in Alaska in 1899, the descending glaciers may be shattered, and snow-avalanches may cause a temporary advance of the glaciers.

Even on level ground, many changes occur through the compression of the alluvium. Rice-fields in Assam and Bengal that were level before the earthquake of 1897 became gently undulated, the difference between crest and hollow being two or three feet. Railway lines are often buckled or twisted into loops. The ground is extensively fissured. When they occur near a river, the fissures run parallel to the bank, being due to the oscillation of ground unsupported on one side. Usually, they are a few hundred yards in length and two or more feet wide. They are distinguished from the permanent dislocations of the crust by their short length and variable direction. Others are formed on hillsides by incipient landslips and are horseshoe-shaped. They may also occur quite apart from any slope or excavation. They are then aligned in parallel series, and have been seen to open as the visible waves passed. The underground water-system is naturally disturbed by such changes. As a rule, the level of water in wells rises, but occasionally the supply is reduced, the variations being connected with changes in the width of the underground water-channels. When the surface-beds overlie water-bearing sands, the compression of the latter forces water through the fissures above in jets that may rise to a height of several feet and bring up sand and earth with them. As the current of water diminishes, the sand is left round the opening in the form of a shallow crater or saucer, sometimes zoft. in diameter.

Distribution of Earthquakes. — How unequally earthquakes are distributed over the world is well known. There are countries, like Italy, China, Japan or Peru, in which earthquakes are of frequent occurrence and of destructive strength. There are others, such as Switzerland, in which earthquakes are numerous but seldom cause damage; and there are a few, like Egypt or Brazil or the centre of Russia, in which they occur but rarely and are always weak. To give some numerical illustrations: in the years 1891–1920, 4,954 earthquakes were observed in Italy, an average of 165 a year; in the years 1893–98, 3,187 earthquakes were felt in Greece, or 531 a year; in the years 1885–92, 8,331 earthquakes were recorded in Japan, or 1,041 a year. In Switzerland, 998 earthquakes were felt in 1880–1909, an average of 33 a year; in Great Britain, 366 in 1889–1916, or 13 a year. In Brazil, 39 earthquakes were recorded during the 19th century. If we confine ourselves to the earthquakes that desolate cities, there were during the last century 39 in China, 22 in Japan, 21 in the Philippines, 19 in Greece, 16 in Italy, 11 in Chile and 8 in Peru.

In his earthquake-map of the world, Mallet coloured the disturbed area of each earthquake with a tint depending on its intensity. Such a method of mapping obscures details, but nevertheless the map led to results of general interest, namely, that earthquakes occur in bands of from 5° to 15° in width, that these bands follow as a rule the lines of elevation that divide the great oceanic or continental areas of the earth and so lie along the lines of mountains and volcanic vents, and that the areas of least disturbance are the central portions of great oceanic and continental areas or large islands in shallow seas. More detailed results are obtained from the methods of mapping meizoseismal areas or epicentres. Montessus' world-map is based on his great catalogue of nearly 160,000 earthquakes. The principal conclusion at which he arrived is expressed in the following law: The earth's crust trembles almost only along two narrow bands which lie along great circles of the earth, the Mediterranean or Alpino-Caucasian-Himalayan circle and the circum-Pacific or Ando-Japanese-Malayan circle. Earthquakes are not uniformly distributed along these bands; there are gaps in them in which few or no shocks occur. But that the great seismic zones cling to them is evident from Montessus' figures. Out of every 100 earthquakes, 53 occurred along the Mediterranean circle, 38 along the circum-Pacific circle and nine elsewhere. In this map, Montessus made use of all recorded earthquakes whatever their intensity. Milne relied only on earthquakes registered by seismographs over an area not less than about one-tenth of the whole surface of the earth. In essentials, his map is not unlike that of Montessus. There is the same great terrestrial region ranging west and east from Italy to the Himalayas and containing 21% of all the earthquakes. Six regions border the Pacific ocean with 68%, while four small oceanic regions include the remaining 11% of the earthquakes.

These maps show the distribution of earthquakes on a large scale. Coming to details, the most important law is that which Montessus expressed thus: "in a general way, we may say that, of two contiguous regions . . . the more unstable is that which presents the greater average slope." Milne, dealing with the earthquakes of Japan, came to a similar conclusion. The earthquakes of Japan, indeed, furnish one of the best examples of the law. Of the strong earthquakes from 1885 to 1905 (257 in number), Omori found that 145 originated in zones bordering the Pacific

coast and only nine on the Japan sea coast. The Japan sea occupies a depression in no place deeper than 1,646 fathoms, the gradient of the sea-bed ranging from 1 in 67 to 1 in 220. On the other side, the sea-bed slopes rapidly, with gradients of 1 in 27 and 1 in 16, into the basin of the Tuscarora Deep (4,376 fathoms).

One other law of distribution should be referred to. It is generally supposed that there is an intimate connection between earthquakes and volcanoes. Milne's seismic map of Japan shows, however, that "the central portions of Japan, which are the mountainous districts where active volcanoes are numerous, is singularly free from earthquakes." In Central America, the old town of Guatemala, built on the flank of an extinct or almost extinct volcano, was ruined seven times by earthquakes from 1541 to 1775. The new town, close to an active volcano, has never been destroyed.

Frequency of Earthquakes.—If we confine ourselves to earthquakes perceptible to man, one of our earliest estimates is that of Perrey, who in 1843 assigned a frequency of only 33 earthquakes a year to the whole of Europe and adjacent parts of Asia and Africa. For the first half of the 19th century Mallet recorded 65 a year. In 1900, Montessus estimated the annual number of earthquakes at about 3,830. Including slight tremors, Milne suggested that there were not less than 30,000 a year, or about two a minute. Of great earthquakes—those which reduce towns to ruins—Mallet recorded one a year in the first half of the 19th century, and Milne four a year during the last quarter. A noteworthy point about destructive earthquakes is their tendency to occur in groups. In Italy, according to G. Mercalli, from 1601 to 1881, 182 destructive earthquakes occurred in 103 years and 27 in the remaining 178 years. Similarly in Japan, as Omori remarks, the destructive earthquakes since 1301 have occurred in 41 groups separated by an average interval of about 13 years. This tendency to clustering, as Milne showed, is characteristic of the great earthquakes of the whole world. They occur in groups of two or three to 15 or more; the groups last from one to three days, seldom more than six days, and the interval between successive groups ranges from two to seven weeks. Milne also pointed out that, in widely separated regions, such as Italy and Japan or the opposite sides of the Pacific, alternations of activity were to some extent synchronous.

Periodicity of Earthquakes.—The clustering of earthquakes leads naturally to their periodicity, to the inquiry whether there is any regularity in the recurrence of clusters. Whatever the causes of such periodicity may be, it is not to be supposed that they produce the earthquakes, but merely that they tend to precipitate movements that are almost on the point of taking place. They may be more or less superficial in their action, or they may be deeply-seated within the earth or even quite outside it. We have thus two groups of periods, one of a year and a day, the other of 21 minutes, 429 days and 11, 19, etc., years.

Of these periods, the annual period has been longest known, since 1834, when P. Merian noticed that the earthquakes felt at Basle were more frequent in winter than in other seasons. This variation has been confirmed by many other seismologists. The chief result is that the maximum epoch, or epoch of greatest frequency, occurs in winter in both hemispheres. But there are many exceptions to this law. It does not apply to the most destructive of all earthquakes, and, in insular and peninsular regions, the frequency is greatest in summer. The diurnal period is less pronounced than the annual period, and can only be detected in earthquakes recorded by seismographs, for shocks are naturally felt more frequently during the quiet hours of the night. For ordinary earthquakes, the maximum epoch occurs near local noon in each district. For the after-shocks of strong earthquakes, it occurs at first shortly after midnight, but after a few months returns to noon. Several causes have been suggested for these periods, the variations of atmospheric pressure being the most probable.

The second group of periods, depending more or less on the structure of the earth or on its relations to the rest of the solar system, are of great interest. The shortest is one of 21 minutes. The period of 429 days was noticed by Milne in 1900. He showed that great earthquakes are frequent near the times when changes occur in the direction of the polar movements. Shortly afterwards, Omori found that the connection holds for strong, but not for slight, earthquakes in Japan. Recently, other periods have been added to the list. Making use of the destructive earthquakes from 1701 to 1899 recorded in Milne's great catalogue, it has been shown that there are periods of 11, 22, 33 and 19 years in the earthquakes of the northern hemisphere, the first maxima of which occurred in 1709, 1716, 1724 and 1715–16, respectively. The epochs are the same for different centuries, for different seasons of the year and for every large region of the northern hemisphere.

Position of the **Epicentre.**—The first element to be determined in the study of an earthquake is the position of its epicentre. Various methods have been suggested, depending on observations of the time, direction or intensity of the shock.

Time-records, as a rule, are not accurate enough for the purpose. They have been used by Seebach and others with results of doubtful value. It is easier to estimate the interval between two events than the precise time of either, and thus the only time-method used with profit is one proposed by Omori. This depends on the duration of the preliminary tremor at not less than three stations. If x is the duration in seconds of the tremor at a place not more than 1,000km. from the origin, Omori showed that the distance in kilometres between the station and the origin is $7{\cdot}27x+38$. Knowing, then, the distances of the origin from three stations, circles drawn with the stations as centres and the corresponding distances as radii, should intersect close to the epicentre. This method is much used in Japan, especially for locating the epicentres of submarine earthquakes. The second method, depending on the lines of direction of the shock at two or more places, was used by Mallet in his investigation of the Neapolitan earthquake of 1857. Most of the 78 lines of direction in this earthquake passed close to the village of Caggiano. Greater accuracy can be obtained by using the means of a large number of observations. In the Hereford earthquake of 1896, the position of the principal epicentre was fixed by the lines of mean direction in London and Birmingham. The last method, which makes use of the intensity of the shock, is the one most frequently applied. In a violent earthquake, the area of greatest destruction must include the epicentre. In weak or moderately strong earthquakes, the centre of the innermost isoseismal line cannot be far distant from it.

Depth of the Focus.—Up to the present time, though many attempts have been made to determine the depth of the focus—one of the most interesting problems of seismology—we can lay claim to no more than approximate results. The methods suggested for the purpose depend, as with the epicentre, on observations of the time or intervals of time, and on the direction and intensity of the shock. Seebach's method is of theoretical, rather than practical, interest, owing to the difficulty of obtaining exact time records. It has been used for five German earthquakes, giving depths ranging from seven to 24 miles. For near earthquakes, Omori's method, involving the duration of the preliminary tremor, is less open to objection. Knowing the distance of the focus by the duration of the tremor and also the distance of the epicentre, it is a simple matter to estimate the depth of the focus. In this way, he found the mean focal depth in 729 non-eruptive earthquakes of the volcano Asama-yama to be about 2m. below the base of the mountain. He also applied the method to 21 earthquakes felt in Tokyo, and found the depth to lie between 10 and 31½m., with an average value of 20 miles. The well known method devised by Mallet was the first in actual use. In his study of the Neapolitan earthquake, he measured the inclinations of fissures in many buildings. Assuming the direction of the shock to be at right angles to the fissures, he obtained 26 lines of direction which he took to point directly to some part of the focus. The position of the epicentre at Caggiano being known, he found the depth of the focus to lie between 3.2 and 9·3m., the mean value of all the estimates being 6.6 miles. Mallet's method has been employed in several later earthquakes, the results being about one-third of a mile for the volcanic Ischian earthquakes,

and from 6½m. to 10¾m. for four other earthquakes. Similar to Mallet's method is one used by Milne, in which the lines of direction were obtained from the horizontal and vertical components of the motion as given by seismographs. In the Yokohama earthquake of 1880, he found the depth to lie between 1½ and 5 miles. Two later estimates, by Omori, are 5.6 and 9.3 miles.

Of the methods depending on variations in the surface intensity, the best known is that devised by C. E. Dutton in his investigation of the Charleston earthquake of 1886. Assuming that the intensity of the shock varies inversely as the square of the distance from the focus, Dutton showed that the rate of decline in the intensity of the shock is greatest at a distance from the epicentre which, when multiplied by 1·732, gives the depth of the focus. In the Charleston earthquake, there were two foci, the depths of which were calculated in this way to be 12m. and 8 miles. In five later earthquakes, the depths were found by the same method to lie between 4m. and 21m. Dutton's method, apart from the difficulty of applying it, is open to the objection that it takes no account of the loss of energy that the waves suffer in traversing the crust. From a comparison of the intensities at the epicentre and along an isoseismal line, the objection has been partly met by R. D. Oldham, who found that of 5,605 recent Italian earthquakes, 90% originated at depths less than 6½m. and only 1% at depths greater than 19 miles.

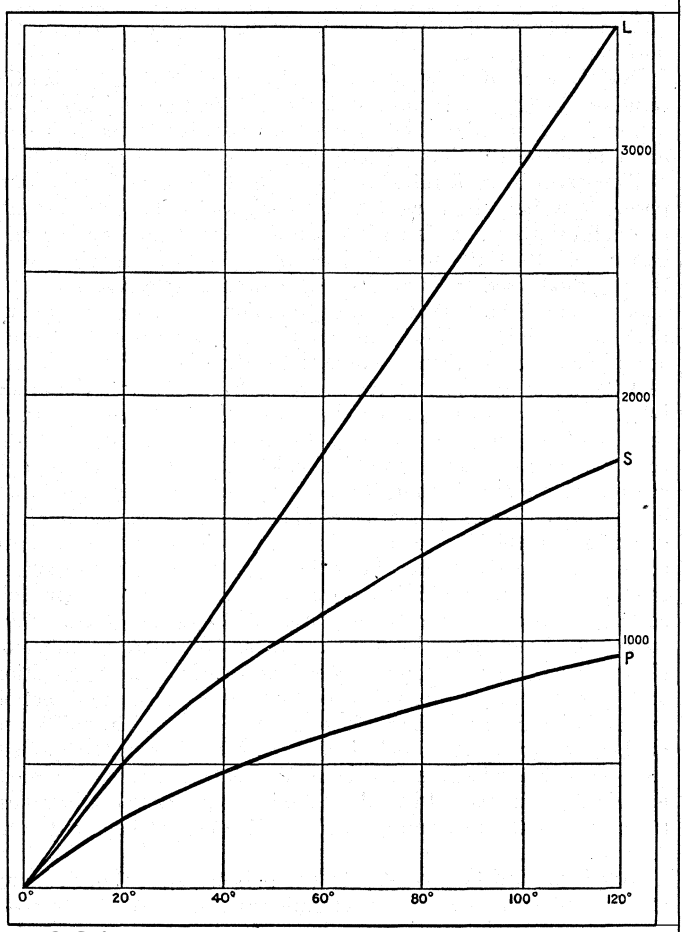


FIG. 3.—GRAPH OF TIME CURVES: PRELIMINARY TREMORS, P: SECONDARY WAVES. S; END (LARGER) WAVES. 12 TO 20 SECONDS IN DURATION, L
The abscissa measures distance of seismometer from epicentre; the ordinate, the time taken by seismio waves to travel from epicentre to recording station

Teleseismology.—We come now to the most recent and fascinating development of seismology—the registration of distant earthquakes. The instruments by which they are recorded are described under the heading SEISMOMETER (*q.v.*). Here, we are concerned only with the results obtained from a study of the seismograms or records. A brief glance at one of them shows a series of waves, small at first, then rapidly increasing in magnitude, and concluding with long, slow undulations—corresponding to the preliminary tremors, the "principal" portion and the "end" portion of the early writers on the subject. A closer inspection shows that the preliminary tremors consist of two phases. The first phase, known as the first preliminary tremors or primary waves, begins with a small but sudden displacement, followed by rapid vibration of a few seconds in period, and including at times reinforcements of the motion. The second preliminary tremors or secondary waves begin with a comparatively large vibration, succeeded by irregular vibrations, among which sudden reinforcements may appear as in the first phase. As the secondary waves end, the third phase, that of the long waves or large waves, begins, at first with large and irregular undulations of perhaps more than half a minute in period. Then come still larger waves, 12 to 20 sec. in period, concluding with smaller and irregular undulations forming the end portion. The whole movement may last one or two hours, sometimes more. In great earthquakes, after the end portion closes, a detached group of small long period waves may be seen, followed, perhaps, by a second group of still smaller range. There are other movements traceable in the records, but these are the principal features.

The first vibrations of the above phases are usually denoted by the letters P, S and L, respectively, the reinforcements in the earlier phases by PR, SR or PR_1, SR_2, etc., when there is more than one. The groups of small waves following the end portion are denoted by W_2 and W_3, W_1 referring to the first passage of the long waves.

One of the most interesting points about the P and S waves is that they do not travel with uniform velocity along the surface of the earth. The variations in velocity may be represented by time-curves or hodographs. In these, the distance of a station from the epicentre along the great circle joining them is measured along the horizontal axis of the diagram, and the time taken by the waves to travel this distance along a line at right angles to that axis. A time-curve may be drawn in this way for any earthquake. The curves in fig. 3 are average time-curves. In them points are plotted corresponding to the times of traversing given distances for a number of earthquakes, and the curves are drawn through or near these groups of points. The time-curve for a given earthquake may thus differ slightly from the average curves, the divergences depending in part on the depth of the focus, and, indeed, furnishing some clue as to that depth.

The first point to be noticed in these curves is that, while the line L is straight, the lines P and S are both so curved that, as the surface distance increases, the time required to traverse it does not increase in the same proportion. In other words, as the surface distance increases, the velocities of both P and S waves also increase. Near the epicentre, the velocities of these waves are, respectively, 7.1 and 4·0kilo. per sec. At distances of 30°, 60°, 90° and 120°, the velocities of the P waves along the surface are, respectively, 8.6, 10·9, 12.6 and 13·6kilo. per sec.; those of the S waves are 4.8, 6·0, 6.9 and 7·7kilo. per sec. The only inference that we can draw from these increases is that both waves travel, not along the surface, but along curved paths through the earth, and that the velocities increase generally with the depth below the surface.

Earthquake Waves.—From the straightness of the line L in fig. 3, we conclude that the time taken to travel any distance along the surface is proportional to that distance, that is, that the long waves travel along the surface with constant velocity, namely, 3·8kilo. per sec. Now, the great circle that passes through the epicentre and a given station is divided into two arcs, the minor and the major arcs. The first long waves that reach a station are of course those that travel with the above velocity along the minor arc. The waves continue their journey to the antipodes of the epicentre, cross there and pursue their way back towards the epicentre. They thus pass the given station a second time, that is, after traversing the major arc, and appear on the record there as the waves called W_2, the mean value of the velocity being 3·7kilo. per sec. Crossing at the epicentre, they again travel along the minor arc and, if strong enough, are recorded as the waves W_3, their mean velocity being 3·4kilo. per sec. The lower velocity for

the waves W_3 is no doubt due to the fact that they are the representatives of the most prominent but later of the long waves L. The mean time taken by the long waves to travel completely round the globe (that is, W_3-W_1) is 3hr. 20min. 46sec.

Returning to the P and S waves and their curved paths through the body of the earth, we have the valuable suggestion by R. D. Oldham, in 1899, that the primary waves consist of compressional vibrations and the secondary waves of distortional vibrations. It is now recognized that both types of vibrations (owing to repeated reflections and refractions in the outer layers of the crust) occur in both primary and secondary waves, but that compressional vibrations predominate in the former and distortional vibrations in the latter.

Estimates have been made by several seismologists as to the forms of the paths followed by the primary and secondary waves, those by C. G. Knott, founded on Turner's tables, being the most detailed. Assuming that the earthquake originates at a small depth below the surface, he has calculated the forms of ten curves or rays for the primary waves and seven for the secondary waves. He found that all the rays that emerge at the surface at distances less than 60° from the epicentre are concave towards the surface throughout. The ray that emerges at a distance of 73° is, in its deeper portion, slightly convex towards the surface, and this shows that, at a depth of about three-tenths of the earth's radius, the velocity has ceased to increase with the depth. This is further shown by the comparative straightness of still deeper rays in their central portions.

Two other points in connection with these waves must be referred to. The first is that, at distances of more than 120° from the epicentre, the secondary waves seem to disappear. The significance of this fact will be referred to later. The second is that, besides the waves either primary or secondary that proceed directly towards a station, there are others of the same types that reach the surface at some intermediate place, are reflected there, and, travelling on to the station, appear as reinforcements of the motion known by the letters PR, SR, etc.

Observational Methods.— Several methods have been used to determine the position of a distant epicentre. It will be sufficient to refer to two that are frequently employed. The first method, which is practically the same as Omori's for near earthquakes, depends on the duration of the primary waves; that is, on the interval S-P. For the average earthquake, this is shown to be constant at the same distance from the epicentre. For instance, if S-P were 6min. 42sec., then the distance measured along the surface would be 45" or 5,000km. If the distances were known for two other stations, the epicentre must lie near the point of intersection of the three circles drawn with the stations as centres and the corresponding distances as radii. In practice, it is found advisable to make use of the observations at several or many stations. By the second method, Galitzin's, the position may be determined from observations at one station only. The distance of the epicentre is given, as before, by the value of S-P. The direction of the epicentre is taken as that of the resultant of the N—S and E—W components of the first displacement. The epicentre must therefore lie at one end of the diameter in this direction of the circle of radius corresponding to S-P, which of the two ends is decided by the vertical component of the initial motion.

Seismographic observations on both near and distant earthquakes have thrown much welcome light on the nature of the earth's interior. They have shown that there is, first, an outer crust consisting of two layers, an upper granitic layer roughly 7½m. in thickness and a lower basaltic layer about twice as thick. Below the latter lies the homogeneous layer of great thickness. It probably reaches nearly half-way to the centre of the earth, for, at about this depth, the rigidity begins to break down. Within it is the central core. This allows the primary waves to pass, but with a velocity one-third less than that just outside it. It does not, however, transmit the secondary waves, as is shown by their disappearance at the distance of about 120" from the epicentre, and, on this account, it has been supposed that the core is fluid.

Origin of Earthquakes.— The distinction between volcanic earthquakes and earthquakes that occur far away from active volcanoes has long been recognized. In 1878, R. Hoernes divided earthquakes into rock-fall, volcanic and tectonic earthquakes. The first may be neglected as of little consequence, but lately an important addition has been made of very deep-seated movements, the origin of which may be at a depth that may be a perceptible fraction of the earth's radius. To these, Oldham has given the name of *bathyseisms*. The different classes, however, cannot always be kept distinct. Tectonic earthquakes may occur in immediate connection with a volcanic eruption, and bathyseisms may merge into tectonic earthquakes.

Volcanic earthquakes are confined to the neighbourhood of a volcano, which may be active (as Etna), dormant (as Monte Epomeo in Ischia) or extinct (as the Alban Hills near Rome). In the first case, they usually precede a volcanic eruption and decline in frequency as the eruption begins. The most significant features of volcanic earthquakes are their small disturbed areas (seldom more than 100 or 2000sq m.) and their great intensity near the centre. These point unmistakably to very shallow foci, as a rule, only a fraction of a mile; that is, to foci within or just below the mass of the volcano. With regard to the origin of most volcanic earthquakes, there can be little doubt. The slight shocks felt before or with the eruptions are due to explosions or to the injection of lava into fractures or cavities in the volcano. The sharp earthquakes that follow an eruption after some months or that occur near dormant or extinct volcanoes are probably caused by the slipping of the rock adjoining a fracture, the slipping being due to the contraction or displacement of the magma.

Coming next to the origin of tectonic earthquakes proper, by far the most numerous of all, it is generally held that they are due to the formation of faults. In some rare cases, perhaps, they may be caused by the actual fracturing, but nearly always by the growth of the faults. With every step in such growth, it is evident that an earthquake must occur—a slight tremor or earth-sound when the movement is a mere creep over a small section of the fault, a strong or destructive earthquake when the displacement is considerable over an area many miles in length. Such a connection is evident when there are permanent dislocations of the crust along a pre-existing fault. In slight earthquakes, such as those which visit Great Britain, the displacement may be no more than a small fraction of an inch, and it must die out far below the surface. In such earthquakes, the longer axes of the isoseismal lines are usually parallel to well-known faults, the centres of the curves lie on the downthrow side of the faults; and, when a series of earthquakes occur in a district, such as with the Inverness earthquake of 1901, the epicentres migrate to and fro within a narrow band parallel to the direction of the fault.

In every earthquake country, it is found that a prolonged interval of recovery follo s a great earthquake. The interval may extend to hundreds of years, even to 1,000 years or more. The Lisbon earthquake of 1755 has had no successor yet to compare with it in magnitude. Before an earthquake occurs, we may imagine a continual growth in the forces that will ultimately overcome all resistance. Here and there on the fault-surface, there are obstacles that must first be cleared away, and each such removal will give rise to a fore-shock. When the effective forces have become uniform over a large region of the fault-surface, it will then be possible for a general movement to take place, and it is to this movement that the principal shock is due. It is of course followed by a sudden readjustment of the stresses that produced the motion, to an increase chiefly along the lateral and upper margins of the focus. Thus it follows that after-shocks are at first more frequent near the terminal and central regions of the meizoseismal area, that they gradually forsake the former and become concentrated in the central portion, as in the Mino-Owari earthquake of 1891 and the Inverness earthquake of 1901.

In recent years, the conception of a simple focus has been extended for many earthquakes to that of a complex origin. The twin-earthquakes of Great Britain originate in two detached foci from 8m. to 20m. apart. Calabrian earthquakes belong to several foci, at some times successively in action, at others almost simultaneously. Foci more complex or more extensive than these are in many earthquakes the mere surface manifestations of deep-

seated movements or bathyseisms. In the Californian earthquake of 1906, the focus certainly reached up to the surface; the depth of the main portion has been variously estimated at from 12½m. to 67 miles. The Assam earthquake of 1897, with its vast meizoseismal area and its widely scattered movements, was probably due, as Oldham suggests, to a great bathyseismic displacement. How great may be the depth of these displacements is evident from their seismographic records. It has been variously estimated at from 30 to 800 miles. Even if we regard the latter figure as excessive, we have the conclusions drawn by H. H. Turner from many observations that the majority of these great movements originate at a depth of about 125m. and some even as far as 375 miles.

Destructiveness **of** Earthquakes. — To most persons, the loss of life and the damage to property are the chief features of a great earthquake. The number of persons killed within a few minutes is sometimes appalling, such as 50,000 in the Lisbon earthquake of 1755, 100,000 in the Messina earthquake of 1908, 180,000 in the Chinese earthquake of 1920, 200,000 in the Japanese earthquake of 1703, and, highest of all known, 300,000 in the Indian earthquake of 1737. Figures such as these may be exaggerated, but there can be no mistaking those for the Japanese earthquake of 1923, namely, 99,331 killed, 103,733 wounded and 43,476 missing, figures which of course include deaths by fire as well as by earthquake. If we reckon the loss by the percentage killed of the total number of inhabitants, the death-rates in the Japanese earthquake were only 2·7% in Tokyo and 5·5% in Yokohama. Far higher are the rates for some Italian earthquakes, for instance, 41% at Casamicciola in the Ischian earthquake of 1883, about 50% at Messina in the earthquake of 1908, 71% at Montemurro in the Neapolitan earthquake of 1857, and, in the Marsican earthquake of 1914, 91% at Avezzano and 94% and 97% in two neighbouring villages. In Great Britain, only one life is known to have been lost, an apprentice being killed in London by a falling stone during the earthquake of 1580.

We may endeavour to lessen the destructive power of earthquakes in two ways, by forecasting the occurrence of earthquakes, or, and at present more usefully, by a proper choice of site and modes of building. The prevision of earthquakes is as yet in its initial stage. One rather hopeful method depends on the study of the fore-shocks. As the obstacles to slipping are situated in all parts of a fault, it follows that the epicentres of the fore-shocks must mark out roughly the fault-system, or the part of it in which displacement is about to occur. In the case of the Mino-Owari earthquake of 1891, the whole region was so outlined within a year or two of the great earthquake. Another method has lately been put into practice. From a study of the earthquakes felt at Tokyo from 1914 to 1921, Omori outlined two zones in which earthquakes were then frequent, one covering the Boso peninsula (fig. 1), the other the north-west portion of Sagami bay and beyond. Between them lies part of the epicentral area of the earthquake of 1923. Omori inferred that activity would return to the intermediate region when the frequency of earthquakes in the others showed signs of lessening, as it did in the years 1920–21. Lastly, it has been suggested, that before sliding along a great fault takes place, the crust on either side would show signs of distortion that might be detected by the displacement of pillars erected along a line at right angles to the fault.

At present, more can be done to counter the destructiveness of earthquakes by the choice of a suitable site and the proper design of buildings. In every earthquake the damage to property is always least on hard rocks; it is more in houses built on soft ground; greatest of all on recently "made" land, especially on that filling up a marsh or creek. Sites on hard ground should therefore be selected, while the neighbourhood of unsupported openings, such as the edges of cliffs or river-banks, should be avoided.

In Japan and other earthquake countries, much attention has been paid to the proper form and structure of buildings. In ordinary works, yielding first shows itself at the base of a pier or wall, and thus such structures as the piers of bridges are made wider and stronger below and tapering upwards. In a so-called earthquake-proof house, the roofs are exceedingly light, chimneys are short and thick, arches are avoided, rafters run from the ridge pole to the floor-sills. The essential point, as was well shown in the Japanese earthquake of 1923, is that the building should be so framed and braced that it will move bodily as one block with its foundations. Thus, in 1923, brick buildings crumbled down at once into ruin. Wooden houses withstood the shock fairly well, but were an easy prey to the fires that followed. The modern steel-brick buildings offered a stout resistance to both earthquake and fire, and nearly half of those in Tokyo passed through the trial unharmed.

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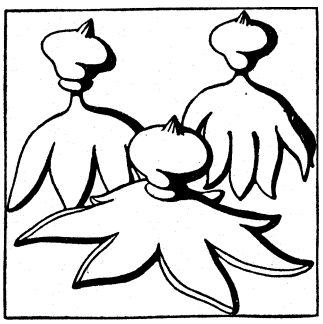
(C. D.)

In late April and early May 1928 the modern city of Corinth was almost completely destroyed by repeated earthquake shocks of great intensity and thousands of citizens were rendered homeless. The country districts were also badly affected and in Bulgaria many towns and cities were shaken to their foundations. Smyrna and other cities in Asia Minor were very badly damaged.

A severe earthquake occurred in Burma (1930), killing several hundred and virtually obliterating Pegu. This was immediately followed by a shock of equal force in Persia. Another at Managua, Nicaragua (1931) brought death to hundreds and gave the United States marines a chance to employ themselves humanely in the succour of the thousands left homeless. In January 1934 a violent tremor shook all of India, destroying about 6,000 lives. (X.)

EARTHSHINE. The earth is a luminary to the moon as the moon is to the earth; consequently the portion of the moon's disc which is not illuminated by the sun is illuminated by earthshine analogous to moonlight. It is a familiar observation that when the moon is a crescent the earthshine is powerful enough to make the whole disc easily visible. The phases of the earth and moon are complementary, so that the earth is near "full" when the moon is near "new" and the earthshine is then strongest.



FROM LASZLO, "GASTEROMYCETES HUNGARIAE"
EARTH STAR (GEASTER GRANULOSUS), A KIND OF PUFF-BALL GROWING ON DECAYED LEAVES

EARTH-STAR *(Geaster),* in botany, a kind of puff-ball (*q.v.*), with a distinct outer coat which, on separating from the

inner, splits into several divisions, which become reflexed and spread like a star. The inner coat enveloping the spores is supported, like a ball, with or without a stalk on the upper face of the star. The spores generally escape by a distinct aperture which appears in the top of the ball. There are several species in Britain, found on the ground or on decaying leaves. They are generally distributed throughout America. *(See* FUNGI.)

EARTHWORM, the name of oligochaete worms found nearly all over the world. There are now more than 1,000 species known and the number is increasing. The earthworms of England belong almost entirely to the family *Lumbricidae,* which forms the prevalent earthworm fauna of the Palaearctic region and is also strongly represented in the Nearctic. Elsewhere they are replaced by the numerous genera of the families enumerated in the article ANNELIDA (*q.v.*). It is a remarkable fact that members of the family *Lumbricidae,* when introduced into tropical and other countries, thrive abundantly and oust the indigenous forms. In gatherings of earthworms from various extra-European countries it is always found that the worms of the cultivated ground and that near the coast are European species, the native forms being met with farther inland. The *Lumbricidae* from non-Palaearctic countries are mostly identical with Palaearctic species; and since they are impatient of sea-water, it seems clear that they must have been accidentally transported with plants, etc. Most earthworms live in the soil, which they devour as they burrow through it. A few, like their allies the river worms *(Limicolae),* habitually frequent streams, lakes, etc. Truly oceanic islands have no indigenous earthworm fauna, but are inhabited by forms identical with those of neighbouring continents, accidentally introduced.

Earthworms are hermaphrodite. Like the leeches (*q.v.*) they produce cocoons which are a product of the glandular epithelium of the clitellum. In pairing, earthworms come together with the head of one directed towards the tail of the other. The spermatozoa are then exchanged, passing into the *spermathecae* of the partner, whence they are transferred to the cocoon as the latter passes forward over the head. In these cocoons are previously deposited the eggs together with albumen upon which the embryos feed. So far as is known, the production of cocoons is universal among the *Oligochaeta.* The young hatch as fully formed earthworms. The work of earthworms in aiding the production of subsoil and in levelling the surface was first studied by Darwin, and has since been investigated by others. This work is partly carried out beneath the surface and partly on the surface, upon which the worms wander at night and eject the swallowed and triturated earth. Frequently castings of some height are formed of coiled ropes of agglutinated particles of mould. The British species, between 30 and 40 in number, do not grow to a greater length than 10in.; but in tropical countries there are species which reach a length of 4ft. Thus we have in Natal the gigantic *Microchaetus microchaetus;* in southern India, *Drawida grandis;* in Australia, *Megascolides australis;* and in South America, *Glossoscolex giganteus. See* ANNELIDA: *Oligochaeta.*

See Darwin, *Formation of Vegetable Mould by Action of Earthworms;* F. Beddard, *Earthworms and their Allies.*

EARWIG, an insect belonging to the family *Forficulidae* of the order Dermaptera. It is characterized by the very short leathery fore-wings, or tegmina, and the large semi-circular membranous hind wings which have highly modified veins disposed in a radial manner. When the insect is at rest the hind wings are folded longitudinally in a fan-like fashion: there are also two other folds in a transverse direction and, in this way, they are tucked away beneath the tegmina. The body is terminated by a pair of horny forceps which exhibit evident differences of form in the two sexes. A remarkable fact about them is that the males fall into two sharply marked classes as regards the length of their forceps. It appears that the development of forceps of intermediate length is very unusual. The significance of this fact is still obscure. These forceps are highly modified cerci and, in the Ceylon genus *Diplatys,* the immature forms carry long jointed cerci, which are replaced by forceps only at the last moult. The function of the forceps is by no means clear, but in all probability they are mainly used as organs of offence and defence: when alarmed an earwig often uplifts the apex of the abdomen with the forceps widely opened in a threatening manner. The origin of the name earwig is uncertain: by some it is believed to be due to the fact that the insect has been known to use the human ear for purposes of concealment, but others claim it is a corruption of earwing in allusion to the form of the hind wings.

The family *Forficulidae* is almost cosmopolitan and the best known species is the common European earwig, *Forficula auricularia.* This insect is gregarious and nocturnal, hiding by day under loose bark, in hollow stems, under stones or in any suitable dark crevice. At night it becomes active, feeding upon tender foliage, flower petals, fruit, etc., and being especially partial to dahlias. The extent to which it partakes of animal food is uncertain but it is known to devour both living and dead insects. It is a curious fact that, in spite of the possession of well-formed wings, this insect has only on very rare occasions been seen to fly: also, the often repeated statement that the forceps assist in folding up the wings needs substantiation. The eggs are laid in masses up to 50 or more in number. They are deposited in a cavity in the soil where they are guarded by the female earwig, who rests over them until they hatch and the young nymphs are able to shift for themselves. The eggs are found during winter and early spring and the nymphs, after moulting four to six times, become mature during the summer. The European earwig has secured a footing on the Pacific side of N. America as well as in parts of New Zealand. In these localities it has become exceedingly numerous and destructive. Efforts are being made to control the insect by importing certain natural enemies from Europe into those lands which the earwig has adopted. The enemies known to parasitize the earwig are two species of flies of the family *Tachinidae* whose larvae live within and finally kill their host. Under ordinary circumstances earwigs are usually destroyed by means of traps or poison baits. Plant pots stuffed with straw and inverted on canes are a well known lure: in the United States the broadcasting of a poisoned bran mash bait has been recommended in places where the insect is very numerous. (A. D. I.)

EASEL, a support for a picture, painting or other work of art. Many types of ornate easels are also used for the display of works of arts, announcements, etc.

In construction, easels are divided generally into two classes: those of light construction, the so-called "sketching easels," and the heavier type, known as the "studio easels." Sketching easels are made to fold compactly so as to be conveniently carried for sketching purposes in the open. These easels should be as light in weight as possible but of very sturdy construction. There are a great many types, but practically all of them follow the tripod design, *i.e.,* three adjustable legs. When setting up the easel for use, the three legs spread apart and are adjusted to a height at which the artist may either sit or stand while painting. A tray is used to hold the painting on which the artist is working. The top of the picture is generally held fast with a clamp or attachment either attached to the third back leg or constructed into the easel between the front two legs. To keep the sketching easel rigid while working in a strong wind, a stout cord is tied to the head of the easel, to the other end of which a weight is attached and allowed to hang perpendicular, thereby maintaining the centre of gravity. Studio easels differ in construction from sketching easels in that they are of a heavier type. They do not follow any particular design, but are more or less elaborate both in finish and construction, according to the artist's preference. They may be obtained, finished in different kinds of wood, in keeping with the other furniture of the studio. The tray of the easel is adjustable, so that the artist may sit or stand while painting. There is also an attachment by which the painting may be tilted at different angles, to suit the artist's pleasure. The base of the easel is equipped with castors, permitting it to be turned or moved quickly to any part of the studio. (F. W. WE.)

EASEMENT, in law, signifies a right of accommodation. or limited right of use over land belonging to another. It is distinguished from *profit à prendre* since an easement confers merely a convenience to be exercised over the land of another without any participation in the profits of it. Thus a right of way is an

easement, a right of common is a profit. An easement is distinguishable also from a licence, which, unless it is coupled with a grant, is personal to both grantor and grantee, and is neither binding on the licensor, nor, in general, assignable by the licensee; while both the benefit and the burden are annexed to land.

The essential features of an easement, in the strict sense of the term, are therefore these: (i.) It is an incorporeal right; a right to the use and enjoyment of land—not to the land itself; (ii.) it is imposed upon corporeal property; (iii.) it is a right without profit; (iv.) it requires for its constitution two distinct tenements—the "dominant tenement" which enjoys the right, and the "servient tenement" which submits to it. This last characteristic excludes from the category of easements the so-called "easements in gross" (if such can subsist by English law), such as a right of way conferred by grant independently of the possession of any tenement by the grantee. The true easement is a right "appendant" or "appurtenant" to the dominant tenement.

Further classifications of easements must be noted. They are divided into (a) *affirmative* or positive, those which authorize the commission of an act by the dominant owner, *e.g.*, rights of way, and negative, when the easement restricts the rights of the servient owner over his own property, *e.g.*, prevents him from building on land so as to obstruct ancient lights (*q.v.*); (b) *continuous*, of which the enjoyment may be continual without the interference of man, *e.g.*, access to light, and *discontinuous*, where there must be a fresh act on each occasion of the exercise of the right, *e.g.*, a right of way; (c) apparent, where there are visible external signs of the exercise of the right, *e.g.*, a right to dam up a watercourse, and non-apparent, where such signs are absent, *e.g.*, a right to support of one house by another.

Acquisition of Easements.—Easements may be acquired (a) by express grant; (b) by an implied grant; (c) by express or implied reservation, *e.g.*, by the owner of land in selling the fee; (d) by prescription, either at common law or under the Prescription Act, 1832. An express grant, or express reservation (inter *vivos*), of an easement cannot be effected except by deed. An easement by implied grant usually arises under the principle that a grantor cannot derogate from his own grant. Thus a man builds two houses on a close with windows deriving light from the grounds of each other. If he sells one a grant of the light derived by it over the other's ground is implied.

Easements are acquired by prescription at common law by proof of "immemorial user" by the dominant owner and those through whom he claims. A "lost grant" is presumed on proof that an easement has been enjoyed uninterruptedly for 20 years before action brought unless the contrary is shown. To avoid the difficulties of proof of prescriptive right at common law, the Prescription Act, 1832, established more definite periods of use. In the case of easements other than light, the periods of prescription are 20 years to establish a prima facie, and 40 years to establish an indefeasible title. (As to light see ANCIENT LIGHTS.) The enjoyment of the easement by the dominant tenement must be open, *i.e.*, not hidden, and of right, *i.e.*, not by arrangement with the owner of the tenement affected by it (*Kilgour* v. Gaddes, 1904, 1 K.B. 457).

Easements may be extinguished (i.) by express release—here an instrument under seal is necessary; (ii.) by "merger," *i.e.*, where both tenements become the property of the same owner; (iii.) by abandonment through non-user. In the case of discontinuous easements, the shortest period of non-user may suffice if there is direct evidence of an intention to abandon.

A word may be added here as to the right to air. The owner of a dwelling-house may acquire a right to the passage of air through it by a defined channel. If it is claimed by prescription the proof required to establish it is the old common law proof, since the air easement is not one within the Prescription Act. It may also be acquired by grant, express or implied.

In Scots law the term "easement" is unknown. Both the name "servitude" and the main species of servitudes existing in Roman law (*q.v.*) have been adopted. The modes of their creation and extinction are similar to those of English law. The statutory period of prescription is 40 years (Scots Acts, 1617, c. 12), or 20 years in the case of enjoyment under any ex facie valid irredeemable title duly recorded in the appropriate register of sasines (Conveyancing [Scotland] Act, 1874). There are certain servitudes special to Scots law, *e.g.*, "thirlage," by which lands are "thirled" or bound to a particular mill, and the possessors obliged to grind their grain there, for payment of certain quantities of grain or meal as the customary price of grinding. Statutory provision has been made for the commutation of these duties (Thirlage Act, 1799), and they have now almost disappeared.

The French civil code and those of Belgium, Holland, Italy and Spain closely follow Roman law. French law is in force in Mauritius, and has been followed in Quebec (Civil Code, arts. 499 et seq.) and St. Lucia (Civil Code, arts. 449 et seq.). In India the law is regulated, on English lines, by the Easements Act, 1882 (Act v. of 1882). The term "easements," however, in India includes *profits à prendre*. In the South African colonies the law of easements is based on the Roman Dutch law. In most of the other colonies the law of easements is similar to English law. In some, however, it has been provided by statute that rights to the access and use of light or water cannot be acquired by prescription; but municipal bye-laws must be examined in this relation.

In the United States the law of easements is founded upon, and substantially identical with, English law. The English doctrine, however, as to acquisition of light and air by prescription is not accepted in most of the States.

See Gale, Lnw *of Easements* (8th ed., 1908); Goddard, *Law of Easements* (6th ed., 1904); Peacock, *Easements in British India* (Calcutta, 1904); W. Burge, *Commentaries on Colonial and Foreign Laws*, vol. iv., pt. 2 (new ed., 4 vols., 1907–27); Jacques Vollenweider, Étude sur les droits distincts et permanents en droit civil suisse, Lausanne (1923).

EAST, ALFRED (1849–1913), British painter and etcher, was born at Kettering, Northamptonshire, on Dec. 1j, 1849. He studied at the Glasgow School of Art and then in Paris at the École des Beaux-Arts, and under Robert Fleury and Bouguereau. He began to exhibit at the Royal Academy in 1883, and became R.A. in 1913 a few months before his death. In 1906 he became president of the Royal Society of British Artists. Many of his works are to be found in the English provincial galleries; his "Passing Storm" is at the Luxembourg, Paris; "The Nene Valley" at the Venice gallery; and "A Haunt of Ancient Peace" at the National gallery in Budapest. East visited Japan in 1889, and among his best works are the landscapes he painted there. From 1902 onwards he took a keen interest in etching, and produced a large number of plates. He also published a useful, practical book on landscape painting, The Art of Landscape Painting in Oil *Colour* (1906). Shortly before his death he presented a collection of his pictures to his native town, Kettering. He died in London on Sept. 28, 1913.

EAST AFRICA, OPERATIONS IN. When the World War broke out in 1914 the garrison of British East Africa, the territory immediately north of German East Africa, was scattered and engaged on punitive expeditions remote from the enemy frontier. In the case of each Protectorate the troops were native with European officers. The German forces, some 5,000 strong, including 260 Europeans, lay ready to the hand of their commander, Von Lettow-Vorbeck, a capable and determined soldier well able to employ them to full advantage. If it is remembered how keenly sensitive the native soldier is to any shortcoming in his superior and that Von Lettow had only been with his command for six months when hostilities began and kept that command efficient and formidable through four years of steadily declining fortune, some idea may be formed of the resolute nature and soldierly qualities of the German commander-in-chief. His operations consistently bore the clear imprint of his skill and personality, and there were advantages, other than his professional capacity and steady courage, upon which he could rely.

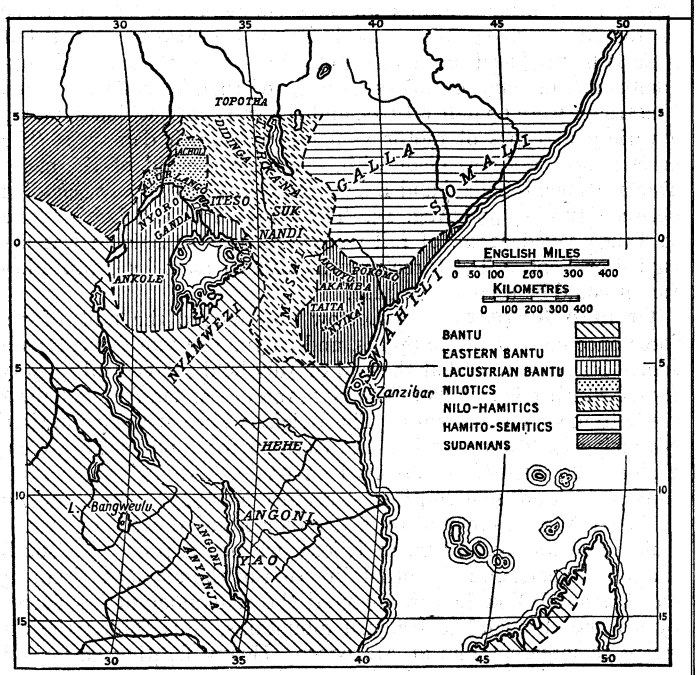
I. EARLY OPERATIONS.

The country—nearly double the size of Germany in 1914—which was the scene of operations, is for the most part covered by bush, dense as a rule, but occasionally thinning out to something like park land. High mountain ranges, thick with vegeta-

tion, rear themselves from bush and jungle which are fever stricken and liable to wholesale inundation during the rainy season. Rivers abound and malaria and dysentery of a malignant type, with other tropical diseases, combined to swell the casualty list of a European or Anglo-Indian force. Practically every animal imported into East Africa for the use of the British forces succumbed to the tsetse fly. The route of every British advance was marked by casualties due to diseases from which the rank and file of the enemy—askaris recruited from local tribes—were immune. Surprise by the attacker was as difficult as it was simple by the defender, who waited concealed and warned by the laborious approach of his adversary cutting roads and bridging rivers.

Supply and transport presented appalling difficulties to an advance through hundreds of miles of naturally impenetrable bush, while the defending force slowly fell back upon the magazines posted in its rear. Only an overwhelming preponderance in numbers made any advance possible, but a force starting with a strength adequate for an offensive enterprise constantly found itself reduced at best to an equality of strength on contact with the enemy. Many good cards were thus in the hand of the German commander; and he rarely failed to play them with full effect.

Naval Operations *and German* Advance.—On Aug. 8, 1914, two British cruisers, "Astraea" and "Pegasus," arrived opposite Dar es Salaam from Zanzibar, and, being unable to leave a garrison, the naval commander covenanted with the German governor that the latter should forbear from any hostile action in Dar es Salaam itself. Parallel to the southern frontier of British East Africa and about 50m. distant from it ran the Uganda railway from Mombasa to Lake Victoria. This tempting and exposed objective, for the protection of which the British troops at the outset were hopelessly inadequate, at once appealed to Von Lettow, who on Aug. 15 seized Taveta, which lay in British territory at the eastern end of the gap between the southern slopes of Mt. Kilimanjaro and the northern end of the Pare mountains in the German Pro-



RACE MAP OF EAST AFRICA

tectorate. An enemy force here was a standing menace to the British capital at Nairobi, and constantly raided the railway line.

In September the enemy cruiser "Königsberg" returned to Dar es Salaam and on Sept. 20 surprised and destroyed the "Pegasus" while undergoing repair in the Zanzibar roadstead. A combined enemy operation against Mombasa, for the execution of which the "Konigsberg" was to attack the port in conjunction with a land force moving north along the coast, failed, as the "Königsberg" was driven by the ships of the Cape Squadron into the Rufiji delta, where she was run aground. The land force began its march along the coast on Sept. 20, was repulsed at Gazi, 25m. from Mombasa, on Sept. 23, and retired to the frontier on Oct. 8. The crew of the "Konigsberg," which was blown up in July 1915, after being set on fire by the monitors "Severn" and "Mersey," joined the enemy land forces, with an armament of ten 4·1 guns.

German raids along the coast, on the Uganda railway, and into the frontier districts of Uganda, Belgian Congo, Rhodesia and Nyasaland were frequent in the opening months of the campaign. These small enterprises were much simplified by the central position of the enemy and the excellent lateral communication afforded by the central railway from Dar es Salaam to Kigoma, on Lake Tanganyika. This lake was under German control until Dec. 1915, when by the operations of motor boats specially brought from Capetown the enemy was deprived of the one lake which had not been in British hands since the earliest days of the campaign.

Reinforcements from India.—It soon became apparent that, unaided, the British Protectorate forces could not hold their own, and the Government of India consented to send an expedition. On Aug. 25 its leading unit reached Mombasa with Brig.-Gen. Stewart, who assumed command. The rest of the expeditionary force was directed on Tanga, the northernmost German port, at the southern extremity of the Usambara mountains, healthy highlands where the bulk of the German settlers resided. Coincident with an attack on Tanga an advance against Moshi by the north of Kilimanjaro was to be made by Stewart. The expeditionary force under Brig.-Gen. A. E. Aitken was about 7,000 strong and (except the 2nd Loyal North Lancs.) composed of Indian troops.

Failure of British Offensive.—The transports reached Tanga on Nov. 2, when the local commissioner represented the place as an open and undefended port and bombardment was deferred. Meanwhile, Von Lettow, advised of the plan by captured Indian mails, was hurrying reinforcements to the coast. When one and a half British battalions landed two miles east of the town on the evening of the arrival, they met with strong opposition and fell back. Von Lettow arrived on the evening of the following day, when British reinforcements had been landed and fighting resumed, and on Nov. 4 heavily defeated his opponent, whose casualties were 795. On the same day Stewart, checked at Longido, was compelled to retire. The British force at Tanga re-embarked and reached Mombasa on Nov. 5. The first British offensive had thus failed completely. Von Lettow's success at Tanga put an end for the time being to any general offensive against him, and it was not until 1916 that the next British advance was set in train.

The intervening period was occupied in raiding by both forces, with occasional engagements of a more ambitious nature. A British force was compelled to surrender on Jan. 17, 1915, at Jasin, in enemy territory, to a superior force, after 48 hours' fighting, which exhausted their ammunition and water. German losses, especially in officers, were serious, as was the shrinkage of ammunition. Maj.-Gen. M. I. Tighe assumed chief British command in April 1915 and in June, Bukoba, on Lake Victoria, was taken.

Reinforcements Arrive.—Aid was now sought from a different quarter, for, with the conquest of German South-west Africa by General Louis Botha in July 1915, the resources of the Union of South Africa became disposable to an extent which was impossible till the disappearance of the enemy from her own border. During the latter half of 1915 there was continuous preparation in South Africa of troops, depôts, supplies, medical stores, transport, animals and material of all kinds for use in East Africa. By Feb. 1916 one mounted brigade, two infantry brigades and one field artillery brigade, complete with all their auxiliary units, had arrived from South Africa to join Tighe. A second mounted brigade followed, together with a battalion of the Cape Corps (coloured men from the Cape Province). Tighe also had the following European units: the Calcutta Volunteer Battery, the 2nd Loyal North Lancs., 25th Royal Fusiliers, 2nd Rhodesians and two local settlers' corps; India sent him from her native army ten infantry regiments, one squadron of cavalry and two mountain batteries. The battalions of King's African Rifles were the original native Protectorate force. At the same time, Von Lettow's force had reached the highest limit which it attained in the campaign and was probably over 20,000. The exact combatant strength

is difficult to estimate, for there were many carriers of whom a percentage were armed and many trained as askaris. The askari in his own country is a soldier of high value. Such a force, with a strong leaven of Europeans, under a skilful and determined commander, was a formidable adversary in tropical bush country.

German Ammunition Supplies. — In April 1915 the mind of Von Lettow, which had been sorely exercised by his shortage of ammunition, was relieved in the following remarkable manner: A British ship, the "Rubens," seized at Hamburg, left that port loaded with arms and ammunition and appeared off Tanga on April 4, being sighted by H.M.S. "Hyacinth." Entering Manza Bay on fire and abandoned, she was boarded by bluejackets, who found her timbered up and battened down. After firing more rounds the "Hyacinth" steamed away on the assumption that her quarry would burn herself out. The Germans returned and salved almost the entire cargo, and a largely increased volume of enemy fire from the Mauser pattern 1898 rifles which the "Rubens" had brought was the result. This operation was repeated a year later.

II. OPERATIONS UNDER GENERAL SMUTS

The chief command in East Africa was assumed by General Smuts in Feb. 1916. He had previously declined the post, but when General Smith-Dorrien was compelled to relinquish the command in consequence of illness he accepted it. He reached Mombasa on Feb. 19 and found the railway completed from Voi to Serengeti, 5m. from Salaita Hill, the German advanced position from Taveta. A week earlier an attack on Salaita had failed. The rainy season was at hand and movement would then become impossible; Smuts telegraphed to Lord Kitchener that he was ready to carry out the occupation of the Kilimanjaro area at once. The proposal was agreed to and Smuts proceeded to advance.

British Advance on **Taveta.**—An attack, designed primarily to hold the enemy, was to be delivered on Salaita by a force under General Malleson, while Stewart was to repeat his attempt of 1914 to reach Moshi by the north of Kilimanjaro and thence to intercept any enemy retirement in his direction. General van Deventer with a mounted brigade, moving by Malleson's right, was to cross the Lumi river, and by way of the foothills of Kilimanjaro cut the enemy line of retreat between Taveta and Moshi. The execution of this movement unobserved was the only chance of surprising the enemy, for it was apparent to Von Lettow, who had made all preparations for retirement, that Taveta was Smuts' objective. This surprise was effected. Van Deventer moved on March 8 and on the following day his troops were astride the Moshi-Taveta road. On the same day the Germans evacuated Salaita and took up new positions on two hills, Latema and Reata, covering the gap between the Pare mountains and Kilirnanjaro. The main enemy force was posted at Himo, 5m. from the gap, whence it could move in any direction to attack or retire. The progress of Stewart's force was so slow that his movement was without effect.

The new enemy position was attacked on March 11 and, after severe fighting all day and the succeeding night, was occupied on the morning of the 12th by a general advance in support of detachments which had won their way to the two crests during the night and caused a retirement by the enemy.

German Withdrawal. — Von Lettow now withdrew his entire force to a position (Kahe-Ruvu) which stretched south of the Taveta-Moshi road from Kahe railway station eastward along the northern end of the Pare mountains. He was followed up and attacked on March 18 from Latema Nek by Brig.-Gen. Sheppard, and on March 20 van Deventer was sent from Moshi to turn the enemy at Kahe. He seized Kahe on March 21 and on the following night, after a very severe action with Sheppard, the enemy withdrew to Lembeni, zom. S. of Kahe. Von Lettow abandoned one 4·1 gun, and had expended ammunition to an extent which he could ill afford, but his force was intact and the timely arrival of the second blockade runner at this juncture with four 4.1 field howitzers, gun and small-arm ammunition, machine-guns, stores, provisions and clothing was an inestimable stroke of good fortune. Here the operations which had been undertaken before the rainy season were concluded and the British forces took up positions covering Taveta and Moshi and facing the enemy at Lembeni.

During the ensuing rains Smuts reorganized his force and prepared to resume the offensive at the earliest possible date. He could rely for assistance in his main operations upon the Belgians in the north-west and the British force under Maj.-Gen. Northey, operating from Nyasaland, to the south-west. For reasons fully recorded in his dispatches, Smuts decided at once to send van Deventer with a mounted force rapidly by Arusha to Kondoa Irangi and thence to the central railway and east along that line to Morogoro. His own force was to move south by the Pangani, and make for the same ultimate objective, Morogoro. It was hoped that Von Lettow would there be brought to bay by the two converging forces.

New British Offensive. — Van Deventer moved on April 3 and occupied Kondoa Irangi on April 19, capturing the enemy garrison at Lol Kisale en route. He reached Kondoa Irangi after heavy casualties in men and animals from disease and was there cut off and reduced to immobility as a consequence of his losses and the advent of the rainy season. Von Lettow concentrated a force against van Deventer and fighting ensued, but the German attacks, with one exception, lacked vigour and were all repulsed. Van Deventer's position was eased by the end of May, when Smuts began his advance down the Pangani and the Belgians moved on Tabora. Maj. Kraut was in command of the German force opposite Smuts when the latter set his troops in motion southwards from Moshi on May 18, Von Lettow having assumed direction of his concentration against van Deventer.

Systematically outflanked by his opponent, whose main advance along the Pangani was supplemented by flank movements by the Pare and Usambara ranges, Kraut found himself compelled to leave the Tanga railway and retire upon Handeni. This place was seized by Smuts on June 19, Korogwe having been occupied four days earlier. On June 24 the Germans were attacked simultaneously on three sides, but, after determined fighting, withdrew into the Nguru hills. Smuts was now compelled to halt his force on the Msiha river. In a month 250m. had been covered, but malaria had reduced the strength of all units, combatant and non-combatant, in some instances to 30% of their original numbers. The troops were on half rations, and the transport, which included a variety of types of motor vehicles, was much damaged. The coast region was now dealt with, and with the aid. of the navy, Tanga, Pangani, Sadani and Bagamoyo were successively occupied between July 17 and Aug. 15. The removal of the British base to Tanga saved zoom. of rail transport. Dar es Salaam was occupied on Sept. 4, but three months elapsed from its capture before it could be used as the base.

German Retreat. — Von Lettow now moved the bulk of his force once more opposite Smuts, and on June 24 van Deventer resumed his advance and at the end of July held the central railway from Kilimatinde to Kikombo, about 100 miles. On Aug. 9 he was ready to move on Morogoro. The Belgians were at the same time advancing on Tabora against the German force under Maj.-Gen. Wahle, who was left to do his best unaided, though some reinforcements were sent south-west against Northey. Smuts moved again on Aug. 5, opposed by a detachment of the enemy whose main force was withdrawn to Kilosa, whence it proceeded south towards Mahenge, the eventual direction of the enemy retirement on all fronts. Von Lettow directed the remainder of his forces by a route through the Uluguru mountains, thus foiling the attempt to intercept him at Morogoro. Heavy fighting ensued in these mountains but Kisaki fell into British hands on Sept. 15 and Von Lettow retired to Mgeta river and there entrenched himself. On this front, during the last three months of 1916, activity was confined to such minor affairs as are usual between opposite entrenched forces. Civil administration was instituted in the occupied area behind the British forces.

Belgian Operations. — The Belgian force (also native), under Maj.-Gen. Tombeur with European officers, was divided into two brigades, the Northern (Col. Molitor) and the Southern (Lt.-Col. Olsen) and operated in the north-west of German territory, opposed by Wahle, who was instructed to avoid a decisive action. The Belgian operations, well planned and successfully executed,

were of prime importance to the general campaign. Broadly described, they were as follows. Molitor invaded Ruanda by the north of Lake Kivu while Olsen co-operated south of him by the north of Tanganyika. The movements started on April 4, and by the end of May the Belgians were in possession of Ruanda. Molitor then sent columns south-west to join hands with Olsen and other columns south-west to Lake Victoria, which was reached on June 27.

In the middle of July, on a front between Tanganyika and Victoria, Molitor and Olsen moved south on the respective objectives of Tabora and Kigoma, the terminus of the central railway on Tanganyika. Olsen occupied Kigoma on July 28 and Ujiji on Aug. 2, and then moved east on Tabora. Co-operating with Molitor was a British column under Brig.-Gen. Sir C. P. Crewe, who captured Mwanza on the southern shore of Lake Victoria on July 14. On Sept. 19 Molitor occupied Tabora which Wahle had evacuated the previous day, leaving behind his sick with civilians and prisoners of war. Crewe reached the central railway a week later.

British Advance from Rhodesia.—By this time Northey had succeeded in interposing some of his forces, which were in three columns under Lt.-Cols. Hawthorn, Murray and Rodgers (the last a South African unit), between Tabora and Mahenge. His advance was on an original front between Lakes Nyasa and Tanganyika. Murray occupied Kasanga (Bismarckburg) at the south end of Tanganyika on June 8. The Germans were defeated at Malangali on July 24, and on Aug. 29 Iringa was occupied, Lupembe having been seized ten days earlier. Northey, ordered with van Deventer, now at Kilosa, to deal with the enemy in the Mahenge district, was much outnumbered by forces already in touch with him and Wahle's columns approaching from the north, and on the night of Oct. 21 most of Wahle's troops broke through him. On the same day Kraut was heavily defeated at Mkapira. Hawthorn secured the surrender of an enemy column at Ilembule. On Dec. 24 van Deventer and Northey attacked the Mahenge force. An enemy column surrendered to Northey, but the force engaged with van Deventer escaped him after fighting from Dec. 25 to 28.

Position at End of 1916.—By the beginning of 1917 Smuts had evacuated 12,000 to 15,000 white troops (South Africans), mostly victims to malaria, and they had been replaced by the Nigerian Brigade (Brig.-Gen. Cunliffe) and fresh battalions of the King's African Rifles. Kilwa and Lindi, south of Dar es Salaam, had been seized by the navy and a force under Maj.-Gen. Hoskins had been concentrated at Kilwa. On Jan. 1, 1917, an advance was made on the Mgeta position, but after heavy fighting the enemy retired across the Rufiji at Kibambawe. Smuts now went to England and Hoskins assumed the chief command. The rains ensued, and to clear the north bank of the Rufiji was all that could be barely accomplished before operations ceased perforce. Hoskins completely reorganized his command, but before operations were resumed he was ordered to Palestine. His successor was van Deventer, who assumed command at the end of May 1917.

III. VAN DEVENTER'S OPERATIONS

The enemy forces were disposed as follows: Von Lettow near Kilwa, Wahle in the Lindi area, Tafel at Mahenge, detachments between Kilwa and Lindi, and near the Ruvuma. Northey lay south and west of Tafel with another British force at Iringa, north-west of the enemy. The rest of van Deventer's troops were to act against Von Lettow. In pursuance of this decision an advance was made by the Kilwa force under Brig.-Gen. Beves on July 5 towards Liwale. The enemy fell back to Narungombe, where a severe engagement took place on July 19. The enemy retired south, but the Kilwa force was unable to move again until mid-September. In August the enemy was driven from the Lukuledi estuary to allow of an advance inland from Lindi. The Kilwa force (Hannyngton) was to move south and that at Lindi (Beves) west. These operations were marked by the hardest fighting of the whole campaign. Von Lettow fell back, under pressure by Hannyngton. towards Nyanga, 40 mi. S.W. of Lindi, Wahle retiring before Beves. On Oct. 15 a four days' battle began between Beves' force and the enemy under Von Lettow joined by Wahle. The latter retained their position and it was ten days before Beves' force under the command of Cunliffe could resume the offensive.

On Oct. 8 Tafel, pressed by Northey with Belgian co-operation from the north, had retired from Mahenge, and, breaking through two weak detachments on Nov. 16, moved south-east towards Von Lettow, whom he was debarred from joining by the Kilwa force. Vainly endeavouring to join the main body, Tafel reached the Ruvuma, but, unable to procure food, surrendered with his entire force on Nov. 28.

Germans Retire to Portuguese Territory.—On the night of Nov. 25–26 Von Lettow, having shed all weaklings, crossed the Ruvuma into Portuguese territory and thenceforward moved as the circumstances of his position, without bases and short of ammunition, dictated. Early successes in the new sphere of action, especially at Ngomano, gave the Germans food, ammunition, arms and clothing, and when the rainy season set in, in Jan. 1918, they were able to rest for a short time.

The operations during 1918 were carried out almost entirely by natives, the King's African Rifles, and Von Lettow fell back upon guerilla tactics. Against him in Portuguese territory were sent columns from the east and south shores of Nyasa; and another (Brig.-Gen. Edwards) advanced west from Porto Amelia midway between the Ruvuma and Mozambique. After various engagements Von Lettow marched in May south to the Lurio river, zoom. from German territory, captured Ille, and in June reached the coastal region near Quelimane. On July 1 he captured Nyamakura, 25m. from Quelimane, and in the middle of August at Chalana, eluded envelopment by converging columns. Turning north-west, he was engaged by Hawthorn (who had succeeded Northey) at Lioma, east of Lake Shirwa. After several encounters, the German force reached the Ruvuma again on Sept. 28 and, after resting at Ubena, where Wahle was left, set out for Rhodesia. On Nov. 1 Von Lettow made an unsuccessful attack on Fife and, turning south-west, took Kasama on Nov. 9. Advised on Nov. 13 of the Armistice, he accepted it the following day, and on Nov. 23 formally surrendered to General Edwards at Abercorn. With him were Dr. Schnee, the governor, and Maj. Kraut, together with a force of 30 officers and 125 other Europeans, 1,165 askaris and 2,891 other natives (including 819 women), 1 small field gun, 24 machine-guns and 14 Lewis guns.

Troops Engaged, Casualties, Etc.—The troops employed by the Allies in East Africa included 52,339 sent from India (5,403 British) and 43,477 South African whites. East African and Nyasaland settlers, Rhodesian volunteers and the 25th Fusiliers numbered about 3,000; African troops (King's African Rifles, Nigerians, Gold Coast Regiment, Gambia Company, Cape Corps) and West Indians about 15,000; an approximate total of 114,000 not reckoning Belgian native troops (about 12,000 in all), Portuguese and the naval force engaged. The greatest number in the field at any one time, May to Sept. 1916, was about 55,000; the lowest, in 1918, 10,000, all African, save administrative services. See also KENYA COLONY; TANGANYIKA TERRITORY.

British and Indian casualties were returned at 17,823; of these 2,762 were in the South African Forces. These figures are exclusive of casualties among carriers and of deaths and invaliding through sickness, which among the South Africans alone exceeded 12,000. The cost of the campaign to Great Britain, inclusive of Indian and South African expenditure and that of the local protectorates to March 1919, was officially estimated at £72,000,000.

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EAST ANGLIA, one of the kingdoms into which Anglo-Saxon Britain was divided. Bede gives no information about its origin except that its earliest settlers were Angles. The kingdom of East Anglia comprised the two counties of Norfolk and Suffolk, with a western boundary probably formed by the fens of Cambridgeshire.

This kingdom first appears in Bede's narrative early in the 7th century, when its power was at its height. Towards the end

of the reign of Aethelbert, who died about 616, Raedwald of East Anglia began to win for himself the chief position among the Anglo-Saxon kings of his day. His position was assured, at least temporarily, in 617, when he decided to espouse the cause of the Northumbrian prince Edwin, then a fugitive at his court, and defeated Aethelfrith of Northumbria on the banks of the Idle, a tributary of the Trent, in Mercian territory. Raedwald had been converted to Christianity in Kent, but after his return home he relapsed. Bede states that he was the son of Tytil, the son of Wuffa, from whom the East Anglian royal family derived their name Wuffingas. According to the *Historia Brittonum* Guffa (Wuffa) was the son of (Guecha) Wehha, who first ruled the East Angles in Britain. This would put the organization of the kingdom in the first or second quarter of the 6th century. Eorpwald, the son of Raedwald, was converted to Christianity by Edwin, but was soon afterwards slain by Ricbert (627 or 628), whereupon the kingdom again became pagan for three years, when Sigebert, the brother of Eorpwald, became king and founded a see for Felix at Dunwich. Sigebert also founded a school in East Anglia, and on the arrival of an Irish missionary named Furšeus built him a monastery at *Cnobheresburg,* perhaps to be identified with Burgh Castle. Before 644, however, Sigebert resigned the crown in favour of his brother Egric and retired to *a* monastery. Shortly afterwards both brothers were slain by Penda of Mercia in his invasion of East Anglia, and Anna became king. This king was an enthusiastic Christian, and converted Coenwalh, king of Wessex, who had fled to his court. Two of his daughters, Saethryth and Aethelberg, took the veil; while another, Sexburg, was married to Earconbert, king of Kent; and a fourth, Aethelthryth, after two marriages, with Tondbert of the South Gyrwe and Egfrith of Northumbria, became abbess of Ely. In 654 Anna was slain by Penda of Mercia, and was succeeded by his brother Aethelhere, who was killed in 655 at the Winwaed, fighting for the Mercian king against Oswio of Northumbria. In 673 Archbishop Theodore divided the East Anglian diocese into two, Elmham being the seat of the northern, Dunwich that of the southern bishop. A long blank follows in the history of this kingdom, until in 792 we find Offa of Mercia slaying Aethelbert, king of East Anglia, who is said to have been his son-in-law. East Anglia was subject to the supremacy of the Mercian kings until 825, when its people slew Beornwulf of Mercia, and with their king acknowledged Egbert of Wessex as their lord. In 870 Edmund, king of East Anglia, was killed by the Danes under Ivarr and Ubbi, the sons of Ragnar Loðkbrok.

The following is a list of the kings of East Anglia of whom there is record:—Wehha; Wuffa; Raedwald, son of Tytil and grandson of Wuffa (reigning 617); Eorpwald, son of Raedwald (d. 627 or 628); Sigebert, brother of Eorpwald; Egric, brother of Sigebert (both slain before 644); Anna, son of Ene and grandson of Tytil (d. 654); Aethelhere, brother of Anna (d. 655); Aethelwald, a third brother; Aldwulf (succ. 663, d. 713), son of Aethelric and grandson of Ene; Elfwald, son of Aldwulf (d. 749); Hun Beonna and Albert; Aethelbert (792); Edmund (870).

After the death of Ragnar Loðkbrok's sons East Anglia was occupied by the Danish king Guthrum, who made a treaty with Alfred settling their respective boundaries, probably about 880. Guthrum died in 890. A later king named Eohric took up the cause of Aethelwald, the son of Aethelred I., and was slain in the fight with the Kentish army at the Holm in 905. A war broke out with King Edward the Elder in 913; in 921 a king whose name is unknown was killed at the fall of Tempsford, and in the same year the Danes of East Anglia submitted to Edward the Eider. From this time, probably, East Anglia was governed by English earls, the most famous of whom were Aethelstan, surnamed Half-King (932–956) and his sons, Aethelwold (956–962), and Aethelwine, surnamed *Dei amicus* (962–992).

See Bede, *Hist. Eccl.* (ed. *C.* Plummer, Oxford, 1896), ii. 5, 15, iii. 7, 8, 18–20, 22, iv. 3, 5, 23; *Saxon Chronicle* (ed. Earle and Plummer, Oxford, 1899), *s. a.* 823, 838, 866, 870, 880, 885, 890, 894, goj, 921; *Historia Brittonum* (ed. Mommsen, *Mon.* Germ. *Hist:* 1894), s. 59; H. Sweet, *Oldest English Tents,* p. 171 (1885). (F. *G.* M. *B.)*

EASTBOURNE, a watering place and county borough in the Eastbourne parliamentary division of East Sussex, England, 65¾ mi. S.S.E. of London by the Southern railway. Pop. (1938) 56,445 (augmented in the holiday season). Area 10 2 sq.mi. The long range of the South Downs terminates here in the lofty headland of Bcachy Head, 3 mi. S.W. of Eastbourne. Eastbourne once consisted of three parts—the village of East Bourne, a mile inland; South Bourne, lying back from the shore, and Seahouses, facing the beach. Owing to its modern extension, the part inland is now known as the Old Town. The church of St. Mary, a fine Transitional Norman building, is the ancient parish church of East Bourne. The marine parade, nearly 3 mi. long, is arranged in terraced promenades, and there is a pier with pavilion. There is a municipal orchestra. Hampden park (over 80 ac.) was acquired by the corporation; Devonshire park *(c.* 13 ac.) has recreation grounds and winter gardens. The principal buildings and institutions include the town hall, the corporation art gallery and technical institute, the Princess Alice Memorial and other hospitals and, among many high-class schools, Eastbourne college for boys, founded in 1867. The duke of Devonshire is one of the principal landowners, Golf links are laid out on the neighbouring downs, and Beachy Head is connected by a fine drive, which is continued through Birling Gap to the village of East Dean. which possesses an ancient Early English parish church with pre-Norman tower. The foundations of a Roman villa and other remains have been found at Eastbourne. The town was incorporated in 1883. The county borough was constituted in 1911, and the greater parliamentary division in 1918. The corporation consists of a mayor, 9 aldermen and 27 councillors. Eastbourne has its own commission of the peace and a separate police force. The council owns the electricity undertaking. At the end of 1941 air raids of World War II had damaged 3,700 houses.

EAST CHICAGO, a city of Lake county, Indiana, U.S.A., on Lake Michigan, adjoining Gary, Hammond and Whiting, and 20 mi. S.E. of the Chicago "Loop." It is served by the Baltimore and Ohio Chicago Terminal, The Chicago, South Shore and South Bend (electric), the Elgin, Joliet and Eastern, the Indiana Harbor Belt, the Pennsylvania, the New York Central, the Pere Marquette and the Wabash railways. Pop. 35,967 in 1920, of whom 14,663 were foreign-born white, and 54,637 in 1940.

East Chicago is one of the rapidly growing cities in the "Calumet region," an important manufacturing district. Indiana Harbor, the part of the city that lies along the lake, is connected with the Grand Calumet river by a 3m. ship canal. The commerce of the port in 1937 was 9,216,414 tons, consisting largely of incoming coal, iron ore and limestone, and shipments of gasoline and steel products. The city's factory output in 1937 was valued at $304,323,701. There are immense steel works and oil refineries and other important industries. The assessed valuation of property in 1940 was $86,131,860. East Chicago was founded in 1888; incorporated as a city in 1893. Its rapid growth began in the 20th century. Between 1900 and 1910 the population increased from 3,411 to 19,098, and, next decade, almost doubled.

EAST CLEVELAND, a city of Cuyahoga county, Ohio, U S.A., on the New York Central railroad, adjoining Cleveland. It is a rapidly growing residential suburb. The population increased from 2,757 in 1900 to 39,667 in 1930, and was 39,495 in 1940. It has a city-manager form of government.

EAST CONEMAUGH, a borough of Cambria county, Pa., U.S.A., on the Conemaugh river and the Pennsylvania railroad, 3m. N.E. of Johnstown. Pop. (1920) 5,256 (23% foreign-born white); 1930, 4,979; 1940, 4,810.

EASTER, the annual festival observed throughout Christendom in commemoration of the resurrection of Jesus Christ. The name Easter, like the names of the days of the week, is a survival from the old Teutonic mythology. According to Bede (De Temp. *Rat.* c. xv.) it is derived from *Eostre,* or *Ostâra,* the Anglo-Saxon goddess of spring, to whom the month answering to our April, and called *Eostur-monath,* was dedicated. This month, Bede says, was the same as the *mensis paschalis,* "when the old festival was observed with the gladness of a new solemnity."

The root *pasch,* from which so many other names for Easter are derived, is from the Hebrew *pisach* (Passover) from the verb form "he passed over."

There is no indication of the observance of the Easter festival in the New Testament, or in the writings of the apostolic Fathers. The sanctity of special times was an idea absent from the minds of the first Christians, who continued to observe the Jewish festivals, though in a new spirit, as commemorations of events which those festivals had foreshadowed. Thus the Passover, with a new conception added to it of Christ as the true Paschal Lamb and the first fruits from the dead, continued to be observed, and became the Christian Easter.

Although the observance of Easter was at a very early period the practice of the Christian church, a serious difference as to the day for its observance soon arose between the Christians of Jewish and those of Gentile descent, which led to a long and bitter controversy. The point at issue was when the Paschal fast was to be reckoned as ending. With the Jewish Christians, whose leading thought was the death of Christ as the Paschal Lamb, the fast ended at the same time as that of the Jews, on the fourteenth day of the moon at evening, and the Easter festival immediately followed, without regard to the day of the week. The Gentile Christians, on the other hand, unfettered by Jewish traditions, identified the first day of the week with the Resurrection, and kept the preceding Friday as the commemoration of the crucifixion, irrespective of the day of the month. With the one the observance of the day of the month, with the other the observance of the day of the week, was the guiding principle.

Generally speaking, the Western churches kept Easter on the first day of the week, while the Eastern churches followed the Jewish rule, and kept Easter on the fourteenth day.

A final settlement of the dispute was one among the other reasons which led Constantine to summon the Council of Nicaea in 325. At that time the Syrians and Antiochenes were the solitary champions of the observance of the fourteenth day. The decision of the council was unanimous that Easter was to be kept on Sunday, and on the same Sunday throughout the world, and "that none should hereafter follow the blindness of the Jews" (Socrates, *H.E.* i. 9). The correct date of the Easter festival was to be calculated at Alexandria, the home of astronomical science, and the bishop of that see was to announce it yearly to the churches under his jurisdiction, and also to the occupant of the Roman see, by whom it was to be communicated to the Western churches. The few who afterwards separated themselves from the unity of the church, and continued to keep the fourteenth day, were named *Quartodecimani,* and the dispute itself is known as the *Quartodeciman* controversy.

Easter day is the first Sunday after the full moon following the vernal equinox. This, of course, varies in different longitudes. A further difficulty occurred in the attempt to fix the correct time of Easter by means of cycles of years, when the changes of the sun and moon more or less exactly repeat themselves. At first an eight years' cycle was adopted, but it was found to be faulty, then the Jewish cycle of 84 years was used, and remained in force at Rome till the year 457, when a more accurate calculation of a cycle of 532 years, invented by Victorius of Aquitaine, took its place. Ultimately a cycle of 19 years was accepted, and it is the use of this cycle which makes the Golden Number and Sunday Letter, explained in the preface to the Book of Common Prayer, necessary. Owing to this lack of decision as to the accurate finding of Easter, St. Augustine tells us (*Epist.* 23) that in the year 387 the churches of Gaul kept Easter on the 21st of March, those of Italy on the 18th of April, and those of Egypt on the 25th of April; and it appears from a letter of Leo the Great (*Epist.* 64, ad *Marcian*) that in 455 there was a difference of eight days between the Roman and the Alexandrine Easter.

The ancient British and Celtic churches followed the cycle of 84 years which they had originally received from Rome, and their stubborn refusal to abandon it caused much bitter controversy in the 7th century between their representatives and St. Augustine of Canterbury and the Latin missionaries. These latter unfairly attempted to fix the stigma of the Quartodeciman observance on the British and Celtic churches, and they are even now sometimes ignorantly spoken of as having followed the Asiatic practice as to Easter. This, however, is quite erroneous. The British and Celtic churches always kept Easter according to the Nicene decree on a Sunday. The difference between them and the Roman Church, at this period, was that they still followed the 84 years' cycle in computing Easter, which had been abandoned at Rome for the more accurate cycle of 532 years. This difference of calculation led to Easter being observed on different Sundays, in certain years, in England, by the adherents of the two churches. To Archbishop Theodore is usually ascribed the credit of ending the difference in the rest of England in 669.

The Gregorian correction of the calendar in 1582 has once more led to different days being observed. So far as Western Christendom is concerned the corrected calendar is now universally accepted, and Easter is kept on the same day, but it was not until 1752 that the Gregorian reformation of the calendar was adopted in Great Britain and Ireland. Jealousy of everything emanating from Rome still keeps the Eastern churches from correcting the calendar according to the Gregorian reformation, and thus their Easter usually falls before, or after, that of the Western churches, and only very rarely, as was the case in 1865, do the two coincide.

Easter, as commemorating the central fact of the Christian religion, has always been regarded as the chief festival of the Christian year, and according to a regulation of Constantine it was to be the first day of the year. This reckoning of the year as beginning at Easter lingered in France till 1564, when, by an ordinance of Charles IX., the 1st of January finally took its place.

Four different periods may be mentioned as connected with the observance of Easter, viz., (1) the preparatory fast of the forty days of Lent; (2) the fifteen days, beginning with the Sunday before and ending with the Sunday after Easter, during which the ceremonies of Holy Week and the services of the Octave of Easter were observed; this period, called by the French the *Quinzaine de Piques*, was specially observed in that country; (3) the Octave of Easter, during which the newly-baptized wore their white garments, which they laid aside on the Sunday after Easter, known as *Dominica* in albis depositis from this custom; another name for this Sunday was Pascha *clausum,* or the close of Easter, and from a clipping of the word "close" the English name of "Low" Sunday is believed to be derived; (4) Eastertide proper, or the paschal season beginning at Easter and lasting till Whit Sunday, during the whole of which time the festival character of the Easter season was maintained in the services of the church.

The liturgical colour for Easter was everywhere white, as the sign of joy, light and purity, and the churches and altars were adorned with the best ornaments that each possessed.

Fixed Easter.—The Gospels record that our Lord celebrated the Passover on the Thursday, while Caiaphas and the Priesthood apparently celebrated it on the Friday, the day of the Crucifixion. As the Jewish day is counted from sunset to sunset there may be some explanation of the difference in this fact, but when the festival of Easter was established by the Church, there was a sharp controversy between those who celebrated the event on the 14th day and those who celebrated it on the 11th, the Quartodecimans, and the Quintodecimans (*v.* sup.), which led to much bloodshed.

The Council of Nicaea, held in A.D. 325, decided that Easter should be celebrated on a Sunday, but we are left with a method of fixing the date of Easter by which it can vary from year to year by no less than 35 days, between March 22 and April 25. The date is fixed in accordance with the tables prepared by Clavius for Pope Gregory XIII., when he reformed the calendar on Feb. 24, 1582, and is an attempt to reconcile the solar with the lunar year, on the Metonic system, with all the complications of the week, the month, the epact and an inexact calendar. The tables occasionally produce strange results. In 1923 the full moon of the heavens fell on the Sunday given by the tables for the celebration of Easter; and the Resurrection, going by the real moon, was being celebrated before the Crucifixion.

Proposals for Fixing Easter.—The inconvenience of an oscillating Easter is felt by all sections of the community, as school terms, university terms, law terms and the great holidays of Easter and Whitsuntide are all affected by a moving Easter. Chambers of Commerce, national and international, have since

1900 year by year passed resolutions in favour of a fixed date for Easter. At the International Congress of Chambers of Commerce held in Rome in 1923 such a resolution was re-affirmed and addressed to the Holy See. Not long afterwards the matter was referred to the League of Nations, and a conference was summoned at which the Roman, the Eastern Orthodox and the Anglican churches were represented, and it was agreed that there was a practically unanimous wish among the nations concerned that Easter should be fixed.

The Movement in Great Britain.--On April 27, 1921 Lord Desborough introduced a Fixed Easter bill in the House of Lords. Under this, Easter was always to be kept and observed on the second Sunday in April, which was the date in 1925. The three main arguments in favour of the date were: (1) That it is the nearest Sunday to the generally accepted date of the event which it commemorates; (2) that as the mean date of Easter for 100 years has been April 8.3, such a Sunday complies to the full with the requisition that any date selected should fall within the present limits of deviation, and (3) it divides the Christian year equally, and is a convenient date for the people.

As regards No. 1 it may be stated that, though the matter cannot be absolutely decided, the balance of opinion seems to be that the Crucifixion took place on Friday, April 7 A.D. 30, so calculating by Sundays, and in order to secure a date which can be very easily remembered, the second Sunday in April would appear to be an appropriate one, but it would be still more accurate to make Easter Sunday on April g, if that day were a Sunday, or on the Sunday following April 9. Certain ecclesiastical difficulties would then be avoided and there would always be 24 Sundays after Trinity, and the whole ecclesiastical calendar would be admirably fixed.

The supporters of the reform point out that the celebration of the Birth of our Lord was fixed in the 4th century by enactment for Dec. 25, thus consecrating the old Saturnalia of Rome to the new religion, and that, this having been done, there is no good reason why the celebration of the Death and Resurrection should vary 35 days in accordance with a fictitious moon.

In 1928 again the question of a Fixed Easter bill was raised in parliament and a referendum to various European countries was advised. As a result of the League of Nations Committee of 1923, the Easter Act was passed in England, Aug. 1928, fixing Easter day, conditionally upon international acceptance, as the first Sunday after the second Saturday in April. *(See* CHRONOLOGY.)

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EASTER ISLAND, also known as Rapanui or Te Pito te Henua, situated in 27° 10′ S. lat. and 109° 26′ W. long., about 2,000m. from the coast of Chile and 1,100m. from Pitcairn, the nearest inhabited island to the west, is the most easterly and most isolated outpost of the Polynesian race. It was probably sighted by Capt. Davis in 1687; but the first European to land was the Dutch admiral Roggeveen on Easter day, 1722, whence its name. The name *Rapanui* is recent, and its various other native names, including *Te Pito te Henua,* really referred to particular localities, not to the island as a whole. Its abundant and remarkable stone monuments, and its unique ideographic script incised on wooden tablets have been the subject of much speculation (sometimes of an extravagant kind). The number of the monuments and their size, the smallness of the island and of the population, never more than 5,000 or 6,000 and estimated at only half that number at the time of discovery, indicate an extraordinarily intensive application to the arts of masonry and sculpture. The successful transportation of the huge monolithic sculptures and their erection in places remote from the quarries where they were made, are unexplained.

Archaeology. — Archaeology is here concerned almost exclusively with stone remains, together with a few small objects in shell and bone. Such skulls as have been collected from graves show no traces of high antiquity. Easter island is destitute of metal objects and pottery, although clay suitable for potting occurs in the craters. The stone remains include houses, platforms, semi-pyramidal cairns, circular towers, cisterns, statues, rock-carvings, adzes or chisels, obsidian spear-heads and fish-hooks.

The most striking monuments are the burial platforms, called *ahu,* and the statues surmounting them. Some 260 platforms have been counted in varying degrees of preservation, fringing the coast in almost unbroken succession, while a few are also found inland. Only about 100 of these were intended to support images.

A typical image *ahu* consists of a wall parallel with the sea, measuring up to 300ft. in length and 15ft. in height, and buttressed to landward with a slope of masonry. The images stood in a single row facing inland on the central portion of the wall, which projected towards the sea, and a single *ahu* might contain from one to 15 statues. The maximum extension of the landward slope was about 250ft., and beyond this was a paved area. The masonry, of huge polygonal or rectangular blocks, is sometimes beautifully finished and fitted together, but is more often of rough material. These *ahu,* which were still used within living memory, served for the exposure of dead bodies and contained vaults for the subsequent burial of the bones. There are also a number of rough semi-pyramidal cairns, up to 12ft. in height, containing burial vaults; these appear to be of more recent construction than the *ahu.*

All the statues belonging to the *ahu* have now been thrown down, and many broken. But by the accounts of the early voyagers the greater number of them were standing in the 18th century, and Roggeveen refers to religious ceremonies which appeared to him to indicate worship of the statues. The *ahu* were sacred places, corresponding to the Polynesian *marae,* and some, if not all, of the statues were erected in honour of ancestors.

The statues were cut from compressed volcanic ash, a soft and easily worked stone. All conform to a single distinctive type, representing only the upper half of the body with an upturned face and long ears, but vary in height from 3 to 36 feet. One example has even been found in the quarry with a length of 66ft., but it had never been moved. The usual height of the images on the *ahu* was from 12 to 20ft., and they were surmounted by tall cylindrical hats or crowns (as much as 6ft. high and 8ft. in diameter) in proportion. These consisted of a red volcanic tuff and were quarried in a different crater from the statues.

The quarry for the statues was both inside and outside the large crater of the volcano called Rano-Raraku at the north-east end of the island; here they are found in large numbers and in all stages of completion, as though the work had been suddenly interrupted and never afterwards resumed. The sculptors worked in niches surrounding the statues and the carving was completed before the back was detached by undercutting. The stone chisels used were found in *situ* and are of two main types; the rougher kinds somewhat resembling a European palaeolithic "handaxe," occur in large numbers and were evidently employed for roughing out the contours of the figures. The finer kinds, of hard stone, are without shaped butts and resemble the adzes of western Polynesia and New Zealand more closely than eastern Polynesian types. The tanged spear-heads of flaked obsidian are peculiar to the island. Apart from the statues on the *ahu* and in the quarry, there are a large number standing about the slopes of Rano-Raraku facing westwards, others in isolated positions, and a series placed at intervals along an ancient processional road, running westward from the quarry for six miles. This road, and two others less distinctly visible, probably served for transporting the statues. It is about 10ft. wide and levelled by shallow cuttings and embankments.

The means of transporting the larger images, the heaviest of which must have weighed about 50 tons, have never been satisfactorily explained. But a native account states that they were dragged into position (presumably with ropes, the native hemp and hibiscus fibre furnishing adequate materials) and that round pebbles were placed underneath to serve as rollers. Seaweed may also have been used to minimize friction with the ground. The statues were probably erected on the *ahu* by being hauled up an incline of earth or stones and then gradually "up-ended" into position by withdrawing the supporting material from under their bases.

Habitations, though generally constructed of perishable materi-

als, were sometimes provided with wrought foundation-stones, resembling kerb-stones, sunk into the ground and provided with holes in their upper surface for inserting the wooden rods which provided the framework of the houses. Their ground plan was long, narrow and boat-shaped, and they were large enough to accommodate from ten to 30 persons. There are also remains of stone chicken houses, and of round chambered towers on the coast used as fishing look-outs. Natural caves were extensively used as habitations, and some have been supplemented by frontal walls.

Apart from these houses, there is one "sacred" village at the south-west corner of the island, called Orongo, situated in a romantic position on a narrow and precipitous ridge between cliff and crater. It contains 48 houses built entirely of stone, the only examples of their kind in Polynesia. They were roofed by partial corbelling and a flat capstone, over which earth was heaped. Their low and narrow interiors, illuminated only by small doors, were often decorated with designs and figures in colour.

This village was connected with a bird-cult (still remembered) which played an important part in native life. A leading feature was an annual competition to secure the first egg laid on an outlying islet by the migratory sooty tern. Orongo was occupied by the competitors, and the numerous rock-carvings in the vicinity depicting a bird-headed man, sometimes holding an egg in his hand, presumably commemorate the victors. The rock-carvings, some much weathered, also depict faces and geometric designs.

There can be little doubt that the stone structures of Easter island are the work of the ancestors of the present inhabitants (now reduced in numbers to about 250). The statues and platforms were actually in use at the time of discovery, and some of the sculptors' names are still remembered. But apart from traditional evidence, the occurrence of certain peculiar designs carved on the backs of some of the stone statues, as well as on small wooden figures of recent date, furnishes an unquestionable link between the culture of past and present.

Date of Settlement.—The date of the earliest settlers' arrival, their point of departure and the question whether there was more than one migration are still uncertain. Tradition states that the ancestors arrived, under a chief named Hotu Matua, in two canoes coming from the west, but supplies no clear evidence of previous inhabitants or of subsequent immigrations. On the basis of the shortest recorded genealogy of 22 chiefs descended from Hotu Matua this migration can hardly be assigned to a period later than the 14th century A.D., and although the monuments contain no evidence for accurate dating, their number and the weathered condition of many of them indicate an age of many centuries. On the other hand, there is no evidence of a succession of cultures.

Racial and Cultural Affinities.—Racially and linguistically there is no doubt that the Easter islanders are predominantly Polynesian, with a considerable negroid admixture. The skulls collected from graves supply corroborative evidence. It seems simpler to account for the negroid element by presuming that the racial intermixture occurred in Melanesia previous to the arrival of the settlers than by postulating an earlier migration of Melanesians to Easter island. Nevertheless Hotu Matua's migration may have been preceded by another, also of Polynesian stock, but with a stronger infusion of Melanesian blood and culture. This would help to explain the social dichotomy and clan antagonisms to which some of the traditions bear witness. Attention has also been called to a number of remarkable resemblances in the bird-cult and the art associated with it as between Easter and the Solomon islands; these seem almost to amount to proof of a special cultural affinity.

Script.—The "writing" engraved on wooden tablets, unique in Polynesia and first noted in 1864, is undoubtedly of considerable antiquity. It takes the form of pictographs (or ideograms), representing stylized figures of men, birds, fish, etc., arranged in the inverted position in alternate lines ("boustrophedon"), so that the reader of a tablet is obliged to turn it upside down at the end of each line. The figures seem to have served as mnemonic symbols and cannot be translated word for word. Some of the stories which the tablets record have been obtained from living natives, but the exact meaning of the symbols and method of interpretation have been lost, probably beyond hope of recovery. (H. J. Br.)

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EASTERN BENGAL AND ASSAM, a former province of British India, which was in 1905 constituted out of Assam and the eastern portion of Bengal, viz., the divisions of Dacca, Chittagong and Rajshahi (except Darjeeling, the district of Malda and the State of Hill Tippera [now Tripuna]). The capital was at Dacca. This province ceased to exist in 1912, when Assam was restored to its position as a separate province and the remainder of Eastern Bengal and Assam was retransferred to Bengal, which was created a presidency under a governor-in-council.

EASTERN QUESTION, THE. The expression used in diplomacy from about the time of the Congress of Verona (1822) to comprehend the international problems involved in the impending dissolution of the Turkish empire. Its use in this narrow sense is due to the conditions in which it was invented. In the early 19th century the Ottoman empire was still the only East with which European diplomatists were collectively brought into contact; for the questions of the Middle and Far East had not yet arisen.

The Eastern Question—though its roots are set far back in history: in the ancient contest between the cultures of Europe and Asia, the antagonism of Christian and Muslim, and the perennial rivalry of the Powers for the control of the trade routes to the Orient—dates in its modern sense from the treaty of Kuchuk Kainardji (1774), which marked the establishment of Russia as a Black sea power and formed the basis of her special claim to interfere in the internal affairs of the Ottoman empire. The actual right conceded was, however, very limited. Art. VII. of the treaty runs: "The Sublime Porte promises to protect firmly both the Christian religion and its churches; and also permits the Minister of the Imperial Court of Russia to make on all occasions representations in favour of the new Church in Constantinople, and of those who carry on its services." In view of later Russian claims, the wording of this article is important.

The compact between Napoleon and Alexander I. of Russia at Tilsit (1807) marked a new phase, which culminated in the Treaty of Bucharest (1812). By this instrument the Russian frontier was advanced to the Pruth and to the northern or Kilia branch of the Danube, and Russia's claim to intervene between the sultan and his orthodox subjects received a new sanction in Art. V., which confirmed "the contracts and conventions which had been counted among the privileges of Moldavia," and in Art. VIII., which stipulated for certain concessions to the insurgent Serbs.

The attitude of the various Powers in the Eastern Question was now defined. Russia, apart from her interest in the orthodox subjects of Turkey, aimed at owning or controlling the straits which were her only outlet to the Mediterranean and the ocean beyond. Austria, once the champion of Europe against the Turk, saw in Russia's advance a greater danger than any to be feared from the moribund Ottoman Power, and made the maintenance of Turkey's integrity a prime object of her policy; thus agreeing with Great Britain, whose traditional friendship with Turkey was strengthened by the rise of a new Power whose rapid advance threatened her communications with India and the stability of her rule there. But though Austria, Great Britain, and presently France, were all equally interested in maintaining the Ottoman empire, the failure of the Congress of Vienna (1815) to take action regarding the guarantee of Turkey[1] seemed to endorse Russia's claim to regard the Eastern Question as her "domestic concern" in which Europe had no right to interfere

[1] This was due to the sultan's obstinate refusal to ratify the Treaty of Bucharest. As Castlereagh put it, it was impossible to guarantee territories of which the boundaries were in dispute.

The Greek Revolt.—When, in March 1821, the news reached the Powers assembled at the Congress of Laibach that Prince Alexander Hypsilanti, a Greek officer in Russian service, had crossed the Pruth and raised the standard of revolt in the Danubian Principalities, it was feared that his claim to have Russian support was well founded. The Emperor Alexander I., however, yielding to Metternich's influence, repudiated Hypsilanti's action, and the revolt, unsupported by the Rumanian people, collapsed.

It was different, however, when, on April 2, Archbishop Germanos of Patras raised the standard of revolt in the Morea; here the Greek population rose en *masse,* massacred the Muslims and by September had completed the liberation of the peninsula by capturing the capital, Tripolitza. The revolt now spread north of the Isthmus, and, above all, to the Greek islands, whose loss—since they were the only recruiting grounds of the Ottoman navy—deprived Turkey of the command of the sea, thus frustrating all efforts to suppress the rising until the intervention of Mehemet Ali of Egypt at the end of 1824.

The unexpected success of the insurgents threatened to produce a European crisis; for the hideous reprisals of the Turks, culminating in the execution of the Orthodox Patriarch Gregorios (April 22, 1821), roused intense feeling in Russia and it needed the united effortsof Castlereagh and Metternich—who met at Hanover in October—to persuade the Emperor Alexander not to stultify his mission as the peace-maker of Europe by intervening in Turkey.

The accession of George Canning to office (Aug. 1822) made no immediate change in British policy; but in March 1823 he recognized the belligerency of the Greeks, in order to make their provisional Government responsible for their piracies. It was not, however, until Sultan Mahmud appealed to his vassal, Mehemet Ali of Egypt, to assist him with his trained army and fleet, that the Powers made any concerted effort to influence the situation.

The Emperor Alexander now proposed that the Powers should impose a settlement on the basis of Greek principalities tributary to the sultan. Metternich, who took this as implying an extension of Russian influence, countered by proposing an independent Greek State. A conference was summoned at St. Petersburg; but, as the majority favoured collective intervention, on a principle which Great Britain had always opposed, the British representative was withdrawn, and the meeting resulted in nothing but a futile offer of mediation (March 25, 1825).

Mehemet Ali Intervenes.—Meanwhile Ibrahim, Mehemet Ali's adopted son, had landed at Modon and begun the systematic conquest of the Morea. His fleet commanded the sea, and on land the Greek guerilla fighters had no chance against the trained Egyptian troops; only the heroic defence of Missolonghi (May 1825–April 1826) relieved the gloom of this terrible year. The death of the Tsar Alexander I. (Dec. 1, 1825), however, changed the European situation. His successor, Nicholas I., had begun his reign by quelling a serious mutiny of the troops, and a war with Turkey seemed an admirable way of restoring the morale of his army. A step in this direction was taken when, at the outcome of the Duke of Wellington's congratulatory mission to the new tsar (Jan. 1826), a protocol was signed at St. Petersburg under which Great Britain and Russia were to offer their mediation with a view to a settlement on the basis of tributary principalities, and if the mediation were rejected, the Powers might take action "jointly or separately."

Nicholas now sent an ultimatum to the Porte, demanding the execution of the terms of the Treaty of Bucharest; and since the sultan had just massacred the Janissaries (*q.v.*) Turkey could not resist. On Oct. 1 was signed the Treaty of Akkerman, which conceded all the Russian claims.

The Treaty of London.—This action of Russia, together with the barbarities of Ibrahim—who threatened to depopulate Greece and colonize it with fellaheen and negroes—stirred the other Powers to activity. A conference met in London and on July 6, 1827, the Protocol of St. Petersburg was turned into the Treaty of London. This treaty Austria and Prussia refused to sign, and the settlement of the Greek Question therefore passed into the hands of Great Britain, France and Russia, who engaged to procure the autonomy of Grerce under the sultan's suzerainty. There was to be no breach of friendly relations with Turkey; but should the sultan refuse mediation, the Powers were to send consuls to Greece. Meanwhile, an armistice was to be proposed to both sides, to be enforced by such means as might "suggest themselves to the prudence" of the contracting Powers. The readiest means seemed to be a "peaceful blockade" of Ibrahim in the Morea.

Navarino and the Russo-Turkish War.—On Oct. 20, in order to bring peaceful pressure on Ibrahim, who had rejected the armistice, Admiral Codrington sailed the allied fleet into the Bay of Navarino, where the Turco-Egyptian fleet lay at anchor. A chance encounter led to a general engagement and the total destruction of the Ottoman navy. The British Government tried to explain away this "untoward event"; but Sultan Mahmud refused to regard the demonstration as "peaceful," and proclaimed a holy war. The Emperor Nicholas seized the occasion and there followed the Russian invasion of Turkey, which ended with the Treaty of Adrianople (1829). The other Powers, meanwhile, feared that Russia would thus secure her influence over liberated Greece, and in July 1828 Britain, France and Russia signed the Protocol of London, by which France was entrusted with the task of ousting Ibrahim from the Morea. By the time the French troops arrived, however, this object had already been achieved by a naval demonstration by Codrington at Alexandria. By a protocol signed at London on Nov. 16, 1828, the conference placed the Morea and the Cycladees under the guarantee of the three Powers, this guarantee being extended on March 22, 1829—after General Church's victories over the Turks north of the Isthmus—to the mainland south of the line Arta-Volo and including the island of Euboea. These territories were to be erected into a tributary principality governed by a prince chosen by the Powers.

The Russian victory and the fact that the terms of the Treaty of London were embodied in the treaty of Adrianople led the other Powers to acquire merit by insisting on further concessions. On Feb. 3, 1830, a protocol of the London Conference settled that Greece should be an independent principality and be offered to Leopold of Coburg (afterwards King of the Belgians). Leopold having refused the honour another protocol laid down that Greece should be an independent sovereignty, extended the frontier to the line Arta-Volo and proposed Prince Otto of Bavaria as its ruler. King Louis of Bavaria accepted the offer on behalf of his young son, but stipulated that he should be king. This was agreed, and on May 13, 1832, another Treaty of London (antedated the 7th) was signed, placing the new Kingdom of Greece under the guarantee of the three Powers. (See GREECE: History.)

Revolt **of Mehemet Ali.**—The Greek question was still unsettled when a new phase of the Eastern Question was opened by the revolt of Mehemet Ali, pasha of Egypt. The immediate occasion, though not the pretext for his revolt, was the sultan's refusal to give him the pashaliks promised as the price of his intervention in Greece; he feared, too, that if he waited till the reform of the Turkish army was completed, he would share the fate of Hussein of Bosnia and Mustafa of Scutari, whom the sultan had crushed in the spring of 1831. On Nov. 1, 1831, accordingly, an Egyptian force entered Syria, met the fleet under Ibrahim at Jaffa, and at once besieged Acre. The garrison's resistance delayed the Egyptian advance; at Constantinople efforts were made to persuade the sultan to come to terms; and only in May 1833 was the ban of outlawry launched against Mehemet Ali. Meanwhile, Ibrahim had been pushing on. He had already occupied Gaza and Jerusalem before Acre fell (May 27). On June 15 he was in Damascus. On July 9 and 11 he defeated the Ottoman advance-guard at Homs and Hamah, and on the 17th crushed the main Turkish army, under Hussein Pasha, at the pass of Beilan. Pushing on into Anatolia, he gained a crowning victory at Konia over another Ottoman army under Reshid Pasha (Dec. 23), and advanced to Afium-Karahissar and Kiutayah. Nothing lay between him and Constantinople but the uncertain attitude of the Powers.

After the first defeats Sultan Mahmud, in his rage and despair, had turned first to Great Britain for aid. But, though Stratford Canning wrote from Constantinople, urging the necessity for upholding the sultan's authority even by arms, Palmerston was not prepared for an isolated intervention which would involve a breach

with France and Russia. The news that no active aid could be expected from England was followed by that of the disastrous defeat at Konia, which chanced to coincide with the arrival in Constantinople of a special Russian envoy, Count Muraviev, who at once renewed the tsar's previous offer of ships and troops to protect the capital. The sultan, in desperation, accepted, and on Feb. 20, 1833, a Russian squadron entered the Bosporus.

The French and British representatives had in vain tried to persuade Mahmud to reverse his fatal decision. They now agreed to take a new line, and induced the Porte to invite the Russians to withdraw by undertaking that France would persuade Mehemet Ali to accept the Sultan's terms. But the Emperor Nicholas sent peremptory orders for his fleet t9 remain until Ibrahim should have recrossed the Taurus mountains, and Mehemet Ali scornfully rejected the sultan's offers; he insisted on his full demands — Syria, Icheli, Aleppo, Damascus and Adana. The two Western Powers, intent on getting the Russians away, now pressed the Porte to yield; and, as the result of this combined pressure on both sides, and incidentally of a famine in the capital, an arrangement was reached. On April 8 was signed the Convention of Kutayah, under which all the Egyptian demands were conceded. The immediate result, for the Powers, was to throw Turkey wholly into the arms of Russia. Russia had given the sultan deeds, not words, and to Russia he committed himself. Before the Russian forces left there was signed in the palace of Unkiar Skelessi the famous treaty (June 8, 1833) which, under the guise of an offensive and defensive alliance, practically made Russia the custodian of the gates of the Black sea.

This temporary settlement was nowhere expected to prove permanent. Sultan Mahmud dreamed only of revenge, and engaged German officers — Moltke among them — to reorganize his army. The crisis came in 1838. In 1834 the Syrians had revolted against Mehemet Ali's tyranny; now the Arabs of the Hauran were in arms. The sultan, urging that he must rescue his subjects from oppression, could no longer be restrained, and on April 21, 1839, the Ottoman army invaded Syria, only to meet with a crushing defeat by Ibrahim at Nezib (June 23). Before the news reached Constantinople the old sultan died (July 1), leaving his throne to Abd-ul-Mejid, a lad of 16.

Finally, the news reached the capital that Ahmed Pasha, the Ottoman admiral-in-chief, had handed over his fleet to Mehemet Ali, on the pretext that the sultan's advisers were sold to Russia. So far as the Ottoman empire was concerned, Mehemet Ali was now master of the situation. He had, however, to walk warily.

At the outset these showed an apparently united front, the ambassadors of the five Powers on July 27 presenting a joint note to the Porte, in which they declared that an agreement had been reached in the Eastern Question and urged the Ottoman Government "to suspend all definite decision made without their concurrence." But the Powers were actually agreed only on the need for agreement. Britain, especially, insisted on this; for she feared isolated action by Russia under the Treaty of Unkiar Skelessi. Yet to preserve even apparent unity was almost impossible. France and Britain had hitherto acted together through fear of Russian designs, and Austria was now also reverting to her traditional policy of antagonism to Russia. Everything depended on the attitude of the Emperor Nicholas, and this was ultimately determined by his growing distrust of Austria and his hatred of the democratic régime in France. The first caused him to reject Metternich's proposal of a conference. The second led him to seek to loosen the Anglo-French *entente* by making direct overtures to Great Britain. In short, he announced through the Russian ambassador in London, Baron Brunnow, that he was prepared to accept the British views on the Turco-Egyptian question, to allow the Treaty of Unkiar Skelessi to lapse, and to act in the Ottoman empire only in concert with the other Powers, in return for an agreement closing the Dardanelles to the warships of all nations. Brunnow was empowered to arrange a coalition to settle the Egyptian question.

To this proposal all the Powers agreed, including France, and for nearly a year negotiations continued. In France public opinion violently supported Mehemet Ali's claims, while Palmerston believed that the Ottoman empire would never be secure until "the desert had been placed between the pasha and the sultan." The deadlock thus created developed into a crisis when, on Feb. 20, 1840, Thiers came into power in France. Not only did he reject a compromise which, on May 7, Guizot, as French ambassador, arranged with Palmerston, but it presently transpired that, without openly breaking with the concert, and without informing the other Powers, he was encouraging a "*direct* arrangement" between Mehemet Ali and the Porte. The discovery of what seemed an underhand intrigue by France to secure her "complete individual triumph" at Constantinople and Alexandria, led at once to a strong countermove from the other Powers, who on July 15, without the concurrence of France, signed with the Porte a Convention for The Settlement of the affairs of the Levant. By the instrument it was agreed that, the terms to be given to Mehemet Ali having been arranged with the Porte, the signatory Powers would force the pasha to accept them. If he yielded within ten days he was to receive the hereditary pashalik of Egypt, the administration of southern Syria for life and possession of the fortress of Acre. After ten days the offer of Syria was to be withdrawn, and after another ten days the sultan was to be free to take such action as his own interests and the counsels of his allies might suggest,

The news of this "mortal affront" caused immense excitement in Paris, and Thiers, declaring that the alliance with Great Britain was shattered, hurried on preparation for war. The immediate effect was that Mehemet Ali, confident of French assistance, maintained a defiant attitude. The unexpected outcome of the armed intervention of the Powers, however, soon changed the situation, The allied fleet, under Sir Charles Napier, had hardly appeared off Beirut (Aug. 11) when the Syrians rose in revolt against Ibrahim's tyranny. On Sept. 11, Suleiman Pasha not having obeyed the summons to evacuate the town, the bombardment of Beirut began. On Oct. 3 the town fell, and Ibrahim, cut off from his communications by sea and surrounded by a hostile population, began a hurried retreat. On Nov. 3, Acre surrendered to the allied fleet. The Legends of Mehemet Ali's invincibility and humane and enlightened rule were now pricked bubbles. The only question was whether he should retain Egypt,

Already, on Sept. 15, the sultan had, in accordance with the terms of the Convention of London, declared him deposed. But the news of this, and of the events in Syria, produced an exceedingly dangerous temper in France; there was loud clamour for war; and it looked as though the pacific Louis Philippe were faced by the alternative of war or revolution. To most of the British cabinet it looked as though concessions must be made to France for the sake of European peace. Therefore, when Guizot, on Oct. 8, presented to Palmerston what was practically a French ultimatum, "it was determined that this intimation should be taken in a friendly spirit," and that Palmerston should come to an agreement with the ministers of the other Powers jointly to persuade the Porte not to insist on depriving Mehemet Ali so far as Egypt was concerned. This did not at once stop the war fever in Paris; but Louis Philippe did not want war; the dismissal of Thiers, and the appointment of Guizot as foreign minister in the new Government under Marshal Soult, made for more moderate counsels, and by Dec. 4, the danger was past.

Nine days earlier Sir Charles Napier had appeared with the British squadron before Alexandria and had induced Mehemet Ali to submit to the sultan and restore the Ottoman fleet, in exchange for a guarantee of the hereditary pashalik of Egypt. Gentle pressure by the combined Powers on the Porte did the rest, On Feb. 13, 1841, the sultan issued a *firman* appointing Mehemet Ali hereditary pasha of Egypt, a second *firman* of the same date investing him with the government of Nubia, Darfur, Kordofan, Sennaar and their dependencies.

The Crimean War. — The Russian policy, initiated in 1829, of maintaining the integrity of Turkey while practically treating her as a vassal state, ended in 1841; the Emperor Nicholas reverted to the idea of expelling the Turks from Europe. The Eastern Question, however, slumbered for a while, the European Powers being fully engaged with the troubles which culminated in the revolutionary movements of 1848–49. In 1850, however, a new and fateful phase developed. Under the capitulations *sf*

1740 France held the right to protect the Catholics in Turkey and the guardianship of certain holy places in Palestine. These rights had been in abeyance since the French Revolution, and Russia had assumed the guardianship of the holy places. But Louis Napoleon, now Prince President of the French Republic, desiring to conciliate the clergy and to increase his prestige, instructed his ambassador in Constantinople to demand the restoration of French property and rights in the holy places. The Porte appointed a mixed commission to enquire into the matter; but since France objected to any documents being considered of later date than 1740 (which would have excluded the Treaty of Kuchuk Kainardji) and Russia peremptorily demanded that no change should be made, no mutually satisfactory solution was possible; and on Nov. 4, 1851, the British ambassador, Stratford Canning, reported to his Government that the question had "assumed a character of extreme gravity." It had developed into a struggle between France and Russia for influence in the East.

In vain the Ottoman Government suggested various compromises. Napoleon, now Emperor of the French, needed a war, and the Emperor Nicholas' refusal to recognize him as an equal embittered him against Russia. Nicholas, too, thought the moment opportune for carrying out his plans for ousting the Turks. He believed that he could rely on the neutrality of Austria, out of gratitude for his assistance to her in crushing the Hungarian insurrection in 1849. Great Britain's benevolence seemed to be assumed when the pacific Lord Aberdeen became prime minister in Dec. 1852. The tsar even revived his earlier idea of an arrangement with Great Britain for the partition of Turkey. In the famous conversations (Jan. 9 and 14, 1853) with the British ambassador at St. Petersburg, Sir Hamilton Seymour, he spoke of Turkey as the "Sick Man," and gave his ideas as to the disposal of his inheritance: the Balkans should be divided into a series of Christian States, Great Britain receiving compensation in Egypt, Cyprus and Crete. The comment on this by Lord John Russell, on behalf of the British Government, was to deny that Turkey was sick, and to insist that the whole question must be settled by general agreement. But Nicholas was deceived by the hesitations of Aberdeen, who was hopelessly divided between his fear of Russia and his dislike of the Turks; he was deceived, too, by his ambassador, Baron Brunnow, who reported that in England the pacifist influence of Bright and Cobden was supreme. Accordingly, after ordering the mobilization of his forces, he despatched Gen. Menshikov to Constantinople with an ultimatum demanding the preservation of the *status* quo as regarded the holy places and Russia's right to protect Christians in Turkey.

Menshikov, a blustering soldier, reached Constantinople on April 19, but the crisis was delayed by the diplomacy of Lord Stratford de Redcliffe, the British ambassador, who persuaded the Porte to yield respecting the holy places, but to resist the demand for a protectorate over the Christians.

On May 5, arguments and threats having failed, Menshikov presented the ultimatum; on the 22nd the Porte rejected it. This meant war, and on June 22 the Russians crossed the Pruth and proceeded to occupy the Principalities.

This was met by a collective protest of the Powers, and Austria concentrated her forces on the Serbian frontier. In these circumstances Russia agreed to a conference, which met at Vienna in August. The four points on which the other Powers insisted were: (1) the substitution of an international for a Russian protectorate of the Principalities; (2) freedom of navigation on the Danube; (3) maintenance of the integrity and independence of Turkey, and (4) renunciation by Russia of her claim to protect the orthodox subjects of Turkey. The conference drafted a convention, to be proposed to Russia by the Porte, confirming the rights granted by the treaties of 1774 and 1829 and by the *firmans* recently issued, and conceding to the orthodox rite a share in all privileges, etc., granted to other Churches under the Capitulations. Russia accepted this on condition that no modifications were made "under bellicose influences." But when, on Aug. 19, the Porte accepted the draft, it was with an amendment reserving to the sultan the right to protect the Christians. This amendment the tsar refused to accept; and, since this seemed to show that he intended to press his extreme claims, the British fleet was ordered to pass the Dardanelles, ostensibly to protect the sultan from the danger of a Muslim rising. The British Government announced that no aggressive action would be taken unless the Russians crossed the Danube or attacked an Ottoman port on the Black sea. The immediate *casus belli* which opened the Crimean War was the destruction by the Russian fleet of an Ottoman squadron in the harbour of Sinope on Nov. 3, 1853. On Jan. 3, 1854, a combined British and French squadron entered the Black sea; it was not, however, till March 27 that France and Great Britain declared war against Russia.

The Russians now advanced into the Balkan peninsula, but on June 3 an Austrian ultimatum forced them to retire not only from the Balkans, but from the Danubian Principalities which Austria occupied. Although the immediate menace to Turkey was thus removed, the Allies determined to continue the war and to secure the acceptance of the Four Points, and on Sept. 14 their combined armies landed in the Crimea. (See CRIMEAN WAR.) The initial disasters of the war bent the stubborn resolution of the "Iron Tsar," and on Nov. 28, strongly urged by Frederick William IV. of Prussia, he consented to accept the Four Points. It was too late. The successes of the Allies were bringing them fresh strength. On Dec. 2 Austria signed with them a formal defensive alliance, and in Jan. 1855 Cavour's determination to secure a position for the Kingdom of Sardinia in the councils of the Powers brought the Piedmontese into the Allied camp. On March 2 the Emperor Nicholas died, and the succession of Alexander II. seemed to promise peace. Conferences were resumed at Vienna; but honour and prestige were involved on both sides, and the war dragged on. The fall of Sevastopol (Sept. 9) might have been taken as decisive, but it was not till December that an Austrian ultimatum persuaded the tsar to yield. The terms of peace were to be settled by a congress in Paris.

The Treaty of Paris was signed on March 30, 1856. By this instrument the Eastern Question seemed to be settled, in the sense desired by the Allies. By the cession of a portion of Bessarabia, Russia was thrust back from the mouths of the Danube, of which the navigation was declared free; Russian naval power was destroyed in the Black sea, which was made neutral; the right of Russia to intervene in Turkey was formally repudiated, and the Ottoman empire, in return for elaborate promises of reform, was admitted to the concert of the Powers. Wallachia and Moldavia, with their existing privileges, were placed under the collective guarantee of the Powers, while remaining under the suzerainty of the Porte. It was not till three years later that the union of the Rumanian nation was accomplished by the election of John Alexander Cuza as prince in both principalities.

The Russo-Turkish War, 1877–78.—It was to be expected that Russia would seize the first opportunity of repudiating the humiliating terms thus imposed upon her. This came in 1870, and she took advantage of the collapse of France to denounce the Black sea clauses of the Treaty of Paris. The action of the Conference of London in regularizing this proceeding prevented any immediate critical developments. But though for five years longer the Eastern Question was to remain quiescent, beneath the surface it was exercising a strong and disturbing influence on the relations of the Powers. In spite of the League of the three Emperors, founded in 1872, Austria and Russia were once more hatching rival plans of aggression in the East: Russia was determined to seize the first opportunity for recovering the lost strip of Bessarabia and so removing the last tangible results of the Crimean War; while Austria, encouraged by Bismarck—who wished to reconcile her to her depositions as a German Power—was hoping to find in the Balkan peninsula compensation for her losses in Italy and Germany. Behind the Russian policy was the Pan-Slav ideal, which Russian agents were busy propagating among the Balkan peoples; behind the Austrian policy was the conviction that Serbia was already aspiring to play the part played by Piedmont in Italy, and to become the head of a Southern Slav empire built up out of the ruins of the Austrian and Ottoman empires. If the rivalry between Russia and Austria did not lead to a breach, this was because Russia saw that in the event of

war Germany would have to support Austria, now once more regarded as the bulwark of Germanism against the Slavs, while Austria feared that such an alliance would merely add to the overgrown power of Germany. As for Bismarck, who was preoccupied by the reviving power of France, the last thing he wanted was a war with Russia. It was such considerations as these which determined the attitude of the three Powers when the next critical phase of the Eastern Question began.

It opened in July 1875, when the Christian Slavs of Hercegovina rose against Turkish misrule. The failure of the Turks to suppress the insurrection and the consequent danger of a general conflagration led to the intervention of the Powers, and on Dec. 30, 1875, Russia, Germany and Austria-Hungary agreed to the terms of a joint note, drawn up by Count Andrássy, for presentation to the Porte. This declared that the time had come for joint action to compel Turkey to translate her promises of reform into acts. It demanded the formal recognition of the equal status of the Christian religion, and certain reforms in Bosnia-Hercegovina which were to be watched over by a mixed commission of Christians and Muslims. Great Britain and France having adhered, the "Andrássy Note" (*q.v.*) was presented to the Porte on Jan. 31, 1876.

The sultan, as usual, promised everything and performed nothing. Meanwhile the revolt spread. In May the signs were ominous; Serbia was arming, and Prince Milan gave the command of his troops to the Russian general Chernayev; Montenegro also was arming. The three emperors thought it time to take action, and on May 13 signed the Berlin Memorandum, which proposed combined action of the fleets, the enforcement of a two months' armistice, and further action if no settlement were reached. This broke down on the opposition of Great Britain, Disraeli arguing that it would only encourage the insurgents to go on. On May 24 the British fleet was ordered to Besika bay, for the defence of Turkey in case of need. On June 30 Serbia declared war on Turkey, and on July 2 Montenegro followed suit. On July 8 the Emperors Alexander II. and Francis Joseph met at Reichstadt and signed a convention defining the policy of Austria and Russia. There was to be no intervention so long as the contest was undecided. In the event of the defeat of Serbia, the two Powers would combine to preserve the status ***quo***. In the event of her victory, Austria-Hungary was to receive Bosnia-Hercegovina and Russia the ceded portion of Bessarabia. This agreement, which was significant in the light of later events, secured the neutrality of Austria-Hungary during the forthcoming Russo-Turkish War.

Meanwhile a fresh complication had arisen. In May the Bulgarian peasants had also risen and massacred many Turkish officials. The Turks, on their march northwards against the Serbs, took horrible vengeance, and the news of the "Bulgarian atrocities" caused immense excitement in England, and more especially in Russia. The Serbs, too, were soon in danger of being overwhelmed, and it was only a Russian ultimatum that prevented the Turks from advancing on Belgrade. In August the British Government, which wished to prevent the isolated action of Russia, persuaded Prince Milan of Serbia to ask for the mediation of the Powers, and took advantage of this to urge the Porte to come to terms with the Serbs and Montenegrins, for fear of a worse thing. This attempt at mediation, however, broke down at the obstinacy of both the Serbs and Turks. The Serbs were feeling increasingly certain of Russian support; as for the Turks, the deposition of Sultan Abd-ul-Aziz in May, and of his imbecile successor Murad in August, had infused a new spirit into their government; for the astute and ruthless Abd-ul-Hamid II. was now sultan. His policy was to pose as a reformer, and, for the rest, to procrastinate in the hope of splitting the European concert. He countered a British proposal for a comprehensive scheme of reforms in the Ottoman empire, to be embodied in a protocol concluded between the Porte and the Powers, by issuing an elaborate scheme himself (Oct. 12) But the patience of Russia was now exhausted; on Oct. 1j Gen. Ignatiev arrived in Constantinople, and on the 31st presented an ultimatum demanding the conclusion of an armistice with Serbia within 48 hours. On Nov. 2 the Porte yielded, and the field was cleared for fresh diplomatic action. On the 4th, Lord Derby proposed a conference at Constantinople on the basis of the integrity of Turkey. All the Powers accepted: but on the 8th the Emperor Alexander declared publicly that, if the Powers did not at once take effective measures in concert to enforce reforms, he would act alone.

The conference opened on Dec. 31, but it was soon clear that the Porte had no intention of accepting its decisions. On the 11th a constitution for the Ottoman empire was solemnly proclaimed, and the Porte rejected the demands of the conference on the ground that they must now be submitted to the new parliament. The case foreseen by the tsar had now arisen; the conference had proved abortive; and when on March 19, 1877, the new Turkish parliament met, almost its only act was to reject the demands presented by Russia. On April 24 Russia declared war.

The events of the war are described elsewhere. (*See* RUSSO-TURKISH WARS.) So far as the relations between the Powers were concerned, the most critical period was after Gen. Gurko's capture of Adrianople (Jan. 20, 1878), when the Russian advance threatened Constantinople and the straits. The British Government on Jan. 14 warned the tsar that any treaty between Russia and Turkey which might affect the engagements of 1856 and 1871 "would not be valid without the assent of the Powers who were parties to those treaties," and on the 23rd the British fleet was ordered to Gallipoli. On the 31st the preliminaries of peace between Russia and Turkey were signed at Adrianople, the terms of the armistice allowing the Russians to advance to within a few miles of Constantinople. The Grand Duke Nicholas now pushed forward to the lines of Chataldja; whereupon the British fleet was ordered to enter the Sea of Marmora. The situation was now extremely critical, for Austria-Hungary declared the terms of the Convention of Adrianople to be inconsistent with her interests, and it soon became clear that the only way of peace lay through a European congress. On Feb. 5 Count Andrássy formally invited the great Powers to a conference, and Russia, which was in no condition to continue the war with Great Britain and Austria ranged against her, had perforce to agree.

Before the final arrangements for the congress could be made, however, the Convention of Adrianople was converted into the Treaty of San Stefano (March 3). This seemed to realize the worst fears of the Powers. In default of the payment of a huge war indemnity, Turkey was to cede to Russia, Batum, Ardahan and Kars in Asia, and the Dobruja in Europe—this latter to be exchanged with Rumania for Bessarabia. Serbia, Rumania and Montenegro were to be independent States, Bosnia and Hercegovina were to receive autonomous institutions under the joint control of Russia and Austria-Hungary; above all, Bulgaria was to be erected into an autonomous principality, stretching from the Danube to the Aegean and embracing Eastern Rumelia and Macedonia, and its prince was to be advised for two years by a Russian commissioner supported by an army of occupation.

The news of the conclusion of this treaty, which seemed not only to bar Austrian advance in the Balkans but to be fatal to British interests by giving Russia a crushing preponderance in the East, again brought war very near. But in the end the strong representations of the Powers, backed by the diplomacy of Bismarck persuaded the tsar to consent to submit the treaty to the approaching congress.

This met in Berlin on June 13 and, after heated debates, arrived at a definite settlement a month later. By the Treaty of Berlin, signed on July 13, 1878, the terms of the Treaty of San Stefano were greatly modified. (See BERLIN, CONGRESS AND TREATY OF.) Its signature was hailed in Great Britain as a great diplomatic victory; the preponderance of Russia in the East had been checked; and Lord Beaconsfield boasted that he had secured "peace with honour," but the treaty represented, in fact, the starting-point of the latest and most disastrous phase of the Eastern Question which culminated in the World War.

Three new sovereign States were created by the treaty, Rumania, Serbia and Montenegro, but in the case of the former two at least the boundaries assigned to them left them bitterly dissatisfied. Rumania resented the enforced cession of Bessarabia to Russia in exchange for the less desirable Dobruja, and was

bound sooner or later to cast covetous eyes on Transylvania with its preponderantly Ruman population. Serbia mas in even worse case. She received indeed an increase of territory, at the expense of Bulgaria, but other terms of the treaty seemed to have been specially devised to make her dream of a Southern Slav union for ever unrealizable; for the Sanjak of Novi Pazar, which was to be garrisoned by the Austrians but still administered by the Turks, cut her off from Montenegro, while the permission given to Austria-Hungary to occupy and administer Bosnia-Hercegovina gave the Habsburg Monarchy what seemed likely to prove a permanent foothold in the Balkan peninsula. The foreign trade of Serbia (mainly pigs), cut off from access to the sea, was placed almost wholly at the mercy of Austria.

The Union of Bulgaria.— The most fateful of all the provisions of the treaty, however, was the splitting up of the greater Bulgaria created by the Treaty of San Stefano; for this not only kept the Balkan peninsula in a ferment for go years, but opened up a new problem, that of Macedonia, which was left to Turkey and, inhabited as it was and is by an inextricable mixture of races, was to become a bone of contention between Greeks, Serbs and Bulgarians (see MACEDONIA). As for Bulgaria herself, the artificial severance of East Rumelia could not long endure, and after a period of agitation on both sides of the Balkans, Prince Alexander accepted the offer of the crown of united Bulgaria (Sept. 20, 1885). Union was opposed by Russia, whose efforts to dominate the councils of Bulgaria had been frustrated by Alexander and his ministers, and for this very reason Great Britain now favoured the union, since she saw in a strong Bulgaria the best possible obstacle to the extension of Russian power. Austria-Hungary, on the other hand, had no wish to see a strong barrier erected between her and the coveted seaboard on the Aegean, and Serbia, more especially, resented a growth of Bulgarian power which threatened her own ambitious plans. This led to the Serbo-Bulgarian War of Nov. 1885, and when Prince Alexander crushed the Serbs at the battle of Slivnitsa, Austria-Hungary interposed to save Serbia from extinction. British influence at Constantinople, however, obtained from the sultan the formal recognition of the union of the Bulgarias. But the breach between Prince Alexander and the tsar was irreparable, and led to the abdication of the prince (Sept. 7, 1886) and the election of Prince Ferdinand of Coburg in his place. The new prince, who had been an Austrian cavalry officer, was not acceptable to Tsar Alexander III., who refused to recognize him; strained relations continued between Bulgaria and Russia; and it was not till 1898, under Tsar Nicholas II., that the two courts were reconciled. (See BULGARIA: History.)

The Greek War, 1897.—The union of Bulgaria had aroused among the Greeks too much excitement and heart-burning; the Cretans proclaimed their union with the kingdom; and only a blockade by the Powers prevented Greece from declaring war on Turkey. The crisis was thus tided over for the time; but in 1894 a secret society known as the Ethnikk Hetaireia (National Society) was founded, among whose objects were the union between the Greek islands and the kingdom, and the encouragement of the Greek movement in Macedonia, in order to prevent its absorption in Bulgaria. When, in 1896, the Cretans again revolted, the influence of this society was enough to compel King George of Greece to take up their cause. The naval forces of the Powers forced the submission of the Cretans to the arbitrament of Europe; but on the mainland the excitement continued; Greek irregulars were raiding into Thessaly; and in April 1897 the sultan, encouraged by the German emperor, declared war on Greece. The result was not long in doubt. The Greeks were no match for the Turkish forces, reorganized by German officers, and but for the Powers who imposed an armistice on both combatants (May 20), their ruin might have been complete. As it was, the war was a disaster for Greece. It discredited the dynasty, and by the terms of the peace treaty, signed in December, Greece had to cede a strip of Thessaly and pay a huge war indemnity. (See GREECE: History.) One gain, however, was made. Though Germany and Austria-Hungary had seceded from the European Concert in the Eastern Question, and in spite of the critical situation as between France and Great Britain arising out of the Fashoda incident (see AFRICA; FASHODA; SUDAN), France, Great Britain and Russia had continued to act together in the Cretan question, had forced the Porte to withdraw its officials from the island, and on Nov. 14, 1897, had invited Prince George of Greece to act as high commissioner.

German Influence in Turkey.— The breach in the Concert of Europe in the Cretan question was significant of profound changes in the grouping of the Powers. So far as the Eastern Question was concerned, a new factor of supreme importance had been introduced. Germany, so long as Bismarck was in power, had maintained a disinterested attitude so far as she herself was concerned, though she had consistently encouraged the eastward expansion of Austria. But with the accession of the Emperor William II. came a change of policy, the opening of which was marked by the State visit paid by the emperor and empress to Sultan Abd-ul-Hamid in Nov. 1889. More than 50 years earlier Moltke had pointed out the opportunities offered by Asia Minor for German exploitation, and the immediate object of the emperor was to forward German economic penetration, and for this and other purposes to establish his influence in Constantinople. His opportunity came in 1894, when the Turks, in their determination to stifle yet another incipient national revolt, began a systematic massacre of the Christian Armenians. All Europe stood aghast at these horrors, repeated year after year. By Art. LXI. of the Treaty of Berlin the Porte had undertaken to carry out reforms in the Armenian provinces, under the superintendence of the Powers; and a special responsibility attached to Great Britain in this matter under the secret treaty which had secured her Cyprus. But even without the despairing appeal of the Armenians to treaty obligations which had never been fulfilled, public opinion in England would have forced the British Government to take some action, and in 1896 Lord Salisbury induced the other Powers to unite in urging upon the Porte the carrying out of the promised reform. Since, however, these representations were not followed up by acts, the sole result was to alienate the Turks from Great Britain, and throw them into the arms of Germany. From Berlin there came, not protests, but a signed photograph of the emperor and his family as a birthday gift for the sultan. That was in 1896. The success of the German-trained troops in 1897 was followed in 1898 by a congratulatory visit of the emperor to Constantinople. The imperial pilgrimage to the Holy Land and Syria followed. It was inspired by a mixture of orthodox piety and *Realpolitik,* and was crowned on Nov. 8 by a speech at Damascus in which the emperor declared that he would at all times be the friend of the Sultan Abd-ul-Hamid, and of the 300 million Mohammedans who reverenced him as caliph. This, according to Pastor Friederich Naumann, was said with an eye on the time when a world war would break out, when the Caliph of Islam would once more raise the standard of a holy war and summon Egypt, the Sudan, East Africa, Persia, Afghanistan and India to war against England. The immediate outcome of the emperor's visit to Constantinople was more tangible: the concession of the port of Haidar-Pasha to the "German Company of Anatolian Railways." The idea of directing German capital and German emigration towards Asia Minor and Mesopotamia had takep definite shape. In 1902 it received a further development in the conclusion of a convention for the building of a railway from Constantinople to Baghdad. The contemplated extension of this line to Basra would have linked up Hamburg and Berlin with the Persian gulf, turned the flank of the British trade routes to the East, and secured the economic, if not the political, domination of Germany in the Ottoman empire. The ultimate idea, partly realized on paper during the World War, was the creation of a great Central European Customs Union, forming an "economic area" stretching from the Baltic to the Persian gulf, as a counterpoise to the United States and the British empire. (See Gratz and Schiiller, The Economic Policy of Austria-Hungary during the *War,* Eng. trans., 1927).

The Macedonian Question.--Meanwhile the question of what was to be done with Macedonia had become acute. All the

new Balkan States claimed the reversion of the lion's share of that country of inextricably mixed races, and in order to substantiate their respective claims Greeks, Serbs and Bulgars were busy exterminating each other. The efforts of the Turks to maintain order were worse than useless, and merely led to armed revolts. In 1903 a serious insurrection of Macedonian Bulgars led to the intervention of the Powers; Austria and Russia agreeing on the so-called Miirzsteg Programme, reluctantly accepted by the Porte, under which the three *vilayets* of Monastir, Salonika and Kosovo were placed under the supervision of Austrian and Russian civil agents and their gendarmerie was organized and commanded by officers appointed by the Powers. The experiment, which had but poor success, came to an end in 1908 with the breach of the *entente* between Russia and Austria and the attempt to substitute for it an Anglo-Russian programme was frustrated by the revolution in Turkey.

The Young Turk Revolution.—This revolution, by which in 1908 Abd-ul-Hamid and his régime were overthrown, made a profound change in the general situation. The programme of the Committee of Union and Progress, which had carried out the coup, appealed to the sentiment of Europe, which welcomed the birth of a liberalized Turkey, established on the basis of nationality without distinction of creed. It was soon clear, however, that the new liberalism was make-believe, while the new nationalism threatened to be more intransigent than the old Ottoman overlordship. The whole elaborate system of shams by which diplomacy had sought to disguise the disruption of Turkey was especially threatened; for in the new unified and Europeanized State there would be no room for provinces "occupied and administered" by foreign Powers, like Bosnia-Hercegovina (or possibly Egypt), or for "vassal" states like Bulgaria. Therefore, in order to forestall any attempt of a regenerated Turkey to reclaim what it considered its own, those interested took action. On Oct. 7, 1908, the Emperor Francis Joseph issued a rescript annexing Bosnia-Hercegovina to the Habsburg monarchy. Two days earlier Prince Ferdinand of Bulgaria had proclaimed his independence and assumed the title of king (tsar). In July 1909, after the withdrawal of the allied forces, the Cretans proclaimed their union with Greece, though the caution of King Constantine, disallowed this for the time being.

The Italian-Turkish War, 1911.—The annexation of Bosnia-Hercegovina, which had only been possible owing to the weakening of Russia in the war with Japan, revealed the breakup of even the pretence of a Concert of Europe in the Eastern Question. Here too the division of Europe between the Triple Entente and the Triple Alliance made itself felt. Russia and France joined in the protest of Great Britain against the annexation of Bosnia-Hercegovina as a violation of the treaties and a blow to the very foundations of international iaw; but the German emperor proclaimed his readiness to support his ally "in shining armour" and the protest began and ended in diplomatic notes.

The attitude of Italy was more doubtful. Though a member of the Triple Alliance, she resented the strengthening of Austria's position on the opposite coast of the Adriatic; for the rival ambitions of the Italians, the Serbs and the Habsburg monarchy were now adding an Adriatic question to all the others. Then, too, there was the question of Tripoli, the last remnant of the Ottoman empire in northern Africa still available for Italian expansion. The reversions of this had been reserved for Italy when France had occupied Tunis, but the disquieting activities of the Emperor William II. led to suspicions of German designs upon it. The result was a rapprochement between Italy and Russia, advertised in Oct. 1909 by the proposal of the Tsar Nicholas II. to pay a State visit to Rome.

The alarms of Italy were increased by the Agadir incident of July 1911, and she determined to take action at once. On Sept. 27, an Italian ultimatum was presented to the Porte demanding its consent to an Italian occupation of Tripoli under the sovereignty of the sultan; on the 29th she declared war on Turkey. But for fresh developments in the Balkans the war which followed might have dragged on indefinitely. But threatened by a new and more instant danger, the Porte suddenly came to terms. By the Treaty of Lausanne (Oct. 18, 1912), Tripoli, Rhodes and the Dodecanese archipelago were, under a thin disguise, ceded to Italy, which thus also obtained a foothold in the Aegean and was brought into conflict with Greek aspirations.

The Balkan League and Balkan Wars, 1912–13.—The new danger to Turkey which led to the hasty conclusion of the war with Italy was the formation of the often mooted league of the Christian States of the Balkan peninsula. In view of their clashing interests, especially in the matter of the reversion of Macedonia, such a league might well have seemed impossible; but the Young Turk revolution, with its threat of a revived spirit of Ottoman national aggression, drew them together, and the rapprochement was encouraged by the split in the concert of the Great Powers. The first step was the conclusion, on March 13, 1912, of a defensive alliance between Serbia and Bulgaria, in which they agreed to take common action in the event of an attack by a great Power upon Turkey and defined their respective claims in Macedonia. A military convention was also signed on May 29.

Meanwhile Greece too had, on May 10, concluded a defensive alliance with Bulgaria, though no mention was made in the treaty of Macedonia, and the Bulgarians, in the event of war arising out of the admission of the Cretan Deputies to the Greek parliament, only bound themselves to observe a benevolent neutrality. This treaty, too, was followed by a military convention (Sept. 22).

The crisis was provoked by a serious rising against the Young Turk régime in Albania. The movement rapidly spread into Macedonia; and the Albanians, flushed with victory, demanded the cession to them of the *vilayets* of Monastir and Skoplie, which Greece and Serbia had earmarked respectively as their own. Clearly, if their ambitions were to be realized, it was time for the new Balkan League to intervene. Bulgaria, violently excited by the news of a terrible massacre of Macedonian Bulgars by the Turks, was more than willing to take part. The Powers, appealed to by the League to join in demanding a drastic system of reforms in Macedonia, united only in urging concession upon the Porte and patience on the members of the League; and, when preparations for war continued, they contented themselves with threatening the Balkan States that, if they went to war, the Powers would see that they gained nothing by it. In view of the dislocation of the European Concert it seemed safe to ignore these warnings, and on Oct. 12 Montenegro declared war on Turkey.

The story of the Balkan wars is told elsewhere. (*See* BALKAN WARS.) Here it must suffice to note their outcome. The unexpected collapse of the Turks created a wholly new situation which forced the intervention of the Powers. On Dec. 3, 1912, an armistice was concluded, and on the 13th a conference of the belligerent States met in London to settle terms of peace, the ambassadors of the five Great Powers sitting simultaneously to watch over and direct the settlements. (*See* LONDON, CONFERENCES OF.) The conference broke up on Feb. 1, 1913, as the result of Enver Pasha's coup *d'état* of Jan. 23 which led the Balkan States to denounce the armistice. But one thing it had accomplished. It had been agreed by the Powers that Albania should be erected into an independent principality, and that Scutari should be placed under its sovereignty. Thus, so long as Austria-Hungary held the Dalmatian coast, Serbia would be effectually cut off from the Adriatic seaboard and forced into rivalry with Bulgaria and Greece for access to the coast of the Aegean at Salonika. This would lead to the breakup of the Balkan League, which threatened to be a barrier to the eastward pressure of the Central European Powers.

The Treaty of London, signed on May 30, 1913, under the mediation of the Powers, proved less a settlement than the cause of fresh dispute. Crete and all Turkey in Europe beyond the line Enos-Midia were ceded to the Balkan allies; the question of Albania and that of the islands were left to be settled by the Powers. It was inevitable that the victors should quarrel over the spoils, the more so as the creation of an autonomous Albania had profoundly modified the conditions under which the partition treaties between them had been concluded.

The quarrel was precipitated by the complete collapse of new Turkish efforts at resistance. Greece, Serbia and Bulgaria were

alike victorious; but Greece and Serbia, by the chances of war, now held the territories which Bulgaria coveted, and they showed no disposition to surrender them. Rumania, too, now joined in the scramble, demanding a rectification of the frontier of the Dobruja; and though on May 7 Bulgaria signed an agreement conceding this demand, Rumania concluded a military convention with Serbia and Greece. The rupture came on the night of June 29, with a sudden attack by the Bulgarians on the Serbs.

The war was soon over, and Bulgaria, utterly defeated, had to submit to hard terms. By the Treaty of Bucharest (Aug. 10, 1913) she ceded Rumania a considerable strip of the Dobruja, with the fortress of Silistria. In the south she received only a narrow strip to give her access to the Aegean at Dedeagatch. She restored Adrianople, Demotica and Kirk Kilissa to Turkey. Serbia and Greece, on the other hand, received large accessions of territory. Serbia acquired central Macedonia, including Okkrida and Monastir, Kosovo, and the eastern half of Novi Pazar, the western half going to Montenegro. Greece obtained Epirus, southern Macedonia, Salonika and the seaboard as far east as Mesta, thus including the port of Kavala. Crete, too, was soon afterwards assigned by the Powers to Greece, together with all the Turkish islands, except Imbros and Tenedos—which command the Dardanelles—and Rhodes and the Dodecanese archipelago, which were in the occupation of Italy.

The Crisis of 1914.—This settlement, as was inevitable, satisfied nobody. Greece desired to round off her territories to the north by acquiring southern Albania; she wished to complete her empire in the Aegean by adding to it Rhodes and the Dodecanese. This brought her into conflict with Italy, which held firmly to the islands and regarded the new Albanian principality as her peculiar interest. Bulgaria, of course, was profoundly dissatisfied; and her sense of grievance at the settlement-especially the loss of Thrace to Turkey—was not mitigated by the consciousness that the fault was her own. The most fateful outcome of the settlement, however, was the simultaneous strengthening and discontent of Serbia. Cut off from the Aegean by the Greek occupation of Salonika, it was inevitable that she should aspire to find an outlet to the Adriatic, which could only be done at the expense of the Habsburg monarchy. National irredentism—the vision of the oppressed Slavs of the dual monarchy united with their liberated brethren—combined with economic necessity to throw the Serbs into antagonism to Austria-Hungary. Hence the agitation which culminated in the crime of Sarajevo, the immediate occasion of the World War. Austrian statesmen now saw, or thought they saw, in the rise of the Serbian power, not only a bar to the expansion of the monarchy southwards, but an instant menace to its very existence, and so in July 1914 sent the fatal ultimatum to Belgrade. The nightmare vision which for more than a century had tormented the cabinets of Europe was now to become a reality. Hitherto it had been possible for the powers to suppress or to isolate the perpetual fires due to the shrinkage of Turkey. Now, suddenly, they had sent out a flame which lighted conflagration in all the world.

With the end of the World War the Eastern Question, in the sense defined, also came to an end; for the Ottoman empire had ceased to exist. It left, however, a plentiful aftermath of questions, some of which—like that of Albania and the Adriatic coast generally—remain dangerous sources of unrest.

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EAST GRINSTEAD, a market town and urban district in the East Grinstead parliamentary division of East Sussex, England, 30 mi. S.E. of London by the S.R. Pop. (1938) 9,655. Area 10.3 sq.mi. East Grinstead is a junction station with branch lines to Groombridge (connecting with the Tunbridge Wells and Uckfield lines), Lewes, Hayward's Heath and Three Bridges. St. Swithin's church, rebuilt in the 18th century, occupies the site of a Saxon church, which later belonged to the priory of St. Pancras at Lewes, by whom its incumbents were appointed. Sackville college is an almshouse founded in 1608, and St. Margaret's home and orphanage was founded in the last century. Brewing and brick and tile making are carried on. The electricity undertaking is owned by the council. In the vicinity (near Forest Row station) is the golf course of the Royal Ashdown Forest Golf club. The hundred of East Grinstead (Grenestede, Estgrensted) was in the possession of the count of Mortain in 1086, and in the reign of Henry III. was part of the honour of Aquila, then in the king's hands. The honour was granted by him to Peter of Savoy, through whom it passed to his niece Queen Eleanor. In the next reign the king's mother held the borough of East Grinstead as parcel of the honour of Aquila. East Grinstead was included in a grant by Edward III. to John of Gaunt, duke of Lancaster, and it remained part of the duchy of Lancaster until James I. granted the borough to Sir George Rivers, through whom it was obtained by the Sackvilles, earls of Dorset. East Grinstead was a borough by prescription. In the 16th century it was governed by an alderman, bailiff and constable. It returned two members to parliament from 1307 until 1832, when it was disenfranchised. In 1285 the king ordered the market to be held on Saturday instead of Sunday, and in 1516 a yearly fair was granted.

EAST HAM, a municipal, county and parliamentary borough of Essex, England, 6 mi. E. by N. of London Bridge, on the District, L.M.S. and L.N.E. railways. Pop. (1938) 129,500, area 3.2 sq.mi. East Ham extends from Wanstead Flats on the north to the Royal Albert docks and the Thames at North Woolwich on the south. It is intersected by the two main highways out of east London, the Romford and Barking roads respectively; a by-pass road cuts off the southern angle of the borough nearer the river on the way to Grays and Tilbury. Its modern growth has been very rapid and it now forms, geographically, part of the eastward extension of London. It contains chemical, food and other factories, while the docks and river employ a large part of the population in the southern area. East Ham belonged before the Conquest to Waltham Abbey, whose possession of it was confirmed by Edward the Confessor The old parish church of St. Mary Magdalen retains Norman work in the chancel, and contains a monument for Edmund Nevill who claimed the earldom of Westmorland in the 16th century; William Stukeley, the antiquary (d. 1765), was buried in the churchyard. The ancient parish church of Little Ilford, now absorbed into Manor Park at the northern end of the borough, contains some interesting monuments. East Ham was incorporated in 1904, received a separate commission of the peace in 1906 and became a county borough in 1915.

Since 1918 it has been represented by two members of Parliament in the two constituencies of East Ham, North and South. The corporation owns the tramways and electricity undertakings and has a well-equipped technical college and public libraries. The Passmore Edwards hospital was founded in 1902.

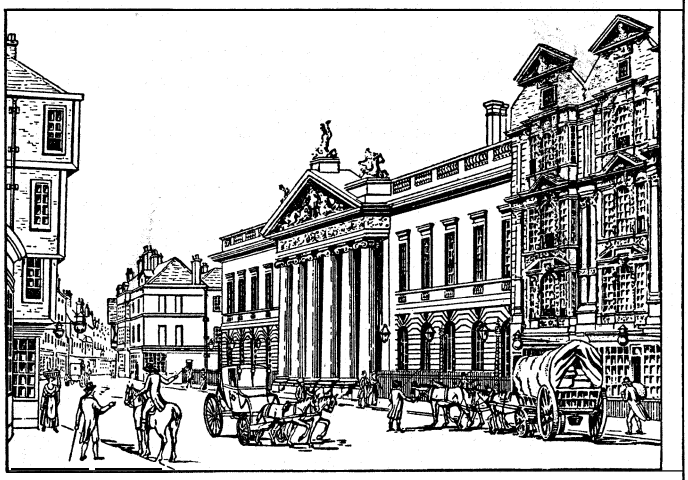
There are over 200 ac. of open space and recreation grounds, including Wanstead Flats (100 ac.), Central and Manor parks (25 and 10 ac.), and other playing fields. A town planning scheme for the borough is in force. East Ham is included in the metropolitan police district of Greater London.

EASTHAMPTON, a town of Hampshire county, Massachusetts, U.S.A., in the Connecticut river valley, 17 m. N.W. of Springfield, just west of Mount Tom. It is served by the Boston and Maine and the New York, New Haven and Hartford railways Pop. (1930) 11,323; and in 1940 it was 10.316. Manufactures include elastic fabrics, felt, rubber thread, fireproof doors, men's shirts, slippers, metal furniture, mechanical rubber goods, advertising novelties, mercerized yarns and print goods. The manufacture of cloth-covered buttons (long a leading industry but discontinued) was built up by Samuel Williston (1795–1874) and his wife Emily Graves Williston, who first did the work by hand, then (1827) experimented with machinery, and in 1848 built a factory; and who in 1841 founded Williston academy, one of the oldest preparatory schools in New England. Easthampton was formed from parts of Northampton and Southampton in 1785 and was incorporated as a town in 1809.

EAST HAMPTON, a town of Suffolk county, New York, occupying the peninsula of Montauk at the E. end of Long island;

served by the Long Island railroad. The population in 1940 was 1,756. The scenery is varied and picturesque, and there are many summer homes and hotels. Montauk lighthouse, on Turtle hill, was first built in 1795. At Montauk Point a large military camp was established after the Spanish-American War. The principal villages are Sag Harbor (partly in the adjoining town), East Hampton and Amagansett. Most of the town was bought from the Indians in 1648 for about £30 by nine men from Massachusetts, who with 20 other families settled here in 1649; and until 1664, when all Long island passed to the duke of York, the settlement was practically independent. In 1683 Gardiner's island, settled in 1639, was made a part of East Hampton township. There are many tales of treasure buried by Captain Kidd on Gardiner's island and Montauk point. Sag Harbor (settled in 1730 and incorporated in 1803) was held by the British after the battle of Long island as a strategic naval and shipping point. It was an important whaling centre from 1785 until the embargo ruined the fisheries, and again from 1830 to 1870. "Home Sweet Home," the childhood home of John Howard Payne is at East Hampton. East Hampton is a summer resort.

EAST INDIA COMPANY, an incorporated company for exploiting the trade with India and the Far East. In the 17th and 18th centuries East India companies were established by England, Holland, France, Denmark, Scotland, Spain, Austria, and Sweden. The English, the most important of these, survived until it handed over its functions to the British government in 1858. It was founded at the end of the 16th century in order to compete with the Dutch merchants, who had obtained a practical monopoly of the trade with the Spice islands and had raised the price of pepper from 3s. to 8s. per lb. Queen Elizabeth incorporated it by royal charter, dated Dec. 31, 1600, under the title of "The Governor and Company of Merchants of London, trading into the East Indies." This charter conferred the sole right of trading with the East Indies, *i.e.,* with all countries lying beyond the Cape of Good Hope or the Straits of Magellan, upon the company for a term of 15 years. Unauthorized interlopers were liable to forfeiture of ships and cargo. There were 125 shareholders in the original East India Company, with a capital of £72,000: the first governor was Sir Thomas Smythe. The early voyages of the company, from 1601 to 1612, reached as far as Japan *(see* Purchas' narratives), and are distinguished



BY COURTESY OF MESSRS. COLNAGHI, SALA AND COMPANY

EAST INDIA HOUSE, THE LAST HOME OF THE EAST INDIA COMPANY
This building, on the site of the old house in 1726, was sold in 1859

as the "separate voyages," because the subscribers individually bore the cost of each voyage and reaped the whole profits, which seldom fell below 100%. After 1612 the voyages were conducted on the joint stock system for the benefit of the company as a whole. In 1610–11 Captain Hippon planted the first English factories on the mainland of India, at Masulipatam and at Pettapoli in the Bay of Bengal. In 1609 James I. renewed the company's charter "for ever," though with a proviso that it might be revoked on three years' notice if the trade should not prove profitable to the realm.

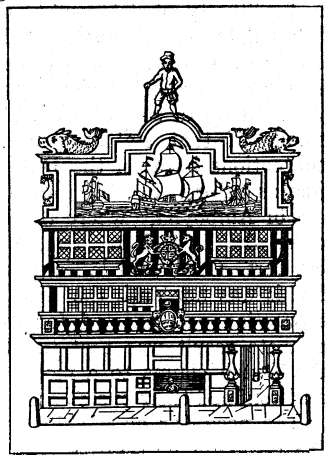
Meanwhile friction was arising between the English and Dutch companies. The Dutch traders considered that they had prior rights in the Far East, and their ascendancy in the Indian archipelago was indeed firmly established on the basis of territorial dominion and authority. In 1613 they made advances to the English company with a suggestion for co-operation, but the offer was declined, and the next few years were fertile in disputes between the armed traders of both nations. In 1619 was ratified a "treaty of defence" to prevent disputes between the English and Dutch companies. When it was proclaimed in the East, hostilities solemnly ceased for the space of an hour, while the Dutch and English fleets, dressed out in all their flags and with yards manned, saluted each other; but the treaty ended in the smoke of that stately salutation, and perpetual and fruitless contentions between the Dutch and English companies went on just as before. In 1623 these disputes culminated in the "massacre of Amboyna," where the Dutch governor tortured and executed the English residents on a charge of conspiring to seize the fort. Great and lasting indignation was aroused in England, but it was not until the time of Cromwell that some pecuniary reparation was exacted for the heirs of the victims. The immediate result was that the English company tacitly admitted the Dutch claims to a monopoly of the trade in the Far East and confined their operations to India and adjoining countries.

The need for good ships for the East Indian trade had led the company in 1609 to construct their dockyard at Deptford, from which, as Monson observes, dates "the increase of great ships in England." Down to the middle of the 19th century, the famous "East Indiamen" held unquestioned pre-eminence among the merchant vessels of the world. Throughout the 17th century they had to be prepared at any moment to fight not merely Malay pirates, but the armed trading vessels of their Dutch, French, and Portuguese rivals. Many such battles, usually with successful results, are recorded in the company's history.

It was not until it had been in existence for more than a century that the English East India Company obtained a practical monopoly of the Indian trade. In 1635, a year after the Great Mogul had granted it the liberty of trading throughout Bengal, Charles I. issued a licence to Courten's rival association, known as "the Assada merchants," on the ground that the company had neglected English interests. The piratical methods of their rivals disgraced the company with the Mogul officials, and a *modus vivendi* was only reached in 1649. In 1657 Cromwell renewed the charter of 1609, providing that the Indian trade should be in the hands of a single joint stock company. The new company thus formed bought up the factories, forts, and privileges of the old one. It was further consolidated by the fostering care of Charles II., who granted it five important charters. From a simple trading company, it grew under his reign into a great chartered company—to use the modern term—with the right to acquire territory, coin money, command fortresses and troops, form alliances, make war and peace, and exercise both civil and criminal jurisdiction. It is accordingly in 1689, when the three presidencies of Bengal, Madras, and Bombay had lately been established, that the ruling career of the East India Company begins. From this moment the history of the transactions of the East India Company becomes the history of British India (see INDIA: History). Here we shall only trace the later changes in the constitution of the ruling body itself.

The great prosperity of the company under the Restoration and the immense profits of the Indian trade attracted a number of private traders, both outside merchants and dismissed or retired servants of the company, who came to be known as "interlopers." In 1683 the case of Thomas Sandys, an interloper, raised the whole question of the royal prerogative to create a monopoly of the Indian trade. The case was tried by Judge Jeffreys, who upheld the royal prerogative; but in spite of his decision the custom of interloping continued and laid the foundation of many great fortunes. By 1691 the interlopers had formed themselves into a new society, meeting at Dowgate, and rivalling the old company; the case was carried before the House of Conimons, which declared in 1694 that "all the subjects of England have

equal right to trade to the East Indies unless prohibited by act of parliament." This decision led up to the act of 1698, which set up a new East India Company in consideration of a loan of two million to the state. The old company subscribed £315,000 and became the dominant factor in the new body; while at the same time it retained its charter for three years, its factories, forts, and assured position in India. The rivalry between the two companies continued both in England and in India, until they were finally amalgamated by a tripartite indenture between the companies and Queen Anne (1702), which was ratified under the Godolphin award (1708). Under this award the company was to lend the nation £3,200,000, and its exclusive privileges were to cease at three years' notice after this amount had been repaid. But by this time the need for permanence in the Indian establishment began to be felt, while parliament would not relinquish its privilege of "milking" the company from time to time. In 1712 an act was passed continuing the privileges of the company even after their fund should be redeemed; in 1730 the charter was prolonged until 1766, and in 1742 the term was extended until 1783 in return for the loan of a million. This million was required for the war with France, which extended to India and involved the English and French companies there in long-drawn hostilities, in which Dupleix and Clive became prominent.



BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM

OLD EAST INDIA HOUSE, LEADENHALL ST., LONDON. 1714

So long as the company's chief business was that of trade, it was left to manage its own affairs. The original charter of Elizabeth had placed its control in the hands of a governor and a committee of 24, the chairman and court of directors in London exercising unchecked control over their servants in India. But after Clive's brilliant victory at Plassey (1757) had made the company a ruling power in India, it was considered essential that the British government should have some control over the territories thus acquired. Lord North's Regulating act (1773) raised the governor of Bengal—Warren Hastings—to the rank of governor-general, and provided that his nomination, though made by a court of directors, should in future be subject to the approval of the crown; in conjunction with a council of four, he was entrusted with the power of peace and war; a supreme court of judicature was established, to which the judges were appointed by the crown; and legislative power was conferred on the governor-general and his council. In 1784 Pitt's India bill created a board of control, as a department of the English government, to exercise political, military, and financial superintendence over the British possessions in India. This bill first authorized the historic phrase "governor-general in council." From this date the direction of Indian policy passed definitely from the company to the governor-general in India and the ministry in London. In 1813 Lord Liverpool passed a bill which gave the board of control authority over the company's commercial transactions and abolished its monopoly of Indian trade. The monopoly of the valuable trade with China, chiefly in tea, was ended by Earl Grey's act of 1833. Its property was then secured on the Indian possessions, and its annual dividends of ten guineas per £100 stock were made a charge upon the Indian revenue. Henceforward the East India Company ceased to be a trading concern and exercised only administrative functions. Such a position could not, in the nature of things, be permanent, and the Indian Mutiny was followed by the entire transference of Indian administration to the crown on Aug. 2, 1858.

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EAST INDIES, a name formerly applied vaguely, in its widest sense, to the whole area of India, Further India and the Malay archipelago, in distinction from the West Indies, which, at the time of their discovery, were taken to be the extreme parts of the Indian region. The term "East Indies" is still sometimes applied to the Malay archipelago (*q.v.*) alone, and the phrase "Dutch East Indies" is often used to denote the Dutch territories which constitute the greater part of that archipelago. The Dutch themselves use the term *Nederlandsch Indië* and, in English translation, "Netherlands Indies," a term generally accepted in official U.S. statements. Another name in use is INDONESIA.

NETHERLANDS INDIES

The Netherlands territories in Asia are an integral part of the Netherlands kingdom. Their status as colonies was abolished in 1922. They lie between 6° N., off Sumatra, to 11° 30' S., off Timor, and from 95° E., in Sumatra, to 140° E., in New Guinea. Politically they are divided into lands under direct government and subject native states. The islands are described officially as of two groups, Java and Madura forming one, and the other consisting of Sumatra, Borneo, the Riouw-Lingga archipelago, Banka, Billiton, Celebes, the Molucca archipelago, the Lesser Sunda islands, and a part of New Guinea—the outer provinces, as they are named collectively.

The governor-general represents the queen in the Indies and has the highest executive authority. He is assisted by an advisory council, the Council of the Indies, consisting of five members, of whom two are Indonesians. Together with the representative body—the *volksraad* (People's council)—the governor-general passes laws and regulations, except in a few instances in so far as these by their nature belong of right to the home government. He can veto legislation passed by the People's council, but in recent years this right was rarely used. He is bound by the constitutional principles, by which, according to the Netherlands Indies constitution of 1925, the Indies must be governed. The *volksraad* was established in 1918. It is a full co-legislative body, consisting of 60 members, of whom 30 are Indonesians, 25 Europeans and 5 Chinese or other "foreign Asiatics." There are eight departments of administration, each under a director who represents the government in the debates in the *volksraad.* These departments are: internal administration, justice, education and public worship, economic affairs, communications and public works, finance, navy and war. For administrative purposes the Indies are divided in six provinces: Sumatra, West Java, Middle Java, East Java, Borneo and the Great East, besides the four principalities in South Middle Java, two in Surakarta and two in Jokjakarta. These provinces are headed by Dutch governors, while the further territorial subdivisions in the outer provinces are in the hands of residents, assistant residents and *controleurs.* In Java these divisions are headed by residents and the Javanese chiefs of the internal administration, the regents, wedanas and assistant wedanas.

In local government a wide use is made of Indonesians, in the appointment of whom a primary consideration is that if possible the people should be under their own chieftains. In Surakarta and Jokjakarta in Java, also in many parts of the outer provinces, native princes preserve their position; they have limited power, and act generally under the supervision of a Dutch official.

In 1903 democratic government was introduced by the establishment of local councils in Java and some towns and regions in the outer provinces. Between 1926 and 1930 democratic institutions were extended in Java by the creation of provincial and regency councils, while in 1938 a similar reform was started in the outer provinces.

Population. — The accompanying table gives the area and population of Java and Madura, and of the outer provinces.

Since the Indonesian population increased 2.04% yearly from 1920–30, according to estimates the total population of the Indies

	Area	Population	
		Census 1920	Census 1930
	English sq. miles		
Java and Madura	50,745	34,984,171	41,719,524
Sumatra: Sumatra, West Coast	18,029	1,522,240	1,910,298
Tapanuli	14,760	843,585	1,042,583
Sumatra, East Coast	36,100	1,197,554	1,693,200
Benkulen	9,995	257,140	323,123
Lampongs	10,914	233,903	361,563
Palembang	33,173	828,004	1,098,725
Jambi	18,719	233,344	245,272
Achin	21,448	736,365	1,003,062
Riouw-Lingga archipelago	12,506	223,122	298,329
Banka	4,549	154,141	205,363
Billiton	1,873	68,582	73,409
Celebes: Celebes and dependencies	48,061	2,347,645	3,087,335
Manado	34,203	760,692	1,139,251
Borneo, West Coast	..	536,355	827,898
Borneo, South and East Districts		1,020,599	1,366,635
Moluccas: Amboina	..	277,966	400,057
Ternate	17,372	149,245	492,973
New Guinea	160,692	195,460	*
Timor archipelago	26,410	1,146,660	1,656,636
Bali and Lombok	2,479	1,565,014	1,902,683
Total	4,072	49,281,787	69,747,919

*The New Guinea population, not separately computed for 1930, included under Amboina and Ternate.

in 1940 was 72,000,000. The population is divided legally into Europeans and persons assimilated to them, Indonesians and persons assimilated to them and foreign Asiatics. The first includes Eurasians, and also Armenians and Japanese. The total number of people classed as Europeans, in 1930, was 242,372, mainly Dutch and Eurasians, a large proportion of the Dutch being born in the Dutch East Indies. The remainder consisted of British, French, Belgians, Americans, Germans and Japanese. Foreign Asiatics numbered 1,344,878, mostly Chinese and Arabs, and mainly the former, but with many Indians; Indonesians numbered 59,143,775. A large proportion of the Europeans consists of government officials, or retired officials, for many of the Dutch, once established in the colonies, settle there for life. The remaining Europeans are mostly planters and heads of industrial establishments. The Arabs and Indians are quite generally traders; the Chinese are generally the middlemen and moneylenders, while many are plantation labourers in Sumatra and Borneo, and in the tin mines of Banka and Billiton. The natives are mainly agriculturists[1].

Religion and Education.— Entire liberty is granted to the members of all religious confessions. Apart from Christian converts and the Hindu Balinese and animistic tribes in the least-developed parts of the Dutch East Indies, the great majority of the Indonesians are Mohammedan, though not generally of a bigoted type, animistic practices being often in use together with Mohammedan rites, and particularly in regard to marriage customs, inheritance, and family life in general. Conversion to Islam among the animists means an upward step, hence Mohammedanism is gaining ground among such peoples. Islam was brought to the Indies from Gujarat (British India) in the 13th century by traders. At the end of that century several Mohammedan kings ruled in Sumatra (Achin), and gradually Islam spread over the islands, penetrating also to Java, where already in the 15th century many people, especially in the coastal regions, mere Mohammedans. The first followers of Islam in Java (wali's) are still worshipped. Of the four schools of Islam, the one founded by Mohammed ibn Idris ash-Shāfi'ī is generally accepted in the Indies. Mosques are found even in smaller towns, while in every village there is at least one chapel (langgar). Of the five fundamental obligations of Islam, the fast during the month Ramadān is observed most carefully. Another obligation is the haddj, the pilgrimage to Mecca, which was made by 40,000 to 50,000 people yearly shortly before the economic depression of the 1930s. In 1938 their number was 10,327.

The Protestant Church in 1939 had for its Netherlands-speaking community 45 ministers and 9 preachers and for its non-Netherlands-speaking community 31 assistant-ministers, 349 Indonesian preachers and 977 Indonesian assistants. The Roman Catholic Church had 554 European and 16 Indonesian priests. 474 European and 46 Indonesian brethren and 1,677 European and 164 Indonesian sisters. Before World War II there were numerous missionaries at work, Protestant. Roman Catholic and Salvation army; their progress may be gauged from the fact that in 1896 the Christian population was 280,065, while in 1939 it numbered 1,665,871 Protestants and 477,922 Roman Catholics (exclusive of 119,520 Protestant Europeans and 76,541 Roman Catholic Europeans), totalling 2,143,793 or about 3% of the total Indonesian population. The chief Christian church is the Dutch Protestant Church, to which most of the Protestant Europeans belong. Minahassa (North Celebes) proved the most fertile field for missionary enterprise, practically the whole population being Christian; Christianity by 1941 was making most headway in the Moluccas and New Guinea. The Indonesian Roman Catholic population is mostly in Manado, Amboina, Flores, Timor, Solor, Kei and Tenimbar Islands.

Both the government and missionaries maintain vernacular schools. Large sums were voted for the establishment of primary and secondary schools, and the government undertook to assist in the establishment of village schools, with the aim of providing one in each village at least in Java. A plan was put into effect by which 800 new village schools were opened yearly. There are schools for secondary education in all important towns, and schools for mechanical engineering and craft schools in Bandung, Batavia, Malang, Semarang and Surabaya. There are colleges for Indonesian school teachers, for Indonesian officials of the internal administration and special schools for Indonesian girls. Government schools exist for European education of Indonesian and Chinese children. There are commercial schools, navigation schools and training institutes for analysts and controllers of public health, pharmacists' assistants and municipal servants. There is a school for training sugar chemists in Suyabaya, a mining school at Sawah Lunto, and a training institution for veterinaries and an agricultural high school at Buitenzorg. On the university level are law and medical schools and a college of arts and sciences in Batavia; also an engineering college in Bandung. The educational policy is to increase the number of vernacular schools for the masses, create secondary schools adapted to the special requirements of the country (suitable for all races), and develop higher general scientific, technical and professional education. The percentage of literacy according to the census of 1930 was 7.2%. More than 40% of the children of school age receive instruction.

Justice and Finance.— As regards the administration of justice, a distinction is maintained between Europeans and persons assimilated with them and Indonesians, together with Chinese, Arabs, etc. The former are subject to laws closely resembling those of the mother country, while the customs and institutions (*adat*) of Indonesians are respected in connection with the administration of justice to the latter. The penal code, however, is the same for Europeans, Indonesians and foreign Asiatics. There is a high court of justice in Batavia for the whole of the Indies, and there are courts of justice in Batavia, Semarang, Surabaya, Padang, Medan (on Sumatra) and Makassar (Celebes). The court for the majority of the Indonesians and Chinese is the landraad, while there is the *landgerecht* for all groups for cases of minor offenses. In some regions in the outer provinces Indonesian courts and penal law are maintained. For minor cases of Indonesian common law in Java there are courts in the districts and regencies; matrimonial disputes among Indonesians are dealt with by courts of Mohammedan priests, while questions of suc-

[1]The density for the colony as a whole is 67 per sq. mi., and for Java and Madura, 815. There is over-population in Java, and emigration to Sumatra is encouraged by the government. Before World War II. 50,000 to 60,000 Javanese farmers moved yearly to the outer provinces Javanese coolies are employed as labourers in the Straits Settlements and Malay States, also in Surinam, but few settle Average mortality in Java and Madura is 18 per 1,000 It is higher than this in the crowded native and Chinese quarters of the largest towns: in some coolie lines on plantations with very modern organization it has been brought down to 12 per 1,000

cession among them are taken care of by the *landraad*.

The revenue is derived mainly from taxes on land and houses, customs and excise, import and export duties, corporation tax, income tax, land revenue and other duties; from government monopolies, *e.g.*, in opium, salt and pawnshops; and from government enterprises such as tin and coal mines, teak forests and rubber.

The condition of the monetary system before the Japanese occupation was sound. During the period 1922–31, annual expenditures and revenues of ordinary and extra-ordinary services together averaged 785,000,000 and 755,000,000 guilders respectively. The economic depression of 1929, however, was almost disastrous for the financial situation of the country, which was largely dependent upon the profits of western enterprise. A strong policy of curtailment, honever, kept public finances in order, though revenues fell to 466,000,000 guilders in 1935. The situation in world trade improved in 1936, while in the same year Holland and the Indies left the gold standard, with the result that a surplus of 29,000,000 guilders was shown. A few years later, however, the threat of war and the pressing need of defense made great demands on the public finances, reaching a climax in 1941 when the revenue amounted to 694,000,000 guilders and the expenditure to 829,000,000. The long-term public debt, 84,000,000 in 1913, reached a peak in 1924 of 1,124,000,000, diminished gradually to 983,000,000 in 1929 and rose again to 1,369,000,000 in 1934. From there on it decreased to 1,212,000,000 in 1940.

The monetary system is similar to that of Holland, the unit being the guilder (53 cents U.S.). The 5- and 10-guilder pieces are gold coins. Silver is usual, *i.e.*, 23, 1, ½, ¼ and 1/10 guilder pieces. There is a five-cent nickel piece, and there are copper, 2½, 1, and ½ cent pieces. Minting is at Utrecht, in Holland. The Java bank, established in 1828, with headquarters at Batavia, is the only bank issuing notes, two-fifths of the amount of which must be covered by specie or bullion. The government controls the bank. There is a postal savings bank and there are local native savings banks, and an extensive system of popular credit, *i.e.*, village rice credit banks, village money credit banks, and divisional, or district banks. There are also ample banking facilities, European and Asiatic (Chinese), throughout the archipelago.

Defense.—The army was organized as distinct from that of the Netherlands. Its strength in 1942 was about 40,000. In addition to this there were the legions of native princes in Jokjakarta and Surakarta—3,600 infantry; the Barisan, or native infantry of Madura, 1,400; the military police, nearly 10,000; and the colonial reserve and civic guard, to be mobilized for general service. In 1941 military draft was introduced for the Indonesian people. About a third of the regular army was composed of Europeans, mostly Dutch, some Eurasians; the remainder was made up, in order of numerical strength, of Javanese, Amboinese, Sundanese, Buginese, Alfurese, Manadonese, Timorese, Achenese and Bataks. No portion of the regular army of the Netherlands was allowed to be sent to the Indies, but individual soldiers were allowed to enlist in the colonial army, and they formed its nucleus. Native and European soldiers were mixed, but they were in separate companies. Officers, with very few exceptions, were Dutch from Holland, or born in the Indies. The artillery comprised field, mountain and siege batteries, with magazines, arsenals and workshops. There was a cavalry force, a flying corps and engineers corps. The threat of war that preceded the Japanese invasion in 1942 led to budget provisions for an enlargement and motorization of the army in all its fighting branches, and other new measures of a protective nature. The department of war was set up at Bandung, the military headquarters, with training schools, cavalry depot, motor artillery depot, air service depot, artillery construction shops, projectile factory, pyrotechnical factory, war stores depot, and a garrison. Most important other garrisons were at Magelang (Middle Java) and Malang (East Java). There were garrisons in Achin, Borneo and Celebes, while troops were stationed at many points in Sumatra and in Amboina and Ternate, Timor and New Guinea.

The naval service of the Indies had two branches: the squadron of the royal Netherlands navy and the so-called government navy. The former, while at the disposal of the governor-general, the commander in chief of the army and the navy in the Indies, was administered by the Netherlands minister of the navy at The Hague; the government navy, however, was a nonmilitary organization at the disposal of the local civil authorities and carried government employees and goods. Other tasks included patrol duty in the territorial waters and survey of coastal installations The most important naval base was Surabaya, while Amboina in the eastern part of the archipelago was an additional base. The usual squadron of the royal Netherlands navy is 4 cruisers, 6 destroyers, 18 submarines and several minelayers and motor torpedo boats.

Agriculture.— The agricultural industry is of two types, estate agriculture and native agriculture: the former is purely for export; the latter mainly to provide the necessities of life. Since the alienation to non-Indonesians of land in the hands of Indonesians is prohibited, uncleared land may be leased from the government or from native rulers; or may be rented voluntarily from native owners (with restrictions to protect native interests). There are some extensive private lands, dating from the time of the East India company, with manorial rights, but these are gradually being repurchased by the government. Estates are mostly European-owned and are situated mainly in Java and Sumatra. The main native-grown products are: rice, maize, cassava (tapioca), sweet potatoes, soya beans, groundnuts, cinnamon, cloves, nutmegs, pepper, tobacco, coconuts, rubber, coffee, tea, kapok, betel nuts and native fruits and vegetables of many kinds; estate products are: sugar cane, rubber, coffee, tea, tobacco, cinchona, tapioca, agava fibres, cocoa, coca, palm oil and lemon grass. Rice is the chief native crop, maize comes next in importance, then cassava. Sugar has been the chief estate product for a long time, grown principally in east and central Java. The yield is high and the quality first-class; the sugar is manufactured locally, in mills equipped with the latest scientific appliances. Production, about 3,000,000 tons in 1929, had to be restricted during the economic crisis, and Java in 1941 was producing only 1,500,000 tons yearly. Thus, one of the oldest commodities of the Indies, sugar, lost its predominant position to the newest, rubber. The systematic planting of the rubber tree (Hevea brasiliensis) did not start until about 1910. The planted area extended rapidly and in 1940, 1,640,000 ac. of estates were covered with rubber while the native rubber cultivation occupied at least 2,500,000 ac., according to estimates. In 1939 the Indies produced 383,000 tons or 37% of the uorld's rubber. Indonesians grew half of that production. Rubber is mainly grown on the islands of Sumatra and Borneo; Java's share was only 74,500 tons in 1939.

The collapse of the rubber market in 1927 was followed in 1934, after long deliberations, by an international regulation for the production and export of rubber signed by practically all rubber-producing countries. Each country had a basic quantity allotted while every three months the quantity to be exported was fixed in close co-operation with the consumers. This agreement worked satisfactorily and had a stabilizing influence on the price of rubber, which varied from $.09 to $.185 per pound after 1934. It was difficult to carry out the agreement with regard to the Indonesian rubber growers, but the problem was solved when, in 1937, the 715,000 Indonesian small holders were registered and export licences were issued. Most of the rubber is put on the market in yellow-brown smoked sheets weighing a little more than two pounds.

Rubber was the most valuable export commodity from the Indies in 1940, forming 40% of the total export value of the country.

Coffee no longer holds the pride of place it held formerly. The coffee industry had to combat an epidemic of disease in 1880, which led to much acreage being devoted to other cultures. Compulsory cultivation was abandoned in 1885, government cultivation in 1915, and the industry, relying largely on the Robusta variety of plant, which has shown little susceptibility to disease, instead of on *Coffea* arabica and *liberica*, is one of only moderate significance; production in 1939 was 121,000 tons. Tea (1939 crop, 83,000 tons) is grown principally in West Java and Sumatra East Coast. Tobacco is grown mostly in Sumatra (East Coast)

and Middle and East Java, the former being of superior quality: 1939 total production was 117,000 tons. Java, alone, produces more than 90% of the cinchona on the world market; it is grown in West Java, with a few estates in Sumatra. Palm oil is cultivated principally in East Coast Sumatra, and is one of the most promising of Dutch East Indian industries (production in 1939 was 244,000 tons). Kapok rose from about 3,000 tons in 1900 to 22,000 tons in 1939, the Java product being termed the best on the market. The Indies supply 72% of the world requirements of kapok, 90% of the total production is grown by Indonesians. Copra (1939 production, 537,000 tons) may be termed the "mainstay" of the archipelago, for it is produced everywhere, and, by ensuring a sure supply of cargo, enables steamers to call at very small ports and yet engage in profitable trade; coco nut cultivation is almost exclusively in Indonesian hands. Agave fibre cultivation is important in Java (Java sisal and Java cantala) and in Sumatra, and there has been a large extension of cassava cultivation, which has made the Dutch East Indies the most important tapioca-products' producer in the world. The output increased from 91,053 tons in 1921 to 200,000 tons in 1939. Other important products are pepper (1939, 71,000 tons, being 83% of the world's requirements) which is grown chiefly by Chinese and natives, in the Lampongs, Achin and west and southeast Borneo; spices, especially mace and nutmeg, grown in Java, Sumatra and the Moluccas; and essential oils, *i.e.*, citronella, lemon grass, patchouli and cajeput (4,000 tons annually) the two first-named grown mostly in Java, patchouli in Sumatra and cajeput principally in Buru and Ceram. Gutta-percha is also produced in small quantities. Forced labor exists no longer in the Dutch East Indies. Labour is cheap and plentiful in Java, and Javanese, with Chinese and other immigrants, aid cultivation in Sumatra. Elsewhere in the archipelago the scanty labour supply makes agricultural development possible by very slow stages only, and European capital fights shy of the uncertain situation. There can be little further expansion in Java; Sumatra is next most favourably placed for expansion, then Borneo and Celebes. Dutch New Guinea, with its very scanty Papuan population, is an agricultural problem. The government aided agriculture by means of irrigation and in every manner possible, maintaining agricultural training colleges and experts, experimental stations and advisers and keeping a constant watch for disease.

Next to agriculture, cattle breeding is of great importance in native life. Cows and buffaloes are raised generally, pigs in Bali. Madura and Bali cattle, being thoroughbreds, rank first; everywhere the indigenous breeds are crossed with Ongole and Hissar bulls, in order to obtain heavier specimens for draught and slaughter. Thoroughbred Dutch cattle are raised in Java. The total export of livestock in 1939 was: pigs, 83,692 and cattle, 16,600. An efficient veterinary service safeguards the industry. Fishing is of great importance. Motorboat fishing is done by Japanese, and in places the Chinese have developed sea fishing as an important industry. Motorboat fishing by Indonesians is gradually developing. Generally speaking, fishing is carried on in primitive fashion, by means of nets and traps and by spearing. Most of the fish is consumed fresh, but large quantities are dried and exported. Shells, pearl shell and tortoise shell are collected for export, also trepang and edible bird's nests. Another occupation is the collection of forest products, *i.e.*, timber, rattan, gums (copal, damar and benzoin), sago, bird skins, *atap*, wild cinnamon, wild rubber, gutta-percha and gutta jelutong. A forestry service, with experimental stations, watches over forest interests and restricts timber extraction. Chief among timber woods, and grown mostly in East Java, is teak, of which the production in 1939 was 10,876,949 cu. ft. of timber. Other valuable woods are ebony, sandalwood and ironwood, ebony averaging 8,000 tons in export.

Mining.— The mining industry is under the supervision of a bureau of mines of the department of communications and public works. The government grants prospecting licences and concessions, on certain terms, for all minerals and all kinds of bituminous coal and lignites, petroleum, asphalt and all other kinds of bituminous substances, solid as well as liquid and inflammable gases, with iodine and allied substances. Coal is mined by the government at the Ombilin mines, near Sawah Lunto, in the Padang highlands, Sumatra, the Bukit Asem mines, Palembang residency, Sumatra, and on the island of Pulau Laut, off the southeast coast of Borneo. production in 1939 was 1,222,406 tons. There are private concerns working coal in Sumatra and Borneo, with a production in 1939 of nearly 558,000 tons. Most of the coal is consumed locally. Tin is mined by the government on the island of Banka, which yields exceedingly pure tin, 99.9%. Banka production in 1939 was 17,035 tons. There is a large semiprivate tin-mining industry on the island of Billiton, in which the government has five-eighths of the profits (production in 1939, 9,929 tons), and another at Singkep, in the Riouw archipelago (production, 1,304 tons, 1939). There are gold and silver mines in Sumatra, Borneo, Celebes and Java which produced (1939) gold valued at 5,213,747 and silver at 463,076 guilders. Dutch Borneo yielded diamonds totalling 2,287 carats. An important oil industry has been developed in East Borneo, Palembang, Jambi, Achin and the East Coast of Sumatra, in East Java and in Ceram. The principal company is the Royal Dutch Petroleum company, while the Standard-Vacuum has large oil interests as well. The output of crude petroleum and of petroleum gas for 1939 was, respectively, 7,948,694 tons and 1,263,254 tons. Petroleum exports are in the form of kerosene, benzine, gasoline, liquid fuel, solar and Diesel oil, paraffin and lubricating oils; paraffin wax is made, also batik wax. Asphalt deposits are worked in the island of Buton, southeast Celebes. Bauxite has been exploited on the island of Bintan in the Riouw archipelago. Production in 1939 was 237,000 tons. In the Celebes some nickel has been mined.

Industry, Trade and Commerce.— Industry in the Dutch East Indies, especially in Java, developed rather rapidly after the economic depression of 1930. Apart from the industries connected with the manufacture of cane sugar, rubber, tea, cinchona, cocoa, essential oils and cassava products, and the petroleum and tin-mining industries, there are soap, ice, cigar and cigarette, aerated waters, cement, sulphuric acid, oxygen and explosives factories, paper mills, machine repair, metal construction, paint and varnish, tin packing, cement and brick and tile works, alcohol and arrack distilleries, potteries, tanneries, rice mills, coconut oil mills, lime kilns and cement tile factories, most in European, some in Chinese hands; in later years, a tire plant, an automobile assembly plant, beer breweries and shoe manufactures were established, while a weaving industry developed. The government gave special attention to the cottage industries. These industries are mainly on Java. The native plaited hat industry of Java produces bamboo and pandan hats.

Retail trade is carried on in native markets, and is almost entirely in native hands; Chinese and Arabs, with a few Indians, act as intermediaries. Wholesale trade is largely in European hands, but there are many Chinese and a few Japanese wholesale trade organizations. There are many trading associations, and chambers of commerce, and there is a government department of economic affairs.

The origin of the imports (totalling 529,900,000 guilders in 1939) was as follows (in millions of guilders): The Netherlands, 99.2; Japan, 85.0; United States, 63.7; Germany (including Austria), 41.2; Singapore, 33.8; Great Britain, 33.3. The destination of the total exports of 787,100,000 guilders in 1939 was as follows (in millions of guilders): United States, 146.0; Singapore, 125.0; The Netherlands, 109.0; Australia, 34.3; Great Britain, 34.1; Egypt (including Sudan), 25.1; Japan, 24.6; British India (including Burma), 23.9. Exports and imports for the year 1940 were as follows; Imports (in millions of guilders): textiles and yarns, 120.4; metals and metal goods, 72.9; foodstuffs, 66.4; chemical products, 47.9; machinery, 37.8; miscellaneous, 99.6; total, 445.0. Exports (in millions of guilders): rubber, 368.6; petroleum products, 169.6; tin and tin ore, 81.6; sugar, 52.0; tea, 48.9; deli tobacco, 31.7; cinchona bark and quinine, 27.1; tapioca products, 13.0; copra, 12.6; agave fibres, 10.3; palm oil, 9.6; coffee, 7.8; other leaf tobacco, 6.6; coal, 5.1; gums and resins, 3.8; pepper, 3.5; bauxite, 1.9; essential oils, 2.9; miscellaneous, 74.4; total, 931.0.

Shipping and Communications.—The principal steamship company operating almost exclusively in the archipelago is the *Koninklijke Paketvaart Maatschappij* (the Royal Packet Navigation company), Half the tonnage in Dutch East Indian waters is under the Dutch flag, other chief companies being the Netherlands Steamship company and Rotterdam Lloyd, plying between Europe and Java; and of other tonnage, British ships are by far in the majority. There are ordinarily frequent services between ports in Java and Sumatra and ports in the Straits Settlements, Australia, India, China, Japan, Europe and America; and Royal Packet vessels ensure constant communication between Java and Sumatra and the rest of the archipelago, while the company extended their lines to Australia, South Africa and South America. The total length of rail and tramways is 3,268 mi. in Java, 1,204 mi. in Sumatra. An air service between Batavia and Surabaya and the islands in the outer provinces, altogether 10 regular interinsular services, was established and a twice-weekly air service connected Amsterdam (Holland) and Bandung. Good motor roads exist in most parts of Java, and in several parts of Sumatra, and there are many motor services which link up with rail and tramways. There are rather good roads elsewhere. Good radio, cable and telegraph services exist, even in the remote islands; Java has one of the most powerful wireless stations in the world near Bandung, and numerous minor stations are scattered over the archipelago. There is an extensive and efficient telephone service (by the beam wireless system this was linked up with Amsterdam and London) also in some towns

and districts of Sumatra, Celebes and Manado, Borneo, Amboina, Bali and Lombok. There are regular programs of broadcasting for European as well as Indonesian listeners.

After a month of air and sea warfare the Japanese made their first landings in the Netherlands Indies on Jan. 10, 1942. On March 8 the last strategic points on Java fell to the enemy. (E. E. L.; J. O. M. B.)

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EASTLAXE, SIR CHARLES LOCK (1793–1865), English painter, was born on Nov. 17, 1793, at Plymouth. Charles was educated (like Sir Joshua Reynolds) at the Plympton grammar-school, and in London at the Charterhouse. Towards 1809, partly through the influence of his fellow Devonian, Haydon, he determined to be a painter; he also studied in the Royal Academy school. In 1813 he exhibited in the British Institution his first picture, "Christ restoring life to the Daughter of Jairus."

In 1827 he was elected Associate of the Royal Academy and R.A. in 1830; and in 1850 succeeded Shee as president of the Royal Academy, and was knighted. In 1841 he had been appointed secretary to the royal commission for decorating the Houses of Parliament. In 1843 he was made keeper of the National Gallery, but resigned in 1847; in 1855 he became director.

In 1849 he married Miss Elizabeth Rigby, the author of *Letters from the Baltic* (1841), and other works. Lady Eastlake (1809–93) translated Waagen's *Treasures of Art in Great Britain* (1854–57), and completed Mrs. Jameson's *History of our Lord in Works of Art.* Eastlake died at Pisa on Dec. 24, 1865.

Sir Charles Eastlake was an accomplished scholar in matters of art, and published, in 1840, a translation of Goethe's *Theory of Colours;* in 1847 (his chief literary work) *Materials for a History of Oil Painting,* especially valuable as regards the Flemish school; in 1848, *Contributions to the Literature of the Fine Arts* (a second series was edited by Lady Eastlake in 1870, and accompanied by a Memoir from her pen); in 1851 and 1855, translated editions of Kugler's *History of the Italian School of Painting,* and *Handbook of Painting* (new ed., by Lady Eastlake, 1874).

See W. Cosmo Monkhouse, *Pictures by Sir Charles Eastlake, with biographical and critical Sketclz* (1875).

EASTLAND, a city of Texas, U.S.A., 90m. W. by S. of Fort Worth; the county seat of Eastland county. It is on Federal highway 80, and is served by the Eastland, Wichita Falls and Gulf and the Texas and Pacific railways.

In 1910 the population was 855; in 1920, at the height of the oil boom, 9,368; but in 1940 had fallen to 3,849 by the federal census.

It is the trade centre of a farming, stock-raising and oil-producing region, and ships large quantities of grain, peanuts, fruits, pecans and livestock. Numerous oil pools and large gas fields were discovered in 1927.

EAST LIVERPOOL, a city of Columbiana county, O., U.S.A., 44m. W. by N. of Pittsburgh, on the Ohio river, opposite Newell and Chester, West Virginia. It is on the Lincoln highway, and is served by the Pennsylvania railroad, interurban trolleys and motor buses and river steamboats. The population was 21,411 in 1920 (90% native white) and 23,555 in 1940 by the federal census.

It has large machine works, drawn steel plant and several small machine plants, electric porcelain plants and other diversified industries.

There are pottery plants in this city and in Chester and Newell; the latter two cities are served with two large passenger and traffic bridges.

The potteries employ 6,500 wage earners. The city is built on sloping ground, rising from the river bank, in the midst of beautiful scenery.

In 1798 Thomas Fawcett settled here, and in 1802 he laid out a town, which he named St. Clair hut others persisted in calling Fawcettstown. The name Liverpool was adopted in 1816, and in 1834, when the town was incorporated, East was prefixed, to distinguish it from another settlement in the State. The dominating industry dates from 1839, when James Bennett, an English potter, reached the small town, and judged that the clays in the surrounding hills would make an excellent quality of yellow ware. The manufacture of white ware began in 1872; of semi-vitreous china about 1890; while the production of porcelain electrical fixtures and supplies has developed in the present century. Local clays are still used for yellow ware by one plant, but with this exception all the raw materials needed by the potteries come from a distance: the clays from Florida, North Carolina, Kentucky and England; other minerals from distant States, Canada and Italy. Labour-saving machinery displaced the potter's wheel in East Liverpool at an early date.

EAST LONDON, a town of South Africa 33° 3' S., 27° 55' E. Its population, including that of the suburbs, such as Cambridge, 4 miles away, included 31,313 Europeans (1936) and, in 1921, about 11,600 natives, 2,006 coloured persons and 692 Asiatics. The town is situated at the mouth of the Buffalo river, 543 miles by sea from Cape Town, 253 from Durban, and 665 by rail from Johannesburg. The first settlement was a military post on the right bank of the river. It was established to serve as a base port during the Kafir Wars of 1846 and 1847 and was then known as Port Rex. When the railway was constructed on the opposite bank, the centre of gravity moved across the river, which is now spanned by a combined road and railway bridge. The main town is now built on a plateau, 150 to 200 feet high, overlooking the river and the sea coast. It is laid out in broad, straight streets, the principal one being Oxford street. There is also a large open square about which are banks and wool warehouses.

The climate is influenced by the warm Mozambique current off the coast. The mean minimum temperature is 57·1°, and the relative humidity about 87 per cent. The mean annual rainfall is about 30 inches, about 60% falling from October to March, inclusive. Owing to its equable climate, its facilities for surf bathing and to the attraction of its river, East London is one of the principal holiday resorts of the South African coast. Along the shore to the north-east of the river a fine weather esplanade has been made. There is also a park of 80 acres between the main town and the river, contaihing much indigenous hush, and laid out with drives, open lawns and beds of flowers.

The mouth of the river is constricted by a shifting sand bar. The river itself has been made narrower by the construction of training walls to increase the tidal scour. This, combined with dredging, has deepened the entrance, so that there is now a minimum depth of 22 to 23 feet at L.W.O.S.T. The range of spring tides is five or six feet. Vessels up to over 8,000 tons can enter the river, and ships, with a draught of up to 20 feet, can lie alongside the wharves, which extend for over a mile along the left bank. A wharf, now being constructed, will have a depth of 32 feet. The railway has been extended to the wharves so that ships can unload directly into the trucks. Five hundred yards of wharfage on the right bank of the river has a depth of 27 feet,

and is connected with the railway system. The repairing facilities include a shipway with a capacity of 1,000 tons dead weight. In 1928 larger vessels had to anchor in the bay, and load and unload by means of lighters. Important harbour works are however being undertaken with the intention of providing a fine enclosed harbour.

East London ranks as the fourth port of South Africa. It takes a large part of the trade of the eastern part of Cape Colony, of the Transkei and native territories, of Basutoland and part of the Orange Free State. As an exporter of wool and mohair it takes first place in the country. (R. U. S.)

EAST LOTHIAN or **HADDINGTONSHIRE,** a south-eastern county of Scotland, bounded north by the Firth of Forth, north-east by the North sea, east and south by Berwickshire, and south-west and west by Edinburghshire. It covers an area of 170,-971 acres. The sea coast measures 41 miles. On parts of it there are wide stretches of blown sand; on others grassy links, and there are several residential villages with such well-known golf courses as that of North Berwick. Traces of old raised beaches are seen. The Bass rock and Fidra isle belong to the shire, and there are numerous rocks and reefs off the shore, especially between Dunbar and Gullane bay. The northern half of the shire slopes gently to the coast, and the southern half is hilly. In the south the Lammermuir hills reach 1,733 ft ; the rocks here are of Silurian age mainly, bordered by Ordovician and broken by igneous intrusions. The more level tract, mainly of Carboniferous rocks, is broken by Traprain Law (724) in the parish of Prestonkirk, and North Berwick Law (612), both volcanic necks, and Garleton Hill (590) to the north of the county town. The river Tyne (28m.) rises south-east of Borthwick in Mid-Lothian, and reaches the sea just beyond the park of Tynninghame House. It is noted for a fine variety of trout, and salmon are sometimes taken below the linn at East Linton. The Whiteadder rises in the parish of Whittingehame, but leaves the shire to join the Tweed near Berwick.

Agriculture **and** Industries — Throughout nearly the whole of the 19th century East Lothian agriculture was held to be the best in Scotland, because of the enterprise of cultivators like George Hope of Fenton Barns (1811–76). East Lothian is famous for the richness of its grain and green crops, the size of its holdings and the good housing of its labourers. Much of the Lammermuirs is unproductive, though the lower slopes are cultivated. In the centre of the shire occurs a belt of tenacious boulder clay on a tilly subsoil not adapted for agriculture. The coast is sandy, but farther inland the rich loam is very fertile. The land about Dunbar is the most productive, yielding a potato — the "Dunbar red" — highly esteemed in the markets. Of the grain crops, oats and barley are the principal, and wheat also is grown. Turnips and potatoes are cultivated extensively. Many sheep are kept on the Lammermuirs.

Some fishing is carried on at Dunbar, North Berwick and Port Seton. Fireclay as well as limestone is worked, and there are some stone quarries. The chief industries are the manufacture of agricultural implements, pottery, bricks, woollens, and salt, besides brewing and distilling. Only a limited part of the Carboniferous limestone area includes the coal-measures, but coal is extensively worked at Tranent, Ormiston and near Prestonpans, the coalfield having an area of about 30 sq. miles. Ironstone is mined at Macmerry.

The county is served by the main line of the L.N.E R., with branches at Drem to North Berwick. at Longniddry to Haddington, and also to Gullane, at Smeaton (in Mid-Lothian) to Macmerry, and at Ormiston to Gifford.

Population and Government. — The population was 47,753 in 1938. The chief towns are Dunbar (pop. in 1938, 3,827), Haddington (4,664), North Berwick (3,165), Prestonpans (2,669), and Tranent (5,034).

The county, which returns one member to parliament. with Berwickshire, forms part of the sheriffdcm of Mid-Lothian, and a sheriff-substitute sits at Haddington, North Berwick and Tranent.

History. — Of the early Celtic inhabitants, traces are found in a few place-names and circular camps (in the parishes of Garvald and Whittingehame), and hill forts (in the parish of Bolton). Excavations at Traprain Law, carried on since 1914, gave evidence that this hill, a natural stronghold strengthened by earthworks, was in occupation nearly continually from the Bronze age to the beginning of the 5th century A.D. Most of the objects found are Celtic, but there was also a hoard of Roman silver plate of the 4th century, weighing over 770 oz., and believed to have been pillaged from Gaul by Saxon pirates. After the Roman occupation, of which few traces remain, the district formed part of the Saxon kingdom of Northumbria until 1018, when it was joined to Scotland by Malcolm II. It was comparatively prosperous till the wars of Bruce and Baliol, but from that period down to the union of the kingdoms it suffered from its nearness to the Border and from civil strife. The last battles fought in the county were those of Dunbar (1650) and Prestonpans (1745).

EASTMAN, GEORGE (1854–1932), American inventor, manufacturer, and philanthropist, was born at Waterville (N.Y.) on July 12, 1854. He was educated at Rochester and became interested in photography. In 1880 he began to manufacture dry plates, and four years later produced the first practicable roll film. In 1888 he invented the "kodak." He devoted the greater part of his fortune to the advancement of education, and had given by 1925 a total of over $58,000,000 for such purposes. Of this sum the university of Rochester received over $25,000,000, including upward of $5,500,000 for the medical school and $6,500,000 for the foundation and endowment of the Eastman school of music. He gave also $15,500,000 to the Massachusetts institute of technology and about $2,000,000 to the Hampton and Tuskegee institutes. He died Mar. 14, 1932. *(See* PHOTOGRAPHY.*)*

EASTMAN KODAK COMPANY, manufacturer of photographic equipment and materials, with plants in the United States, Canada, England, France, Germany, Hungary and Australia, and with distributing houses throughout the world, manufactures and sells Kodaks of many types; Ciné-Kodaks and Rodascopes, respectively used for making and projecting amateur motion pictures; photographic lenses and accessories; specialized photographic equipment for scientific, industrial and business uses; Kodak, Ciné-Kodak, X-ray, motion-picture and professional film; Kodachrome film for full-colour photography; film and plates for specialized purposes; photographic p in a wide range of varieties; photographic l nicals and photographic-laboratory equipment· approximately 3,5 synthetic organic chemicals; nonphotographic cellulose trat and cellulose-acetate ti s and sheeting; and Kodapak, a transparent packaging material.

The subsidiary Tennessee Eastman Corporation produces cellulose acetate for the manufacture of safety film and other purposes; acetate rayon yarn and staple fibre, including the crimped fibre, Teca; a cellulose-acetate molding composition, Tenite; and related products.

The industry came into existence with the photographic-plate business founded by George Eastman in 1880. It has grown from six employees to approximately 40,000. In 1889, Eastman and his associates introduced the first transparent film. .

The Kodak, the first compact, hand-held camera, had been invented the year before. In 1891, daylight loading was introduced; in 1923, the Ciné-Kodak; in 1931, the supersensitive panchromatic type of film, which revolutionized movie-studio technique and photography in other fields; and, in 1935, the Kodachrome colour process.

The Eastman Kodak Company has been a pioneer in research, in large-scale precision manufacturing, and in its comprehensive program for emplovee security. (F. C. E.)

EAST MQLINE, a city of Rock Island county, Ill., U.S.A., on the Mississippi river, adjoining Moline. It is served by the Burlington, the' Chicago, Milwaukee, St. Paul and Pacific, the Rock Island, and the Davenport, Rock Island and Northwestern railways. The population was 8,675 in 1920 (28% foreign-born white), and was 12,359 in 1940 by the federal census. It has important manufactures, similar to those of the neighbouring cities. including especially plows, scales. laundry machinery, harvesting machinery, steel playthings. pressed steel and voltage regulators. The city was incorporated in 1907.

EASTON, a city of eastern Pennsylvania, U.S.A., on the Delaware river, at the mouth of the Lehigh and Bushkill rivers, opposite Phillipsburg, N.J., 60 mi. N. of Philadelphia and 70 mi. W. of New York city; the county seat of Northampton county. It is on federal highways 22 and 611; is served by the Central of New Jersey, the Lehigh Valley, the Lehigh and Hudson River, and (through Phillipsburg) the Lackawanna and the Pennsylvania railways; and is at the junction of the Delaware and the Lehigh canals. The population was 33,813 in 1920 (91% native-born); 34,468 in 1930 and 33,589 in 1940 by the federal census; the population in the metropolitan area within 5 mi. of Centre square was 85,000.

The city is beautifully situated on rolling ground, commanding fine views of hills and rivers. The total bank resources are approximately $42,000,000 and building and loan resources, $5,000,000. On a hill overlooking the city is Lafayette college, a Presbyterian institution for men, opened in 1832, which has an enrolment of about 1,000. It was named after Gen. Lafayette, who was on tour through the United States when the movement to establish the college was launched in 1824.

Easton is the commercial centre of a region rich in mineral and agricultural resources. Abundant hydro-electric power is available, and the city has important and varied manufactures, with a total industrial pay roll of more than $15,000,000 annually. Among the principal products are steel, cement, silk, hosiery. paper cups, flour and feed, rope and twine, pumps, machinery of many kinds, plush, awnings, curtains, aluminum castings, auto springs, crayons, castings, men's clothing, railroad cars, steel bodies and showcases.

Easton was settled by Thomas and John Penn, brothers of William Penn, and was named after the family of Thomas Penn's wife. The land was acquired in 1752 from the Indians, who had had a trading post at that point, and several important treaties were negotiated with them there between 1756 and 1762, during the French and Indian war. The First Reformed church, built in 1776 and still standing, was used as a hospital during the Revolution. The bell rung to summon the people to the official reading of the Declaration of Independence on July 8, 1776, still hangs in the belfry of the courthouse, and the flag unfurled on that occasion is in the public library. The city of Easton was incorporated as a borough in 1789, as a city in 1887.

EAST ORANGE, a city of Essex county, New Jersey, 11 mi. W. of New York city, adjoining Newark. It is served by the Erie and the Lackawanna railways, and by interurban trolley and motor-coach lines. The population was 50,710 in 1920 (82% native white), 68,020 in 1930, and 68,945 in 1940 by federal census. East Orange and the adjoining municipalities of Orange, West Orange, South Orange and Maplewood (together known as "the Oranges") form a great residential suburban community, with a total population of about 165,000. The streets are broad and well shaded and there are many beautiful homes and several private schools, besides a public school system of high excellence. In East Orange is Upsala college (Lutheran, established 1893); and in South Orange, Seton Hall college (Roman Catholic, 1856). East Orange has an assessed valuation of $109,440,285 (1941). Its manufacturing industries are concentrated largely in the section called Ampere, and the principal products are sewer pipe, motors, dynamos, valves and pipe fittings and water-works supplies. The aggregate output in 1939 was valued at $6,026,103. In 1863 the township of East Orange was separated from the township of Orange, which had been set off from Newark in 1806; and in 1899 the city was incorporated.

EAST PALESTINE, a city of Columbiana county, Ohio, U.S.A., on the Pennsylvania railroad, near the eastern boundary of the state, 20 mi. S. by E. of Youngstown. Pop. (1930), 5,215; 1940 it was 5,123 by the federal census. Coal, fire clay and oil shales abound; it has manufactures of building tile, chinaware, electrical refractories and wiring devices, steel storage tanks for gas and oil, and various other articles. It is in the finest orchard district of the State.

EAST PITTSBURGH, a borough of Allegheny county, Pa., U.S A , on the Monongahela river, 12 mi. S.E. of Pittsburgh. It is served by the Bessemer and Lake Erie, the Pennsylvania, the Baltimore and Ohio, the Pittsburgh and Lake Erie, and the Union railways. The population was 6,527 in 1920 (30% foreign-born white), and was 6,079 in 1940 by federal census. The principal manufactures are electrical apparatus and dairy products. The borough was settled about 1871 and incorporated in 1894.

EAST POINT, city of Fulton county, Georgia, U.S.A.. $\frac{1}{4}$ mi. from the southern boundary of Atlanta; served by the Atlanta and West Point and the Central of Georgia railways. Pop., 9.512 in 1930 and 12,403 in 1940 by the federal census. It is a residential and industrial suburb, with a land area of 4.9 sq mi.

EASTPORT, a city of Washington county, Maine, occupying Moose island, in Passamaquoddy bay, a port of entry and the most easterly city of the United States. It is served by the Maine Central railroad and by steamer lines and ferries. The population was 3.466 in 1930; in 1940 it was 3,346. It has a large sardine-canning industry and important fisheries; has an airport; is the gateway to a fishing and hunting region; and is the site of the immense hydroelectric tidal power development, having the highest rise and fall of tides in the United States. The largest whirlpool in the western hemisphere forms off its eastern shore. Eastport was settled by fishermen in 1782; became a port of entry in 1790; was'incorporated as a town in 1798 and as a city in 1893. Under the Embargo acts of 1807 and 1808 it was a notorious place for smuggling. During the War of 1812 it was taken by the British (July 11, 1814), and after the close of the war was held under martial law until July, 1818, when it was surrendered to the U.S. in accordance with the provisions of the treaty of Ghent.

EAST PROVIDENCE, a town of Providence county, Rhode Island, U.S.A., on the east side of the Seekonk and Providence rivers, opposite Providence. It is served by the New York, New Haven and Hartford railroad. The population in 1940 was 32,165. There are four sections of the town: Watchemoket, the largest; Phillipsdale, containing most of the manufacturing; Rumford, which has a large chemical works; and Riverside, with attractive summer resorts. Oysters are shipped, and the output of the manufacturing works approximates $40,000,000 annually. Roger Williams established himself here in the spring of 1636, but left when he learned that he was within the jurisdiction of the Plymouth colony. Permanent settlement dates from 1644. In 1861 it was decided that the territory belonged to Rhode Island, and the town was incorporated in 1862.

EAST PRUSSIA, the easternmost province of the Land of Prussia, Germany, in 1939 bounded northwest by the Baltic sea, north and east by Lithuania, south by Poland, west by the territory of Danzig. Its area is 14,283 sq.mi. Population was (1939) 2,496,017, density 174 per sq.mi. It is part of the north German plain diversified in the south by morainic plateaus, thickly studded with small lakes. The dune coast is fringed by lagoons (Frisches Haff and Kurisches Haff) with eastward projecting sand spits to seawards. On the cultivated lands, which comprise about half the province, chiefly in the valleys of the north, are grown oats, rye, potatoes and flax (mainly in Ermeland) Horses and cattle are bred on the pastures. The south of the province is composed largely of forest, sterile moor, sand and bog, where a few wolves and lynxes still survive. Fishing is carried on in the lakes and haffs, while in Samland amber is found in great abundance. Foreign trade (main exports, timber and grain) is conducted through Konigsberg (*q.v.*), the capital. The population is predominantly German and Protestant except in Ermeland where Roman Catholics are in the majority and in the south where Poles have settled. In accordance with the Treaty of Versailles of 1919 plebiscites were held in the southern Marienwerder and Allenstein districts to determine whether they should remain with Prussia or go to Poland. By large majorities the population voted to remain with Prussia. By the Treaty also Memel (*q.v.*) was separated from East Prussia and created into a Free State under the League of Nations administration in order to provide Lithuania with a port. The so-called "Polish corridor" *(see* POMORZE) between East Prussia and Germany proper was forcibly annexed to the reich, along with other Polish territory and Danzig, in the first stages of World War II.

EAST SAINT LOUIS, a city of St. Clair county, Ill., U.S.A., on the Mississippi river, opposite Saint Louis, with which it is connected by three great steel bridges; one of the great railway centres of the country and an important manufacturing city. It is the focus of 21 railroads from the east, north and south, including the Baltimore and Ohio, Illinois Central, the Burlington, New York Central, the Louisville and Nashville, the Missouri Pacific, the Gulf Mobile and Ohio, the Nickel Plate, the Pennsylvania, the Saint Louis Southwestern, the Southern and the Wabash; is on federal highways 40, 50, 66 and 67; and is served by many local and transcontinental bus lines. The population in 1930 was 74,347 of whom 4,657 were foreign-born white and 11,536 were Negroes; and had increased to 75,609 in 1940 according to the federal census.

The city occupies 13.4 sq.mi. of the Mississippi bottom land, not much above the high-water mark of the river, but adequately protected by strong levees. The assessed valuation of property in 1940 was $42,908,014. Coal is mined at its doors (2,474,123 tons in the county in 1939).

The output of the factories within the city limits and in the adjacent metropolitan area in 1937 was valued at $162,000,000. Meat-packing houses employ 5,000 men. Other leading manufactures are aluminium ware, chemicals, glass bottles, paint pigments, railway equipment, roofing, brick, tile, pipe line valves and petroleum products. The stockyards are the second largest concentration point of livestock in the United States. Races are held regularly in the spring and fall.

East Saint Louis was laid out about 1808, and was chartered as a city in 1865. It grew most rapidly between 1900 and 1910, when the population practically doubled. There is a famous prehistoric mound (Monk's mound) near the city. The village of Cahokia, at the southern edge of the city, was one of the earliest French settlements in the Mississippi valley.

EAST STROUDSBURG, a borough of Monroe county, Pa., U.S.A., adjoining Stroudsburg (*q.v.*) and 20 mi. N. of Easton, surrounded by the beautiful scenery of the Kittatinny range and the Pocono mountains.

It is on federal highway 611 and is served by the Lackawanna and the Pennsylvania railways. The population was 4,855 in 1920 (93% native white), and was 6,099 in 1930 and 6.404 in 1940 by the federal census.

The borough has sundry manufacturing industries, has a progressive education system and is the seat of a state teachers' college (opened 1893).

EATON, DORMAN BRIDGMAN (1823–1899), American lawyer, was born at Hardwick (Vt.), June 27, 1823. He graduated at the University of Vermont in 1848 and at the Harvard law school in 1850, and in the same year was admitted to the bar in New York city. There he became associated in practice with William Kent, the son of the great chancellor. He was conspicuous in the fight against Tweed and his followers, by one of whom he was assaulted; he required a long period of rest, and went to Europe, where he studied the workings of the civil service in various countries. From 1873 to 1875 he was a member of the first United States civil service commission. In 1877, at the request of President Hayes, he made a careful study of the British civil service, and three years later published *Civil Service in Great Britain.* He drafted the Pendleton Civil Service Act of 1883, and later became a member of the new commission established by it. He resigned in 1885, but was almost immediately reappointed by President Cleveland, and served till 1886, editing the 3rd and 4th *Reports* of the commission. He was an organizer (1878) of the first society for the furtherance of civil service reform in New York, of the National Civil Service Reform Association, and of the national conference of the Unitarian Church (1865). He died in New York city, Dec. 23, 1899. Among his publications were: *Should Judges Be Elected?* (1873), *The Spoils System and Civil Service Reform* (1882), *Problems of Police Legislation* (1895) and *The Government of Municipalities* (1899).

See the privately printed memorial volume, *Dorman B. Baton, 1823-99* (1900).

EATON, MARGARET O'NEILL (1796–1879), better known as PEGGY O'NEILL, was the daughter of the keeper of a popular Washington tavern, and was noted for her beauty, wit and vivacity. About 1823, she married a purser in the United States navy, John B. Timberlake, who committed suicide while on service in the Mediterranean in 1828. In the following year she married John Henry Eaton (1790–1856), a Tennessee politician, at the time a member of the United States Senate. Senator Eaton was a close personal friend of President Jackson, who in 1829 appointed him secretary of war. This sudden elevation of Mrs. Eaton into the cabinet social circle was resented by the wives of several of Jackson's secretaries, and charges were made against her of improper conduct with Eaton previous to her marriage to him. The refusal of the wives of the cabinet members to recognize the wife of his friend angered President Jackson, and he tried in vain to coerce them. Eventually, and partly for this reason, he almost completely reorganized his cabinet. The effect of the incident on the political fortunes of the vice-president, John C. Calhoun, whose wife was one of the recalcitrants, was perhaps most important. Partly on this account, Jackson's favour was transferred from Calhoun to Martin Van Buren, the secretary of state, who had taken Jackson's side in the quarrel and had shown marked attention to Mrs. Eaton, and whose subsequent elevation to the vice-presidency and presidency through Jackson's favour is no doubt partly attributable to this incident. In 1836 Mrs. Eaton accompanied her husband to Spain, where he was United States minister in 1836–40. After the death of her husband she married a young Italian dancing-master, Antonio Buchignani, but soon obtained a divorce from him. She died in Washington on Nov. 8, 1879.

See James Parton's ***Life*** *of Andrew Jackson* (1860).

EATON, THEOPHILUS (*c.* 1590–1658), English colonial governor in America, born at Stony Stratford, Buckinghamshire, about 1590, settled in London, where he joined the Puritan congregation of the Rev. John Davenport. The pressure upon the Puritans increasing, Eaton, who had been one of the original patentees of the Massachusetts Bay Colony in 1629, determined to use his influence and fortune to establish an independent colony of which his pastor should be the head. He emigrated with Davenport to Massachusetts, and in the following year (March 1638) he and Davenport founded New Haven. In Oct. 1639 a form of government was adopted, based on the Mosaic law, and Eaton was elected governor, a post which he continued to hold, first over New Haven alone, and after 1643 over the New Haven Colony or jurisdiction, until his death at New Haven, Jan. 7, 1658. He was prominent in the affairs of the New England Confederation, of which he was one of the founders (1643). In 16 jS he and Davenport drew up the code of laws, popularly known as the "Connecticut Blue laws."

A sketch of his life appears in Cotton Mather's *Magnalia* (London, 1702); *see* also *J. B.* Moore's "Memoir of Theophilus Eaton" in the *Collections* of the New York Historical Society, second series, vol. ii. (New York, 1849).

EATON, WILLIAM (1764–1811), American soldier, was born in Woodstock, Conn., on Feb. 23, 1764. He was a school teacher for several years, graduated at Dartmouth college in 1790, and in 1792 entered the army as a captain, later serving against the Indians in Ohio and Georgia. In 1797 he was appointed consul to Tunis, where he arrived in Feb. 1799. In March 1799, with the consuls to Tripoli and Algiers, he negotiated alterations in the treaty of 1797 with Tunis. He rendered great service to Danish merchantmen by buying on credit several Danish prizes in Tunis and turning them over to their original owners for the redemption of his notes. In 1803 he quarrelled with the bey, was ordered from the country, and returned to the United States. In 1804 he returned to the Mediterranean as United States naval agent to the Barbary States with Barron's fleet. On Feb. 23, 1805, he agreed with Ahmet that the United States should undertake to re-establish him in Tripoli, that the expenses of the expedition should be repaid to the United States by Ahmet, and that Eaton should be general and commander-in-chief of the land forces in Ahmet's campaign. In making the arrangement Eaton far

exceeded his authority. On March 8 he started for Derna across the Libyan desert from the Arab's Tower, 40 m. west of Alexandria, with a force of about 500 men, including a few Americans, about 40 Greeks and some Arab cavalry. In the march of nearly 600 m. the camel-drivers and the Arab chiefs repeatedly mutinied, and Ahmet Pasha once put himself at the head of the Arabs and ordered them to attack Eaton. Ahmet more than once wished to give up the expedition. But on April 27, with the assistance of three bombarding cruisers, Eaton captured Derna—an exploit commemorated by Whittier's poem *Derne*. In May and again in June he successfully withstood the attacks of Tripolitan forces sent to dislodge him. On June 12 he abandoned the town upon orders from Commodore Rodgers, for peace had already been made (June 4) with Yussuf, the de *facto* pasha of Tripoli. Eaton returned to the United States, and received a grant of 10,000 ac. in Maine from the Massachusetts legislature. According to a deposition which he made in 1807 he was approached by Aaron Burr (*q.v.*), who attempted to enlist him in his "conspiracy." As he received from the Government, soon after making this deposition, about $10,000 to liquidate claims for his expense in Tripoli, which he had long pressed in vain, his good faith has been doubted. At Burr's trial at Richmond in 1807 Eaton was one of the witnesses, but his testimony was unimportant. He died on June 1, 1811, in Brimfield, Mass.

See the anonymously published Life of *the* Late Gen. William *Eaton* (Brookfield, Mass., 1813) by Charles Prentiss; C. C. Felton, "Life of William Eaton" in Sparks's Library of American Biography, vol. ix. (Boston, 1838); Gardner W. Allen's Our Navy and the Barbary Corsairs (Boston, 1905); and William Abbott, "A Forgotten Hero, William Eaton," Mag, of *Hist.*, vol. vi., pp. i.–ii. (1907). See also E. A. Powell, Gentlemen Rovers (1913); and M. Minnigerode, Lives and Times (1925).

EATON, WYATT (1849–1896), American portrait and figure painter, was born at Philipsburg, Canada, on May 6, 1849. He was a pupil of the schools of the National Academy of Design, New York, and in 1872 went to Paris, where he studied in the École des Beaux-Arts under J. L. Gérôme. He made the acquaintance of J. F. Millet at Barbizon, and was also influenced by his friend Jules Bastien-Lepage. After his return to the United States in 1876 he became a teacher in Cooper institute and opened a studio in New York city. He was one of the organizers (and the first secretary) of the Society of American Artists. Among his portraits are those of William Cullen Bryant and Timothy Cole, the wood engraver ("The Man with the Violin"). Eaton died at Newport (R.I.), on June 7, 1896.

EAU CLAIRE (ō′klār′), a city of north-western Wisconsin, U.S.A., 84 mi. E. of Saint Paul, on the Chippewa river at the mouth of the Eau Claire; the county seat of Eau Claire county. It is on Federal highways 10, 12 and 53, and is served by the Chicago and North Western, the Chicago, Milwaukee, St. Paul and Pacific and the Soo Line railways.

The population was 30,745 in 1940, and was 26,287 in 1930 by Federal census. There is abundant waterpower, and the city has large and diversified manufacturing enterprises, with an aggregate output in 1940 valued at $29,172,523. It is the principal jobbing centre for the prosperous Chippewa valley. Since 1912 the city has operated under a commission form of government. It is the scat of a State teachers' college, a county tuberculosis hospital and a county hospital for the insane. There are six musical organizations and a municipal auditorium seating 2,000. A State fish hatchery assures good fishing in the vicinity.

Eau Claire was settled about 1847; chartered as a city in 1872; and grew rapidly with the development of the north-uestern lumber trade in the decade 1870–80. A serious strike in 1881 necessitated the calling out of the State militia.

EAU DE COLOGNE, a perfume, so named from the city of Cologne, where its manufacture was first established by an Italian, Johann (or Giovanni) Maria Farina (1685–1766), who settled at Cologne in 1709. The perfume gained a high reputation by 1766, and Farina associated himself with his nephew, to whose grandson the secret was ultimately imparted; the original perfume is still manufactured by members of this family under the name of the founder. The manufacture is, however, carried on at Cologne, and also in Italy, by other firms bearing the name Farina, and the scent has become part of the regular output of perfumers. The discovery has also been ascribed to a Paul de Ferninis, who is supposed to have brought his recipe from Milan to Cologne, of which he became a citizen in 1690, and sold the perfume under the name Eau admirable, leaving the secret at his death to his nephew Johann Maria Farina. It was prepared from an alcoholic infusion of certain flowers, pot-herbs, drugs and spices, distilling and then adding definite quantities of several vegetable essences. The purity and thorough blending of the ipgredients are of the greatest importance, The original perfume is simulated and even excelled by artificial preparations. The oils of lemon, bergamot and orange are employed, together with the oils of neroli and rosemary in the better class. The common practice consists in dissolving the oils, in certain definite proportions based on experience, in pure alcohol and distilling, the distillate being diluted by rose-water.

EAU DE VIE: see **BRANDY**.

EAUX-BONNES, a watering-place of southwestern France, in the department of Basses-Pyrénées, 3½ mi. S.E. of the small town of Laruns, the latter being 24 mi. S. of Pau by rail. Pop. (1936) 181, commune 462. Eaux-Bonnes stands at a height of 2,460 ft. at the mouth of a fine gorge, at the confluence of two torrents, the Valentin and the Sourde. Its sulphurous and saline mineral waters (famous from the 14th century), are beneficial in affections of the throat and lungs. They vary between 10° and 90° in temperature, and are used for drinking and bathing. There are two thermal establishments, a casino and fine promenades.

The watering-place of LES EAUX-CHAUDES is 5 mi. by road south-west of Eaux-Bonnes, in a wild gorge on the Gave d'Ossau. The springs are sulphurous, varying in temperature from 52° to 97°, and are used in cases of rheumatism, certain maladies of women, etc. There is fine mountain scenery in the neighbourhood of both places. The valley of Ossau, one of the most beautiful in the Pyrénées, before the Revolution formed a community which, though dependent on Béarn, had its own legal organization, manners and costumes.

EAVES (not a plural form as is sometimes supposed, but singular), in architecture, the projecting edge of a sloping roof, which overhangs the face of the wall so as to throw off the water.

EAVESDRIP or **EAVESDROP,** that width of ground around a house or building which receives the rain water dropping from the eaves. By an ancient Saxon law, a landowner was forbidden to erect any building at less than aft. from the boundary of his land, and was thus prevented from injuring his neighbour's house or property by the dripping of water from his eaves. The law of eavesdrip has had its equivalent in the Roman *stillicidium,* which prohibited building up to the very edge of an estate. This prohibition has been adopted by some States which follow the Roman civil law.

From the Saxon custom arose the term "eavesdropper," *i.e.,* any one who stands within "the eavesdrop" of a house, hence one who pries into others' business or listens to secrets. At common law an eavesdropper was regarded as a common nuisance, and was presentable at the court leet, and indictable at the sheriff's tourn and punishable by fine and finding sureties for good behaviour. Though the offence of eavesdropping still exists at common law, there is no modern instance of prosecution or indictment.

EBBW VALE, urban district, Monmouthshire, England, 21 m. N.W. of Neuport, on the G.W. and L.M.S. lines. Pop. (1938) 29,750. The town lies near the head of the Ebbw valley, nearly 1,000 ft. above sea-level. Its position on the northern outcrop of the South Wales coalfield made it, first of all, an important iron-smelting area, and subsequently a coal-mining centre. The extended use of coal and new processes in smelting brought about the establishment of one of the most important steel works in South Wales. Distance from the coast and trade depression after the World War have caused decline and distress.

EBEL, HERMANN WILHELM (1820–1875), German Celtic scholar, studied at Berlin and Halle, and, after holding other professional posts, became professor of comparative philology at Berlin. He died at Misdroy on Aug. 19, 1875. His most

important contribution to Celtic philology was his revised edition (1871) of Zeuss's *Grammatica Celtica.* A selection of his papers was published in English as *Celtic Studies* (edit. Sullivan, 1863).

EBEL, JOHANN GOTTFRIED (1764–1830), author of the first real guide-book to Switzerland, was born at Zullichau in Prussia on Oct. 6, 1764. He first visited Switzerland in 1790. As a result of three years' study he published *Anleitung auf die nützlichste und genussvollste Art in der Schweiz zu reisen* (Zurich, 1793). This was the best Swiss guide-book till "Murray" (1838). In 1801 he was naturalized Swiss and settled in Zurich. He died on Oct. 8, 1830.

Ebel's other works include *Schilderungen der Gebirgsvölker der Schweiz* (2 vols., Leipzig, 1798–1802); *Über den Bau der Erde im Alpengebirge* (2 vols., Ziirich, 1808).

EBENACEAE, a family of dicotyledonous trees and shrubs including the ebony (*q.v.*) and other valuable timber-trees. It has seven genera, with about 320 species, chiefly tropical or subtropical, and especially abundant in Malaya. The fruit is usually a berry. Several tropical species are cultivated for their edible fruits, while the Chinese persimmon *(Diospyros kaki)* is one of the most important fruits of China and Japan, also cultivated in various parts of North America. The family is represented in the United States by two species of persimmon (*q.v.*).

EBER, PAUL (1511–1569), German theologian, was born at Kitzingen in Franconia, and was educated at Nuremberg and Wittenberg, where he became the close friend of Philip Melanchthon. In 1541 he was appointed professor of Latin grammar at Wittenberg, and in 1557 professor of the Old Testament. He published a handbook of Jewish history, a historical calendar intended to supersede the Roman Saints' Calendar, and a revision of the Latin Old Testament. In the theological conflict of the time he sought to mediate between the extremists. From 1559 to the close of his life he was superintendent-general of the electorate of Saxony. He died at Wittenberg on Dec. 10, 1569.

EBERBACH, a town of Germany, in the *Land* of Baden, romantically on the Neckar, at the foot of the Katzenbuckel. 19 mi. E. of Heidelberg by the railway to Wiirzburg. Population 6,973. It manufactures barrel-hoops, chemicals and cigars, and carries on by water an active trade in timber and wine. Eberbach was founded in 1227 by the German king Henry VII, who acquired the castle (now ruined) from the bishop of Worms.

EBERBACH, a famous Cistercian monastery of Germany, in the Prussian province of Hesse-Nassau, situated near Hattenheim in the Rheingau, 10 m. N.W. from Wiesbaden. Founded in 1116 by Archbishop Adalbert of Mainz, as a house of Augustinian canons regular, it was bestowed by him in 1131 upon the Benedictines, but was shortly afterwards repurchased and conferred upon the Cistercian order. The Romanesque church (consecrated in 1186) was despoiled during the Thirty Years' War and secularized in 1803.

EBERHARD (?–939), duke of the Franks, brother of Conrad, duke of Franconia and German king (911–918). In 915 Eberhard supported his brother against the rebel, Henry the Fowler of Saxony, but was defeated, and when Conrad died (918), Eberhard, at his brother's wish, carried to Henry the royal crown and sceptre, obtaining, however, for his support, almost complete independence for his own dukedom of Franconia. In 938 Eberhard rebelled against the new king, Otto the Great. He was defeated and fined, and his abettors condemned to carry dogs through the streets of Magdeburg. In the following year Eberhard, allied with the king's brother Henry and Gilbert of Lorraine, rebelled again, but was surprised and slain at Andernach on the Rhine.

EBERHARD, surnamed IM BART *(Barbatus),* count and afterwards duke of Württemberg (1445–1496), was born on Dec. 11, 1445, the second son of Louis I., count of Wurttemberg-Urach (d. 1450) and succeeded his elder brother Louis II. in 1457. In 1468 he made a pilgrimage to Jerusalem. He visited Italy, became acquainted with some famous scholars, and in 1474 married Barbsra di Gonzaga, daughter of Lodovico III., marquis of Mantua. In 1482 he made with his cousin Eberhard VI., count of Württemberg-Stuttgart, the treaty of Munsingen, by which the districts of Urach and Stuttgart into which Wiirttemberg had been divided in 1437 were again united. The country was declared indivisible, and the right of primogeniture established. *(See* WÜRTTEMBERG.) At the diet of Worms in 1495 the emperor Maximilian I. guaranteed the treaty, and raised Eberhard to the rank of duke. Eberhard was one of the founders of the Swabian League in 1488. He gave charters to the towns of Stuttgart and Tubingen, and introduced order into the convents of his land, some of which he secularized. He took a keen interest in the new learning and founded the university of Tübingen in 1476. In 1482 he again visited Italy and received the Golden Rose from Pope Sixtus IV. He died at Tiibingen on Feb. 25, 1496. The succession passed to his cousin Eberhard, who became Duke Eberhard II.

See Rösslin, *Leben Eberhards im Barte* (Tiibingen, 1793); Bossert, *Eberhard im Bart* (Stuttgart, 1884).

EBERHARD, CHRISTIAN AUGUST GOTTLOB (1769–1845), a versatile German writer, was born at Belzig, near Wittenberg, on Jan. 12, 1769. His best works are *Hannchen und die Küchlein* (1822), a narrative poem in ten parts, and an epic on the Creation, *Der erste Mensch und die Erde* (1828). He died at Dresden on May 13, 1845.

His collected works *(Gesammelte Schriften)* appeared in 20 volumes in 1830–31.

EBERHARD, JOHANN AUGUSTUS (1739–1809), German theologian and philosopher, was born at Halberstadt, Lower Saxony, where his father was singing master at the church of St. Martin's, and teacher of the school of the same name. He studied theology at the university of Halle, and took orders. At Berlin he formed a close friendship with Nicolai and Moses Mendelssohn. His *Neue Apologie des Socrates* (1772) hindered his preferment. But in 1774 he was appointed to the living of Charlottenburg, and in 1778 became professor of philosophy at Halle. He died on Jan. 6, 1809.

His works include: *Amyntor, eine Geschichte in Briefen* (Berlin, 1782)—written to counteract the influence of those sceptical and Epicurean principles in religion and morals then so prevalent in France, and rapidly spreading in Germany; *Über die Zeichen der Aufklärung einer Nation,* etc. (Halle, 1783); *Theorie der schonen Künste und Wissenschaften,* etc. (Halle, 1783, 3rd ed., 1790); *Allgemeine Geschichte der Philosophie,* etc. (Halle, 1788; 2nd ed. with a continuation and chronological tables, 1796); *Versuch einer allgemeinen-deutschen Synonymik* (Halle and Leipzig, 1795–1802, 6 vols., 4th ed., 1852–53), long reckoned the best work on the synonyms of the German language (author's abridgment, 1 vol., Halle, 1802); *Handbuch der Aesthetik* (Halle, 1803–05, and ed., 1807–20).

See F. Nicolai, *Gedachtnisschrift auf* J. *A. Eberhard* (Berlin and Stettin, 1810); also K. H. Jordens, *Lexicon deutscher Dichter und Prosaisten.*

EBERLEIN, GUSTAV (1847–1926). A German sculptor born on July 14, 1847, at Spickershausen, Hanover. He studied at the Academy of Nuremberg and at Berlin under Blaeser, a follower of the classicist Rauch. After a visit to Rome in 1873 where he was attracted to the Baroque he joined the group of sculptors led by Reinhold Begas. In 1887 he became a member of the Berlin academy, in 1893 he was made professor and in 1897 he held an important exhibition of his work at the Berlin academy. His reputation rests chiefly upon his numerous public monuments, such as those of the emperor William I. (Mannheim, Elberfeld and Altona); Bismarck (Krefeld); Richard Wagner (Berlin); Goethe (Rome); Queen Luise (Tilsit). He also executed religious pieces such as the groups representing the life of Adam and Eve; and mythological pieces such as Pygmalion and Galatea. In 1898 he presented the Eberlein museum to Münden in his native Hanover, which contains a representative collection of his work. In 1892 he published *Aus eines Bildners Seelenleben, Plastik, Malerei und Poesie.*

See A. Rosenberg, *Eberlein* (Bielefeld, 1903).

EBERLIN, JOHANN ERNST (1702–1762), German musician and composer, was born in Jettingen, Bavaria, on March 27, 1702, and became court organist to the prince-archbishop of Salzburg, where he died on June 21, 1762. Most of his compositions were for the church (oratorios, etc.), but he also wrote some important fugues, sonatas and preludes, and his pieces were at one time highly valued by Mozart.

EBERS, GEORG MORITZ (1837–1898), German Egyptologist and novelist, was born in Berlin on March 1, 1837. At Gottingen he studied jurisprudence, and at Berlin oriental languages and archaeology. He became in 1865 *docent* in Egyptian language and antiquities at Jena, and from 1870 to 1889 he was professor at Leipzig. He had made two scientific journeys to Egypt, and his first work of importance, *Ägypten und die Bucher Moses,* appeared in 1867–1868. In 1874 he edited the medical papyrus ("Papyrus Ebers") which he had discovered in Thebes (tr. by H. Joachim, 1890). Ebers early conceived the idea of popularizing Egyptology by means of historical romances. *Eine ägyptische Konigstochter* (1864) had a great success. His subsequent works of the same kind—Uarda (1877), *Homo sum* (1878), *Die Schwestern* (1880), *Der Kaiser* (1881), of which the scene is laid in Egypt at the time of Hadrian, *Serapis* (1885), *Die Nilbraut* (1887), and *Kleopatra* (1894), were also popular. Ebers also turned his attention to other historical periods—especially the 16th century *(Die Frau Bürgermeisterin,* 1882; *Die Gred,* 1887)—without, however, attaining the success of his Egyptian novels. His other writings include a descriptive work on Egypt (*Ägypten in Wort und Bild,* 2nd ed., 1880), a guide to Egypt (1886) and a life (1885) of his old teacher, the Egyptologist Karl Richard Lepsius. He died at Tutzing, Bavaria, on Aug. 7, 1898.

Ebers's *Gesanzmelte Werke* appeared in 25 vols. at Stuttgart (1893–1895). Many of his books have been translated into English. For his life *see* his *Die Geschichte meines* ***Lebens*** (Stuttgart, 1893); also R. Gosche, *G. Ebers, der Forscher und Dichter* (2nd ed., Leipzig, 1887).

EBERSWALDE, a town of Germany, in the province of Brandenburg, 28mi. N.E. of Berlin by rail; on the Finow canal. Pop. (1939) 40,985. It received its municipal charter in 1257, but was sacked during the Thirty Years' War. In 1747 Thuringian cutlers came to the town, but the cutlery industry has died out. About 4 mi. to the north lies the Cistercian monastery of Chorin.

The town has a 14th-century church. Industries include iron-founding and the making of roofing material and bricks. Trade is in grain, wood and coal. In the immediate neighbourhood are an important brass-foundry and a Government paper-mill, in which paper for note money is manufactured.

EBERT, ADOLF (1820–1890), German romance philologist, was born at Kassel on June 1, 1820. He was professor of romance languages in Marburg, and from 1862 onwards in Leipzig, where he died on July 1, 1890. He wrote a standard work on mediaeval literature, which is still indispensable to the student and has been the basis of much subsequent work by later writers, *Allgemeine Geschichte der Literatur im Abendlande* (3 vols., 1884–87). From 1859–63 he edited, with F. Wolf, the *Jahrbuch fur romanische und englische Literatur.*

EBERT, FRIEDRICH (1870–1925), German politician, was born in Heidelberg on Nov. 4, 1870, the son of an impecunious tailor. He was an early recruit to the Socialist movement, becoming a fluent speaker and a first-class trade union organizer, suffering persecution and boycott for the cause. He moved to Hanover, and later on to Bremen, where he joined the staff of the local paper of the party, and, having dropped his trade as a saddler, became labour secretary for Bremen. From 1905 Ebert played an important part in the direction of the Socialist Party. He entered the *reichstag* in 1912. A year later he became chairman of the party, which at that time was torn between the Orthodox and Revisionists; his common sense was considered a guarantee for keeping the party together.

At the outbreak of the World War, Ebert, deeply impressed by the danger of Russian victory, led the bulk of the party who voted for war credits. His common sense repudiated the optimistic pacificism of Haase and his followers, who later became the Independent Socialist Party. He continued to strive, however, at home and abroad, especially at the Stockholm Conference in June 1917, for a just peace. He became leader of the Majority Socialists in 1916 and chairman of the budget commission of the *Reichstag* in 1918. Though disapproving of the Peace of Brest-Litovsk, he opposed strikes to bring about peace. In Feb. 1918 he tried hard and fairly successfully to put an end to the Berlin strike, which threatened to become a national calamity. For the part he played at that time he was attacked later on by the Independents as well as by the representatives of the old order.

After Ludendorff's collapse in Sept. 1918 Prince Max of Baden formed the first parliamentary cabinet. Ebert induced his party to join at a time when Ludendorff's insistence on an immediate demand for an armistice was already known. The negotiations about the armistice continued over a month. The suffering working classes began to be restless. When the plans to force a great naval battle became known, a mutiny took place at Kiel. Acting on Ebert's advice, Prince Max sent Noske to Kiel who succeeded in re-establishing order.

Ebert, knowing the historical attachment of the German people to monarchy, wanted a democratic parliamentary government, on English lines, but no republic. When the organized working men began to follow the Independents, Scheidemann intimated to Prince Max (Nov. 7) that the Socialists must withdraw from the cabinet, and that if the emperor did not abdicate by the 9th one of his sons, not the crown prince, should take his place. The emperor vacillated. By the 9th the masses had got out of hand. The monarchy collapsed, but the knowledge of the abdication had not the desired effect. Scheidemann proclaimed the German republic, and Prince Max offered Ebert the chancellorship, which he accepted. He formed a Provisional Government consisting of three Independents and two Majority Socialists besides himself.

From Nov. 1918 to Feb. 1919 it was touch and go whether Germany would be a democratic country or a soviet republic. The small group of German Bolshevists, the Spartacus Union, led by Karl Liebknecht and Rosa Luxemburg, insisted that Russia's example should be followed, whilst the Independents did lip service to democracy, but wanted to postpone the elections. Ebert insisted on early elections for a constituent assembly, to give Germany a Democratic constitution. For nearly two months the Government had no power. The Spartacists had armed their adherents and repeatedly tried to imprison Ebert and his colleagues. Ebert called Noske to Berlin, who succeeded in quelling the December and the January risings by means of quickly organized volunteers. When the struggle was over, the elections to the national assembly took place quietly. Democracy had won the day, thanks to Ebert and the Moderate Socialists. It was but fitting that the assembly elected him the first provisional president of the German republic. Ebert stuck to his post when the Treaty of Versailles had to be signed and later when (March 1920), a military rising, the Kapp Putsch, took place. He left Berlin with his Government to return after the general strike had forced the leaders to surrender.

Ebert's appointment as president was provisional. He wanted to withdraw from office at the appointed time (1922) and to subject himself to a proper election. He bowed, probably unwisely from his point of view, to the wishes of the majority of the *Reichstag,* including the People's Party, who asked him to accept office for a second term from their hands until 1925. When that term drew near its end, reactionary and radical forces had gained strength in Germany. This was shown by the result of the general election of May 1924. But by 1925, after stabilization had done its work, the situation had improved considerably; there appeared to be quite a fair chance that Ebert, if he chose to stand, might be re-elected.

By that time Ebert had dropped the party leadership. He remained on friendly terms with his party, but he considered himself the representative of the German people as a whole. He wielded the great but rather veiled power of the German president with consummate tact. His attitude when forming cabinets, and when reaching decisions was correct, constitutional and wise. He had gained the confidence of all persons with whom he came in contact. He had made the office of the president influential, though not conspicuous. This artisan who had not had the academic training so greatly valued in Germany succeeded in getting a firm grasp on foreign affairs. He saw a point quickly and he knew how to deal with men. Singularly modest and unassuming, his was the dominant influence, nevertheless, in the many crises the German republic had to pass through in the years that.

followed the peace.

But the fact that a plain man of the people was the head of the state did not commend itself to the reactionary elements of German society. A campaign of calumny was organized against him, accusing him of having fomented sedition and broken the back of the German army. He was forced to bring an action for libel against Herr Rothard, who had published in the *Mitteldeutsche Zeitung* a letter and footnote accusing Ebert of treasonable conduct in connection with the munition workers' strike in Jan. 1918. Rothard was found technically guilty, but the judge's finding was unfavourable to Ebert. As the judge's political bias was scarcely denied, the public, including the cabinet sided with Ebert. The central government and many state governments passed votes of confidence; the public assured him of their sympathy, but the strain practically killed Ebert, who had been suffering from repeated attacks of appendicitis. He did not wish to be operated upon before the case was over, and then it was too late. He died on Feb. 28, 1925, at Charlottenburg.

Ebert was a very fortunate combination of the lighthearted spirituality and sober shrewdness of the south German. He had faith in ideas and ideals, but he believed in action and in organization as well. There was passion in him, but there was common sense; there was strength in him, and there was sober suavity. He was by no means a genius towering head and shoulders above his fellow men. He was rather one of them, sharing their feelings and their qualities so that they could trust him completely, being just far enough ahead of them to make them follow him, the true leader for an incipient democracy.

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EBERT, FRIEDRICH ADOLF (1791–1834), German bibliographer, was born at Taucha, near Leipzig, on July 9, 1791, the son of a Lutheran pastor. In 1813 he was attached to the Leipzig university library, and in 1814 was appointed secretary to the Royal library of Dresden and, in 1827, after a short period of absence, chief librarian. The rich resources open to him in the Dresden library enabled him to undertake the work on which his reputation chiefly rests, the *Allgemeines bibliographisches Lexikon* (2 vols 1821–30). This was the first work of the kind produced in Germany, and the most scientific published anywhere. Ebert was a contributor to various journals and took part in the editing of Ersch and Gruber's great encyclopaedia. He died at Dresden on Nov. 13, 1834, in consequence of a fall from the ladder in his library.

See the article in *Ersch und Grubers Encyclopadie,* and that in the *Allg. deutsclze Biog. by* his successor in the post of chief librarian at Dresden, Schnorr von Carolsfeld.

EBERTH, KARL JOSEPH (1835–1926), bacteriologist, was born in Würzburg where he studied under Kolliker and Virchow (*qq.v.*). He was called in 1874 to Ziirich, and in 1881 to Halle. He made numerous important contributions to bacteriology and pathology, and is still commemorated in the so-called "Eberth's bacillus," the organic cause of typhoid fever, which was first distinguished by him in 1880.

See R. Renecke's biography in *Berliner Klinische Wochenschrift,* 1915, *LTI,* 1010–1012; works given in J. Page, *Biographisches Lexikon hervorragender Aerzte* (Vienna) 1901.

EBINGEN, a town of Germany, in the *Land* of Württemberg, on the Schmiecha, a left-hand tributary of the Danube, 37 mi. W. of Ulm by rail. It manufactures velvet and cotton-velvet ("Manchester") goods, stockings, stays, hats, needles, tools, etc. There are also tanneries. Pop. (1939) 14,881.

EBIONITES (Heb. אֶבְיוֹנִים "poor men"), a name given to the ultra-Jewish party in the early Christian church. It is first met with in Irenaeus (Adv. *Haer.* i, 26, 2), who sheds no light on the origin of the Ebionites, but says that while they admit the world to have been made by the true God (in contrast to the Demiurge of the Gnostics), they held that Christ was a miraculously endowed man, and rejected Paul as an apostate from the Mosaic law to the customs and ordinances of which, including circumcision, they steadily adhered. A similar account is given by Hippolytus *(Haer.* vii, 35), who invents a founder named Ebion. Origen *(Contra Celsum,* v. 61; *In Matt.* tom. xvi, 12) divides the Ebionites into two classes according to their acceptance or rejection of the virgin birth of Jesus, but says that all alike reject the Pauline epistles. This is confirmed by Eusebius, who adds that even those who admitted the virgin birth did not accept the pre-existence of Jesus as Logos and Sophia. They kept both the Jewish Sabbath and the Christian Lord's day, and held extreme millenarian ideas in which Jerusalem figured as the centre of the coming Messianic kingdom. Epiphanius with his customary confusion makes two separate sects, Ebionites and Nazarenes; both names, however, refer to the same people (the Jewish Christians of Syria), the latter going back to the designation of apostolic times (Acts xxiv, 5), and the former being the term usually applied to them in the ecclesiastical literature of the 2nd and 3rd centuries.

The origin of the Nazarenes or Ebionites as a distinct sect is very obscure, but may be dated with much likelihood from the edict of Hadrian which in 135 finally scattered the old church of Jerusalem. While Christians of the type of Aristo of Pella and Hegesippus, on the snapping of the old ties, were gradually assimilated to the great church outside, the more conservative section became more and more isolated and exclusive. "It may have been then that they called themselves the Poor Men, probably as claiming to be the true representatives of those who had been blessed in the Sermon on the Mount, but possibly adding to the name other associations." Out of touch with the main stream of the church they developed a new kind of pharisaism. Doctrinally they stood not so much for a theology as for a refusal of theology, and, rejecting the practical liberalism of Paul, became the natural heirs of those early Tudaizers who had caused the apostle so much annoyance and trouble. Though there is insufficient justification for dividing the Ebionites into two separate and distinct communities, labelled respectively Ebionites and Nazarenes, we have good evidence, not only that there were grades of Christological thought among them, but that a considerable section, at the end of the 2nd century and the beginning of the 3rd, exchanged their simple Judaistic creed for a strange blend of Essenism, Gnosticism—as in the Clementine literature (*q.v.*) of the 3rd century—and Christianity.

See W. Beveridge, art. "Ebionism" in Hastings *Encyclopaedia of Religion and Ethics,* with refs.; articles "Ebioniten," "Elkasaiten," "Clementinen," in Herzog-Hauck, *Realenzyclopädie,* with refs.; F. J. A. Hort, *Judaistic Christianity* (still valuable); Harnack, *History* of *Dogma* (Eng. tr., vol. i); Lightfoot, "St. Paul and the Three" in *Commentary on Galatians;* Ottley, *Doctrine of the Incarnation,* pt. iii, § 2; and the general church histories.

EBNER-ESCHENBACH, MARIE, FREIFRAU VON (1830–1916), Austrian novelist, was born at Zdislavič in Moravia, on Sept. 13, 1830, the daughter of a Count Dubsky. She lost her mother in early infancy, but received a careful intellectual training from two slepmothers. In 1848 she married the Austrian captain, and subsequent field marshal, Moritz von Ebner-Eschenbach, and resided first at Vienna, then at Klosterbruck, where her husband had a military charge, and after 1860 again at Vienna. Her first essay was with the drama *Maria Stuart in Schottland,* which *P.* E. Devrient produced at the Karlsruhe theatre in 1860, but she found her true sphere in narrative. Commencing with *Die Prinzessin von Banalien* (1872), she graphically depicted in *Bofena* (1876, 4th ed. 1899) and *Das Gemeindekind* (1887, 4th

ed. 1900) the surroundings of her Moravian home, and in *Lotti, die Uhrmacherin* (1883, 4th ed. 1900), *Zwei Comtessen* (1885, 5th ed. 1898; Eng. trans. 1893), *Unsühnbar* (1890, 5th ed. 1900) and *Glaubenslos?* (1893) the life of the Austrian aristocracy in town and country. Later books are *Neue Erzahlungen* (1881, 3rd ed. 1894), *Aphorismen* (1880, 4th ed. 1895), *Parabehz, Märchen und Gedichte* (2nd ed. 1892), *Aus Spatherbsttagen* (1901) and *Agave* (1903). Frau von Ebner-Eschenbach's incisive wit and masterly character-drawing give her a foremost place among the German writers of her time. She died in Vienna on March 12, 1916.

See A. Bettelheirn, "Marie von Ebner Eschenbach und Julius Rodenberg," *Deutsche Rundschau.* Jahrg. *46,* pp. 6–23 (Berlin, 1920); A. Bettelheim, *Marie von Ebner Eschenbach's Wirken und Vermächtnis* (Leipzig, 1920).

EBONITE, a substance manufactured by over-vulcanizing rubber. Pure rubber is mixed with about 40% of sulphur by rolling, and the resulting mass heated for from six to ten hours at a temperature of 150°. The valuable material thus obtained is a non-conductor of electricity and resists many chemical reagents. *(See* RUBBER: PRODUCTION AND MANUFACTURE.)

EBONY, the wood of trees of the genus *Diospyros* (family Ebenaceae), widely distributed in the tropical parts of the world. The best kinds are very heavy, deep black, and consist of heartwood only. On account of its colour, durability, hardness and susceptibility of polish, ebony is much used for cabinet work and inlaying, pianoforte-keys, knife-handles and turned articles. The best Indian and Ceylon ebony is furnished by *D. Ebenum,* which grows in abundance throughout the flat country west of Trincomalee in Ceylon. The tree is distinguished by the inferior width of its trunk, and its jet-black, charred-looking bark, beneath which the wood is perfectly white until the heart is reached. The wood is stated to excel all other varieties in the fineness and intensity of its dark colour. Although the centre of the tree alone is employed, reduced logs 1 to 3ft. in diameter can readily be procured. Much of the East Indian ebony is yielded by *D. melanoxylon* (Coromandel ebony), *a* large tree attaining a height of 60 to 8oft., and 8 to 1oft. in circumference, with irregular rigid branches, and oblong or oblong-lanceolate leaves. The wood of *D. tomentosa,* a native of north Bengal, is black, hard and of great weight. *D. montana,* another Indian species, produces a yellowish-grey soft but durable wood. *D. quaesita* is the tree from which is obtained the wood known in Ceylon as *Calanzander.* Its closeness of grain, great hardness and fine hazel-brown colour, mottled and striped with black, render it valuable for veneering and furniture making. *D. dendo,* a native of Angola, is a valuable timber tree, 25 to 35ft. high, with a trunk 1 to 2ft. in diameter. The heart-wood is very black and hard and is known as black ebony, also as billet-wood, Gabun, Lagos, Calabar or Niger ebony. What is termed Jamaica or American ebony, and the green ebony of commerce, is produced by *Brya Ebenus,* a leguminous tree or shrub, having a trunk rarely more than 4in. in diameter, flexible spiny branches, and orange-yellow, sweet-scented flowers. The heart-wood is rich dark brown, heavier than water, exceedingly hard and capable of receiving a high polish.

Ebony was among the articles of merchandise brought to Tyre (Ezekiel xxvii. 15), and Herodotus states (iii. 97) that the Ethiopians every three years sent a tribute of 200 logs of it to Persia. By the ancients it was esteemed of equal value for durability with the cypress and cedar *(see* Pliny, *Nat. Hist.* xii. 9, xvi. 79). According to Solinus (*Polyhistor,* Paris, 1621), it was employed by the kings of India for sceptres and images, also on account of its supposed antagonism to poison, for drinking-cups. The hardness and black colour of the wood appear to have given rise to the tradition, alluded to by Southey (*Thalaba,* i. 22), that the tree produced neither leaves nor fruit, and was never seen exposed to the sun.

EBRARD, JOHANNES HEINRICH AUGUST (1818–1888), German theologian, was born at Erlangen on Jan. 18, 1818. Educated in his native town and at Berlin, he became *Privatdocent* at Erlangen (1841) and then professor of theology at Zürich (1844). From 1847–61 he held a similar post at Erlangen, where in 1875 he became pastor of the French reformed church. His chief works were *Christliche Dogmatik* (2 vols., 1851), *Vorlesungen über praktische Theologie* (1864), *Handbuch der Christ. Kirchen- u. Dogmengesch.* (4 vols. 1865–66), *Apologetik* (1874–75, Eng. trans. 1886). He also edited and completed H. Olshausen's commentary, himself writing on the Epistle to the Hebrews, the Johannine Epistles and Revelation. He died at Erlangen on July 23, 1888.

EBRO (anc. *Iberus* or *Hiberus*), the only one of the five great rivers of the Iberian Peninsula which flows into the Mediterranean. The Ebro, approximately 465 m. in length, rises at Fuentibre, a hamlet among the Cantabrian mountains, in the province of Santander; at Reinosa, 4 m. E., it is joined on the right by the Hijar, and thus gains considerably in volume. It flows generally east by south through a tortuous valley as far as Miranda de Ebro. The chief cities on its banks are Logroño, Calahorra, Tudela, Saragossa and Caspe. Near Mora in Catalonia it forces a way through the coastal mountains, and, passing Tortosa, falls into the Mediterranean about 80 m. S.W. of Barcelona. It drains an area of nearly 32,000 sq.m. Its principal tributaries are—(right) the Jalon with its affluent the Jiloca, the Huerva, Aguas, Martin, Guadalope and Matarraña; (left) the Ega, Aragon, Arba, Gallego and the Segre with its system of confluent rivers. The Ebro and its tributaries have been utilized for irrigation since the Moorish conquest; the main stream becomes navigable by small boats about Tudela; but seafaring vessels cannot proceed farther than Tortosa. The great Imperial Canal, begun under the emperor Charles V., proceeds along the right bank from a point about 3 m. below Tudela, to El Burgo de Ebro, 5 m. below Saragossa; the irrigation canal of Tauste skirts the opposite bank for a shorter distance; and the San Carlos or New Canal affords direct communication between Amposta at the head of the delta and the harbour of Los Alfaques.

EBROÏN (d. 681), Frankish "mayor of the palace," was a Neustrian, and wished to impose the authority of Neustria over Burgundy and Austrasia. In 656, at the moment of his accession to power, Sigebert III., the king of Austrasia, had just died, and the Austrasian mayor of the palace, Grimoald, was attempting to usurp the authority. The great nobles, however, appealed to the king of Neustria, Clovis II., and unity was re-established. But in spite of a very firm policy Ebroïn was unable to maintain this unity, and while Clotaire III., son of Clovis II., reigned in Neustria and Burgundy, he was obliged in 660 to give the Austrasians a special king, Childeric II., brother of Clotaire III., and a special mayor of the palace, Wulfoald. His efforts to maintain the union of Neustria and Burgundy were opposed by the great Burgundian nobles, who rose under St. Leger (Leodegar), bishop of Autun, defeated Ebroin, and interned him in the monastery of Luxeuil (670). Soon, however, Leger was defeated by Wulfoald and the Austrasians, and was himself confined at Luxeuil in 673. Ebroi'n and Leger then left the cloister. Each looked for support to a different Merovingian king, Ebroi'n even proclaiming a false Merovingian as sovereign. Leger was besieged in Autun, was forced to surrender and had his eyes put out, and, on Oct. 12, 678, he was put to death after undergoing prolonged tortures. The church honours him as a saint. After his death Ebroi'n became sole and absolute ruler of the Franks, imposing his authority over Burgundy and subduing the Austrasians, whom he defeated in 678 at Bois-du-Fay, near Laon. He was assassinated in 681.

See *Liber historiae Francorum,* edit. by *B.* Krusch, in Mon. *Germ. hist. script. rer. Merov.* vol. ii.; *Vita sancti Leodegarii,* by Ursinus, *a* monk of St. Maixent (Migne, *Patr. Latina,* vol. xcvi.); "Vita metrica" in *Poëtae Latini aevi Carolini,* vol. iii. (*Mon. Germ. hist.*); J. B. Pitra, *Histoire de Saint Léger* (1846); and J. Friedrich, "Zur Gesch. des Hausmeiers Ebroi'n," in the *Proceedings of the Academy of Munich* (1887, pp. 42–61).

EBURĀCUM or EBORĀCUM (probably a later variant), Roman name of York (*q.v.*) in England. Established about 75–80 as fortress of the Ninth legion and garrisoned (after the annihilation of that legion about A.D. 118) by the Sixth legion, it developed outside its walls a town of civil life, which later obtained Roman municipal rank and in the 4th century was the seat of a Christian bishop. The fortress and town were separated by the Ouse. On the left bank, where the minster stands, was

the fortress, of which the walls can be partly traced. At the west corner a bastion of the 4th century type (the so-called Multangular Tower) survives, while at the east corner an internal tower of earlier date has been uncovered. The municipality occupied the right bank near the present railway station. The place was important for its garrison and as an administrative centre. The name is preserved in the abbreviated form Ebor in the official name of the archbishop of York, but the philological connexion between Eboracum and the modern name York is doubtful and bas probably been complicated by Danish influence. (S. N. M.)

EÇA DE QUEIROZ, JOSE MARÍA (1843- goo), Portuguese novelist, was born at Villa do Conde, his father being a retired judge. Entering the consular service in 1872, he went to Havana, and, after a tour in the United States, was transferred two years later to Newcastle-on-Tyne and in 1876 to Bristol. In 1888 he became Portuguese consul-general in Paris and died there in 1900.

Queiroz in 1870, in collaboration with Ramalho Ortigão, wrote a sensational story, *The Mystery* of *the Cintra Road,* but the first publication which brought him fame was *The Farpas,* a series of satirical and humorous sketches of various phases of social life. At this period French literature and French politics interested Queiroz profoundly, while he ignored the *belles-lettres* of his own country and its public affairs. He founded the Portuguese Realist-Naturalist school, of which he remained for the rest of his life the chief exponent, by a powerful romance, *The Crime of Father Amaro,* written in 1871 at Leiria but only issued in 1875. During a stay in England he produced two masterpieces, *Cousin Basil* and *The Maias,* but they show no traces of English influence, nor again are they French in tone, for his disillusionment progressed and was completed when he went to Paris and had to live under the régime of the Third Republic. Settling at Neuilly, the novelist became chronicler, critic and letter-writer as well, and in all these capacities Queiroz displayed a spontaneity, power and artistic finish unequalled in the literature of his country since the death of Garrett. Many of his pages descriptive of natural scenery, such for instance as the episode of the return to Tormes in *The City and the Mountains,* are classic examples of Portuguese prose. He manifested a predilection for middle-class types, but his portrait-gallery comprises men and women of all social conditions.

Queiroz also wrote a number of short stories, some of which have been printed in a volume under the title of *Contos.* The gems of this remarkable collection are perhaps *The Peculiarities* of *a Fair-haired Girl, A Lyric Poet, José Matthias* and *The Corpse.*

One of Queiroz's romances and two of his short stories have been published in English. **An** unsatisfactory version of *Cousin Basil,* under the title *Dragon's Teeth,* appeared at Boston, U.S.A., in 1889, while *Sweet Miracle* has had three editions in England and one in America, and there is also a translation of *O Defunto (The Corpse),* under the name of *Our Lady of the Pillar. See* J. Pereira de Sampais, *A Geração Nova — Os Novellistas* (Oporto, 1886), and Senhor Batalha Reis's preface to some prose fragments of Queiroz edited by him and named *Prosas Barbaras* (Oporto, 1903).

ECARTE (Fr. for "separated," "discarded"), a game at cards, of modern origin, probably first played in the Paris *salons* in the first quarter of the 19th century. It is a development of a very old card game called *la triomphe* or *French-ruff.* Écarté is generally played by two persons, but a pool of three may be formed, the player who is out taking the place of the loser, and the winner of two consecutive games winning the pool.

The small cards (from the two to the six, both inclusive) are rernoved from an ordinary pack. The players cut for deal, the higher having the choice. The king is highest, the ace ranking next below the knave. The dealer gives five cards to his adversary, and five to himself, by two at a time to each and by three at a time to each or vice versa. The eleventh card is turned up for trumps. If it is a king, the dealer scores one, at any time before the next deal. The non-dealer then looks at his cards. If satisfied with them he plays, and there is no discarding; if not satisfied he "proposes." The dealer may either accept or refuse. If he accepts, each player discards, face downwards, as many cards or "stock," first to complete the non-dealer's hand to five, cards as he thinks fit, and fresh ones are given from the undealt then to complete the dealer's. To ask for "a book" is to ask for five cards. Similarly a second proposal may be made, and so on, until one player is satisfied with his hand. If the dealer refuses, the hand is played without discarding. If the non-dealer announces that he holds the king of trumps, he scores one; similarly. if the dealer holds the king and announces it, he scores one. The announcement must be made before playing one's first card, or if that card be the king, on playing it. The non-dealer, being satisfied with his hand, leads a card. The dealer plays a card to it, the two cards thus played forming a trick. The winner of the trick leads to the next, and so on. The second to play to a trick must follow suit if able, and must win the trick if he can.

The scores are for the king and for the majority of tricks. The player who wins three tricks scores one for the "point"; if he wins all five tricks, he scores two for the "vole." If the non-dealer plays without proposing, or the dealer refuses the first proposal, and fails to win three tricks, the adversary scores two, but no more even if he wins the vole. The game is five up. The points are conveniently marked with a three-card and a two-card, as at euchre. The three is put face upwards with the two face downwards on the top of it. When one or two or three points are scored the top card is moved so as to expose them. At four, one pip of the two-card is put under the other card. Games may be recorded similarly.

Hints to Players. — The following hints may be of service to beginners:—

Do not announce the king until in the act of playing your first card.

The hands which should be played without proposing, called *jeux de rigle* (standard hands), ought to be thoroughly known. They are as follows:—

1. AH hands with three or more trumps, whatever the other cards.
2. Hands with *two trumps* which contain also:—
   (*a*) Any three cards of one plain suit;
   (*b*) Two cards of one plain suit, one being as high as a queen;
   (*c*) Two small cards of one suit, the fifth card being a king of another suit;
   (*d*) Three high cards of different suits.
3. Hands with *one trump,* which contain also:—
   (a) King, queen, knave of one suit, and a small card of another;
   (*b*) Four cards of one suit headed by king;
   (*c*) Three cards of one suit headed by queen, and queen of another suit.
4. Hands with *no trump,* which contain three queens or cards of equal value in different suits, *e.g.,* four court cards.
5. Hands from which only two cards can be discarded without throwing a king or a trump.

Holding cards which make the point certain, propose. If you hold a *jeu de règle,* and one of the trumps is the king, propose, as your adversary cannot then take in the king.

When discarding, throw out all cards except trumps and kings.

If your adversary proposes you should accept, unless you are guarded in three suits (a queen being a sufficient guard), or in two suits with a trump, or in one suit with two trumps. Hence the rule not to discard two cards, unless holding the king of trumps, applies to the dealer.

The hands with which to refuse are the same as those with which to play without proposing, except as follows:—

1. Two trumps and three cards of one plain suit should not be played unless the plain suit is headed by a court card.
2. One trump and a tierce major is too weak, unless the fifth card is a court card. With similar hands weaker in the tierce major suit, accept unless the fifth card is a queen.
3. One trump and four cards of a plain suit is too weak to play.
4. One trump and two queens is too weak, unless both queens are singly guarded.
5. One trump, queen of one suit, and knave guarded of another should not be played unless the queen is also guarded, or the card of the fourth suit is a court card.
6. One trump, a king and a queen, both unguarded, should not be played, unless the fourth suit contains a card as high as an ace.
7. Four court cards without a trump are too weak to play, unless they are of three different suits.

Refuse with three queens, if two are singly guarded; otherwise, accept.

Lead from your guarded suit, and lead the highest.

If the strong suit led is not trumped, persevere with it, unless with king of trumps, or queen (king not having been announced), or knave ace, when lead a trump before continuing your suit.

You should not lead trumps at starting, unless you hold king or queen, knave, or knave ace, with court cards out of trumps.

The score has to be considered. If the dealer is at four, and the king is not in your hand nor turned up, play any cards without proposing which give an even chance of three tricks, *e.g.*, a queen a guarded knave, and a guarded ten. The same rule applies to the dealer's refusal.

At the adverse score of four, and king not being in hand or turned up, any hand with one trump should be played, unless the plain cards are very small and of different suits.

If the non-dealer plays without proposing when he is four to three, and the dealer holds the king he ought not to mark it. The same rule applies to the non-dealer after a refusal, if the dealer is four to three.

At the score of non-dealer three, dealer four, the dealer should refuse on moderate cards, as the player proposing at this score must have a very bad hand.

At four a forward game should not be played in trumps, as there is no advantage in winning the vole.

Laws of Écarté.—The following laws are abridged from the revised code adopted by the Turf club: A cut must consist of at least two cards. Cards exposed in cutting, fresh cut. Order of distribution of cards, whether by three and two, or vice versa, once selected, dealer must not change it during game. Player announcing king when he has not got it, and playing a card without declaring error, adversary may correct score and have hand over again. If offender wins point or vole that hand, he scores one less than he wins. Proposal, acceptance, or refusal made cannot be retracted. Cards discarded must not be looked at. Cards exposed in giving cards to non-dealer, he has option of taking them or of having next cards; dealer exposing his own cards, no penalty. Dealer turning up top card after giving cards, cannot refuse second discard. Dealer accepting when too few cards in stock to supply both, non-dealer may take cards, and dealer must play his hand. Card led in turn cannot be taken up again. Card played to a lead can only be taken up prior to another lead, to save revoke or to correct error of not winning trick. Card led out of turn may be taken up prior to its being played to. Player naming one suit and leading another, adversary has option of requiring suit named to be led. If offender has none, no penalty. Player abandoning hand, adversary is deemed to win remaining tricks and scores accordingly. If a player revokes or does not win trick when he can do so, the adversary may correct score and have hand replayed.

See *Acade'mie des jeux* (various editions after the first quarter of the 19th century); *Hoyle's Games Modernised* (ed. Lawrence *H.* Dawson, 1928); Ch. Van-Tenac et Louis Delanoue, *Traité du jeu de l'écarté* (Paris, 1845), translated in Bohn's *Handbook of Games* (1850); "Cavendish," *The Laws of Écarté, adopted by the Turf Club, with a Treatise on the Game* (London, 1878); and *Pocket Guide to Écarté* (1897); R. Foster, *Encyclopedia* of *Games* (1916).

ECBATANA (Old Persian *Hangmatána*), situated at the foot of Mount Orontes (Alwand), was the capital of Media and the summer residence of the Achaemenian kings, being afterwards also the Parthian capital. According to the Greeks (*e.g.*, Herodotus, i., 96 ff.), it was founded by Deioces the Mede, but it appears to be mentioned in an inscription of Tiglath-Pileser I., who was much earlier. Though surrounded by seven walls and possessing a citadel, that was at the same time a treasure-house, it was captured by Cyrus from Astyages in 550 B.C., and was taken from the last Achaemenian by Alexander in 330 B.C. Amongst the Achaemenian relics found in the city in recent times is a trilingual inscription in which Artaxerxes Mnemon celebrated the building of a palace. The Ecbatana at which, according to Herodotus (iii., 64), Cambyses died, is probably a blunder for Hamáth.

See Perrot and Chipiez, *History of Art in Persia* (Eng. trans., 1892); M. Dieulafoy, *L'Art antique de la Perse*, pt. i. (1884); J. de Morgan, *Mission scientifique en Perse*, ii. (1894); W. Geiger and E. Kuhn, *Grundriss der Iranischen Philologie*, ii. (1896–1904). *See* also HAMADAN and PERSIA: *Ancient History*. (R. LEV.)

ECCARD, JOHANN (1553–1611), German composer of church music, was born at Miihlhausen, Thuringia, in 1553. He studied at Munich, under Orlando Lasso, in whose company he is said to have visited Paris. In 1583 he became assistant conductor, and in 1599 conductor, at Konigsberg, to Georg Friedrich, margrave of Brandenburg-Anspach, and in 1608 he was called by the elector Joachim Friedrich to Berlin as chief conductor. He died at Konigsberg in 1611. Eccard's works consist exclusively of vocal compositions, such as songs, sacred cantatas and chorales for four or five, and sometimes for seven, eight, or even nine voices. Their polyphonic structure is remarkable and still excites the admiration of musicians. At the same time his works are instinct with a spirit of true religious feeling. Eccard and his school are inseparably connected with the history of the Reformation and "Ein' feste Burg" is only one of many Lutheran hymns for which he provided memorable settings.

See K. G. A. von Winterfeld, *Deu Evangelische Kirchengesang* (1843); and G. Reichmann, *Joh. Eccards weltliche Werke* (Heidelberg, 1922).

ECCELINO DA ROMANO (1194–1259), Ghibelline leader, and supporter of the emperor Frederick II., was born on April 25, 1194, of a German family settled in Italy in the first half of the 11th century. They were lords of Romano, near Padua. In 1226, at the head of a band of Ghibellines, Eccelino seized Verona and became *podestà* of the city. He lost Verona, but regained it in 1230; and in 1232 Frederick II. issued a charter confirming him in his possessions. In 1236–37 the emperor gave him the government of Vicenza, Padua and Treviso; and on Nov. 27, 1237, he shared in the victory over the Lombards at Cortenuova. In 1238 he married Frederick's natural daughter, Selvaggia; in 1239 was appointed imperial vicar of the march of Treviso; but in the same year was excommunicated by Pope Gregory IX. After Frederick's death in 1250 he supported his son, the German king Conrad IV. His cruelties had, however, aroused general disgust, and in 1254 he was again excommunicated. In 1256 Pope Alexander IV. proclaimed a crusade against him, which was led by Philip, archbishop of Ravenna. Eccelino lost Padua, but on Sept. 1, 1258, he defeated his enemies at Torricella. At Cassano on Sept. 27, 1259, Eccelino was wounded and taken prisoner. Enraged at his capture, he tore the bandages from his wounds, refused to take food and died at Soncino on Oct. 7, 1259. In the following year his brother Albert was put to death, and the Romano family became extinct. Eccelino, sometimes called the tyrant, acquired a reputation for cruelty that gained him a place in Dante's Inferno; but his unswerving loyalty to Frederick II. contrasts favourably with many of his contemporaries. Eccelino is the subject of a novel by Cesare Cantu and of a drama by J. Eichendorff.

See J. M. Gittermann, *Ezzelino da Romano* (Freiburg, 1890); S. Mitis, *Storia d'Ezzelino IV. da Romano* (Maddaloni, 1896); and F. Stieve, *Ezzelino von Romano* (Leipzig, 1909). *See* also Hampe, *Mittelalt. Geschichte* (1922).

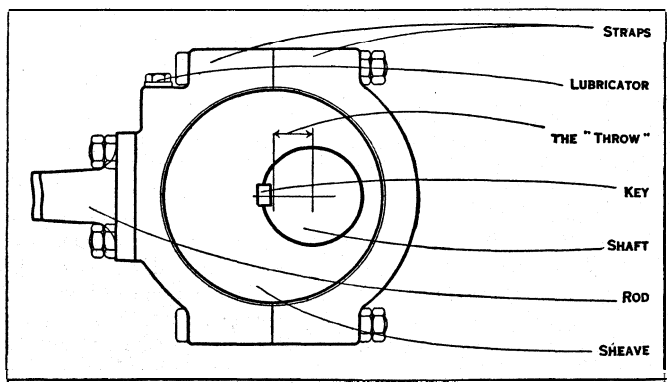

DIAGRAM OF AN ECCENTRIC USED IN STEAM ENGINES, SHOWING PARTS
The eccentric converts rotary into reciprocating motion and moves the valve controlling the flow of steam and the exhaust to and from the cylinder

ECCENTRIC, from two Greek words, meaning literally "out from the centre," and thus used to connote generally any deviation from the normal. In ancient astronomy the word denotes a circle round which a body revolves, but whose centre is displaced from the visible centre of motion. In early times the ellipses in which the planets revolve around the sun as focus could not be distinguished from circles, but the unequal angular motion due to ellipticity was observed. A point, however, can be found on the major axis of the ellipse (namely the empty focus) such that the angular velocity of the planet about it is nearly

constant. It was therefore supposed that the deferent of the epicycle of the planet moved uniformly in a circle about this point. For eccentric angle see ELLIPSE.

In engineering, an eccentric is a disc mounted out of centre on a shaft, to give reciprocating movement to a lever; it is an agent much used in steam-engines and other mechanisms. It is fixed with a key or screw on to the crankshaft and moves the valve-rod to and fro to control the flow of steam and the exhaust. Using two eccentrics with link-motion, the engine can be reversed, and the steam used expansively, *e.g.*, in locomotives, when a good rate of speed has been reached. A reversing eccentric is one with a slotted fitting whereby it can be moved in relation to the shaft, thus reversing the action of the valve to run the engine in the opposite direction. This is but little used, however, the link motion having preference. Eccentrics are also fitted on the popular drop-valve steam-engines, being located then on a shaft running parallel with the cylinder. An eccentric is often employed to work a pump, and operate the slides of certain machines, such as those for shearing and punching. Eccentrics are used to work the jaws of powerful rock- and stone-crushers, and to'close quick-acting clamps and safety mechanisms that check slipping.

ECCHELLENSIS (or ECHELLENSIS), **ABRAHAM** (c. 1600–1664), a learned Maronite, was born at Eckel, Syria. Educated at Rome, he became professor of Arabic and Syriac in the college of the Propaganda at Rome, and in 1646 professor at the Collège de France. Invited to take part in the preparation of an Arabic version of the Bible, Ecchellensis returned in 1652 to Rome, where he died. Of his Latin translations of Arabic works, the most important was the Chronicon *Orientale* of Ibnar-Rāhib (Paris, 1653), a history of the patriarchs of Alexandria. With Giovanni Rorelli he wrote a Latin translation of the 5th, 6th and 7th books of the Conics of Apollonius of Perga (1661). He also published *Eutychius vindicatus*, sive *Responsio* ad *Seldeni* Origines (Rome, 1661). To Le Jay's polyglot Bible he contributed the Arabic and Latin version of Ruth and the Arabic version of the third book of Maccabees.

ECCLES, municipal borough, Eccles parliamentary division, Lancashire, England, 4 m. W. of Manchester, of which it forms practically a suburb. Pop. (1938) 42,550. It is served by the L.M.S. railway. The Manchester Ship canal passes through. Before the Reformation the monks of Whalley abbey had a grange here at what is still called Monks' Hall; and in 1864 many thousands of silver pennies of Henry III. and John of England and William I. of Scotland were discovered near the spot. From early times "wakes" were held at Eccles, and bull-baiting, bear-baiting and cock-fighting were carried on. Under Elizabeth these festivals were abolished, but were revived under James I., and maintained until late in the 19th century. The church of St. Mary, believed to date from the 12th century, has been much restored. There are several modern churches and chapels, a town hall and numerous cotton mills, while silk-throwing and the manufacture of fustians and ginghams are also among the industries, and there are also large engine works. Eccles cakes have a wide reputation. Eccles was incorporated in 1892. The borough maintains the tramway service, etc., but water and gas are supplied from Manchester and Salford respectively.

ECCLESFIELD, township, Wortley rural district, Penistone parliamentary division, West Riding of Yorkshire, England, 5 m. N. of Sheffield on the L.M.S. and L.N E. railways. Population 22,944. The church of St. Mary is Perpendicular, with a central tower. It contains excellent woodwork, and formerly bore the familiar title of the "Minster of the Moors." Ecclesfield was the seat of a Benedictine priory, which passed to the Carthusians in the 14th century. Cutlery and tools are largely manufactured, and there are coal-mines, paper-mills, and iron and fire-clay works.

ECCLESHALL, market town, Stone parliamentary division, Staffordshire, England; 7 mi. N.W. from Stafford, and 140 mi. from London. Pop. (1931) 3,532. Holy Trinity church is principally Early English and has fine stained glass. Several bishops of Lichfield are buried there, as Eccleshall castle, of which only the walls enclosing the moat remain, the main building being relatively modern, was the episcopal residence from the 13th century until 1867. Blore Heath was the scene of a defeat of the Lancastrians by the Yorkists in 1459.

ECCLESIA, the general assembly of freemen in Athens (ἐκκλησία). In the primitive state the king was absolute, though his great nobles in council (see BOULE) were able to influence him considerably. In the earliest times the free people, *i.e.*, the fighting force of the state, were called together to ratify the decisions of the king. In Athens, as in Rome, where the Plebs obtained the codification of the laws (the Twelve Tables), it was owing to the growing power of the people meeting in the agora that Dracon was entrusted with the task of publishing a code of law.

The precise powers which Solon gave the people are not known. The executive power (see ARCHON) was still vested in the Eupatrid class (see EUPATRIDAE). It seems that, though the officials of the state were still Eupatrid, the Ecclesia elected those of the Eupatrids whom they could trust, and had the right of criticizing their official actions. Solon admitted the Thetes (see SOLON) to the Ecclesia, thus recognizing them as citizens. Under Cleisthenes (*q.v.*) the Ecclesia remained the sovereign power. The relation of Boule and Ecclesia in the Cleisthenic democracy was of the greatest importance. The Ecclesia alone, a heterogeneous body of untrained citizens, could not have drawn up intelligible measures; the preliminary drafting was done by the Boule (*q.v.*). In the 5th century the functions of the Ecclesia and the popular courts of justice were increased by the exigencies of empire. At the beginning of the 4th century B.C. the system of payment was introduced (see below). Under Roman rule the powers of the Ecclesia and the popular courts were much diminished. They still assembled to elect strategi, and, under Hadrian, had some small judicial duties, but as a governing body the Ecclesia died when, Athens became a civitas *libera* under Roman protection.

Constitution and Functions.—Throughout the period of Athenian greatness the Ecclesia was the sovereign power. The regular place of meeting was the Pnyx. From the 5th century it met sometimes in the theatre, which in the 3rd century was the regular place. Special meetings were held at times at Peiraeus. Certain meetings, however, for voting ostracism (*q.v.*) and on questions affecting individual status took place in the agora. Meetings were (1) ordinary, (2) extraordinary, and (3) convened by special messengers (kuriai *sunklētoi* and katakldtoi), these last being called when it was desirable that the country people should attend. At ordinary meetings the attendance was practically confined to Athenian residents. According to Aristotle there were four meetings in each of the prytanies; probably only the first of these was called *Kuria*. In the kuria *ekklēsia* of each month took place the Epicheirotonia (monthly inquiry) of the state officials, and if it proved unsatisfactory a trial before the Heliaea (supreme court) was arranged; the council reported on the general security and the corn supply. In the sixth prytany of each year at the *kuria* ekkldsia the question whether ostracism should take place that year was put to the vote. On occasions of sudden importance the herald of the council summoned the people with a trumpet, and sometimes special messengers were despatched to "bring in" the country people (katakalein).

All Athenians over the age of 18 years were eligible to attend the assembly, save those who for some reason had suffered atimia (loss of civil rights). The introduction of pay, which belongs to the early years of the 4th century, was a device to secure a larger attendance. The rate rose from one to two obols and then to three obols, while at the time of Aristotle it was one and a half drachmas for the kuria ekkldsia and one drachma for other meetings.

Procedure.—The proceedings opened with formalities: the purification; the curse against all who should deceive the people; the report as to the weather omens. The assembly was always dismissed if there were thunder, rain, or an eclipse. These formalities over, the Prytaneis communicated the probouleuma of the council, without which the Ecclesia could not debate. This recommendation either submitted definite proposals or merely brought the agenda before the assembly. It explained the business

in hand, which otherwise must often have been beyond the grasp of a miscellaneous assembly. After the reading, a preliminary vote was taken on the question whether the council's report should be accepted *en* bloc. If it was decided to discuss, the herald called upon people to speak. Any person, without distinction of age or position, might obtain leave to speak; any member of the assembly (1) might propose an amendment, (2) might draw up a new resolution founded on the principal motion, (3) might move the rejection of the motion and the substitution of another, (4) might bring in a motion asking the council for a recommendation on a particular matter, (5) might petition the council for leave to speak on a given matter to the assembly. Voting usually was by show of hands and the decision of the assembly had absolute validity. These decisions were deposited in the *Mētrōon* where state documents were preserved; peculiarly important decrees were inscribed also on a column (*stēlē*) erected on the Acropolis. The power of the council was far from sufficient. The real check on the vagaries of amateur legislators was the graphd paranomdn. Any man was at liberty to give notice that he would proceed against the mover of a given resolution. A trial in a Heliastic court was then arranged, and the plaintiff had to prove that the resolution in question contravened an existing law. If this contention was upheld by the court, the resolution was annulled and the defendant had to appear in a new trial for the assessment of the penalty, which was usually a fine. Three convictions under this law involved a certain loss of rights; the loser could no longer move a resolution in the Ecclesia. After the lapse of a year the mover of a resolution could not be attacked. In the 4th century the *graphē* paranomdn took the place of Ostracism.

Revision **of** Laws.—In the 4th century the assembly annually took a general vote on the laws, to decide whether revision was necessary. If the decision was in favour of alteration, any private citizen might put up notice of amendments. The nomothetai, a panel selected by the *prytaneis* from the Heliaea, heard arguments for and against the changes proposed and voted accordingly; new laws so passed were liable to the graph5 paranomdn.

Judicial Functions.—The Ecclesia heard cases of *probolē* and eisangelia (impeachment—see GREEK LAW). The *probolē* was an action against sycophants and persons who had not kept their promises to the people or had disturbed a public festival. The verdict went by show of hands, but no legal consequences ensued; if the plaintiff demanded punishment he had to go to the Heliaea, which was not bound by the previous vote in the Ecclesia. Cases of eisangelia in which the penalty exceeded the legal competence of the council came before the Ecclesia in the form of a *probouleuma.* To prevent vexatious accusations, the accuser who failed to obtain one-fifth of the votes was fined 1,000 drachmas (£40).

Summary.—The Ecclesia had absolute power save for the graph5 paranomdn, which constituted the dicasteries (jurymen) in one sense the sovereign power in the state. It dealt with all matters, home and foreign. It was in practice by no means a representative assembly. The phrase used to describe a special assembly (katakldtos *ekklēsia*) shows that ordinarily the country members did not attend. Thucydides says that 5,000 was the maximum attendance, though he is referring to the time when the number of citizens was reduced owing to the plague and the Sicilian expedition. The Ecclesia did not exercise the power of law-making (*nomothesia*) in the strict sense but passed *psephismata*, which would in many cases be regarded as law in the modern sense. The Ecclesia also was concerned with the supervision of administration.

See articles on SOLON; AREOPAGUS; GREEK LAW, OSTRACISM.

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ECCLESIASTES, one of the Wisdom Books of the Old Testament (see WISDOM LITERATURE). The book, as it stands, is a collection of discourses, observations and aphorisms. The precise meaning of the Hebrew title is not certain. The Greek *ecclesiastes* means one who takes part in the deliberations of an assembly (ecclesia), a debater or speaker in an assembly (Plato, *Gorgias,* 452 E), and this is the general sense of the Hebrew word. Koheleth is employed in the book as the name of a sage. It is intended to represent him as a member of an assembly (Kahal) —not the Jewish congregation, but a body of students or inquirers, such as is referred to in xii, 9–11, a sort of collegium, of which he was the head; and as instructor of this body he gives his criticism of life. The author begins, indeed, by identifying his sage with King Solomon (i. 12, ii. 11, 12*b*); but he soon abandons this literary device, and speaks in his own name. The rendering "preacher" has a misleading connotation.

Contents.—In the book as we have it there is no orderly exposition of a theory; it rather has the appearance of a collection of extracts from a sage's notebook. It is, however, characterized throughout (except in some later additions) by a definite thought, and pervaded by a definite tone of feeling. The keynote is given in the classic phrase with which the discussion opens and with which it closes: "Vanity of vanities (*i.e.,* absolute vanity), all is vanity!" Life, says the author, has nothing of permanent value to offer. His attitude is not one of bitterness but of calm hopelessness, with an occasional tinge of disgust or contempt. He fancies that he has tried or observed everything in human experience, and his deliberate conclusion is that nothing is worth doing. He believes in an all-powerful but indifferent God, and is himself an observer of society, standing aloof from its passions and ambitions, and interested only in pointing out their emptiness.

This general view is set forth in a number of particular observations.

1. His fundamental proposition is that there is a fixed, unchangeable order in the world, a reign of inflexible law (i. 4–11, iii. 1–11, 14, 15, vii. 13, viii. 5–9); natural phenomena, such as sunrise and sunset, recur regularly; for everything in human experience a time has been set; all its phenomena are to be regarded not as utterances of a living, self-directing world, but as incidents in the work of a vast machine that rolls on for ever; there is an endless repetition—nothing is new, nothing is lost; God, the author of all, seeks out the past in order to make it once more present; it is impossible to add to or take from the contents of the world, impossible to change the nature of things; the result is unspeakable weariness—a depressing series of sights and sounds. No goal or purpose is discoverable in this eternal round. To what end was the world created? It is impossible to say. Such is Koheleth's view of life, and it is obvious that such a conception of an aimless cosmos is thoroughly non-Jewish, if we may judge Jewish thought by the great body of the extant literature.

2. Further, says Koheleth, man is impelled to study the world, but under the condition that he shall never comprehend it (iii. 11, vii. 23, 24, viii. 16, 17). God has made the world an object of man's thought, yet so that man can never find out the work that God has done (iii. 11). The reference seems to be not so much to the variety and complexity of phenomena as to the impossibility of construing them rationally or in such a way that man may foresee and provide for his future. Man is in the clutches of fate (ix. 11, 12); there is no observable relation between exertion and result in life; the race is not to the swift nor the battle to the strong.

3. Human life, Koheleth declares, is unsatisfying. He inquired, he says, into everything that is done by men under the sun (i. 12–16); God has inflicted on men a restless desire for movement and work, yet life is but a catalogue of fruitless struggles. He gives a number of illustrations. In his character of king he tried all the bodily pleasures of life (ii. 1–11); all these he set himself to enjoy in a rational way, but, when all was done, he surveyed it only to see that it was weary and unprofitable. Dropping the rôle of Solomon and speaking as an observer of life, the author declares (iv. 4) that the struggle for success is the result of rivalry among men, which has no worthy outcome. The securing of riches is a fallacious achievement—naked man comes into the world, naked he goes out,

If wealth be thus a vain thing, yet a sage might be supposed to find satisfaction in wisdom, that is, practical good sense and sagacity; but this also the author puts aside as bringing no lasting advantage, since a wise man must finally give up the fruit of his wisdom to someone else, who may be a fool, and in any case the final result for both fools and wise men is the same—both are forgotten (ii. 12–23). The whole constitution of society, in fact, seems to the sage a lamentable thing; the poor are oppressed, the earth is full of their cries, and there is no helper (iv. 1); strange social upheavals may be seen; the poor set in high places, the rich cast down, slaves on horseback, princes on foot (x. 5–7). He permits himself a sweeping generalization (vii. 25–28); human beings as a rule are bad; one may occasionally find a good man, never a good woman—woman is a snare and a curse.

4. The natural outcome of these experiences of the author is that he cannot recognize a moral government of the world. He finds, like Job, that there are good men who die prematurely notwithstanding their goodness, and bad men who live long notwithstanding their badness (vii. 15); and in general there is no moral discrimination in the fortunes of men (viii. 14, ix. 2).

5. There is no sacredness or dignity in man or in human life; man has no pre-eminence over beasts, seeing that he and they have the same final fate, die and pass into the dust, and no one knows what becomes of the spirit, whether in man's case it goes up to heaven, and in the case of beasts goes down into Sheol—death is practically the end-all; and so poor a thing is life that the dead are to be considered more fortunate than the living, and more to be envied than either class is he who never came into existence (iv. 2, 3). It is a special grievance that the wicked when they die are buried with pomp and ceremony, while men who have acted well are forgotten in the city (viii. 10).

6. That the author does not believe in a happy or active future life appears in the passage (iv. 2, 3) quoted above. The old Hebrew view of the future excluded from Sheol the common activities of life and also the worship of the national god (Isa. xxxviii. 18); he goes even beyond this in his conception of the blankness of existence in the underworld. The living, he says, at least know that they shall die, but the dead know nothing—the memory of them, their love, hate, envy, perishes, they have no reward, no part in earthly life (ix. 5, 6); there is absolutely no knowledge and no work in Sheol (ix. 10). His conclusion is that men should do now with all their might what they have to do; the future of man's vital part, the spirit, is wholly uncertain.

7. His conception of God is in accord with these views. God for him is the creator and ruler of the world, but hardly more; he is the master of a vast machine that grinds out human destinies without sympathy with man and without visible regard for what man deems justice—a being to be acknowledged as lord, not one to be loved. There can thus be no social contact between man and God, no communion of soul, no enthusiasm of service. Moral conduct is to be regulated not by divine law (of this nothing is said) but by human experience. The author's theism is cold, spiritless, without influence on life.

If now the question be asked what purpose or aim a man can have, seeing that there is nothing of permanent value in human work, an answer is given which recurs, like a refrain, from the beginning to the end of the book, and appears to be from the hand of the original author; after every description of the vanity of things comes the injunction to enjoy such pleasures as may fall to one's lot (ii. 24, 25, iii. 12, 13, 22, v. 18, 19, viii. 15, ix. 7–10, xi. 7, xii. 7). The opportunity and the power to enjoy are represented as being the gift of God; but this statement is not out of accord with the author's general position, which is distinctly theistic.

There are many sayings in the book that appear to be at variance with its fundamental thought. For example, wisdom is praised in a number of passages (iv. 13, vii. 5, 11, 12, 19, viii. 1, ix. 16, 17, x. 2, 3), though it is elsewhere denounced as worthless. It may be said that the author, while denying that wisdom (practical sagacity and level headedness) can give permanent satisfaction, yet admits its practical value in the conduct of life. This may be so; but it would be strange if a writer who could say "in much wisdom is much grief" should deliberately laud wisdom. It may be added that there are in the book a number of aphorisms about fools (v. 3 [4], vii. 5, 6, x. 1–3, 12–15) quite in the style of the book of Proverbs, some of them contrasting the wise man and the fool; these appear to be the insertions of an editor. Further, it may be concluded with reasonable certainty that the passages that affirm a moral government of the world are additions by pious editors who wished to bring the book into harmony with the orthodox thought of the time.

Many practical admonitions and homely aphorisms are scattered through the book: iv. 5, quiet is a blessing; iv. 9–12, two are better than one; iv. 17 (Eng. v. 1), be reverent in visiting the house of God (the temple and the connected buildings)—to listen (to the service of song or the reading of Scripture) is better than to offer a foolish (thoughtless) sacrifice; v. 1 (z), be sparing of words in addressing God; v. 1–5 (2–6), pay your vows—do not say to the priest's messenger that you made a mistake; vii. 2–4, sorrow is better than mirth; vii. 16–18, be not over-righteous (over-attentive to details of ritual and convention) or overwicked (flagrantly neglectful of established beliefs and customs); here "righteous" and "wicked" appear to be technical terms designating two parties in the Jewish world of the 2nd and 1st centuries B.C., the observers and the non-observers of the Jewish ritual law; these parties represent in a general way the Pharisees and the Sadducees; viii. 2–4, x. 20, it is well to obey kings and to be cautious in speaking about them, for there are talebearers everywhere; vii. 20, no man is free from sin; vii. 21, do not listen to all that you may overhear, lest you hear yourself ill spoken of; ix. 4, a living dog is better than a dead lion; xi. 1–6, show prudence, and decision in business; do not sell all your goods on one venture; act promptly and hope for the best.

Composition of the Book.—If the analysis given above is correct, the book is not a unit; it contains passages mutually contradictory and not harmonizable. Various attempts have been made to establish its unity. Other of the biblical Wisdom books (Job, Proverbs) are compilations—why not this? It is not necessary to multiply authors, as is done, for example, by Siegfried, who supposes four principal writers (a pessimistic philosopher, an Epicurean glossator, a sage who upholds the value of wisdom, and an orthodox editor) besides a number of annotators. Nor is it worth while to attempt a logical or symmetrical arrangement of the material.

A simple and adequate view of the growth of the book has been formulated by A. H. McNeile and followed by Barton. Its essence may be briefly stated. The original Koheleth, as has been indicated, was a very heretical work, nevertheless it was so brilliant and so in keeping with the mind of the Greek period that it obtained a firm hold upon the intelligence of the age. Orthodoxy, however, could not allow it to continue unchallenged or unopposed. Two sets of additions, therefore, were attached to it. One of them consists of a series of conventional aphorisms of the sages inserted to give the work a more Hebraic tone and colouring. Examples of this sort are seen in iv. 5*b*, 6, vii. 1–14. The second series is more positively and directly orthodox. It is in flat contradiction to the cold lifeless scepticism of Koheleth. It sets forth the traditional, positive and constructive view of life. It may be seen in such passages, for example, as iii. 17; iv. 17; xi. 9*d*, xii. 1*a*, 13. Had it not been for the mollifying effect of such additions, it is hardly conceivable that Koheleth would ever have entered the Canon, or held its place there long if it had found entry.

Date.—As to the date of the book, there is a gradual approach to a consensus of opinion. The Solomonic authorship has long since been given up; the historical setting of the work and its atmosphere—the silent assumption of monotheism and monogamy, the non-national tone, the attitude towards kings and people, the picture of a complicated social life, the strain of philosophic reflection—are wholly at variance with what is known of the 10th century B.C. and with the Hebrew literature down to the 5th or 4th century B.C. The introduction of Solomon, the ideal of wisdom, is a literary device of the later time and probably

deceived nobody. The decisive considerations for the determination of the date are the language, the historical background and the thought. The language belongs to the post-classical period of Hebrew. More than this, there are many resemblances between the dialect of Koheleth and that of the Mishna. Not only are new words employed, and old words in new significations, but the grammatical structure has a modern stamp—some phrases have the appearance of having been translated out of Aramaic into Hebrew. It is improbable that such Hebrew as that of Koheleth would have been written earlier than the and century B.C. (for details see Driver's Introduction). The general historical situation, also, presupposed or referred to, is that of the period from the year zoo B.C. to the beginning of our era; in particular the familiar references to kings as a part of the social system, and to social dislocations (servants and princes changing places, x. 7), suggest the troublous times of the later Greek and Maccabean rulers, of which the history of Josephus gives a good picture.

The conception of the world and of human life as controlled by natural law, a naturalistic cosmos, is alien not only to the prophetic and liturgical Hebrew literature but also to Hebrew thought in general. Whether borrowed or not, it must be late; and its resemblance to Greek ideas suggests Greek influence. The general air of Greek reflection seems unmistakable. The scepticism of Koheleth differs from that of Job in quality and scope; it is deliberate and calm, not wrung out by personal suffering; and it relates to the whole course and constitution of nature, not merely to the injustice of fortune. Such a conception has a Greek tinge, and would be found in Jewish circles, probably, not before the 2nd century B.C.

A precise indication of date has been sought in certain supposed references or allusions to historical facts. The mention of persons who do not sacrifice or take oaths (ix. 2) is held by some to point to the Essenes; if this be so, it is not chronologically precise, since we have not the means of determining the beginning of the movement of thought that issued in Essenism. So also the coincidences of thought with Ben-Sira (Ecclesiasticus) are not decisive: *cf.* iii. 14 with B.S. xviii. 6; 2-6 (3–7) with B.S. xxxiv. 1–7, vii. 19 with B.S. xxxvii. 14; x. 8 with B.S. xxvii. *26a*; xi. 10 with *B.S.* xxx. 21; xii. 10, 11 with B.S. xxxix. 2 ff., xii. 13 with B.S. xliii. 27; if there be borrowing in these passages it is not clear on which side it lies, and it is not certain that there is borrowing—the thoughts may have been taken independently by the two authors from the same source. In any case since Ben-Sira belongs to about 180 B.C., the date of Koheleth, so far as these coincidences indicate it, would not be far from 200 B.C. The contrast made in x. 16 f. between a king who is a boy and one who is of noble birth may allude to historical persons. Such identifications as have been proposed, however, do not fix the date of the book precisely; the author may have referred to events that happened before his time. The reign of Herod, a period of despotism and terror, and of strife between Jewish religious parties, is preferred by some scholars (Graetz, Cheyne and others) as best answering to the social situation depicted in the book, while still others (as Renan) decide for the reign of Alexander Jannaeus (104–78 B.C.). The data are not numerous and distinct enough to settle the question beyond determining general limits; for reasons given above the book can hardly have been composed before 200 B.C., and if, as is probable, a Septuagint text shows the influence of Aquila, it is to be put earlier than 50 B.C. Probably also, its different parts are of different dates.

Of the author nothing is known beyond the obvious fact that he was a man of wide observation and philosophic thought, of the Sadducean type in religion, but non-Jewish in his attitude toward life. He was, doubtless, a man of high standing, but neither a king nor a high priest, certainly not the apostate priest Alcimus (1 Macc. vii. ix.); nor was he necessarily a physician—there are no details in ch. xii. or elsewhere that any man of good intelligence might not know. The book is a mixture of prose and poetry, in about equal proportions.

The fortunes of the book are not known in detail, but it is clear that its merciless criticism of life and its literary charm made it popular, while its scepticism excited the apprehensions of pious conservatives. Possibly the *Wisdom* of *Solomon* (*c.* 50 B.C.) was written partly as a reply to it. The claim of sacredness made for it was warmly contested by some Jewish scholars. In spite of the relief afforded by orthodox additions, it was urged that its Epicurean sentiments contradicted the Torah and favoured heresy. Finally, by some process of reasoning not fully recorded, the difficulties were set aside and the book was received into the sacred canon; but not until the synod of Jabneh in A.D. 90 was its right to remain in the canon officially and finally allowed. Jerome (on Eccl. xii. 13, 14) declares that the decisive fact was the orthodox statement at the end of the book; the one important thing is to fear God and keep His commandments. It is not certain that it is quoted in the New Testament, but it appears to be included in Josephus' list of sacred books.

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ECCLESIASTICAL COMMISSIONERS, in England, a body corporate, whose full title is "Ecclesiastical and Church Estates Commissioners for England," invested with very important powers, under the operation of which extensive changes have been made in the distribution of the revenues of the Established Church. Their appointment was one of the results of the vigorous movements for the reform of public institutions which followed the Reform Act of 1832. In 183; two commissions were appointed "to consider the state of the several dioceses of England and Wales, with reference to the amount of their revenues and the more equal distribution of episcopal duties, and the prevention of the necessity of attaching by commendam to bishoprics certain benefices with cure of souls; and to consider also the state of the several cathedral and collegiate churches in England and Wales, with a view to the suggestion of such measures as might render them conducive to the efficiency of the established church, and to provide for the best mode of providing for the cure of souls, with special reference to the residence of the clergy on their respective benefices." And it was enacted by an Act of 1835 that during the existence of the commission the profits of dignities and benefices without cure of souls becoming vacant should be paid over to the treasurer of Queen Anne's Bounty. In consequence of the recommendation of these commissioners, a permanent commission was appointed by the Ecclesiastical Commissioners Act 1836 for the purpose of preparing and laying before the king in council such schemes as should appear to them to be best adapted for carrying into effect the alterations recited in the act. The new commission was constituted a corporation with power to purchase and hold lands for the purposes of the act, notwithstanding the statutes of mortmain. The first members of the commission were the two archbishops and three bishops, the lord chancellor and the principal officers of state, and three laymen named in the act.

The constitution of the commission was amended by the Ecclesiastical Commissioners Acts, 1840–41, and 1868. The commission consists of the two archbishops, all the bishops, the deans of Canterbury, St. Paul's and Westminster, the lord chancellor, the lord president of the council, the first lord of the treasury, the chancellor of the exchequer, one of the principal secretaries of State, the lord chief justice, the master of the rolls, and certain lay members of the Church of England appointed by the crown and by the archbishop of Canterbury. The crown also appoints two laymen as church estates commissioners, and the archbishop of Canterbury one. These three are the joint treasurers of the commission and form, with two members appointed by the commission, the church estates committee.

The commission presents an annual report to parliament in which full information is given as to its activities. Its main function at the present time is the management of the estates of the church in order to augment or endow benefices, etc. The following is a summary of the receipts and expenditure for the years 1924, 1925 and 1926:—

Receipts

	1924	1925	1926
	£	£	£
Forward	262,000	300,000	320,000
Estates . . .	1,609,000	1,625,000	1,502,000
Dividends and interest	1,015,000	1,087,000	1,120,000
	2,886,000	3,012,000	2,942,000

Expenditure

	1924	1925	1926
	£	£	£
Benefices, Archbishops, Bishops, Administration, etc. .	1,881,000	1,970,000	1,987,000
Appropriation for future Augmentations, etc. .	625,000	642,000	605,000
Depreciation fund .	80,000	80,000	80.000
Balance forward . .	300,000	320,000	270,000
	2,886,000	3,012,000	2,942,000

ECCLESIASTICAL JURISDICTION. The jurisdiction exercised by ecclesiastics, in taking cognizance of and deciding causes, over other ecclesiastics and over the laity. Before its union with the State, the power of the Church in this direction, as in others, was only spiritual. Coercive authority over their bodies or estates could only be given by concession from the secular power.

The fundamental principle of ecclesiastical jurisdiction with its "sanction" of excommunication will be found in the words attributed to Christ in Matt. xviii. 15–18. These injunctions indicate the customs of the Christian Churches at an early stage in their history. After the time of the Apostles, we find this criminal jurisdiction exercised by bishops individually over their respective "subjects" — doubtless with the advice of their presbyters according to the precept of St. Ignatius (c. 110). As neighbouring dioceses coalesced into "provinces" and provinces into larger districts (corresponding to the civil "dioceses" of the later Roman Empire), the provincial synods of bishops and the synods of the larger districts acquired a criminal jurisdiction, still purely spiritual, of their own. The theory, as expressed in legal phrase by Cyprian in the 3rd century, was that the apostolic power of delegated sovereignty from the Lord, alike legislative and judicial, was held in joint-tenancy by the whole body of Catholic bishops.

Even before the edict of Milan, at least as early as the latter half of the 3rd century, the spiritual sentences of deposition from office had sometimes indirect temporal consequences recognized by the secular courts. The classical example is the case of Paul of Samosata, bishop of Antioch. It would seem that, in the intervals of persecution, some rights of property were recognized in the Christian Church and its officers; although the Church was an illegal society. After some previous abortive trials, Paul of Samosata was deposed and excon~municated in 269, by a great synod of the Antiochene district. Paul, notwithstanding his deposition, kept possession of the episcopal residence. The local church sought recovery of it before the tribunals of the Empire. The judicial authorities requested a rescript from the emperor Aurelian for the decision of the cause. Aurelian referred the matter to the bishop of Rome and the bishops of Italy, who gave their award in favour of the Antiochene Church.

Roman Empire from Constantine. — With the "Nicene period" came a great development on the criminal side. A system begins to be formed, and the secular arm supports the decrees of the Church. The first trace of system is in the limited right of appeal given by the first oecumenical council of Nicaea and its provision that episcopal sentences or those of provincial synods on appeal were to be recognized throughout the world. Still examination must be had whether persons have been expelled from the congregation by any episcopal small-mindedness (μικροψυχία), or contentious spirit, or such-like harshness (ἀηδία). That this may be conveniently inquired into, synods are to be held every year, in each province, and questions of this kind examined. And as regards the secular arm. the practice arose of superadding banishment by the emperor to synodical condemnation. The dogmatic decrees of Nicaea I. were at once enforced in this manner. On the other hand, the Arian reaction at court worked its objects by using the criminal spiritual jurisdiction of synods against the Catholics—often packing the synods for the purpose. The acts of councils of this age are full of the trials of bishops not only for heresy but for immorality and common law crimes. The accusations are frequently unfounded; but the trials are already conducted in a certain regular forensic form. The secular authorities follow the precedent of Nicaea I. and intervene to supplement the spiritual sentence by administrative penalties. Sometimes an imperial officer of high rank is present at the synod, as an assessor to maintain order and advise upon points of procedure.

The trial of Athanasius shows a further stage in the development of ecclesiastical jurisdiction. Its significance is seen in the council of Sardica (347), a council of practically the whole West save Africa. which acquitted Athanasius after a full judicial inquiry. This council endeavoured to set up a system of appeals in the case of bishops, in which the see of Rome was made to play a great part. "Out of honour to the memory of St. Peter," a condemned bishop may ask the intervention of Rome. If the bishop of Rome thinks the cause should be heard again, he is to appoint judges; if otherwise, the original judgment is to be confirmed. Pending appeal, the appellant's see is not to be filled up.

The tendency to give pre-eminence to Rome appears again in an imperial letter to St. Flavian, who, in the judgment of the East, was bishop of Antioch, but who was rejected by the West and Egypt, summoning him to Rome to be there judged by the bishops of the imperial city—a summons which St. Flavian did not obey.

The story of the administrative development of the Church in the 5th century is mainly the story of the final emergence and constitution of the great "patriarchates," as authorities superior to metropolitans and provincial synods. In consequence of the occupants of the thrones of Constantinople and Alexandria falling successively into opposite heresies, the question arose how "patriarchs" were to be judged. In both cases, as it seems, an attempt was made by the bishop of Rome to depose the erring patriarch by his authority as primate of Christendom, acting in concert with a Western synod. In both cases, apparently, an oecumenical synod ignored the Roman deposition and judged the alleged offences of the respective patriarchs in first and last instance. The third and fourth oecumenical synods (Ephesus, 431; Chalcedon, 451) were primarily tribunals for the trials of Nestorius and Dioscorus; it was secondarily that they became organs of the universal episcopate for the definition of the faith, or legislative assemblies for the enactment of canons. Nothing is more remarkable than their minute care as to observance of rules of procedure. In both cases, imperial assessors were appointed. At Chalcedon, on the other hand, the imperial commissioners decided points of order, kept the synod to the question, took the votes and adjourned the court. The fifth oecumenical council came near to sitting in judgment over the pope. Vigilius, although in Constantinople, refused to attend the sittings of the council. He was cited three times, in the canonical manner, and upon not appearing was threatened in the third session with anathema (Hefele, Councils §§ 268 *ff.*). After the council, Justinian banished the pope, until he accepted the council, which he ultimately did.

The constitution of the patriarchal system resulted in the recognition of a certain right of appeal to Rome from the larger part of the West. Britain remained outside that jurisdiction, the Celtic churches of the British islands, after those islands were abandoned by the Empire, pursuing a course of their own. In the East, Constantinople, from its principality. acquired special administrative pre-eminence, naturally followed, as in the case of Rome, by judicial pre-eminence. An example of this is found in the ninth canon of Chalcedon, which also illustrates the enforcement upon a clerical plaintiff in dispute with a brother cleric of recourse to the arbitration of their ecclesiastical superior. The canon provides that any clerk having a complaint against another clerk must not pass by his own bishop and turn to secular tribunals, but first lay bare his cause before him, so that by the sentence of the bishop himself the dispute may be settled by

arbitrators acceptable to both parties. In the next century Justinian put the other patriarchates on the same footing as Constantinople. But the growth of a special "original" jurisdiction at Constantinople, which perhaps developed earlier than the corresponding institution at Rome, may be traced to the fact that bishops from all parts were constantly in Constantinople. The bishop of Constantinople, even before he became properly "patriarch," would often assemble a synod from these visiting bishops, which acquired the technical name of *σύνοδος ἐνδημοῦσα*, the synod of sojourners. This synod frequently decided questions belonging to other patriarchates.

Theodosius I. began the system of giving secular authority to Church tribunals. But it appears definitely in 425, when a constitution of Theodosius II. provides that a recent decree of the usurper John should be disregarded and that clerks whom he had brought before secular judges should be reserved for the episcopal jurisdictions, "since it is not lawful to subject the ministers of the divine office to the arbitrament of temporal powers." Justinian has a clearer perception of the demarcation between the spheres of spiritual and temporal law. His system is based on the principle that if the offence be ecclesiastical, needing ecclesiastical correction, the bishop shall take cognizance of it; but if a cleric be accused of a secular crime he shall be first accused before his bishop, who may depose him from his office and order, and then the competent judge may take him and deal with him according to the laws.

Certain enactments of later Saxon times in England have been sometimes spoken of as though they united together the temporal and spiritual jurisdictions into one mixed tribunal deriving its authority from the State. In the latter part of the 10th century, laws of Edgar provided that the bishop should be at the county court and also the alderman, and that there each of them should put in use both God's laws and the world's law (Johnson's *English* Canons, i. 411). This probably was, as Johnson suggests, that the bishop might enforce secular laws by ecclesiastical censure and the alderman ecclesiastical laws with secular punishment. But the two jurisdictions were kept separate; for by another law of Edgar it was provided that "in the most august assembly the bishop and alderman should be present, and the one should interpret to the people the law of God, the other the laws of men." In the meantime, however, on the Continent, Charlemagne under the mistaken belief that he was following the authority of Constantine I. and Theodosius I., had taken the serious step of empowering bishops to act as real judges; and causes could be taken from lay cognizance and transferred to the bishop's tribunal.

The Mediaeval System. — With the later 9th century we enter upon a new epoch, and by the time of Gregory VII., in the 11th century, the tribunals have fallen into the hands of a regular class of canonists who are in fact professional church-lawyers in orders (see CANON LAW). The changes due to the adoption of the False Decretals by Nicholas I. and the application of their principles by Hildebrand (afterwards Gregory VII.) are discussed elsewhere (see HILDEBRAND; INVESTITURE; and kindred articles). The mediaeval system, thus inaugurated, may be considered (1) in its hierarchy, (2) in the subject matter of its jurisdiction, (3) in its penalties.

(1) It is a system of courts. Much that had been done by bishops is now done in the course of regular judicial procedure; the court takes the place of the synod, which ceases to have judicial work. The court of the metropolitan takes the place of the provincial synod, except possibly for the trial of bishops, and even this becomes doubtful.

At first the bishop was the only judge in the diocesan court and he always remains a judge. But just as the king appoints judges to hear *placita* coram rege *ipso*, and the feudal lord appoints his seneschal or steward, so the bishop appoints his official, the "vicar-general" or "chancellor" (see CHANCELLOR). It was gradually established that as a king should not hear causes but commit them to his judges, so a bishop should not hear causes but appoint an official to hear them. In France the "parlements" were constantly insisting on the independence and irremovability of the official.

The ecclesiastical and secular courts are kept distinct. The charter of William the Conqueror abrogated the laws of Edgar. No bishop or archdeacon "shall any longer hold pleas in the Hundred concerning episcopal law nor draw a cause which concerns the rule of such to the judgment of men of the world" (Stubbs, Select Charters, part iii.). In France, where the bishop was a temporal baron, his feudal and his spiritual courts were kept by distinct officers. From the bishop, or his official, appeal lay to the metropolitan, who again could hear causes by his official. The Constitutions of Clarendon recognize this appeal (c. viii.). An appeal lay from the court of the metropolitan to that of the primate. There were many disputes as to the existence of these primates (see Maitland, Canon Law in the *Church* of *England,* p. 121). In England the dispute between Canterbury and York was settled by making them both primates, giving Canterbury the further honour of being primate of all England. In France the primatial sees and the course of appeals to them were well established.

In England the Constitutions of Clarendon added a provision for appeal to the king, "and if the archbishop shall have failed in doing justice recourse is to be had in the last resort (postremo) to our lord the king, that by his writ the controversy may be ended in the court of the archbishop; because there must be no further process without the assent of our lord the king." The last words were an attempt to limit further appeal to Rome. It will be observed that the king does not hear the cause or adjudicate upon it. He merely corrects slackness or lack of doing justice (Si *archiepiscopus* defecerit in *justitia exhibenda*) and by his writ (precepto) directs the controversy to be determined in the metropolitan's court. As Bishop Stubbs says (Report of Eccl. Comm. vol. i. *Hist. App.* i.): "The appeal to the king is merely a provision for a rehearing before the archbishop, such failure to do justice being not so much applicable to an unfair decision as to the delays or refusal to proceed common at that time" (cf. Joyce, The Sword and the Keys, 2nd ed., pp. 19–20). The *recursus* ad *principem,* in some form or other of appeal or application to the sovereign or his lay judges, was at the end of the middle ages well known over western Europe. This recourse in England sometimes took the form of the appeal to the king given by the Constitutions of Ciarendon, just mentioned, and later by the acts of Henry VIII.; sometimes that of suing for writs of prohibition or mandamus, which were granted by the king's judges, either to restrain excess of jurisdiction, or to compel the spiritual judge to exercise jurisdiction in cases where it seemed to the temporal court that he was failing in his duty. The *appellatio tanquam* ab *abusu* (*appel* comme *d'abus*) in France was an application of a like nature.

Lastly there was the appeal to the patriarchs, *i.e.* in the West to Rome. The distinguishing feature of this appeal was that the rule of the other appeals did not apply to it. In the regular course of those appeals an appellant could not leap the intermediate stages; but he could at any stage go to this final appeal, *omisso medio,* as it was technically called. Van Espen says: "The whole right of appeal to the Roman pontiff *omisso* medio had undoubtedly its origin in this principle, that the Roman pontiff is ordinary of ordinaries, or, in other words, has immediate episcopal authority in all particular churches, and this principle had its own beginning from the False Decretals." There was an alleged original jurisdiction of the pope, which he exercised sometimes by permanent legates, whom Gregory VII. and his successors established in the chief countries of Europs, and to whom were committed the legislative, executive and judicial powers of the spiritual "prince" in the districts assigned to them. After legates came special delegates appointed by the pope to hear a particular cause. It was the general practice to appoint two or three to sit together (Van Espen, pars iii. tit. v. c. 2, 37). These might sub-delegate the whole cause or any part of it as they pleased (ibid. 9–18). These courts were convenient, since it was the custom to appoint delegates resident in the neighbourhood, and the power of sub-delegation, general or limited, simplified questions of distance. In Belgium causes appealed to Rome had to be committed to local delegates (Van Espen, pars iii tit. v. c. 3, tit. x. c. 2).

There could be an appeal from these delegates to the pope and from the pope himself to the pope "better informed" (Van Espen, pars iii. tit. x. c. 2, 13). So personal had the system of jurisdiction become that even the trials of bishops ceased to be necessarily conciliar. Generally they were reserved to the pope (Van Espen, pars iii. tit. iii. c. 5, 17–19); but in England the archbishop, either in synod, or with some of his comprovincial bishops concurring, tried and deposed bishops *(see* case of Bishop Peacock and the other cases cited in *Read* v. *Bishop of Lincoln,* 14 *P.D.* 148, and Phillimore, *Eccl. Law,* pp. 66 *et seq.).* The matrimonial cause between Henry VIII. and Catharine of Aragon was the most famous English cause tried by delegates under the "original" jurisdiction of the pope, and was ultimately "evoked" to Rome. The foreseen adverse termination of this long-drawn cause led to Henry's legislation.

When the temporal courts interfered to prevent excess of jurisdiction, they did so by prohibiting the ecclesiastical court from trying and the suitor from suing in that court. The pope could not be effectively prohibited, and no instance is recorded of a prohibition to papal delegates. But suitors have been prohibited from appealing to the pope *(see* per Willes, *J.,* in *Mayor of London* v. *Cox,* L.R. 2 H.L. 280). Whatever may have been the law, it is certain that, notwithstanding the statutes of Edw. III. and Rich. II., appeals to Rome and original trials by papal delegates did go on, perhaps with the king's licence; for the statute 24 Hen. VIII. c. 12 recites that the hearing of appeals was an usurpation by the pope and a grievous abuse, and proceeds to take away the appeal in matrimonial, testamentary and tithe causes, and to hinder, by forbidding citation and process from Rome, all original hearings also. The statute 25 Hen. VIII. c. 19 follows this up by taking away appeals in all other subjects of ecclesiastical jurisdiction.

In 1438 the council of Basel took away all papal original jurisdiction (save in certain reserved cases), evocation of causes to Rome, appeals to Rome *omisso medio,* and appeals to Rome altogether in many causes. Such appeals when permissible, except the "greater," were to be tried by delegates on the spot (31st Session; Mansi, *Concilia, in loco).* These proceedings at Basel were regarded at Rome as of no effect. Nevertheless this decree and others were adopted by a French national council at Bourges and promulgated by the king as a "Pragmatic Sanction" (*q.v.*). The parlements registered the Sanction and the effect was permanent in France. Louis XI. and Charles VIII. sought to revoke it; but both parlements and states-general refused to recognize the revoking decrees. In 1499 Louis XII. ordered the Pragmatic to be inviolably observed. The parlements thereupon condemned several private persons for obtaining bulls from Rome. In 1516 a Concordat between Leo X. and Francis I. settled all these questions in the sense of the Pragmatic, substantially according to the Basel canon. By this Concordat, by an ordinance of Francis I. in 1539, by two or three other royal edicts, and (above all) by the practice of the parlements, explanatory of this legislation, and their *arrêts,* the conflict of secular and ecclesiastical jurisdictions was settled until the Revolution.

(2.) The subject matter over which the ecclesiastical courts had jurisdiction was no longer purely "criminal" with a civil quasi-jurisdiction by way of arbitration. In the later middle ages these courts had jurisdiction over most questions, except indeed the then most important ones, those relating to real property. This civil jurisdiction was sometimes concurrent with that of the secular courts, sometimes exclusive. In England, for example, in reference to marriage, it included the right to decide in questions of the legitimacy of offspring; in reference to inheritance, the right to examine the administration of bequests of personal property and to intervene in cases of intestacy; the right of intervention to enforce contractual promises made by oath or pledge of faith; as well as in many questions where the church as an organization was directly concerned, as in the tenure of church lands, and questions of fitness or unfitness in the case of presentation to a benefice. The actual working of these wide extensions of ecclesiastical jurisdiction, and their reaction on the social and political life of the country, may be studied in F. W. Maitland's *Canon Law in the Church of England* (1898), in F. Pollock and F. W. Maitland's *History of English Law Before Edward I.* (1898), and J. F. Stephen's *History of the Criminal Law of England* (1883).

In regard to "clerks," the great question at issue in England was whether the ecclesiastical courts had exclusive jurisdiction in the case of criminous clerks, or the king's court, or whether there was a concurrent jurisdiction. The Constitutions of Clarendon, in which the general aim of Henry II. was to restore the rights of the crown over the clergy, ordered that in all civil matters, and in cases of dispute with laymen, the clergy shall be amenable to the royal courts (for text, *see* Mansi, *Concilia,* vol. xxi. pp. 1187 *sqq.;* E. H. Landon, *Manual of Councils,* pp. *132 sqq.).* The sympathies of the English church and nation were divided, for Becket was both violent and inconsistent in his conduct of the case of the church against the Constitutions. But the king's ungovernable temper broke out in a cry of rage that inspired four of his knights to steal away from his court and murder his enemy in Canterbury Cathedral; and the wave of reaction caused by this appalling deed deprived the State of many important rights only recovered at the Reformation. One of the worst evils of the later middle ages was the "Benefit of Clergy." "Not only monks and parish priests, but professional men, and an enormous crowd of menials and minor officers of clerical establishments, and in later times anyone who could make some show of being able to read, were safe from the dread of any serious penalty for such crimes as burglary, rape, and homicide, at any rate for the first offence. It was only too easy to obtain minor orders, and the attraction to baser spirits of such privileges and protection was great" (G. M. Trevelyan, *History of England,* bk. ii. ch. ii.).

The history of ecclesiastical jurisdiction on the continent of Europe during the middle ages is inseparable from the history of the Roman Catholic Church, of which indeed it is an essential part. The larger questions at issue are indicated in the articles dealing with that subject: and the details may be studied in P. Fournier, *Les officialités au moyen âge* (1880), *M.* Gaudry, *Traité de la législation des cultes* (1856), *J. P.* Migne, *Dictionnaire de droit canonique* (1844), and Tillemont, *Mémoires pour servir à l'histoire ecclésiastique* (1701–12).

(3.) The penalties inflicted by ecclesiastical courts were technically divided into punishments *(poenae)* and censures (*censurae*), purely spiritual and remedial *(see* Van Espen, pars iii., tit. xl. c. 1, 3; Phillimore, *Ecclesiastical Law,* p. 1064). The *poenae* were of various kinds. Apart from the case of heresy and kindred offences, the most extreme punishments were imprisonment for life, in the bishop's prison, or, on the other hand, deposition or degradation from the ministry. In the cases of heresy, apostasy and sorcery, the ecclesiastical courts sought the aid of the secular jurisdiction to superadd the punishment of death. Incorrigible offenders on these matters were "left" to the secular power. This provision of the fourth Lateran Council in 1215 was always interpreted to mean death *(see* Van Espen, *Observationes in concilium Lateranense IV.;* and, as to English law and practice, Maitland, *op. cit.,* Essay vi., and pp. 161, 176). The "capital" punishment was generally (always in England) by burning. Burning was an English punishment for some secular offences.

The Concordat with Francis I. by which the pope gave up the right of hearing appeals from France was not many years before the legislation of Henry VIII. in England. Both monarchs proceeded on the same lines; but Francis I. got the pope's consent: Henry VIII. acted *in invitum,* and in time went further.

Ecclesiastical Jurisdiction in England.— The Statute of Appeals (24 Hen. VIII. c. 12) took away appeals to Rome in causes testamentary and matrimonial and in regard to right of tithes and oblations. A final appeal is given to the archbishop of the particular province; but in causes touching the king a final appeal is given to the Upper House of Convocation of the province. The "Act of Submission of the Clergy" (25 Hen. VIII. c. 19) took away *all* appeals to Rome and gave a further appeal, "for lack of justice," from the several courts of the archbishops

to the king in chancery. Thence a commission was to issue to persons named therein to determine the appeal definitely. Henry VIII. exercised his jurisdiction as Supreme Head through a vicar-general. Edward VI. exercised original jurisdiction in spiritual causes by delegated commissions (see Archdeacon Hale, *Precedents* in *Criminal* Cases, p. xlviii.). Unless the king was to be regarded as an ecclesiastical person, they were not properly ecclesiastical courts; although spiritual persons might sit in them, for they sat only as royal commissioners. The same point has been taken by large bodies of clergy and laity in regard to the court of final appeal created by 25 Hen. VIII. c. 19 and its present successor, the judicial committee of Privy Council. At any rate the "original" jurisdiction claimed for the monarch personally and his delegates, under Henry VIII. and Edward VI., has not permanently remained. In theory, Hooker's contentions have been conceded that "kings cannot in their own proper persons decide questions about matters of faith and Christian religion" and that "they have not ordinary spiritual power" (Ecc. Pol. vii. 8, 1, 6; cf. xxxix. Articles, Art. 37). In the case of an "established" church, and in particular, of the Church of England as by law established, Hooker's theory meets with important qualifications (see article ECCLESIASTICAL LAW).

The legal position of the clergy of the Church of England has been affected by a series of enactments of which the most important are the following: the "Church Discipline Act" (3 and 4 Vict. c. 86) creating the "consistory court"; the "Public Worship Regulation Act" (37 and 38 Vict. c. 85); and the "Clergy Discipline Act" (55 and 56 Vict. c. 32). The last remains of the old powers of ecclesiastical jurisdiction in reference to secular causes, have been removed during the 19th century. (1) All matrimonial, testamentary and ab intestate jurisdiction has been taken away by 20 & 21 Vict. c. 77 (testamentary, etc., England), c. 79 (testamentary, etc., Ireland), c. 85 (matrimonial. England); 33 & 34 Vict. c. 110 (matrimonial, Ireland). Matrimonial jurisdiction was taken from the bishop of Sodor and Man in 1884. (2) Since 6 & 7 Will. IV. c. 71, tithe has become, except in a few rare cases, tithe rent charge, and its recovery has been entirely an operation of secular law. Most kinds of offerings are now recoverable in secular courts. (3) Administration of pious gifts has passed to the court of chancery. (4) The enforcement of contractual promises has long been abandoned by the courts Christian themselves. (5) Church rates can no longer be enforced by suit (31 & 32 Vict. c. 109). (6) Defamation was taken away in England by 18 & 19 Vict. c. 41, and in Ireland by 23 & 24 Vict. c. 32. (7) Laymen can no longer be tried in the spiritual courts for offences against clerks. (8) The jurisdiction for "brawling" in church, etc., is taken away by 23 & 24 Vict. c. 32 in the case of the laity (see A. J. Stephens, Ecclesiastical Statutes, i. 336). On the other hand the "Church of England Assembly (Powers) Act, 1919," defined the powers of the Church in reference to internal affairs and facilitated Parliamentary sanction where this is required (see ENGLAND, CHURCH OF).

The position of a disestablished or an unestablished Church is comparatively modern, and has given rise to new jural conceptions. These Churches are collegia *licita* and come within the liberty of association so freely conceded in modern times. The relations of their bishops, priests or other ministers and lay office-bearers inter se and to their lay folk depend upon contract; and these contracts will be enforced by the ordinary courts of law. A consensual ecclesiastical jurisdiction is thus created, which has to this extent temporal sanction. (See ECCLESIASTICAL LAW.)

The case of Scotland presents special features. The Church had the same jurisdiction in Scotland and exercised it through similar courts to those which she had in England and France, till about 1570. As late as 1566 Archbishop Hamilton of Glasgow, upon his appointment, had restitution of his jurisdiction in the probate of testaments and other matters (Keith, History of the Scottish Bishops, Edinburgh, 1824, p. 38). There was an interval of uncertainty, with at any rate titular bishops, till 1592. Then parliament enacted a new system of Church courts which, though to some extent in its turn superseded by the revival of episcopacy under James VI., was revived or ratified by the act of 1690, c. 7, and stands to this day. It is a Presbyterian system, and the Scottish Episcopal Church is a disestablished and voluntary body since 1690 (see PRESBYTERIANISM; SCOTLAND, CHURCH OF; SCOTTISH EPISCOPAL CHURCH).

Protestant Continental European States.—With the Reformation in the 16th century, Church courts properly speaking disappeared from the non-episcopal religious communities which were established in Holland, in the Protestant states of Switzerland and of Germany, and in the then non-episcopal countries of Denmark and Norway.

Discipline over ministers and other office-bearers was exercised by administrative methods in the form of trials before consistories or synods. To this extent ecclesiastical jurisdiction is still exercised in these countries. Consistories and synods have exercised discipline of a penitential kind over their lay members; but in later times their censures have generally ceased to carry temporal consequences. Ecclesiastical jurisdiction on the civil side for the trial of causes soon disappeared.

The matter is now determined for all countries which have adopted codes, whether after the pattern of the Code Napoleon or otherwise. These countries have created a hierarchy of temporal courts competent to deal with every matter of which law takes cognizance, and a penal code which embraces and deals with all crimes or delicts which the state recognizes as offences. Hence, even in countries where the Roman Church is established, such as Belgium and Italy, the most of the Latin republics of America, and the province of Quebec, and a fortiori where this Church is not established, there is now no discipline over the laity, except penitential, and no jurisdiction exercised in civil suits, except possibly the matrimonial questions of princes (of which there was an example in the case of the late prince of Monaco). In Spain causes of nullity and divorce a fhoro, in Portugal causes of nullity between Catholics are still for the court Christian (non-secular).

BIBLIOGRAPHY.—The subject of ecclesiastical jurisdiction in modern times inevitably links itself onto the ecclesiastical and civil history of the countries concerned. On the general subject, *see* ECCLESIASTICAL LAW; and, for further references, articles "Law, Christian" in Hastings' *Encyclopaedia of Religion and Ethics*, vol. vii.: "Roman Catholic" and "Eastern" by Adrian Fortescue, and "Anglican" by A. J. Maclean. For the history of the principal codes *see* CANON LAW. On the development of ecclesiastical jurisdiction in the Church of Rome *see* ROMAN CATHOLIC CHURCH, and (from other points of view) TRENT, COUNCIL OF; VATICAN COUNCIL; and ULTRAMONTANISM. With reference to the Eastern church, *see* ORTHODOX EASTERN CHURCH; also Landon, *Manual of Councils* (1893), s.v. "Constantinople" and "Rome"; Mouravieff, *History of the Russian Church*, Eng. tr. 1842; Hackett, *Orthodox Church in Cyprus* (1901); Milasch, *Das Kirchenrecht der morgenlandischen Kirche* (1905). With reference to the Anglican Church, *see* Blunt, Phillimore and Jones, *Book of Church Law*, 1899; W. E. Collins, *Nature and Force of the Canon Law* (Church Historical Society, no. xxsiv., 1898); and the classical statement of Hooker, *Ecclesiastical Polity*, bk. viii. With reference to the middle ages, *see* the relative parts of the *Cambridge Mediaeval Wtstory* and the classical works of van Espen (Louvain, 1720): *Jus ecclesiasticum universum; Observationes in Concilium Lateranense iv.; De recursu ad Principem.* *See* also other works mentioned in the course of the foregoing article.

(X.)

ECCLESIASTICAL LAW, in its broadest sense, the sum of the authoritative rules governing the Christian Church, whether in its internal polity or in its relations with the secular power. Since there are various churches, widely differing both in their principles and practice, it follows that a like difference exists in their ecclesiastical law, which is the outcome of their corporate consciousness as modified by their several relations to the secular authority. At the outset a distinction must be made between churches which are "established" and those that are "free." The ecclesiastical laws of the latter are, like the rules of a private society or club, the concern of the members of the church only, and come under the purview of the State only in so far as they come in conflict with the secular law (*e.g.*, polygamy among the Mormons, or violation of the trust-deeds under which the property of a church is held). In the case of "established" churches, on the other hand, whatever the principle on which the system is based, or the difference in its practical application, the essential conditions are that the ecclesiastical law is also the law of the land, the decisions of the church courts being enforced by the

civil power. This holds good both of the Roman Catholic church, wherever this is recognized as the "State religion," of the Oriental churches, whether closely identified with the State itself, or endowed with powers over particular nationalities within the State, and of the various Protestant churches established in Great Britain and on the Continent of Europe.

Writers on the theory of ecclesiastical law, moreover, draw a fundamental distinction between that of the church of Rome and that of the Protestant national or territorial churches. This distinction is due to the claim of the Roman Catholic church to be the *only* church, her laws being thus of universal obligation; whereas the laws of the various established Protestant churches are valid—at least so far as legal obligation is concerned—only within the limits of the countries in which they are established. The practical effects of this distinction have been, and still are, of enormous importance. The Roman Catholic church, even when recognized as the State religion, is nowhere "established" in the sense of being identified with the State, but is rather an *imperium in imperio* which negotiates on equal terms with the State, the results being embodied in concordats (*q.v.*) between the State and the pope as head of the church. The concordats are of the nature of truces in the perennial conflict between the spiritual and secular powers, and imply in principle no surrender of the claims of the one to those of the other.

Protestant ecclesiastical law, then, is distinguished from that of the Roman Catholic church (1) by being more limited in its scope, (2) by having for its authoritative source, not the church only or even mainly, but the church in more or less complete union with or subordination to the State, the latter being considered, equally with the church, as an organ of the will of God. The ecclesiastical law of the church of Rome, on the other hand, whatever its origin, is now valid only in so far as it has the sanction of the authority of the Holy See. And it must be noted that the "canon law" in its old sense is not identical with the "ecclesiastical law" of the Roman Catholic church. By the canon law used to be meant the contents of the *Corpus iuris canonici,* which have been largely superseded or added to by, *e g.,* the canons of the Council of Trent and the Vatican decrees. The long projected codification of the whole of the ecclesiastical law of the church of Rome, was completed in 1917 in the pontificate of Benedict XV. (*See* also CANON LAW and ECCLESIASTICAL JURISDICTION.)

The ecclesiastical law of England is in complete dependence upon the authority of the State. The convocations of York and Canterbury are provincial assemblies possessing no legislative or judicial authority; even such purely ecclesiastical questions as may be formally commended to their attention by "letters of business" from the Crown can only be finally settled by act of parliament or, under the Church of England Assembly (Powers) Act 1919, by a measure passed by the church assembly and then assented to by a separate resolution in each house of parliament and submitted for royal assent. The ecclesiastical courts are for the most part officered by laymen, whose subordination to the archbishops and bishops is purely formal, and the final court of appeal is the Judicial Committee of the Privy Council. In like manner changes in the ecclesiastical law have been made directly by parliament in the ordinary course of legislation, and in point of fact a very large portion of the existing ecclesiastical law consists of acts of parliament.

The first principle of the ecclesiastical law in England is the assertion of the supremacy of the Crown, which in the present state of the constitution means the same thing as the supremacy of parliament. This principle has been maintained ever since the Reformation. Before the Reformation the ecclesiastical supremacy of the pope was recognized, with certain limitations, in England, and the church itself had some pretensions to ecclesiastical freedom. The freedom of the church is, in fact, one of the standing provisions of those charters on which the English constitution was based. The first provision of Magna Carta is *quod ecclesia Anglicana libera sit.* By the various enactments of the period of the Reformation the whole constitutional position of the church, not merely with reference to the pope but with reference to the State, was definitely fixed. The legislative power of convocation was held to extend to the clergy only, and even to that extent required the sanction and assent of the Crown. The common law courts controlled the jurisdiction of the ecclesiastical courts, claiming to have "the exposition of such statutes or acts of parliament as concern either the extent of the jurisdiction of these courts or the matters depending before them. And therefore if these courts either refuse to allow these acts of parliament, or expound them in any other sense than is truly and properly the exposition of them, the king's great courts of common law may prohibit and control them."

The design of constructing a code of ecclesiastical laws was entertained during the period of the Reformation but never carried into effect. It is alluded to in various statutes of the reign of Henry VIII., who obtained power to appoint a commission to examine the old ecclesiastical laws, with a view of deciding which ought to be kept and which ought to be abolished, and in the meantime it was enacted that "such canons, institutions, ordinances, synodal or provincial, or other ecclesiastical laws or jurisdictions spiritual as be yet accustomed and used here in the church of England, which necessarily and conveniently are requisite to be put in ure and execution for the time, not being repugnant, contrarient, or derogatory to the laws or statutes of the realm, nor to the prerogatives of the royal crown of the same, or any of them, shall be occupied, exercised, and put in ure for the time with this realm" (25 Henry VIII. c. 19, 35 c. 16).

The work was actually undertaken and finished in the reign of Edward VI. by a subcommittee of eight persons, under the name of the *Reformatio legum ecclesiasticarum,* which, however, never obtained the royal assent. Although the powers of the 25 Henry VIII. c. 19, were revived by the 1 Elizabeth c. 1, the scheme was never executed, and the ecclesiastical laws remained on the footing assigned to them in that statute—so much of the old ecclesiastical laws might be used as had been actually in use, and was not repugnant to the laws of the realm.

The statement is, indeed, made by Sir R. Phillinore (*Ecclesiastical Law,* 2nd ed., 1895) that the "Church of England has at all times, before and since the Reformation, claimed the right of an independent church in an independent kingdom, to be governed by the laws which she has deemed it expedient to adopt." This position can only be accepted if it is confined, as the authorities cited for it are confined, to the resistance of interference from abroad. If it mean that the church, as distinguished from the kingdom, has claimed to be governed by laws of her own making, all that can be said is that the claim has been singularly unsuccessful. From the time of the Reformation no change has been made in the law of the church which has not been made by the king and parliament, sometimes indirectly, as by confirming the resolutions of convocation, but for the most part by statute. The list of statutes cited in Sir R. Phillimore's *Ecclesiastical Law* fills 11 pages. It is only by a kind of legal fiction that the church can be said to have deemed it expedient to adopt these laws.

The terms on which the church establishment of Ireland was abolished, by the Irish Church Act of 1569, may be mentioned. By s. 20 the present ecclesiastical law was made binding on the members for the time being of the church, "as if they had mutually contracted and agreed to abide by and observe the same"; and by s. 21 it was enacted that the ecclesiastical courts should cease after Jan. 1, 1871, and that the ecclesiastical laws of Ireland, except so far as relates to matrimonial causes and matters, should cease to exist as law. (*See* also ENGLAND, THE CHURCH OF.)

BIBLIOGRAPHY.—The number of works on ecclesiastical law is very great, and it must suffice here to mention a few of the more conspicuous modern ones: Ferdinand Walter, *Lehrbuch des Kirchenrechts aller christlichen Konjessionen* (14th ed., Bonn, 1871); G. Phillips, *Kirchenrecht,* Bde. i.–vii. (Regensburg, 1845–72) incomplete; the text-book by Cardinal Hergenrother (*q.v.*); P. Hinschius, *Kirchenrecht der Katholiken und Protestanten in Deutschland,* 6 Bde. (1869 *sqq.*), only the Catholic part, a masterly and detailed survey of the ecclesiastical law, finished; Sir Robert Phillimore, *Eccl. Law of the Church of England* (and ed., ed. by Sir Walter Phillimore, 1895). For further references *see* CANON LAW, and the article "Kirchenrecht" in Herzog-Hauck, *Realencyklopädie* (ed. Leipzig, 1901); C. F. S. Zollman, *Amer. Civil Church Law* (1917); P. Gillet, *La personnalite juridique en droit ecclesiastique* (Malines, 1927).

ECCLESIASTICUS (abbreviated to *Ecclus.*), an alternative title of the apocryphal book otherwise called "The Wisdom of Jesus the son of Sirach." The Latin word ecclesiasticus means "churchly," and might be used of any book which was read in church or received ecclesiastical sanction. The name of the book appears in the authorities in a variety of forms. The writer's full name is given in l. 27 (Heb. text) as "Simeon the son of Jeshua (*i.e.,* Jesus) the son of Eleazar 'the son of Sira." In the Greek text this name appears as "Jesus son of Sirach Eleazar of Jerusalem." The name is shortened sometimes to *Ben* Sira in Hebrew, Bar Sira in Aramaic, and sometimes to Sirach. The work is variously described as the Words (Heb. text), the Book (Talmud), the Proverbs (Jerome), or the Wisdom of the son of Sira (or Sirach).

Of the date of the book we have no certain indication. It was translated by a person who says that he "came into Egypt in the 38th year of Euergetes the king" (Ptolemy VII.), *i.e.,* in 132 B.C., and that he executed the work some time later. The translator believed that the writer of the original was his own grandfather (or ancestor, πάππος). Arguments for a pre-Maccabean date may be derived (a) from the fact that the book contains apparently no reference to the Maccabean struggles, (b) from the eulogy of the priestly house of Zadok which fell into disrepute during these wars for independence.

In the Jewish Church Ecclesiasticus hovered on the border of the canon. The book contains much which attracted and also much which repelled Jewish feeling, and it appears that it was necessary to pronounce against its canonicity. In the Talmud (Sanhedrin 100 b) Rabbi Joseph says that it is forbidden to read (*i.e.,* in the synagogue) the book of Ben Sira. In the Christian Church it was largely used by Clement of Alexandria (c. A.D. 200) and by St. Augustine. Jerome (c. A.D. 390–400) writes: "Let the Church read these two volumes (Wisdom of Solomon and Ecclesiasticus) for the instruction of the people, not for establishing the authority of the dogmas of the Church" (*Praefatio in libros* Salomonis). In the Vulgate Ecclesiasticus immediately precedes Isaiah. The council of Trent declared this book and the rest of the books reckoned in the Thirty-nine Articles as apocryphal to be canonical.

The text of the book raises intricate problems which are still far from solution. The original Hebrew (rediscovered in fragments and published between 1896 and 1900) has come down to us in a mutilated and corrupt form. There are marginal readings which show that two different recensions existed once in Hebrew. The Greek version exists in two forms—(a) that preserved in cod. B and in the other uncial mss., (b) that preserved in the cursive codex 248 (Holmes and Parsons). Owing to the mutilation of the Hebrew the Greek version retains its place as the chief authority for the text.

The restoration of a satisfactory text is beyond our hopes, for we cannot doubt that the translator amplified and paraphrased the text before him. It is probable that at least one considerable omission must be laid to his charge, for the hymn preserved in the Hebrew text after ch. li. 12 is almost certainly original. Ancient translators allowed themselves much liberty in their work, and Ecclesiasticus had no reputation for canonicity in the 2nd century B.C. to serve as a protection for its text.

The uncertainty of the text has affected both English versions unfavourably. The A.V., following the corrupt cursives, is often wrong. The R.V., on the other hand, in following the uncial mss. sometimes departs from the Hebrew, while the A.V. with the cursives agrees with it. Thus the R.V. omits the whole of iii. 19, which the A.V. retains, but for the clause, "Mysteries are revealed unto the meek," the A.V. has the support of the Hebrew. Sometimes both versions go astray in places in which the Hebrew text recommends itself as original by its vigour; *e.g.,* in vii. 26, where the Hebrew is:—

> Hast thou a wife? abominate her not.
> Hast thou a hated wife? trust not in her.

Again in ch. xxxviii. the Hebrew text shows its superiority over both English versions.

	Hebrew	R.V. (similarly A.V.)
Ver. 1.	Acquaint thyself with a physician before thou have need of him.	Honour a physician according to thy need of him with the honours due unto him.
Ver. 15.	He that sinneth against his Maker will behave himself proudly against a physician.	He that sinneth before his Maker, let him fall into the hands of the physician.

In the second instance, while the Hebrew says that the man who rebels against his Heavenly Benefactor will a fortiori rebel against a human benefactor, the Greek text gives a cynical turn to the verse, "Let the man who rebels against his true benefactor be punished through the tender mercies of a quack." The Hebrew text is superior also in xliv. 1: "Let me now praise favoured men;" *i.e.,* men in whom God's grace was shown. The Greek text of v. 1 "famous men," is nothing but a loose paraphrase.

In character Ecclesiasticus resembles the book of Proverbs. It consists mainly of maxims, moral, utilitarian and secular. Occasionally the author attacks prevalent religious doctrines, *e.g.,* the denial of free-will (xv. 11–20), or the assertion of God's indifference towards men's actions (xxxv. 12–19). Occasionally he touches the highest themes, and speaks of the nature of God: "He is All" (xliii. 27); "He is One from everlasting" (xlii. 21, Heb. text); "The mercy of the Lord is upon all flesh" (xviii. 13). The book contains several passages of force and beauty; *e.g.,* ch. ii. (how to fear the Lord); xv. 11–20 (on free-will); xxiv. 1–22 (the song of wisdom); xlii. 15–25 (praise of the works of the Lord); xliv. 1–15 (the well known praise of famous men). Many sayings scattered throughout the book show depth of insight or practical shrewdness. A few examples may be cited. "Call no man blessed before his death" (xi. 28); "He that toucheth pitch shall be defiled" (xiii. 1); "God hath not given any man license to sin" (xv. 20); "Man cherisheth anger against man; and doth he seek healing from the Lord?" (xxviii. 3); "All things are double one against another: and He hath made nothing imperfect" (xlii. 24, the motto of Butler's Analogy); "Work your work before the time cometh, and in His time He will give you your reward" (li. 30). It cannot be said, however, that Ben Sira preaches a hopeful religion. Though he prays, "Renew Thy signs, and repeat Thy wonders. . . . Fill Sion with Thy majesty and Thy Temple with Thy glory" (xxxvi. 6, 14 [19], Heb. text), he does not look for a Messiah. Of the resurrection of the dead or of the immortality of the soul there is no word. In his maxims of life he shows a frigid and narrow mind. He is a pessimist as regards women: "From a woman was the beginning of sin; and because of her we all die" (xxv. 24). He does not believe in home-spun wisdom: "How shall he become wise that holdeth the plough?" (xxxviii. 25). Artificers are not expected to pray like the wise man: "In the handywork of their craft is their prayer" (v. 34). Merchants are expected to cheat: "Sin will thrust itself in between buying and selling" (xxvii. 2).

BIBLIOGRAPHY.—A useful summary of the literature of Ecclesiasticus is found at the end of Israel Levi's article, "Sirach," in the Jewish Encyclopaedia. The most important edition in English is that of G. H. Box and W. O. E. Oesterley in R. H. Charles, Apocrypha and Pseudepigrapha of the O.T. (1913). (W. E. **BA.**)

ECGBERT or **ECGBERHT** (d. 766), archbishop of York, was made bishop of that see in 732 by his cousin Ceolwulf, king of Northumbria, succeeding Wilfrid II. on the latter's resignation. The pall was sent him in 735 and he became the first northern archbishop after Paulinus, none of his predecessors having received the vestment. He was the brother of Eadberht, who ruled Northumbria 737–758. He was the recipient of the famous letter of Bede, dealing with the evils arising from the corrupt state of the monasteries. Ecgbert himself wrote a *Dialogus Ecclesiasticae* Institutionis, a Penitentiale and a Pontificale. He was a correspondent of St. Boniface. His brother Eadberht succeeded to the throne of Northumbria in 738, and Ecgbert, whose power was certainly increased by this relationship, used his authority wisely for the welfare of his see. He gave generously to the churches of his diocese, and, in particular, founded the Cathedral School of York. He died on Nov. 19, 766.

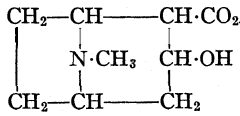
See Bedc, *Continuatio,* sub. ann. 732, 735, 766, and *Epistola* ad *Ecg-*

berctum (ed. Plummer, 1896); Chronicle, sub. ann. 734, 735, 738, 766 (ed. Earle and Plummer, 1899); Haddan and Stubbs, Councils and *Ecclesiastical* Documents (1869–78), iii. 403–431; Proceedings of *Surtees* Society (Durham, 1853).

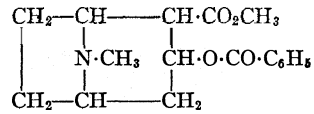
ECGBERT or **ECGBERHT** (d. 839), king of the West Saxons, son of Ealhmund, succeeded to the throne in 802 on the death of Beorhtric. It is said that at an earlier period in his life he had been driven out for three years by Offa and Beorhtric. In 815 Ecgbert ravaged the whole of the territories of the West Welsh, which probably at this time did not include much more than Cornwall. In 825 he joined the men of Devon against the West Welsh, who were again defeated at Camelford. The next important occurrence in the reign was the defeat of Beornwulf of Mercia at Ellandun, probably near Winchester, in 821. Ecgbert sent his son Aethelwulf against Kent; he drove Baldred, king of Kent, across the Thames, and Kent, Surrey, Sussex and Essex submitted to Wessex; while the East Anglians, who slew Beornwulf shortly afterwards, acknowledged Ecgbert as overlord. In 829 the king finally conquered Mercia, and Northumbria, which accepted him as overlord. Ecgbert was the first king to hold the whole of England under his overlordship. He also increased his power by reversing the Mercian policy of resisting the authority of the archbishops, and by making an agreement of perpetual alliance with the church of Canterbury. In 830 he led a successful expedition against the Welsh. In 836 he was defeated by the Danes, but in 838 he entirely routed them and their allies the West Welsh at Hingston Down (Hengest dune) in Cornwall. Ecgbert died in 839, after a reign of 37 years, and was succeeded by his son Aethelwulf.

See Anglo-Saxon Chronicle (ed. Earle and Plummer, 1899); W. de G. Birch, *Cartularium Saxonicum* (1885–93). Also a paper by Sir H. H. Howorth in Numismatic Chronicle, 3rd series, vol. xx. pp. 66–87 (reprinted separately, 1900), where attention is called to the peculiar dating of several of Ecgbert's charters, and the view is put forward that he remained abroad considerably later than the date given by the Chronicle for his accession. On the other hand a charter in Birch, Cart. Sax., purporting to date from 799, contains the curious statement that peace was made between Coenwulf and Ecgbert in that year.

ECGONINE, a white crystalline alkaloid of the tropine group, is chiefly of interest because of its relation to cocaine. Ecgonine is a tropine carboxylic acid $C_9H_{15}NO_3,H_2O$, and cocaine is its benzoyl methyl ester:



Ecgonine



Cocaine

l-Ecgonine results from the alkaline hydrolysis of I-cocaine (the naturally occurring form); it melts at 205° when anhydrous α-Ecgonine is an isomeride, having its CO_2H group attached to the same carbon atom as the OH group. (See CHEMISTRY: ORGANIC, HETEROCYCLIC DIVISION.)

ECHEGARAY Y EIZAGUIRRE, JOSE (1832–1916), Spanish mathematician, statesman and dramatist, passed out at the head of the list of engineers in the Escuela de Caminos at Madrid, and, after a brief practical experience at Almeria and Granada, was appointed professor of pure and applied mathematics in the school where he had lately been a pupil. Between 1867 and 1874 he acted as minister of education and of finance; upon the restoration of the Bourbon dynasty he withdrew from politics and under the pseudonym of Jorge Hayaseca won a new reputation as a dramatist with El Libro talonario (1874). Later in the same year Echegaray achieved a popular triumph with La *Esposa* del vengador, in which the good and bad qualities—the clever stagecraft and unbridled extravagance—of his later work are clearly noticeable. From 1874 onwards he wrote, with varying success, a prodigious number of plays. Among the most favourable specimens of his talent may be mentioned En el *puño* de la *espada* (1875), *O locura ó* santidad (1877) and En el seno de la muerte (1879). El gran Galeoto (1881), perhaps the best of Echegaray's plays in conception and execution, has been translated into several languages. The humorous proverb, ¿ Piensa *mal* y *acertarás?* exemplifies the author's limitations, but the attempt is interesting as an instance of ambitious versatility. His susceptibility to new ideas is illustrated in such pieces as *Mariana* (1892), *Mancha que limpia* (1895), El Hijo de Don Juan (1892) and El Loco Dios (1900); these indicate a close study of Ibsen, and El Loco Dios more especially might be taken for an unintentional parody of Ibsen's symbolism.

Echegaray enjoyed exceptional popularity for over 30 years, but his vogue is now over. He had valuable gifts: in artful construction, in the arrangement of dramatic scenes, in mere theatrical technique, in the focusing of attention on his chief personages, few writers excel him. He had, moreover, a powerful, gloomy imagination, which is momentarily impressive. But in the drawing of character, in the invention of felicitous phrase, in the contrivance of verbal music, he is deficient. He alternates between the use of verse and prose; and his hesitancy in choosing a medium of expression is amply justified, for the writer's prose is not more distinguished than his verse.

See L. Anton del Olmet and A. Garcia Carraffa, Echegaray (1912).

ECHELON, in military tactics and drill, a formation of troops composed of successive and parallel units facing in the same direction, each on a flank, and to the rear of, the unit in front of it (Fr. frpm échelle, ladder). The disposition of the whole thus resembles the steps of a staircase. To form echelon from line, the units forming the line move off, each direct to its front, in succession, so that when the formation is completed the rightmost body, for example, is farthest advanced, the one originally next on its left is to the left rear, a third is to the left rear of the second, and so on. The word is also used more loosely in tactics and strategy to express the successive parts of a unit or force, *e.g.,* forward, reserve or rear echelon, irrespective of distances and relative positions; and in military organization to indicate parts of the headquarters organization which are left in rear of the fighting zone.

ECHIDNA or **SPINY ANT-EATER** (Echidna aculeata), one of the Monotremata (*q.v.*) the lowest subclass of Mammalia. It is a native of Australia, burrowing in sand, or hiding in rock crevices. In size and appearance it resembles a hedgehog, its upper surface being covered over with strong spines directed backwards and inwards, so as to cross each other on the middle line. The tail is very small. It has a long tubular snout with a small mouth; its tongue is long and slender, lubricated with a viscous secretion, by means of which it seizes the insects on which it feeds. It has no teeth. Its legs are short and strong and form powerful burrowing organs. The male echidna has its heel provided with a sharp hollow spur, connected with a gland. It is a nocturnal animal. When attacked it seeks to escape either by rolling itself into a ball or by burrowing rapidly into the sand. Two eggs are laid and these are carried, as are the young at an early stage, in an abdominal pouch, into which open the mammary glands. The echidnas are restless in confinement and constantly endeavour to effect their escape by burrowing.

There are two varieties, the Port Moresby echidna and the hairy echidna. The latter is found in south-eastern New Guinea, Australia, and Tasmania. In all the spines are mixed with hair; in the Tasmanian race they are nearly hidden by the long harsh fur. Of the three-clawed echidnas (Proechidna) confined to New Guinea there are two species.

ECHINODERMA (Echinoderms), a group of animals that live in the sea and constitute one of the great branches (phyla) of the animal kingdom. Familiar examples are the sea-urchin (Echinoid), the sea-star or starfish (Asteroid) and the brittle-star (Ophiuroid). Less familiar are the feather-star and sea-lily (unstalked and stalked Crinoid), and the sea-cucumber (Holothurian) (figs. 1–j). These forms represent the five classes into which the Echinoderma now living are usually divided. In the older periods of the world's history there were other classes, none of which have survived.

The recent forms are of such diverse appearance, and for the most part so unfamiliar, that there is no vernacular English name for the branch. "Echinoderma" is a Greek word and means "prickle-skinned" ("animals" being understood). The Greeks gave

the name "Echinus" to two animals of very different nature, but both protected by a coat of prickles: one the hedgehog or urchin of the land; the other the sea-urchin, which the French call *oursin*. Both urchin and *oursin* are connected with the French *hérisser*, to bristle. The name Echinus has been continued in use for a kind of sea-urchin. The name "Echinodermata," often applied to the whole branch, means "sea-urchin skins," and was

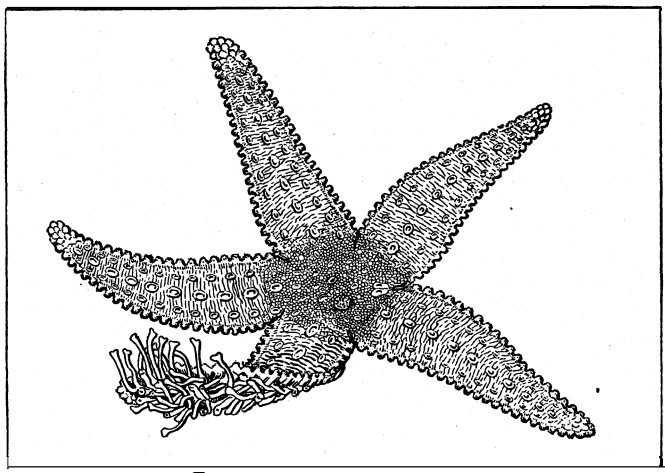
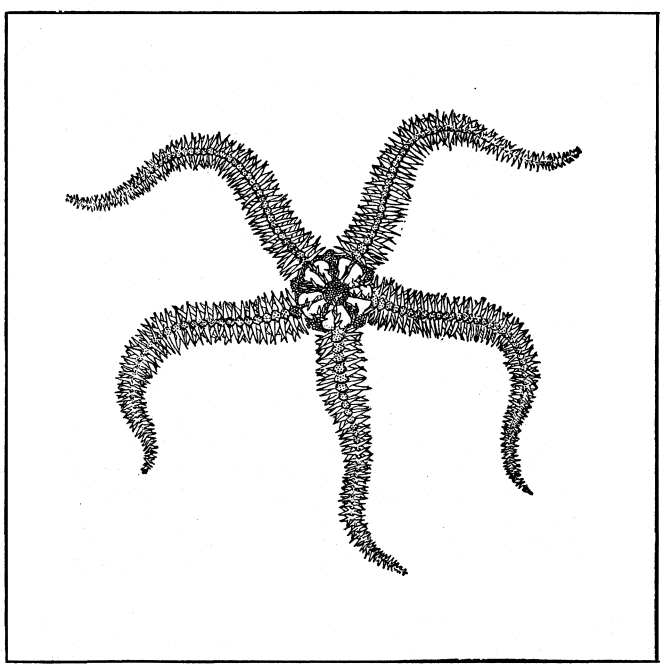


FIG. 1.—SEA-STAR OR ASTEROID

invented in 1734 by J. T. Klein to denote only the empty shells or tests of sea-urchins.

CHARACTERS AND RELATIONS

Diverse though recent echinoderms are, all possess certain characters, some of which they hold in common with other groups of animals, while others are distinctive of the branch. The common characters may be mentioned briefly. The substance of an echinoderm is built of many cells; the animals are multicellular (Metazoa, as opposed to Protozoa). An echinoderm differs from

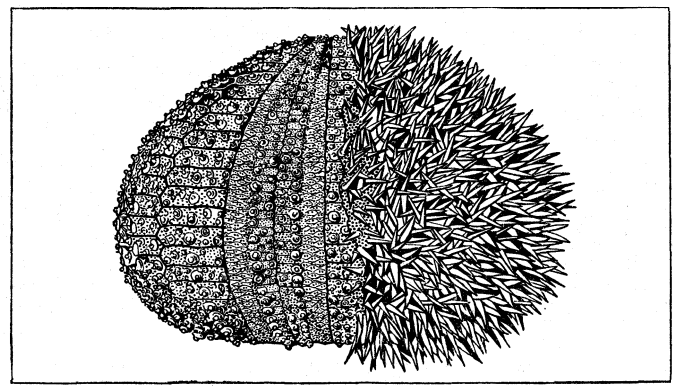


FROM "THE CAMBRIDGE NATURAL HISTORY" (MACMILLAN)

FIG. 2.—BRITTLE-STAR OR OPHIUROID

such animals as sea-anemones and jelly-fish, which are little more than sacs (Coelentera = hollow guts), in having the inside of the sac divided into a gut or digestive tube and a body-cavity or coelom (=hollow); in this it resembles molluscs, flat-worms, arthropods and vertebrates: such animals are called Coelomata. The fundamental plan of an echinoderm, as in all Coelomata, is bilateral, and any appearance of radial symmetry is secondary.

Radial Arrangement. — Recent Echinoderma are distinguished from the other Coelomata by the following characters: — Nearly all show a division of some of the bodily organs into five rays. The rays may fork, may increase, or may be partly suppressed; but the number five governs the plan, though it is not really primitive. The middle line of each ray is termed a radius; a line drawn midway between two adjoining radii is termed an interradius: thus the body-surface may be mapped into five



FROM "ROYAL NATURAL HISTORY" BY PERMISSION OF F. WARNE & CO.

FIG. 3.—SEA-URCHIN OR ECHINOID

radial areas alternating with five interradial areas. In recent echinoderms the organs that show the radial arrangement most clearly are numerous sacs, canals and tubes which carry water through the body and constitute a hydraulic apparatus (water-vascular system). In its most typical form (fig. 6) this consists

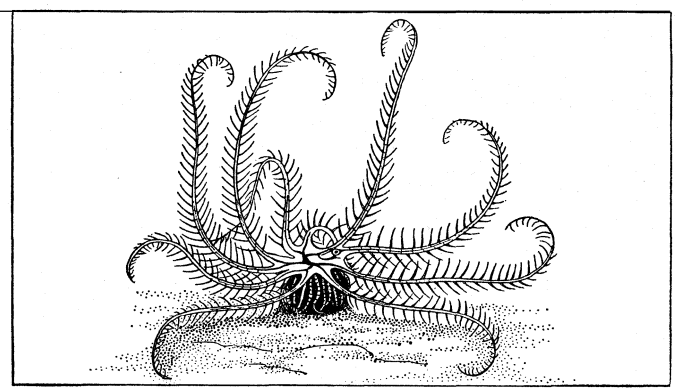
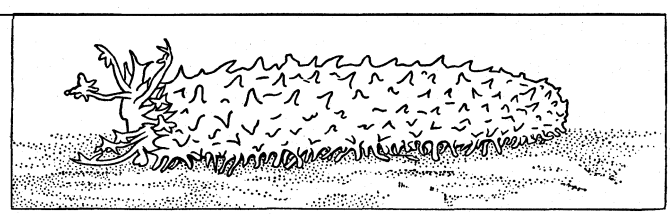


FIG. 4.—FEATHER-STAR OR UNSTALKED CRINOID

of a ring-canal round the mouth, indirectly connected with the water outside, and sending a canal down each of the radii. From each side of this radial water-vessel small branches are given off, and their ends project from the surface of the animal as closed tubes with muscular walls; since in the sea-urchin and sea-star



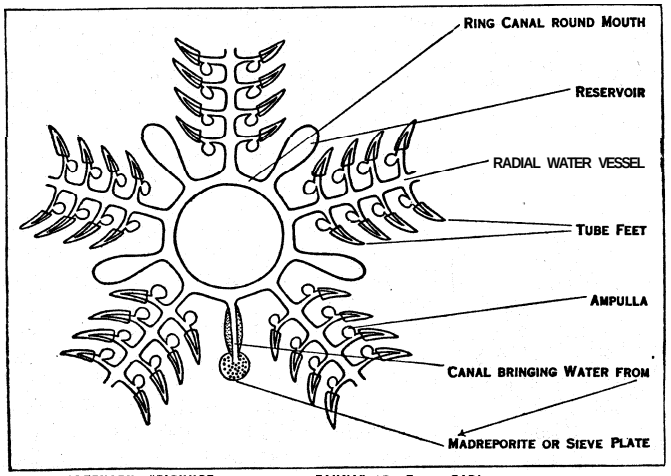
FROM LANKESTER, "TREATISE ON ZOOLOGY" (A. & C. BLACK)

FIG. 5.—SEA CUCUMBER OR HOLOTHURIAN

these tubes end in suckers and aid locomotion, they are called tube-feet or podia (fig. 1). The podia, as they stand up on each side of the radial canal, look like flowers bordering a garden-walk (Lat., *ambulacrum*); hence that radial area of the test is called an ambulacrum, and the interradial areas are called inter-ambulacra.

In the older and more primitive classes of Echinoderma, the hydraulic ambulacral system does not subserve locomotion, but only sensation and respiration. The five-rayed structure did not originate in this system, but was due to the extension from the

mouth of five grooves lined with minute lashes (cilia), which by constant whipping drive a stream of water with food-particles towards the mouth. The food-collecting area was increased by the elongation or branching of the grooves, as in crinoids and sea-stars; and the water-vessels followed the food-grooves. In crinoids and sea-stars the food-grooves are open and in use; but in brittle-stars, sea-urchins, and holothurians they have become



FROM MORTENSEN, "PIGHUDE; DANMARK'S FAUNA" (G. E. C. GAD)

FIG. 6.— HYDRAULIC APPARATUS OF SEA-STAR

closed over, while the ambulacral system continues to send out its podia (fig. 7).

Spicular Structure of Skin.—The name Echinoderma expresses one of the chief characters of the branch. Prickles, it is true, are not so well developed in the other classes as they are in sea-urchins, though they are to be found more or less frequently in most of them. The essential feature is the presence in the deeper layers of the skin of minute spicules of crystalline carbonate of lime (calcite), which usually grow together into plates, or small bones, or prickles, all so interpenetrated with the connecting fibres of the skin that they constitute a beam-and-rafter work (fig. 8). Under the microscope a thin section of this looks like a net. Wherever the mid-layer or mesoderm occurs in the body, and not only in the skin, its cells have this power of deposition of lime; they can also re-absorb it and redeposit it, so that the shape and structure of the skeleton change as the animal grows. In all these respects the skeletal tissue of Echinoderma is paralleled only by the bone of Vertebrata; but it differs from

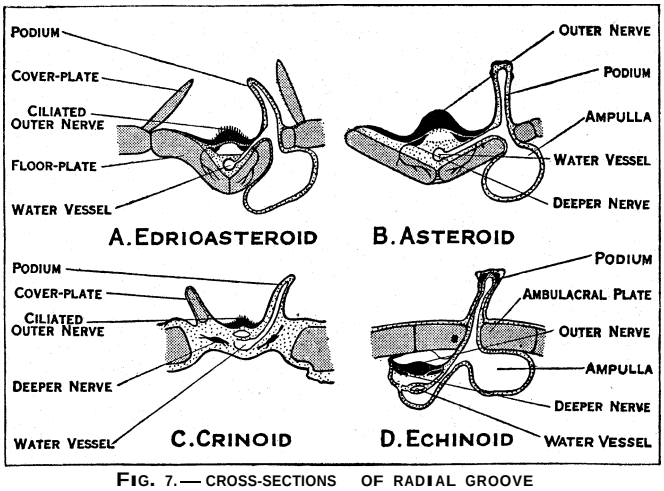
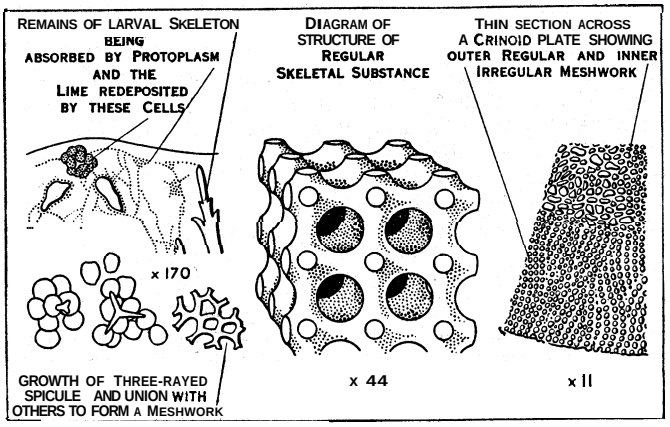


FIG. 7.— CROSS-SECTIONS OF RADIAL GROOVE

bone in chemical composition, in the formation of the spicules within the cells and not outside them, and in the retention of a crystalline character so that each plate acts as an individual crystal. By the cleaved surface characteristic of calcite and the net-like appearance, even minute fragments of echinoderm skeleton embedded in the rocks can be distinguished from the remains of molluscs, corals, arthropods and other animals.

Other Common Characters.— The following characters of less obvious nature are also common to all recent echinoderms:— The egg develops first into an elongate, two-sided larva (figs. 9 and 21), with an untwisted gut, and with the body-cavity essentially arising as three pairs of pouches (coeloms); all or part

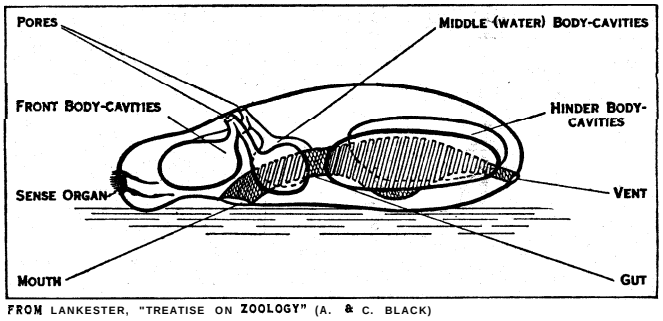


FROM LANKESTER, "TREATISE ON ZOOLOGY" (A. & C. BLACK)

FIG. 8.— SKELETAL SUBSTANCE OF ECHINODERMA

of this is somewhat abruptly changed into a radial creature with coiled gut. This characteristic metamorphosis is described later. The nervous systems are three: (1) the outer oral sensory system, chiefly composed of a ring round the mouth, and radial nerves, lying outside the water-vessels, and derived from the epithelium; (2) the deeper oral motor system, lying just below the former, supplying the muscles in the oral side of the body-wall, and derived from the mesoderm; (3) the apical motor system, most pronounced in crinoids; its centre is where the stem originates, and its cords pass down the stem and the rays to work their muscles; it is in all classes except holothurians, and is derived from endothelium. The blood system consists of a number of spaces rather than definite vessels, without heart or regular circulation; its contents differ from the general fluid of the body-cavity only in containing more albumen. In all the internal fluids float various bodies: some are red with haemoglobin (like human blood-corpuscles), and aid respiration; others are white, wandering amoeba-like cells, which serve many purposes, some eating the various waste-products and then squeezing their way to the exterior, for there is no definite excretory system.

Relationships.— The Echinoderma, as we have seen, differ from other radial animals, but agree with many other branches, in the separation of a body-cavity (coelom) from the primitive hollow, which persists as the gut. The various branches of the



FROM LANKESTER, "TREATISE ON ZOOLOGY" (A. & C. BLACK)

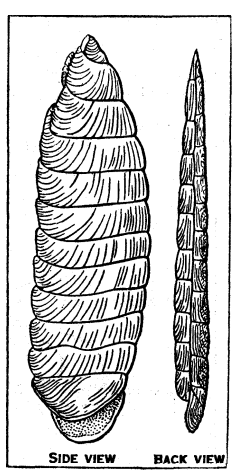
FIG. 9.— SIMPLIFIED DIAGRAM OF THE DIPLEURULA

Coelomata may have sprung independently from the Coelentera, and if there was any connection between them it must have been through forms whose existence we can only infer from a study of the oldest fossils and of the earliest stages in the life-history of their living descendants. Thus we find the mode of origin of the coelom and its early division into three pairs of sacs paralleled only in that great branch of the Coelomata which includes all animals with a backbone or with its cartilaginous precursor termed "notochord." The lower Chordata (as the branch is named) comprise the lancelet (*Amphioxus*), the sea-squirts or

ascidians, and some less-known, often worm-shaped creatures named Enteropneusta. All Chordata, except sea-squirts, show traces of this triple division of the coelom; and the growth of its middle division into lobes and tentacles is seen also in some Enteropneusta. The larva of one of the Enteropneusta (*Balanoglossus*) was originally described as an independent animal *(Tornaria)* and supposed to be related to the Echinoderm larval forms—the presence of a water pore accentuates the outer similarity. The mouth of the developing echinoderm, when it shifts from the original median position, invariably moves to the left not to the right; in the lancelet the mouth appears first on the left side. The central nervous system of Chordata, like the outer oral nervous system of Echinoderma, is derived from the outer epidermis and sinks below the surface in the same manner; this indicates that the ancestral forms responded to certain outer stimuli by a similar mechanism. The resemblances and differences between echinodermal and vertebrate skeletal tissue have already been emphasized. All these facts suggest that the Echinoderma and the Chordata were derived from a common ancestor, differing from the ancestors of other Coelomata, but itself not yet either an echinoderm or a chordate.

CLASSIFICATION

The five classes into which, as said at the outset, Echinoderma now living are usually divided, are not of equal value, for the Asteroidea and Ophiuroidea diverged in a comparatively late geological period, so that the differences between them are not so profound as those that distinguish the other classes; the difficulty is met by merging them in a super-class, Stelliformia. In early Palaeozoic times there existed other classes, all of which became extinct before the Mesozoic era began. Most of those creatures resembled the crinoids in being attached to the sea-floor and in feeding on minute organisms, which they swept along ciliated grooves into their usually upturned mouths. They have therefore been grouped with the crinoids as Pelmatozoa (stalk-animals), while the remaining classes, which are free-moving and generally feed with down-turned mouth on larger organisms, have been opposed to them under the name Eleutherozoa (free animals). These names conveniently connote definite facts of structure and habit, but do not imply any closer relationship between the classes included under them. The classification here adopted embodies a few recent advances. Certain Pelmatozoa that, in editions of the *Encyclopædia Britannica* after 1900, have been placed under Cystoidea as an order Carpoidea are now distinguished as a class. On the other hand the Blastoidea, though numerous and rather sharply defined, are a relatively late offshoot from the Cystoidea, and if they are retained here as a class, it is only because authorities disagree upon their point of origin. W. J. Sollas has proposed a class Ophiocistia for a few rare Silurian fossils, of which the structure was long misunderstood, though correctly given in the *Encyclopedia Britannica* (1911); they may be modified Stelliformia or Echinoidea, but cannot be maintained as a separate class. Recently some Palaeozoic fossils, usually regarded as Cirripedia, have been referred by T. H. Withers (1926) to the Echinoderma, and F. A. Bather has accepted that view, while keeping them apart as a sub-branch. Machaeridia The larger divisions of the Echinoderma here accepted may be tabulated, without implication as to their mutual affinities, thus:—



BY COURTESY OF "THE AMERICAN GEOLOGIST"

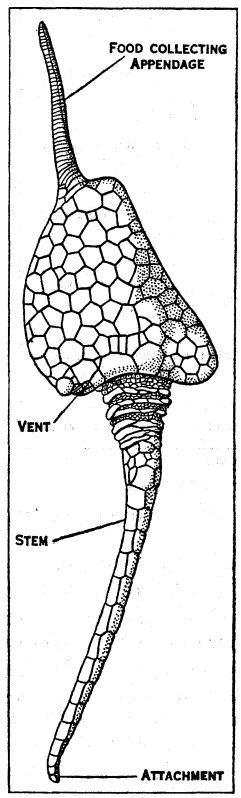
FIG. 10.—MACHAERIDIAN LEPIDOCOLEUS NATURAL SIZE

With no trace of Radial structure		
†Machaeridia		
†Carpoidea		
With more or less Radialstructure		
†Cystoidea	Pelmatozoa	
†Blastoidea		
Crinoidea		
†Edrioasteroidea		
Asteroidea	Stelliformia	Eleutherozoa
Ophiuroidea		
Echinoidea		
Holothuroidea		

The † denotes that the group became extinct before the Mesozoic era.

COMPARATIVE ANATOMY AND PHYSIOLOGY

Machaeridia.—Of the Machaeridia only the skeleton is known, and it is mainly because its plates have shown the crystalline cleavage characteristic of echinoderms that they have been placed in this branch. In the simpler forms the plates are in two rows, hinged down the back, and opening on the other side (fig. 10); scars on their inner face indicate the presence of muscles that would pull the two sides together. One infers that the animal was elongate, flexible, symmetrically two-sided, with a mouth and some sensory organ at the fore-end, and a vent at or near the hind-end; it may have been such a creature as study of recent larvae has led several authors to imagine as a probable ancestor under the name *Dipleurula* (little two-sides) (fig. 9). In that the two front pairs of coeloms would have opened to the exterior by a pore apiece, but no trace of such a pore has yet been seen in machaeridian plates. More advanced forms had four rows of plates, two on each side. At one end a plate was often modified in a way that suggests temporary fixation.



BY COURTESY OF THE ROYAL SOCIETY OF EDINBURGH. FROM BATHER "CARADOCIAN CYSTIDEA"

FIG. 11.—A CARPOID. DENDROCYSTIS

Carpoidea.—All Carpoidea bear traces of a stem by which the body was attached to some object on or near the sea-floor (fig. 11). In most the skeleton shows some two-sided symmetry, if only in a part of the stem; this may have originated in the symmetry of the *Dipleurula,* but its gradual increase in various series of the class is due to adaptation. Nearly all Carpoidea are flattened in a plane parallel to the sea-floor, and either the whole body-wall is flexible or one side remains flexible, so that it could expand and contract as the animal drew in or expelled water for food or aeration. The positions of intake and vent relative to the stem and to each other vary according to the particular habitat and mode of life of each genus; originally, perhaps, they were at opposite ends of the body and the stem arose between them; in any case the arrangement differed from that of all other Pelmatozoa. In the apparent absence of water-pore, genital pore and any trace of radial symmetry, the Carpoidea and Machaeridia differ from all other classes.

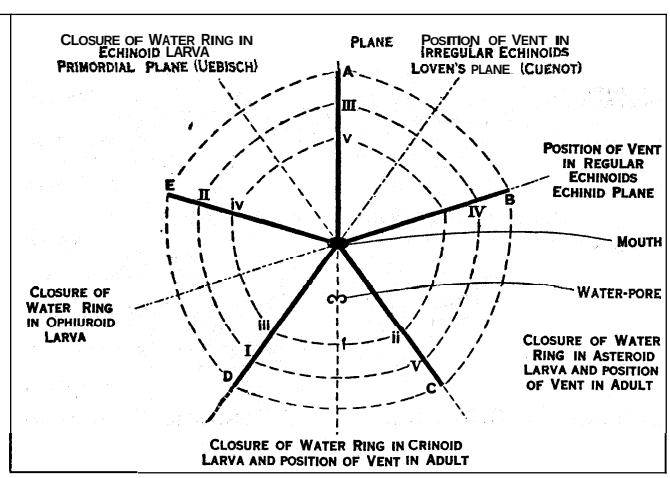
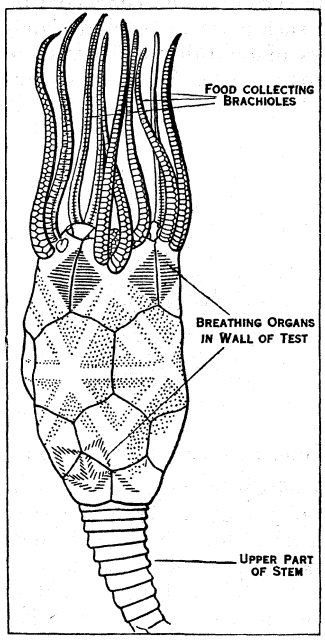


FIG. 12.—THE SYMMETRIES OF THE CHIEF CLASSES

Cystoidea.—The Cystoidea, like all other echinoderms. have a

two-sided symmetry, but in them we see the rise of radial symmetry. Study of this enables one to draw a plan by which the symmetries in other classes can be compared (fig. 12). Normally the cystoids are attached to the sea-floor by one pole of the body and take in food through a mouth at the opposite, upper pole. Near the mouth is a water-pore, and close to it, but further from the mouth, is a genital pore; the vent is usually in the same line, at the side of the body. Thus the body can be divided into similar halves by a plane passing through the mouth or oral pole, the apical hole, and the water-pore. This plane is termed the **M** plane (because in other classes the water-pore is broken up into many, and the perforated plate is called a *madreporite*) and it can always be identified. The rays originate by the extension of the ciliated lining of the gullet over the body-surface; it stretches out in the form of grooves, the first, naturally, away from the vent, towards the front or anterior part of the body, the second and third towards the free space on each side; later, these three grooves become five by the forking of the right and left grooves. The food-collecting surface was usually increased by the extension of the grooves on little jointed appendages (brachioles), which did not contain prolongations of the body-cavity or of the generative system (fig. 13). The water-system may have sent branches through the mouth-opening along the food-grooves, but did not subserve locomotion. Aeration of the body-fluids was effected through thinner portions of the test, and according to the structure of these the Cystoidea may be grouped in two subclasses:—(1) Rhombifera or Dichoporita, in which the breathing organs are folds of the test-wall, crossing the sutures of the plates (fig. 13); (2) Diploporita, in which the breathing organs are canals of **U**-shape within the test wall and not crossing the sutures (fig. 14). There are other differences between these subclasses.



AFTER JAEKEL IN "STAMMESGESCHICHTE DER PELMATOZOREN" (JULIUS SPRINGER, BERLIN)

FIG. 13.—A RHOMBIFEROUS CYSTOID, CHIROCRINUS, NAT. SIZE

Blastoidea.—The Blastoidea proper (fig. 15) have a body-skeleton of 13 main plates arranged in three circlets, according to a marked five-rayed symmetry, viz., five radials, which support the five main food-grooves; five orals, which surround the mouth and lie between the food-grooves; the basals, which lie beneath the radials and form a facet for the stem. The vent lies in one of the interradii, either adjoining, or enclosed by, an oral; the water-pore and genital pore are probably associated with it. Respiration was effected through thin portions of the test wall, strongly folded so as to increase the surface; these *hydrospires* cross the sutures between the radial and oral plates. Each food-groove, after passing between the orals, lies not on the radial plate, but on a special plate in the radial line called, from its shape, the lancet-plate; this is bordered by small side-plates, to which brachioles are attached.

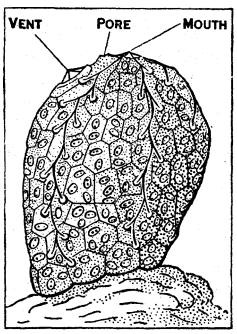
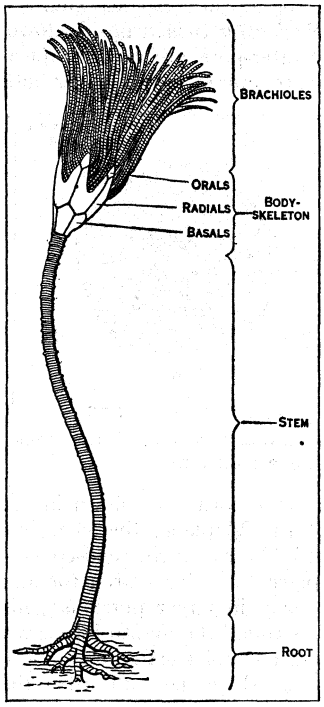


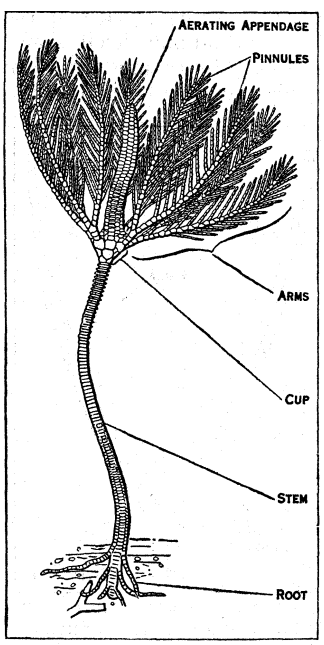
FIG. 14.—A DIPLOPORITE CYSTOID

Crinoidea.—The body of the Crinoidea (fig. 16) is normally borne on a stem, has the food-collecting system upwards, and the vent in the **M** plane at the side or raised away from the intake on a sort of chimney (anal tube). The food-grooves are extended on five arms or hrachia, which are not, like brachioles, mere appendages to the test, but actual outgrowths of the body (fig. 7j containing throughout extensions of the body-cavities, the generative organs, and the apical nervous system, as well as bearing the usual water-vessels with their side-branches and podia, and nerves from the two oral systems. The arms, which are built of successive plates (brachials), may fork or branch repeatedly, and the smaller branches may become arranged along the sides of the larger, forming pinnules. O. Jaekel, however, holds that the pinnules of certain forms represent the brachioles of cystids. The body with its arms is termed the crown; that portion of it below the free part of the arms is the dorsalcup; the covering or lid of the cup, above the free part of the arms, is the tegmen. In the simpler crinoids the cup consists of only two or three circlets of plates: the five radials, from which spring the arms; the (primitively) five basals, beneath the radials and alternating with them; and often the (primitively) five infrabasals, beneath and alternating with the basals. Infrabasals are wanting in some groups (monocyclic), present in others (dicyclic), but may be overgrown by the basals or may atrophy in the adult (cryptodicyclic). The cup may be enlarged by the incorporation of the lower parts of the arms, between which other plates (interbrachials) often arise; to make room for the vent, or to support it, special anal plates may be added. The gut, as viewed from the oral surface, is coiled in a clockwise direction (solar).



BY COURTESY OF THE BRITISH MUSEUM (NATURAL HISTORY)

FIG. 15.—A BLASTOID, OROPHOCRINUS FUSIFORMIS



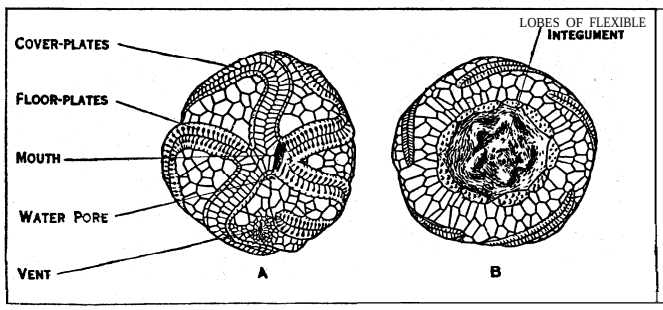
BY COURTESY OF THE TRUSTEES OF THE BRITISH MUSEUM (NATURAL HISTORY)

FIG. 16.—BOTRYOCRINUS DECADACTYLUS, OF SILURIAN AGE

Edrioasteroidea.—The Edrioasteroidea (fig. 17) had a circular test composed of an indefinite number of irregular plates. They were either permanently attached to the sea-floor, or adhered like a limpet with some power of movement. From the upturned mouth five food-grooves stretched over the upper face; these were usually borne on a series of alternating floor-plates and protected by hinged cover-plates. From the structure of the fossils (fig. 7) it is inferred that a water-canal passed from a ring canal round the mouth, beneath each groove but outside the floor-plates, and that it gave off branches, each of which ended in a podium stretching outwards and a swelling (ampulla) stretching inwards between the floor-plates to form a reservoir; no other Pelmatozoa show such a structure. There were no brachioles. The gut seems to have had a solar coil; its vent and madreporite lay on the same side as the mouth. In some genera the depth of the food-grooves impressed a five-rayed symmetry on the generative organs.

Stelliformia.—The Stelliformia (sex-stars, brittle-;Lars. *et al.*)

live as a rule with the mouth downwards; from it radiate five ciliated grooves with a superficial nervous tract, as in Pelmatozoa; the structure of these grooves and of their associated water system is as just described for Edrioasteroidea (fig. 7). The creature indeed resembles an *Edrioaster* turned upside-down, but differs in that both vent and water-pore are on the apical face, which is now uppermost; they are, moreover, no longer both



FROM LANKESTER, "TREATISE OH ZOOLOGY" (A. & C. BLACK)

FIG. 17.—EDRIOASTER (SESSILE STAR) COMBINES ASTEROID STRUCTURE WITH CRINOID HABIT. A UPPER, B. UNDER SURFACE

in the same interradius: while the madreporite, as shown in fig. 12, still marks interradius C/D of the M plane, the vent has moved into B/C. In correlation with the overturn, food-collecting by ciliated grooves has given place to active search for and ingestion of animal food, alive or dead, in larger portions; this again has led to modification of plates round the mouth into jaws, and to prolongation of the ambulacra on radial extensions of the body, giving the animal first the star shape (fig. 1), then the form of a disc with five arms (fig. 2). The terminal plate of each ray is separated from the apical pole by a stretch of plated integument; the grooves never bend round on to the upper surface. Since each terminal bears an organ sensitive to light, it is also called an ocular. According as they move by crawling or wriggling recent Stelliformia fall into two classes: Asteroidea and Ophiuroidea.

In the Asteroidea (fig. 1) the ambulacral grooves remain open and the podia change into tube-feet, each with a sucker at the end, by which the sea-star clings to objects and pulls itself along; a podium can be withdrawn into the groove by its muscles, when its fluid contents pass into the ampulla; contraction of the am-

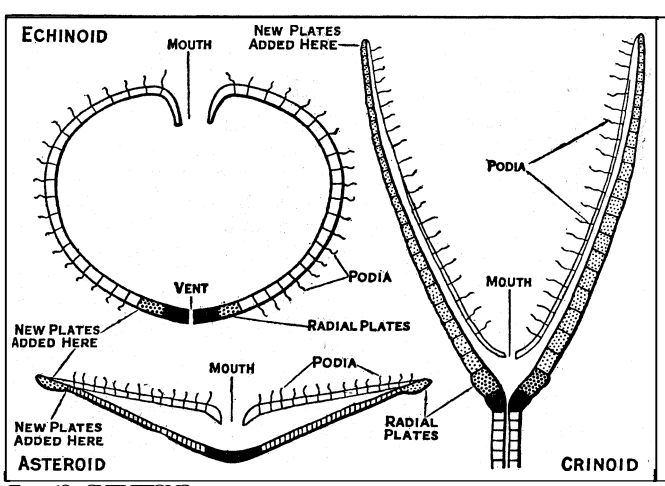


FIG. 18.—SKELETONS OF AN ECHINOID. ASTEROID AND CRINOID PLACED WITH MOUTH UPWARDS AND CUT ACROSS. RADIAL PLATES=OCULARS

pulla squeezes the fluid again into the podium, swelling it out for use. The arms are not, as a rule, sharply distinguished from the body, and they contain both genital glands and blind extensions of the digestive system (caeca). The body-fluids are aerated through thin-walled outgrowths of the body-cavity (papulae) which pass between the plates of the upper surface. Podia and papulae are protected by thorns or spikes, which are sometimes clumped (paxillae), sometimes branched and bearing a membrane, sometimes modified into small grasping organs (pedicellariae). Many sea-stars have more than five arms, but the arms never fork.

The Ophiuroidea (the name means snake-tail forms) owe their name to the long, thin, flexible arms, which spring abruptly from the central disc (fig. 2). The arm-groove is covered, the podia cease to act as tube-feet, the floor-plates are thickened and joined by pairs into solid bones shaped like vertebrae and connected by strong muscles. No room is left in such arms for genital glands or digestive caeca. The outer plates of both disc and arms are broad shields, without interspaces for papulae. Sometimes aëration is through clefts at the bases of the arms. The thorns remain small and usually of simple structure. No ophiuroid has more than five arms, but in one order (basket-fish) the arms may fork several times and the animals cling to branched corals.

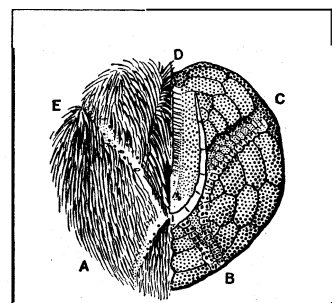


FIG. 19.—IRREGULAR ECHINOID

Echinoidea.—The Echinoidea (sea-urchins, figs. 3, 19) also live mouth downwards. A simple regular echinoid may be compared to an asteroid in which the vent is at the apical pole, and the grooves have grown round on to that face of the test (fig. 18), so that their terminal ocular plates encircle the vent and are separated from it only by five other plates of rather larger size, each pierced by an opening for the extrusion of the genital products (hence called genital plates), and one also pierced by numerous water-pores (madreporite). The test having become rigid as well as globular, the soft structures of the grooves have sunk beneath it, and the podia emerge through the plates (fig. 7). The absence of papulae from the close-built test throws more respiratory work on the podia, and to aid this the canal of each is divided, and cilia sweep a current up one half and down the other; thus the pores for the podia are double like the diplopores of cystoids. The plates through which the podia pass are called ambulacrals; new evidence suggests that they correspond to the floor-plates of Asteroidea and Edrioasteroidea, not to the cover-plates or to any structure in Crinoidea, Cystoidea or Blastoidea. The genital glands are much branched, and here remain interradial.

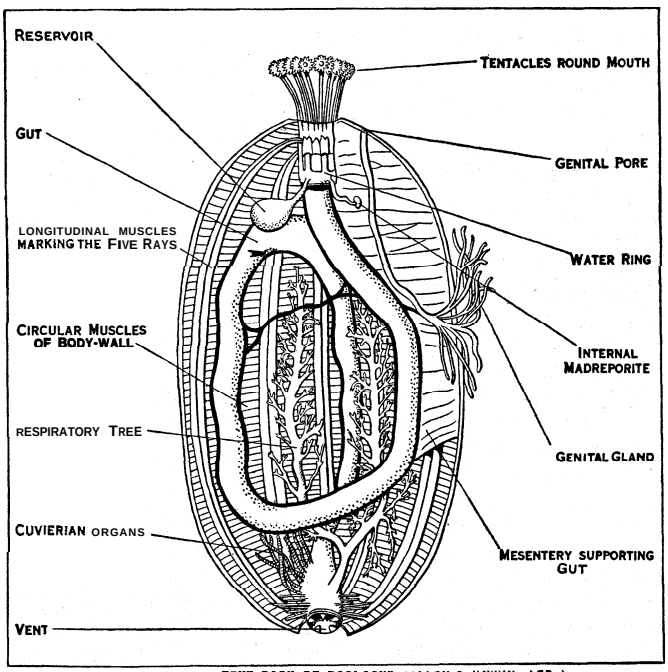
In a regular echinoid (fig. 3) the madreporite and vertical axis mark the M plane; the vent is not precisely at the apical pole, but is shifted in the direction of radius B (fig. 12). According to S. Lovén, the plates of the five interradii are symmetrical with regard to the plane B-D/E, which therefore is called the echinoid plane. In a large number of later sea-urchins the vent moves towards the under-side of the test, whence such forms are called irregular echinoids (fig. 19). In most the vent passes along interradius B/A, while the mouth moves in the other direction along radius D; the plane thus marked is known as Lovén's plane. In such urchins the groove D is termed anterior, and, with the adjacent C and E, forms the trivium, while grooves A and B form the bivium. These are not the same rays as form the so-called trivium and bivium in the other classes. The change to irregular is connected with a change in the mode of feeding. Regular echinoids have five teeth, interradially placed and held in a frame of 20 pieces, which Aristotle compared to a ship's lantern. In those later forms that take to feeding on ooze or minute food, these structures are gradually lost.

It is in the urchins that the spikes or prickles of the skin are most highly developed. They are generally called spines (Lat. *spina,* a thorn), but as "spine" has a different meaning in English and anatomy, the term "radiole" is preferable. They are attached to round-headed tubercles on the test by a ball-and-socket joint, and are moved by muscles. Primarily radioles serve for protection, but the larger radioles may be used like stilts for locomotion or for digging. Some radioles are minute, clothed with cilia, and arranged in narrow bands (fascioles), which are supposed to sweep currents of water for aeration or sanitation. Pedicellariae

are always present, and are of five different types.

Holothuroidea.—The Holothuroidea (holothurians, sea-cucumbers) resemble the Echinoidea in that the outer skin covers the grooves and is pierced by the podia. But, whereas a sea-urchin moves sideways in any direction, a normal holothurian (fig. 5) moves only in the direction of its mouth, with the body stretched along the sea-floor, and the vent at the other end. The surface turned to the sea-floor is always the same, and is usually flattened; down its middle line is one of the radii (A), with radius B to its right and E to its left (fig. 12), the podia of these radii serve as sucking feet, but those of radii C and D, on the upper surface, are used only for feeling and aëration. Near the front or mouth end of the middle upper interradius C/D opens the duct from the single genital gland, while the water-pore opens just in front of it in the larva and in the adult too in some species; in others the pore closes and the water-system obtains its fluid from the body-cavity through openings in the stone-canal. There is no apical system of plates, and no terminal plate or special tentacle at the end of each ray. In these respects and in the symmetry of the rays the holothurians depart from other Eleutherozoa and approach such early Pelmatozoa as *Edrioaster*.

The following special features are found in most holothurians (fig. 20). The mouth is surrounded by the ten front podia, which have become prominent tentacles. Outside these is a rim, which can close over both mouth and tentacles. The body-wall has two sets of muscles: a transverse, circular layer, which, on contraction, compresses the contained fluids and thus elongates the body; five pairs of longitudinal muscles, alongside the radii, which on contraction shorten the body (it is hard to hold a holothurian). The gut passes from the mouth, below interradius C/D to the hinder end of the body, then forwards along interradius D/E, then downwards along A/B to the vent; thus it has a solar coil as in crinoids and echinoids. Most holothurians suck in water through the vent for aeration; to accommodate this the rectum is enlarged and, in numerous species, gives off two many-branched tubes with



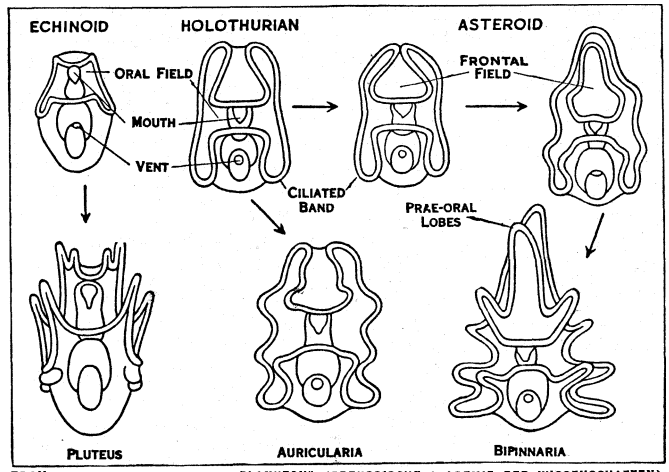
FROM SEDGWICK, "STUDENT'S TEXT BOOK OF ZOOLOGY" (ALLEN & UNWIN, LTD.)

FIG. 20.—A HOLOTHURIAN OPENED ALONG THE BACK

blind ends, termed the respiratory trees. In most holothurians the skeleton is greatly reduced. Round the gullet is usually a ring of five radial and five interradial pieces, which may correspond to the mouth-frame of echinoids. There are no regular plates in the body-wall, but throughout the skin and the connective tissue are scattered minute spicules, which have different shapes characteristic of the various genera and species; in one or two genera some of these are enlarged to form irregular plates, and in one or two they are absent altogether.

REPRODUCTION AND DEVELOPMENT

In most echinoderms the sexes are separate, but not distinguished by any external character. The genital products are discharged into the water, where the eggs are fertilized by the sperm. The egg then divides into a number of cells, which form a hollow ball. One end of this grows inwards, and the result is an open-mouthed sac with a double wall. From the walls cells migrate

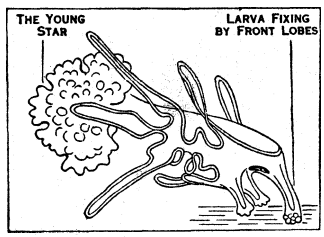


FROM MORTENSEN, "NORDISCHE PLANKTON" (PREUSSISCHE ACADEMIE DER WISSENSCHAFTEN)

FIG. 21.—THE EARLY STAGES OF LARVAE OF VARIOUS ECHINODERMS

into the space between, forming a middle layer. This stage corresponds to the structure of the jelly-fish, etc. (Coelentera). The body-cavity arises from the hollow of the sac as a single pouch growing out into the loose middle layer. By repeated division of this pouch arise the three pairs of coeloms shown in the diagram of the dipleurula (fig. 9). Meanwhile the sac lengthens and is flattened on one side, towards which the original cavity bends down and breaks through to form the larval mouth, leaving the original opening as the larval vent.

The larvae are free-swimming, and are modified from this ground-plan in five directions according to the class to which each belongs. They used to be regarded as distinct animals, and so received special names. Of the four types of pelagic larvae of Eleutherozoa the simplest is the holothurian, of which an early stage is shown in fig. 21. The primitive mouth is surrounded at a little distance by a band of cilia, which by their vibration move the larva. A smaller ciliated band immediately round the mouth sweeps in food. The oral field, within the main band, is shaped like a broad H; in later stages the two side portions are folded on their borders and look like a pair of human ears, whence this larva has been called *Auricularia*. The vent lies in the middle below the cross-piece of the H, and the gut runs through the curved body to it, swelling on its way into a stomach but showing no twist. This larva has no skeleton, only some wheel-shaped spicules scattered through its substance. The larvae of brittle-stars and sea-urchins have a skeleton, in which long rods push out the side-folds and so increase the length of the ciliated band; early stages are shown in fig. 21. A fancied resemblance of later stages to a painter's easel led J. Müller to called the larva *Pluteus* (easel). In the arrangement of the rods the *Ophiopluteus* differs somewhat from the *Echinopluteus*. The asteroid larva has no skeleton. It differs from the auricularia in the meeting of the two upper limbs of the H, so that the oral field is like an A, and there are two complete ciliated bands (fig. 21); their apices are drawn out into long prae-oral lobes, and their margins are folded into narrower lobes or pinnae, whence the larva was called *Bipinnaria*. In the recent unstalked crinoids and some other echinoderms with large yolky eggs, the larva grows within the egg till it emerges as



FROM MORTENSEN, "NORDISCHES PLANKTON" (PREUSSISCHE ACADEMIE DER WISSENSCHAFTEN)

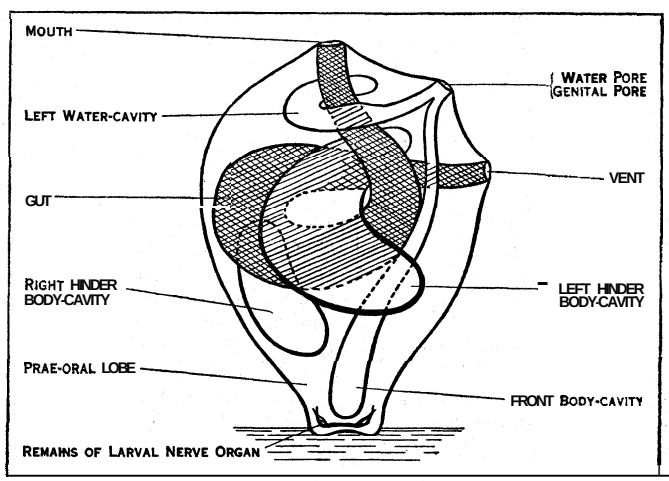
FIG. 22.—LARVA FIXED TO SEA FLOOR AND YOUNG STAR

a barrel-shaped form with five bands of cilia like the hoops of the barrel; the primitive mouth, being unused, closes.

Between the larva and the adult is a series of complicated changes, during which the larval skeleton is absorbed and redeposited as the permanent skeleton, while portions of the creature are often cast aside as worn out trappings. Such a marked change is called a metamorphosis (*q.v.*). It is best known in some of the sea-stars, where it takes about 12 days. The larva sinks and attaches itself to the sea-floor by a portion of the prae-oral lobe (fig. 22); this is pulled out into a stalk, and the future star developed within the body of the larva. The essential change is the curving of the left hydrocoel and the left hinder coelom round the gut, till each becomes a ring. In the asteroid the oral face of the star bends downwards towards the stalk and the floor, and the water-ring closes round the stalk, which then disappears (fig. 24). In the crinoid the oral face is bent upwards, so that the water-ring does not enclose the stalk (fig. 23). As shown in fig. 12 the water-ring closes in a different interradius with reference to the M plane in each class; this is connected with the torsions that occur during metamorphosis.

The later stages of growth are often of interest to the evolutionist as suggesting the ancestry of the present form and the origin of its special structures. The classical instance is the rosy feather-star (*Antedon bifida*). This was thought to be an asteroid, but in 1823 J. V. Thompson, a Cork surgeon, discovered that when quite young it was fixed by a stalk like a crinoid; the growing animal breaks away from the root, and the upper part of the stalk is condensed into a knob bearing numerous stem-tendrils or cirri. This process recapitulates the race-history traced in Jurassic fossils.

Protection of the Brood.—Free-swimming larvae probably represent an ancient stage in echinoderm history, retained in the life-history to ensure the dispersal of creatures that are slow-moving or fixed in the adult. The fixed larval stage that intervenes demands food-yielding and quiet waters. When, as on ice-bound coasts or in ocean abysses, such conditions do not obtain, the eggs are furnished with yolk, and both they and the developing young remain with the mother. Brood-chambers or nurseries may be formed. The thorns of some sea-stars expand like umbrellas over

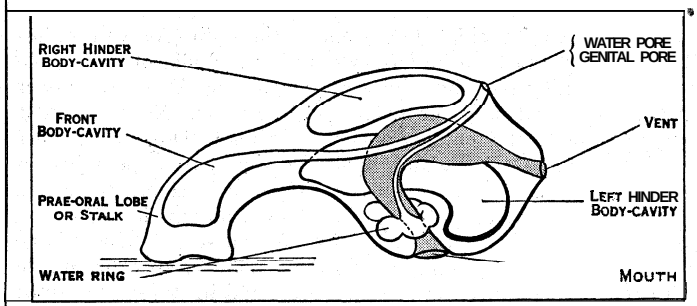


FROM LANKESTER, "TREATISE ON ZOOLOGY" (A. & C. BLACK)

FIG. 23.—DIAGRAM SHOWING THE INTERNAL STRUCTURE OF THE PRIMITIVE PELMATOZOON. PRODUCED WHEN THE DIPLEURULA FIXED ITSELF BY THE HEAD CAUSING THE MOUTH TO MOVE UPWARDS AND SO THROW THE GUT INTO A COIL AND BEND THE BODY-CAVITIES

the young; in some sea-urchins the ambulacral grooves are sunk to receive the eggs; many brittle-stars have pouches hollowed in the sides of the body between the arms; the plated holothurian, *Psolus*, has a nursery roofed by large plates on its back; in some other holothurians the young cling by their podia to the parent's back; the stem and root of a crinoid present a natural surface of attachment for the young.

Self-division and Regeneration.—Many echinoderms can break off portions of themselves, generally under the stimulus of danger or to get out of a difficult situation. The stem and arms of the later crinoids have special breaking-planes; the brittle-star snaps off its arms when seized and disintegrates before the distressed naturalist; holothurians, when attacked, eject portions of their viscera, and to this habit the cotton-spinner owes its name. The discarded portions can be grown again; it has even been claimed that in some cases they can themselves grow fresh bodies and become complete individuals. A sea-star *(Linckia)* commonly



FROM LANKESTER, "TREATISE ON ZOOLOGY" (A. & C. BLACK)

FIG. 24.—DIAGRAM SHOWING CHANGE FROM FIXED ECHINODERM TO FREE

avails itself of this faculty, and one may find big arms with a small body at one end, and four little arms growing out of it; these are known as comet-forms. The power of regeneration is probably due to the extension of all the systems of the body into the arms, but it seems that in general a portion of the central disc must also be present. A development of this power is reproduction by spontaneous division, as practised by many sea-stars, brittle-stars and holothurians; it is indeed the usual method in the British holothurian *Cucumaria lactea*. Sea-stars found with groups of arms of different sizes must have divided in this way.

GEOGRAPHICAL DISTRIBUTION

Echinoderms are confined to the sea, and differ in this from all but one or two branches of the Animal Kingdom. The limitation is probably connected with the density of the water, since echinoderms depend largely on their hydraulic system, and there is besides a constant interchange between the internal fluids and the outer water through the thin membranes. Any sudden change would be particularly fatal to the larval stages, which transport the species to other localities. Some species tolerate a change better than others, but few are found even in brackish water. Within the sea, however, echinoderms may occur from anywhere between tide-marks down to 6,000 metres ($3\frac{3}{4}$ miles). Those between tide-marks are generally buried in moist sand; some urchins bore holes in rock, and these retain a little water; few can stand being left high and dry. In littoral waters examples of all classes are numerous, but the greatest abundance and variety occur between 1,000 and 2,000 metres; in the greater depths both species and individuals are fewer. Most species have a limited range of depth, but a few have considerable extension; thus, the brittle-star *Ophiacantha bidentata* ranges from 5 to 4,450 metres. No order and no family is exclusively either littoral or abyssal, but two highly modified kinds of holothurian occur only floating in the open sea.

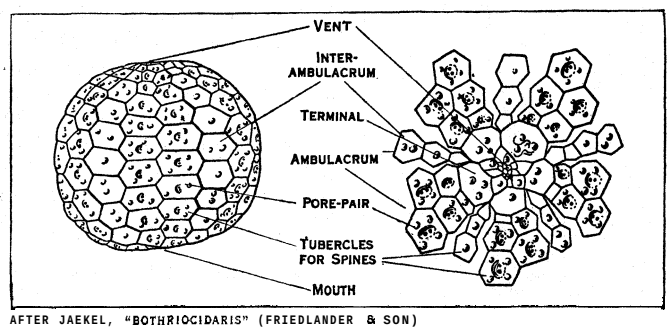
Since the depths of the sea are connected and their conditions uniform, species inhabiting them map be found in any of the oceans. The conditions of coastal waters are varied, and so, consequently, are the species, few having a really wide distribution; the chief exceptions are circum-polar species, which may stretch down the Pacific and Atlantic coasts. Some Arctic species appear to be represented in the Antarctic by similar forms, a phenomenon also observed in other groups of marine animals. Attempts have been made to map out various regions, each characterized by its echinoderm fauna, and from these to infer past migrations and possible changes of land and sea; but knowledge is still incomplete and opinions too diverse for summary here. Echinoderms have been said to abound more in the tropics, where certainly they are more striking in colour; but modern dredging shows that they occur in the same enormous quantities and rich variety in polar and temperate seas. In the Atlantic brittle-stars may be brought up by hundredweights, and the "Challenger" dredged 10,000 unstalked crinoids at a single haul.

GEOLOGICAL HISTORY AND EVOLUTION

Geology gives only a succession of fossil forms; the relation of these to one another is interpreted through facts of anatomy and development, and seen to be an evolution. In its main lines the race-history is now thought to have been as follows. We start with a dipleurula larva (fig. 9), still free-floating and with none of the peculiarities of the modern adult echinoderm. The event that originated the branch was the discovery of the sea-floor, on which followed the adoption of a stationary life and the deposition of lime spicules in the skin. The three-rayed spicules grew into star-shaped plates loosely joined, such as are scattered in Lower and Middle Cambrian rocks. As the plates grew, they were more firmly united, and completer skeletons were preserved. These, at the outset, show a divergence. The Machaeridia (fig. 10) may represent the elongate stage before fixation. If the elongate form became fixed by the middle of its body, the mouth and the vent would be on the two sides of the base of attachment, and from such a creature all the nonradiate Carpoidea (fig. 11) may have descended. They are found only from Middle Cambrian to Devonian.

Origin of Radiate Forms. — Radiate forms had a different origin. The dipleurula, apprehending the floor by its sensory front end. fixed itself, not by the ciliated pole, but a little to one side, the right side being chosen for a reason we cannot yet fathom. The result was the passage of the mouth to the upper surface (fig. 23). As it passed up along the left side, the gut caught hold of the left water-sac and pulled it upwards, curving it in the process. Since this was attached to the left duct from the front body-cavity, that structure was also pulled up and its pore came to lie between mouth and vent, while the stretched part of the front cavity formed a canal lying along the outer wall. The gut, as it coiled, drew the left hinder coelom also upwards in a curve, while the stomach pressed the right hinder coelom down to the fixed end, where it was involved in the elongation of that region. Not only can these changes be traced in the developing *Antedon* today, but several of the older cystoids had the structure of such a primitive pelmatozoon. Notably they retain the pore by which the genital products, formed from the canal alongside the body-wall, were extruded. At this stage no radiate structure was visible, but, unlike Carpoidea and Machaeridia, these forms had the fundamental plan on which the radiate types were built.

Radiation arose from the mode of feeding combined with the effect of gravity. Fixed to the sea-floor, with its mouth upturned to the food-bearing waters, which it swept inwards by the cilia of the gullet, the primitive pelmatozoon extended its food-collecting surface by the outgrowth of ciliated channels from its mouth



AFTER JAEKEL, "BOTHRIOCIDARIS" (FRIEDLANDER & SON)

FIG. 25.—SUPPOSED ANCIENT ECHINODERM. BOTHRIOCIDARIS, SHOWING (RIGHT) ARRANGEMENT OF PLATES ROUND THE VENT

as already described under Cystoidea. A limit was set to this increase by the size of the body itself.

Crinoids and Feather-stars. — Another class, based on a better plan, appeared first at the close of Cambrian time and by the close of Devonian time had taken the place of the cystoids; this class was the Crinoidea. Here the length of the food-grooves was increased by the actual outgrowth of the body-wall in the direction of the five rays, but upwards; the outgrowths became jointed, and repetition of the process led eventually to the long and many-branched arms of the crinoids, in which the grooves sometimes reach the combined length of a quarter of a mile. The Crinoidea early blossomed into some half-dozen orders and became adapted to every habitat which the sea provides. A single instance may be taken from certain shore-dwellers which in Jurassic times found safety by shortening their stem while retaining the whorls of cirri; with these, when torn away by the waves, they could grasp the nearest object. Eventually the stem was fused with the lower part of the cup into a hemisphere covered with cirri. Acquiring some power of free locomotion, this type spread into the group of Comatulida (feather-stars), which today comprises hundreds of species, divided among 98 genera (fig. 4).

Sea-stars and Brittle-stars. — Among the oldest known echinoderms is a genus of Edrioasteroidea, a class in which radiation had affected not only the food-grooves but the hydraulic system. Though clearly Pelmatozoa, they provide a starting-point for all classes of Eleutherozoa. Most adhered by a sucking action of the flexible under-side to smooth surfaces. Through the thin skin of that side, the genital products, it is suggested, were extruded. At that time, if at no other, the creatures were liable to be overturned, and those that could use their podia for locomotion would have an advantage. A sea-star is little more than an overturned *Edrioaster*, and some even now retain the power of feeding in the pelmatozoan way. The anatomical changes in adaptation to the new mode of life have been explained under Stelliformia (fig. 24). Fossils of the crawling asteroid type are known from the top of the Cambrian, but are rare until the Upper Silurian and Lower Devonian, when some adopted a wriggling habit and a structure tending towards the ophiuroid type. Genera with arm-grooves completely closed and with all their floor-plates turned into "vertebrae" are of doubtful occurrence earlier than the Carboniferous. Ophiuroids with elaborate vertebrae of modern type appear first in the Trias.

Sea-urchins. — The first echinoids may also have been derived from overturned edrioasteroids; the vent, as it passed up, was dragged a little farther back, leaving room for the madreporite, with which it became closely associated at the apical pole. The earliest known are from the top of the Ordovician. For half-a-century *Bothriocidaris* (fig. 25), a small fossil from Esthonia, has been regarded as an ancestral echinoid, but T. Mortensen, after fresh examination, refuses to accept it. This leaves in the Ordovician and Silurian only many-plated forms with flexible test; they cannot be derived immediately from *Edrioaster* since they already have well-developed jaws. The family Lepidocentridae, to which they belong, continues to the Carboniferous. Nearly all Palaeozoic echinoids have more than the 20 columns of plates found in later genera; among them the Archaeocidaridae, apparently existing in the Devonian, are nearest the simple cidarid type, which has a solitary representative in the Carboniferous and another in the Pdrmian. The early cidarids retained some flexibility in the union between ambulacral and interambulacral ares; in the Triassic period this gradually gave place to a rigid union, and at the same time appeared the diademoid type, with external gills, close-set podia, and more numerous radioles. Cidaroida and Diademoida have persisted to our own day, the former relatively unchanged, the latter giving rise to successive suborders. Among these, some Jurassic genera show the beginning of that movement of the vent towards the margin which characterizes the irregular urchins. A side-branch originating in Cretaceous times was the Clypeastroida (shield-urchins) as an adaptation to life just below the sand of the shore. Another modification led to elongate urchins in which the jaws were gradually lost as the animal took to extracting nutriment from ooze. The extreme of this line is reached in the modern Spatangidae (heart-urchins).

Sea Cucumbers. — The coiled gut and radiate hydraulic system of the Holothuroidea suggest that this class also was derived from a primitive pelmatozoon. At an early stage the creature took to locomotion in the direction of the mouth, with consequent worm-like lengthening of the body, possibly facilitated by the less calcified integument. Already in Middle Cambrian shales are found the compressed imprints of soft-bodied animals with apparent holothurian structure. The closure of the food-grooves, the elaboration of mouth-tentacles. the suppression of the unused podia on the back, and the retention of the single genital gland with its

pore, were all natural consequences of this mode of life. Spicules ascribed to holothurians have been found fossil from the Carboniferous onwards, but the general absence of other skeletal structures prevents one from tracing the history of the class.

NATURAL HISTORY

Echinoderms are sluggish and frequently immobile for considerable periods. The brittle-stars are the most rapid movers. Free forms shun the light, and hide or bear a cloak of sea-weed by day. Their often brilliant colouring can rarely have protective value. Some sea-stars light the depths with glorious phosphorescence, and many littoral brittle-stars phosphoresce when stimulated. This also may be a useless by-product of some activity. The general mode of life and nutrition have been mentioned under the various classes, and further details are given under STAR-FISH and SEA-URCHIN. Holothurians feed by sweeping minute creatures into the mouth with large shield-shaped tentacles, or by catching them with the slimy surface of bushy tentacles, which they push into the mouth and withdraw cleansed. Abyssal holothurians live in and feed on the ooze, breathing by the podia of the back, which are often monstrously developed. In some holothurians portions of the respiratory trees consist of slime-secreting cells; when irritated, the animal compresses its body and forces the tubes out of the vent; the slime absorbs water and swells enormously, finally splitting into sticky threads in which an enemy can be hopelessly entangled. Many animals live in or on echinoderms as messmates: among them are protozoans, sponges, annelids, arthropods, molluscs, and, most notably, a fish, Fierasfer, which enters the respiratory trees of holothurians. Parasites are even more numerous. Besides the groups mentioned, they include nematodes, trematodes, a myxomycete, and the myzostomes, of uncertain affinity, found chiefly on crinoids. Many of these uninvited guests assume the livery of their host, and frequently compel structural changes.

Economic Aspects.—In the economy of Nature, echinoderms play a larger part than in that of man. The crinoids and other Pelmatozoa seem useless; yet they have extracted from the sea millions of tons of lime and built up huge masses of rock. Derbyshire marble, Belgian petit granit, the *Trochiten-kalk* of Germany, and many of the Oolitic freestones are largely formed of their remains. Holothurians in the sea, like earthworms on land, pass the loose detritus perpetually through their bodies, extracting the organic nutriment, and thus acting as cleansers. The same task is performed by many heart-urchins, while most of the other free-moving forms, especially the sea-stars, are scavengers on a larger scale. An ocean without echinoderms might become a putrid cesspool. Unfortunately sea-stars do not confine themselves to carrion, but attack living molluscs, among them oysters and mussels, doing terrible damage (see STAR-FISH). On the other hand some of the smaller kinds are eaten by bottom-fishes, and thus help to turn Nature's waste into marketable food. For the immediate food of man most echinoderms are unsuitable, but some holothurians are used in the East (see BÊCHE-DE-MER), and in various parts of the world the ovaries of the larger regular sea-urchins are much appreciated. The ease with which the eggs of echinoderms can be fertilized and the early stages of development reared in the laboratory has led to their extensive use as material for research into fundamental problems of life and growth.

History.—During the 18th and first half of the 19th centuries, echinoderms were described by many eminent naturalists: Echinoidea by J. T. Klein, C. Linnaeus, N. G. Leske, E. Desor and L. Agassiz; Stelliformia by J. H. Linck; Crinoidea by J. S. Miller; Cystoidea by L. v. Buch; but it was the researches of Johannes Miiller (1840–50) that laid the foundation for a scientific treatment of the branch. For the host of later writers on this large and varied group, reference must be made to the works cited in the bibliography.

BIBLIOGRAPHY.—An annual index to all publications on Echinoderma has for many years appeared in Zoological Record (London, Zool. Soc.). General works are:—H. Ludwig and O. Harnann, "Echinodermen" in Bronn's *Klassen* und Ordnungen *des* Tierreichs (1889–1907), full bibl., exhaustive accounts of recent forms; F. A. Bather, E. S. Goodrich, J. W. Gregory, "Echinoderma" in Lankester's Treatise on Zoology (1900), bibl., recent and fossil, full on Pelmatozoa; E. W. MacBride, "Echinodermata" in Cambridge Natural History, I. (1906), good on habits; T. Mortensen, Handbook of the Echinoderms *of* the *British* Isles (1927), bibl., good for the zoologist on both sides of the Atlantic. Special Groups are approached on broad lines in:—T. H. Withers, Catalogue of the Machaeridia (1926), Nat. Hist., bibl.; O. Jaekel, "Phylogenie und System der Pelmatozoen," *Palaeont. Zeitschr.* (1918); A. H. Clark, Monograph of existing Crinoids (1915); F. A. Bather, *Studies* in Edrioasteroidea (1915); W. K. Spencer, Monograph on *Palaeozoic Asterozoa* (1914), Stelliformia; H. Matsumoto, "Monograph on Japanese Ophiuroidea," *Journ. Coll.* Sci. Tokyo (1917) new classification. (F. A. B.)

ECHINOIDEA, a class of the Echinoderma (*q.v.*), comprising the sea-urchins (*q.v.*).

ECHINUS, in architecture, a convex moulding! under the abacus of a column capital, so called from its resemblance, in form, to a sea urchin (Greek ἐχῖνος, *echinos*). It is universal in both Greek and Roman Doric orders, in which it usually has a profile of circular or elliptical curvature; occasional Roman examples have a cyma recta, double curved (see CYMA) profile. The convex moulding between the volutes of the Ionic order is also termed an echinus, as is any similar form in a capital of any style. (See ORDER.)

ECHIUROIDEA. The echiuroids are a small group of exclusively marine animals which live in tubes or galleries in the rock. They are of moderate size (*Ikeda* is recorded with a length of two metres) with a sac-like body surmounted by a large preoral lobe or proboscis, with which they explore their surroundings in search of food. In almost all species there is a pair of bristles, strictly comparable with the bristles of the annelids or segmented worms, on the ventral surface a short distance below the mouth; by means of these the animals can enlarge the walls of their burrows. They can also drag themselves from place to place by fixing the proboscis to a stationary object and by its contraction drawing the body forward. *Echiurus* is capable of swimming freely, which it probably does at night; this would account for the occurrence in certain places of large numbers of these animals thrown up on the beach on the morning after a storm.

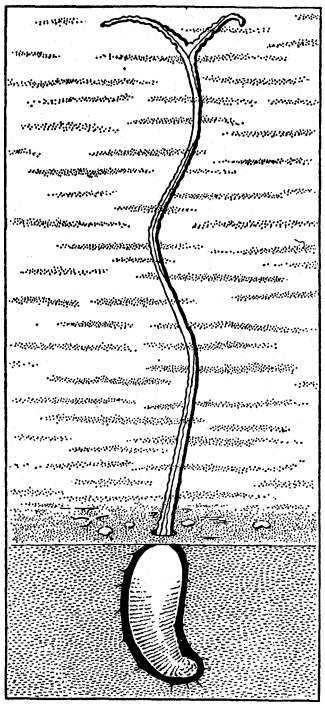


FIG. 1.—BONELLIA VIRIDIS, SHOWN WITH ITS BODY IN ITS HOLE. AND THE LONG DIVIDED PROBOSCIS, OFTEN A METRE LONG. PROTRUDED

Phylogeny.—The precise relation of the echiuroids to other animal groups still remains obscure. Many authorities consider them closely allied to the annelids, but certain primitive features in their development make it preferable to regard them as an early offshoot of the same branch as that which gave rise to the annelids rather than as members of that group that have lost their segmentation.

Anatomy.—The body-wall consists of a cuticle, glandular epidermis, a cutis and three layers of muscle. There is a roomy body cavity or coelom which communicates with the exterior by a varying number of nephridia or ducts, which serve both for excretion and for the passage of the genital products. The coelom is filled with corpuscles and in some species also contains haemoglobin. The ciliated proboscis leads by a simple mouth into the alimentary canal, which is divided into regions according to their function in digestion. The mid-gut is provided ventrally with a ciliated groove and a collateral intestine. From the rectum two large sacs are given off which communicate with the coelom by a number of ciliated funnels and to the exterior by the terminal part of the rectum. These are absent in *Hamingia* sibogae.

Except in Urechis, there is a closed vascular system, consisting of a dorsal and a ventral vessel joined medially by the neuro-intestinal vessel and in front by a vessel which loops round the proboscis. The gonad is a solid cord of cells on the posterior extremity of the ventral vessel, and the genital products develop free in the coelom and escape by way of the nephridia. The nervous system consists of a ventral nerve cord without ganglia, from which the nerves come off at irregular intervals. In front there is a large nerve ring looping round the proboscis.

Embryology. — The larva is a trochophore possessing transitory evidences of segmentation in the arrangement of the pigment and of the cilia. The development is characterized by the enormous elongation of the pre-oral lobe.

Classification. — The echiuroids may be divided into two families, the *Echiuridae* in which the male and female are similar and the Bonelliidae in which the male, lacking both mouth and anus, is a minute parasite on the female. All the *Echiuridae* except Thalassema and its allies have bristles round the anus. Nearly all the *Bonelliidae* have paired ventral hooks and a bifid proboscis, except Hamingia which has no ventral hooks and an undivided proboscis.

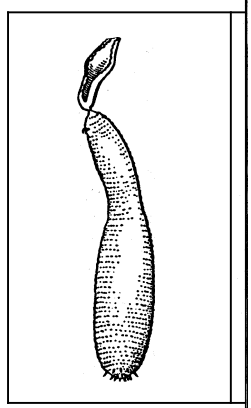


FIG. 2.—ECHIURUS ECHIURUS SHOWING SAC-LIKE BODY AND PRE-ORAL LOBE

Habits.—*Echiurus* forms a tube cemented with mucus; Thalassema and *Bonellia* live in holes in the rock. In *Bonellia* the sex of the adult depends on the mode of life of the larva. The larvae that live a free existence unattached to an adult female develop normally into females. Those that are to become males settle on the proboscis of an adult female; after three days they creep inside, develop male characteristics and eventually come to rest in the uterus of the female. The determining factor seems to be a water-soluble substance secreted by the proboscis and the gut-wall of the female; for Baltzer by feeding an extract of these organs to the free-living larvae has obtained a high percentage of males, which, however, do not reach full development. By removing the larva from the proboscis of the female before the completion of the sex-determining process intersexes can be produced. In *Pseudobonellia* there is a special tube in the body wall in which the male lives.

See W. K. Fisher and G. E. MacGinitie, "The Natural History of an Echiuroid Worm," *Am. Mag. Nat. Hist.* (1928). (C. C. A. M.)

ECHMIADZIN, (1) a monastery in the Armenian S.S.R., in 40° 12' N., 44° 19' E., the seat of the Catholicus or primate of the Armenian church. It is situated close to the village of Vagarshapat, in the plain of the Aras, 2,840 ft. above the sea, 12 m. west of Erivan and 40 north of Mount Ararat. The monastery comprises a complex of buildings, surrounded by brick walls 30 ft. high, which with their loopholes and towers present the appearance of a fortress. Its architectural character has been considerably impaired by additions and alterations in modern Russian style. On the western side of the quadrangle is the residence of the primate, on the south the refectory (1730–1735), on the east the lodgings for the monks, and on the north the cells. The cathedral is a small but fine cruciform building with a Byzantine cupola at the intersection. Its foundation is ascribed to St. Gregory the Illuminator in 302. Of special interest is the porch, built of red porphyry, and profusely adorned with sculptured designs somewhat of a Gothic character. The interior is decorated with Persian frescoes of flowers, birds and scroll-work. It is here that the primate confers episcopal consecration by the sacred hand (relic) of St. Gregory; and here every seven years he prepares the holy oil which is to be used throughout the churches of the Armenian communion. Outside the main entrance are the alabaster tombs of the primates Alexander I. (1714), Alexander II. (1755), Daniel (1806) and Narses (1857), and a white marble monument, erected by the English East India Company to mark the resting-place of Sir John Macdonald Kinneir, who died at Tabriz in 1830, while on an embassy to the Persian court. The library of the monastery is a rich storehouse of Armenian literature (see Brosset's Catalogue de la *bibliothèque d'Etchmiadzin*, St. Petersburg, 1840). Among the more remarkable manuscripts are a copy of the gospels dating from the 10th or 11th century, and three bibles of the 13th century. A type-foundry, a printing-press and a bookbinding establishment are maintained by the monks who supply religious and educational works for their co-religionists.

To the east of the monastery is a modern college and seminary. Half a mile to the east stand the churches of St. Ripsime and St. Gaiana, two of the early martyrs of Armenian Christianity; the latter is the burial-place of those primates who are not deemed worthy of interment beside the cathedral. From a distance the three churches form a fairly striking group, and accordingly the Turkish name for Echmiadzin is *Uch-Kilissi,* or the Three Churches. The town of Vagarshapat dates from the 6th century B.C.; it takes its name from King Vagarsh (Vologaeses), who in the 2nd century A.D. chose it as his residence and surrounded it with walls. Here the apostle of Armenia, St. Gregory the Illuminator, erected a church in 309 and with it the primacy was associated. In 344 Vagarshapat ceased to be the Armenian capital, and in the 5th century the patriarchal seat was removed to Dvin, and then to Ani. The monastery was founded by Narses II., who ruled 524–533; and a restoration was effected in 618. The present name of the monastery was adopted instead of Vagarshapat in the 10th century. At length in 1441 the primate George brought back the see to the original site.

(2) An administrative district of the Armenian S.S.R., with an area of 3,009 sq km., and a population (1926) of 113,930, mainly rural. Vagarshapat (see above) is the centre, pop. (1926) 8.035. The district suffers severely from drought, but a scheme of irrigation is now being inaugurated which should greatly increase the cotton production of the region.

ECHO. A sound reflected from an obstacle. Personified in later Greek mythology, as a mountain nymph or Oread (not before Euripides). In Ovid (*Metam.* III., 356 ff.) she offended Hera by keeping her talking and thus preventing her spying on an amour of Zeus; in punishment, she was deprived of speech, save the power to repeat the last words of another. A hopeless love for Narcissus (*q.v.*) made her fade away to a voice only. In Longus (III., 23), she rejected Pan's advances; he thereupon drove the shepherds mad, and they tore her in pieces; Earth buried her limbs and allowed them still her power of song.

See Roscher's *Lexikon,* art. ECHO.

ECHTERNACH. The oldest town in the old duchy of Luxembourg on the Sûre, close to the Prussian frontier, and the centre from which the English saint Willibrord converted the people to Christianity in the 7th century. A Benedictine abbey is represented mainly by an old Romano-Gothic church. The hospital-almshouse is said to be the oldest in Europe save the Hôtel-Dieu in Paris. The Benedictine abbey has been greatly shorn of its original dimensions, but the Basilica remains a fair monument of Romano-Gothic art.

The Church of SS. Peter and Paul contains the remains of St. Willibrord and stands on an isolated mound; it is reached by 60 steps which are the scene of a remarkable ceremony on Whit-Tuesday. The archbishop of Trier attends on behalf of Germany and holds a religious ceremony on the Prussian side of the Sûre before the procession crosses the bridge into the grand duchy, where it meets a procession of Luxembourgeois, partly religious, partly popular, to go through the streets of the town to the steps of SS. Peter and Paul. The religious procession (300 singers) under the bishop of Luxembourg, chants St. Willibrord's hymn; it is followed by a miscellaneous band which plays the old German air "Adam had seven sons." Next come the dancers who take three steps forward and two steps back up the 60 steps. The procession is thus a considerable strain on those who partake but, as the saint is reputed to cure epilepsy and St. Vitus dance, and other illnesses, many sick persons try to reach the church and may be in danger of being trampled by the throng if they collapse on the way up. It is said that the ceremony dates from a cholera epidemic of the 13th century. The abbey was of old

the goal of the procession. King William I. of the Netherlands tried to change the day from a Tuesday to a Sunday, so as to avoid loss of a full working-day, but the old order re-established itself. In spite of changes of political relations following the war of 1914–18, the ceremony still takes place as of old.

Students of folk-lore have tried to trace a connection between the dancing procession of Echternach and the spring dance of the heathen races, but at any rate it invests the little town with importance.

ECIJA, a town of southern Spain, province of Seville, on the Cádiz-Córdoba railway. Pop. (1930) 29,884. Ecija on the left bank of the river Genil, which is navigable to this point, is the centre of a fertile district producing olives, cereals, wine and some cotton. The heat in summer is so great that the spot is known as *El Sarten,* or the "Frying-pan" of Andalusia. Long famous for its shoe-makers, Ecija also manufactures olive oil, soap, candles, wine, starch, straw-hats, cloth and pottery. The city, once enclosed by walls, now in ruins, is chiefly remarkable for its Moorish gateways, its church towers studded with glazed tiles, its many fine balconied and decorated mansions and its chief square surrounded by colonnades and planted with acacias. It also possesses 20 convents, now mostly secularized. Ecija, called *Estadja* by the Arabs, is the ancient *Astigis,* which was raised to the rank of a Roman colony with the title of *Augusta Firma* and became so flourishing a centre that Pliny and Pomponius Mela, writing in the 1st century A.D., described it as the rival of Córdoba and Seville. Local tradition maintains that it was visited by the apostle Paul, who converted his hostess Santa Xantippa; and, according to one version of his life, it was the see of St. Crispin in the 3rd century.

ECK, JOHANN MAIER (1486–1543), German theologian, the most indefatigable and important opponent of Martin Luther, was born on Nov. 13, 1486, at Eck, Swabia. His father, Michael Maier, was a peasant and bailiff (*Amtmann*) of the village; his uncle Martin Maier, parish priest at Rothenburg on the Neckar, sent him at the age of twelve to the university of Heidelberg, later on to Tubingen, Cologne and Freiburg-im-Breisgau. At the age of 24 he was already doctor and professor of theology. During this period he was known as an opponent of the scholastic philosophy; and, though he did not go to all lengths with the "modernists" (*moderni*) of his day, his first work—Logices *exercitamenta* (1507)—was on their side, an attitude which brought him into conflict with the university senate. His position in Freiburg becoming intolerable he accepted in 1510 an invitation from the duke of Bavaria to fill the theological chair at Ingolstadt, where he was destined for thirty years to exercise a profound influence as teacher and vice-chancellor *(Prokanzler).*

A ducal commission, appointed to find a means for ending the interminable strife between the rival academic parties, entrusted Eck with the preparation of fresh commentaries on Aristotle and Petrus Hispanus, and between 1516 and 1520, in addition to his other duties, he published commentaries on the *Summulae* of Hispanus, and on the *Dialectics, Physics* and lesser scientific works of Aristotle, which became the text-books of the university. These commentaries are inspired with much of the scientific spirit of the New Learning, but he had no sympathy with the revolutionary attitude of the Reformers. He had won laurels in a public disputation at Augsburg in 1514, when he had defended the lawfulness of putting out capital at interest; again at Bologna in 1515, on the same subject and on the question of predestination; and these triumphs had been repeated at Vienna in 1516. These successes gained him the patronage of the Fuggers, and he found himself fairly launched as the recognized apologist of the established order in church and state, the first-fruits of this new position being a quite gratuitous attack on his old friend, the distinguished humanist and jurist Ulrich Zasius (1461–1536), for a doctrine proclaimed ten years before, and a simultaneous assault on Erasmus's *Annotationes in Novum Testamentum.*

Luther sent to Eck in 1517 copies of his celebrated 95 theses. Eck made no public reply; but in 1518 he circulated, privately at first, his *Obelisci,* in which Luther was branded as a Hussite. Luther entrusted his defence to Carlstadt, who answered Eck in 400 distinct theses, and declared his readiness to meet him in a public disputation, which took place at Leipzig in 1519. On June 27 and 28 and on July 1 and 3 Eck disputed with Carlstadt on the subjects of grace, free will and good works, ably defending the Roman standpoint; from July 4 to 14 he engaged with Luther on the absolute supremacy of the papacy, purgatory, penance, etc., showing a brilliant display of patristic and conciliar learning against the reformer's appeals to Scripture. The arbitrators declined to give a verdict, but the general impression was that victory rested with Eck. He made Luther admit that there was some truth in the Hussite opinions and declare himself against the pope. He induced the universities of Cologne and Louvain to condemn the reformer's writings, but failed to enlist the German princes, and in Jan. 1520 went to Rome to obtain strict regulations against those whom he called "Lutherans." He was created a protonotary apostolic, and in July returned to Germany, as papal nuncio, with the bull *Exsurge Domine* directed against Luther's writings. He now thought he could crush not only the Lutheran heretics but also his humanist critics. The effect of the publication of the bull, however, soon undeceived him, and he was glad to escape from Saxony with a whole skin. In his wrath he appealed to force, and his *Epistola ad Carolum V.* (Feb. 18, 1521) called on the emperor to take measures against Luther, a demand soon to be responded to in the edict of Worms. In 1521 and 1522 Eck was again in Rome, reporting on the results of his nunciature. On his return from his second visit he was the prime mover in the promulgation of the Bavarian religious edict of 1522, which led to years of persecution. In return for this action of the duke, Eck obtained for him, during a third visit to Rome in 1523, valuable ecclesiastical concessions. Meanwhile he published eight considerable polemics between 1522 and 1526.

Luther declined to answer his arguments, and Eck turned his attention to Switzerland and the Zwinglians. At Baden-in-Aargau in May and June 1526 a public disputation on the doctrine of transubstantiation was held, in which Eck and Thomas Murner were pitted against Johann Oecolampadius. Though Eck claimed the victory in argument, the only result was to strengthen the Swiss in their memorial view of the Holy Communion, and so to diverge them further from Luther. At the Augsburg diet in 1530 Eck was charged by Charles V. to draw up, in concert with twenty other theologians, the refutation of the Protestant Confession. He was at the colloquy of Worms in 1540 and at the diet of Regensburg (Ratisbon) in 1541. At Worms he showed some signs of a willingness to compromise, but at Regensburg he persuaded the Catholic princes to reject the Interim.

Eck died at Ingolstadt on Feb. 10, 1543. He was a powerful debater, but his victories were those of a dialectician rather than a convincing reasoner, and in him depth of insight and conviction were ill replaced by the controversial violence characteristic of the age. Moreover, even after discounting the bias of his enemies, there is evidence to prove that his championship of the Church was not wholly due to zeal for Christianity; for he was notoriously drunken, unchaste, avaricious and almost insanely ambitious. His chief work was *De primatu Petri* (1519); his *Enchiridion locorum communium adversus Lutherum* ran through 46 editions between 1525 and 1576. In 1530–35 he published a collection of his writings against Luther, *Opera contra Ludderum,* in 4 vols. *See* also LUTHER, MARTIN.

See T. Wiedemann, Dr. Johann ***Eck*** (Regensburg, 1865).

ECKERMANN, JOHANN PETER (1792–1854), German poet and author, best known owing to his association with Goethe, was born at Winsen, Hanover, on Sept. 21, 1792, and was brought up in penury. After serving as a volunteer in the War of Liberation (1813–14), he became a clerk in the War Department at Hanover. In 1817, although 25 years of age, he went to school at Hanover and then, for a year, to the University of Gottingen. His acquaintance with Goethe began in 1823, when he sent him the manuscript of his *Beiträge zur Poesie* (1823). Soon afterwards he went to Weimar, where he instructed the son of the grand duke. In 1830 he travelled in Italy with Goethe's son. In 1838 he was given the title of grand-ducal councillor and appointed librarian to the grand-duchess. Eckermann is chiefly remembered for his

contributions to the knowledge of Goethe contained in his *Conversations with Goethe* (1836–48). To Eckermann Goethe entrusted the publication of his *Nachgelassene Schriften* (posthumous works) (1832–33). He was also joint-editor with Friedrich Wilhelm Riemer (1774–1845) of the complete edition of Goethe's works in 40 vols. (1839–40). He died at Weimar on Dec. 3, 1854.

Eckermann's *Gesprache mit Goethe* (vols. i. and ii., 1836; vol. iii., 1848; 7th ed., 1899; edit. by L. Geiger, 1902) have been translated into almost all the European languages, not excepting Turkish. (Eng. trans. by Margaret Fuller, Boston, 1839, and John Oxenford, London, 1850.) His "remains" were edited by F. Tewes in vol. i. of *Aus Goetlzes Lebenskreise* (1905). *See* Petersen, *Die Entstehung der Eckermannischen Gespräche . . .* (1924); Houden, J. P. *Eckermann, Sein Leben für Goethe* (1925), based on recently discovered letters and diaries.

ECKERNFÖRDE, a town of Germany, in the Prussian province of Schleswig-Holstein, on a fjord of the Baltic, 20 mi. by rail N.W. from Kiel. Pop. (1939) 13,676. It has a good harbour, fishing, trade in agricultural products, and manufactures of tobacco, salt and iron goods. There is a technical school of buildings. Eckernforde was taken by Christian IV. of Denmark in 1628 from the Imperial troops. In 1813 the Danes were defeated here. The place lost most of its trade after the union with Germany in 1864, and suffered severely from a sea-flood in 1872. In the immediate neighbourhood is Borby, popular for sea-bathing.

ECKERSBERG, KRISTOFFER (1783–1853), Danish painter, was born at Warnitz on Jan. 2, 1783. He studied in Paris under J. L. David, and then went to Rome, where he worked until 1816 in close fellowship with Thorwaldsen. His paintings from this period—"The Spartan Boy," "Bacchus and Ariadne" and "Ulysses"—testify to the influence of the great sculptor. After his return to Denmark his chief work was done in landscape and sea-painting. It is claimed for Eckersberg by the native critics that "he created a Danish colour," that is to say, he was the first painter who threw off conventional tones and the pseudo-classical landscape, in exchange for the clear atmosphere and natural outlines of Danish scenery. Ecltersberg died on July 22, 1853, at Copenhagen, where he was professor at the academy.

ECKHART, JOHANNES ["MEISTER ECKHART"] (1260?–1327), German philosopher, the first of the great speculative mystics of the West, was born at Hochheim, near Gotha. He entered the Dominican order and in 1302 became a master of theology at Paris. Two years later he was made provincial of his order for Saxony, and in 1307 vicar-general for Bohemia. In both provinces he was distinguished for his practical reforms and for his power in preaching.

Released from his offices in 1311, Eckhart taught in Paris until 1314, when he was sent to Strasbourg. Later he was transferred to Cologne, where, in 1326, the archbishop took proceedings against his doctrines. In the following year, that of his death, Eckhart publicly declared his orthodoxy and appealed to Pope John SSII. In 1329, 28 of his propositions were condemned by the Holy See.

Eckhart has been termed a scholastic mystic, rather than a mystical scholastic, because he colours the Aristotelian elements in Aquinas with the mysticism of the pseudo-Dionysius. The two most important doctrines in his, as in all mystical systems, are those of the Divine nature and of the relation between God and creatures, especially the human soul.

For Eckhart, God is the absolute and infinite Being best characterized as nothing on the ground that His simplicity is irreconcilable with a plurality of predicates. If any attribute could be ascribed to Him, it would be the *esse* implied in the scriptural *Ego sum qui sum,* though strictly speaking, God is, rather than has, *esse.* In spite of this assertion that the Divine essence and existence are identical, Eckhart goes on to declare that apart from the Divine existence there is nothing. *Ens tantum unum est et Deus est.* Every creature has its own essence, but its existence is that of God, and God and the creature are more closely related than matter or form or than the parts and the whole. In addition to this pantheistic leaning, the statement that at the same time that God engendered His Son, co-eternal and equal to Himself, He created the world, brought Eckhart's orthodoxy under suspicion. The statement may not apply to the exterior effect of the eternal act of God, but Eckhart's interpretation of the in *principio* of Genesis as the *nunc aeternitatis* suggests that it does.

Although the Divine existence permeates all being, it is regarded by Eckhart as especially manifested in the human soul, whose end is union with God. This union is to be accomplished through knowledge. The soul must first understand that creatures in themselves are nothing, and then, having perceived the continuity of its being with the Divine being, it can dispense with the external means of salvation and abandon itself to God, Who finds in it His own existence.

Eckhart's style is unsystematic and abounding in symbolical expression, but his successful exposition of scholastic doctrines in an undeveloped tongue has made him the father of German philosophical language.

For the German writings of Eckart *see* F. Pfeiffer, *Deutsclze Mystiker,* vol. ii. (Leipzig, 18.57; Eng. trans. by C. B. Evans, 1924); for the Latin works, H. Denifle in *Archiv f. Litt.- und Kirchengeschichte d. Mittelalters,* ii. (1886); German translations by G. Landauer (Berlin, 1903), and Buttner (Leipzig, 2 vols., 1917); M. Grabmann, "Neuaufgefundene Pariser Quaestionem Eckharts," in *Abhand.* d. *Bayr. Akademie der Wiss.* (1927); *E.* Longpre, "Quaestions inédites de maître Eckhart," in *Rev. Néoscol* (1927); *A.* Daniels, *Eine lateinische Rechtfertigungsschrift des Meisters Eckhart* (Munster, 1923) and G. Théry, "Edition critique des pièces relatives au procès d'Eckhart," in *Arch. d'hist. doctrinale et litt. du moyen âge,* i. (1926). *See* further *A.* Lasson, *Meister Ecklzart der Mystiker* (1868); *W.* Preger, *Geschichte* d. *deutschen Mystik,* 3 vols. (1874–92); H. Delacroix, *Le Mysticisme spéculatif en Allemagne au XIVe siècle* (Paris, 1900); A. Spamer, "Zur Uberlieferung der Pfeifferschen Echeharttexte," in *Beitr. z. Gesch. de deutschen Sprache* (1908) and in the same periodical for 1909, M. Pahncke, "Untersuchungen zu den deutschen Predigten M. Eckharts"; P. Strauch, *Meister Ecklzart- Probleme* (Halle, 1912); X. de Hornstein, *Les grands Mystiques allemands du XIVe Siècle* (Lucerne, 1922); O. Karrar, *Meister Eckhart* (Munich, 1926); Ueberweg, *Grundriss der Gesch. der Phil.,* bd. ii., containing a full bibliography (1928). *(See* MYSTICISM.)

ECKHEL, JOSEPH HILARIUS (1737–1798), Austrian numismatist, born at Enzersfeld, lower Austria, was for over 20 years professor of antiquities and numismatics at the university of Vienna, and keeper of the imperial cabinet of coins. Eckhel's great work is the *Doctrina numorum veterum* (8 vols., 1792–98). Out of the mass of previously loose and confused facts Eckhel constituted a true science. A volume of *Addenda,* prepared by Steinbiichel from Eckhel's papers after his death, was published in 1826. He died at Vienna on May 16, 1798.

ECKMÜHL or **EGGMUHL,** a village of Germany, in Bavaria, on the Grosse Laaber, 13m. S.E. of Regensburg by the railway to Munich. It is famous as the scene of a battle fought here on April 22, 1809, between the French, Bavarians and Württembergers under Napoleon, and the Austrians under the archduke Charles, which resulted in the defeat of the latter. Napoleon, in recognition of Marshal Davout's great share in the victory, conferred on him the title of prince of Eckmiihl. For an account of this action and those of Abensberg and Landshut *see* NAPOLEONIC CAMPAIGNS.

ECLECTICISM, a term used specially in philosophy and theology for a composite system of thought made up of views chosen from various other systems (from Gr. ἐκλέγω, I select). Where the characteristic doctrines of a philosophy are not thus merely adopted, but are the modified products of a blending of the systems from which it takes its rise, the philosophy is not properly eclectic. Eclecticism always tends to spring up after a period of vigorous constructive speculation, especially in the later stages of a controversy between thinkers of pre-eminent ability. Their respective followers, and more especially cultured laymen, lacking the capacity for original work, seeking for a solution in some kind of compromise, and possibly failing to grasp the essentials of the controversy, take refuge in a combination of those elements in the opposing systems which seem to afford a sound practical theory. Since these combinations have often been as illogical as facile, "eclecticism" has generally acquired a somewhat con-

temptuous significance. At the same time, the essence of eclecticism is the refusal to follow blindly one set of formulae and conventions, coupled with a determination to recognize and select from all sources those elements which are good or true in the abstract, or in practical affairs most useful *ad hoc*. Theoretically, therefore, eclecticism is a perfectly sound method, and the contemptuous significance which the word has acquired is due partly to the fact that many eclectics have been intellectual trimmers, sceptics or dilettanti, and partly to mere partisanship. On the other hand, eclecticism in the sphere of abstract thought is open to this main objection that, in so far as every philosophic system is, at least in theory, an integral whole, the combination of principles from hostile theories must result in an incoherent patchwork. Thus it might be argued that there can be no logical combination of elements from Christian ethics, with its divine sanction, and purely intuitional or evolutionary ethical theories, where the sanction is essentially different in quality. It is in practical affairs that the eclectic or undogmatic spirit is most valuable, and also least dangerous.

In the 2nd century B.C. a remarkable tendency toward eclecticism began to manifest itself. The longing to arrive at the one explanation of all things, which had inspired the older philosophers, became less earnest; the belief, indeed, that any such explanation was attainable began to fail. Thus men came to adopt from all systems the doctrines which best pleased them. In Panaetius we find one of the earliest examples of the modification of Stoicism by the eclectic spirit; about the same time the same spirit displayed itself among the Peripatetics. In Rome philosophy never became more than a secondary pursuit; naturally, therefore, the Roman thinkers were for the most part eclectic. Of this tendency Cicero is the most striking illustration—his philosophical works consisting of an aggregation, with little or no blending, of doctrines borrowed from Stoicism, Peripateticism, and the Scepticism of the Middle Academy.

In the last stage of Greek philosophy the eclectic spirit produced remarkable results outside the philosophies of those properly called eclectics. Thinkers chose their doctrines from many sources—from the venerated teaching of Aristotle and Plato, from that of the Pythagoreans and of the Stoics, from the old Greek mythology, and from the Jewish and other Oriental systems. Yet it must be observed that Neoplatonism, Gnosticism, and the other systems which are grouped under the name Alexandrian, were not truly eclectic, consisting, as they did, not of a mere syncretism of Greek and Oriental thought, but of a mutual modification of the two. It is true that several of the Neoplatonists professed to accept all the teaching both of Plato and of Aristotle, whereas, in fact, they arbitrarily interpreted Aristotle so as to make him agree with Plato, and Plato so as to make his teachings consistent with the oriental doctrines which they had adopted, in the same manner as the schoolmen attempted to reconcile Aristotle with the doctrines of the church. Among the early Christians, Clement of Alexandria, Origen and Synesius were eclectics in philosophy.

The eclectics of modern philosophy are too numerous to name. Of Italian philosophers the eclectics form a large proportion. Among the German we may mention Wolf and his followers, as well as Mendelssohn, J. A. Eberhard, Ernst Platner, and to some extent Schelling, whom, however, it would be incorrect to describe as merely an eclectic. In the first place, his speculations were largely original; and in the second place, it is not so much that his views of any time were borrowed from a number of philosophers, as that his thinking was influenced first by one philosopher, then by another.

In the 19th century the term "eclectic" came to be applied specially to a number of French philosophers who differed considerably from one another. Of these the earliest were Pierre Paul Royer-Collard, who was mainly a follower of Thomas Reid, and Maine de Biran; but the name is still more appropriately given to the school of which the most distinguished members are Victor Cousin, Théodore Jouffroy, J. P Damiron, Barthélemy St Hilaire, C. F. M. de Rémusat, Adolphe Garnier and Ravaisson-Mollien. (See COUSIN, VICTOR).

ECLIPSE. One heavenly body is said to be eclipsed by another when the second body passes between the observer and the first body so as to obscure part or all of it. Thus an eclipse (from Gr. ἔκλειψις, failing to appear) of the sun occurs when the moon comes between the earth and the sun. If the more remote body be completely obscured by the nearer body the eclipse is said to be total, otherwise it is termed partial. If the distant body be visible all round the nearer body at any moment the partial eclipse is then termed annular.

We shall divide the consideration of eclipses as follows:

I. General considerations.
II. Eclipses of satellites of Jupiter.
III. Eclipsing binary stars.
IV. The calculation and prediction of eclipses (explained in detail for eclipses of the sun) laws and cycles of eclipses of the sun and moon.
V. Phenomena of eclipses of the sun.
VI. " " " " " moon.
VII. Table of eclipses in the 20th Century.

I. GENERAL CONSIDERATIONS

A convenient way of regarding an eclipse is to consider the shadow cast by a dark body (such as the earth or moon) into the space surrounding a bright body (such as the sun). Thus if fig. 1 represents a section through the centres S and M of a bright body S and a dark body M, and AA', BB' be the exterior and CC', DD' the interior common tangents respectively we see that to an observer situated, as at O_1, outside the cone formed by CC', DD', there will be no obscuration of S; from an observer situated within the cone, as at O_2 part of S will be hidden; and if he be within the cone formed by AA', BB' and between its apex P and M, as at O_3, the whole of S is hidden from him.

If we know the sizes of S and M and their motions we can determine the form and position of the shadow cones at any moment, and hence can say whether any other body (*e.g.*, the earth or a particular point on it) falls within them.

In fig. 2 if S represents the sun, M the moon and E the earth we have in (1) the configuration necessary for an eclipse of the moon, in (2) that required for an eclipse of the sun.

If all the members of the solar system revolved in orbits which were in the same plane, then there would be an eclipse at every revolution of a satellite around its primary. Thus once a month we should have an eclipse of the sun when the moon was between us and the sun (*i.e.*, at a time of new moon) and an eclipse of the moon a fortnight later when we were between the sun and moon (*i.e.*, at a time of full moon). The orbits are not coplanar but slightly inclined to one another, and so it can happen that the axis of the shadow cones passes above or below the more distant body and no eclipse visible on the planet may occur. We shall explain the matter in detail for eclipses of the sun, and it will be seen that the considerations advanced apply *mutatis mutandis* to eclipses of the moon or other bodies. The planets between the earth and the sun (Venus and Mercury) clearly may pass between us and the sun. These occurrences are technically termed transits, but the calculations concerning them are essentially the same as for eclipses.

FIG. 1.—DIAGRAM DEMONSTRATING THE NATURE OF AN ECLIPSE
A dark body (M), the moon, casts shadow cones into the space surrounding a bright body (S), the sun. No eclipse is seen in the unshaded region (O_1); in the lightly shaded area there is a partial eclipse (O_2); at O_3, there is a total eclipse; and at O_4 an annular eclipse

II. ECLIPSES OF SATELLITES OF JUPITER

In fig. 2 (3) we have a representation of eclipses of one of the outer planets, Jupiter say, and its satellites. Satellite I. is drawn inside the umbral cone of Jupiter and so, since it is not self-luminous, is temporarily (*i.e.*, while passing through the cone) invisible from the earth (E). Satellite II. is drawn passing between Jupiter and the sun and so casting a shadow on Jupiter. If

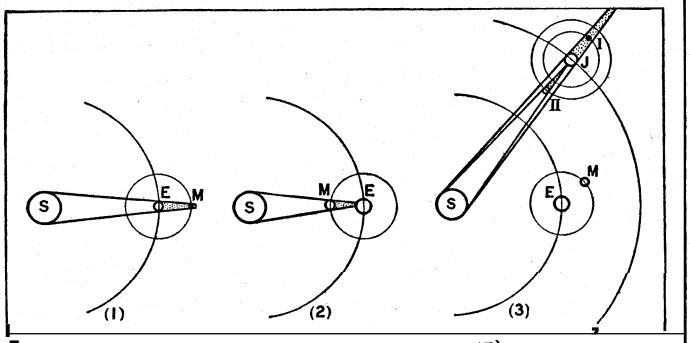


FIG. 2.— RELATIVE POSITIONS OF SUN (S), EARTH (E), MOON (M), AND JUPITER (J) IN AN ECLIPSE
1. An eclipse of the moon; the moon is drawn inside the umbral cone, so the eclipse is total
2. An eclipse of the sun; part of the earth's surface is inside the umbral cone; over this region of the earth a total solar eclipse takes place
3. Eclipses of Jupiter's satellites visible from the earth. Satellite I is eclipsed and therefore invisible temporarily. Satellite II is casting a shadow on the surface of Jupiter, which is visible through a telescope as a round dark spot

the umbral cone be long enough to reach the surface of Jupiter there will be a dark spot on the surface (the shadow of its moon) visible from the earth if it falls on the half of Jupiter visible to us.

The eclipses of the satellites of Jupiter provide a frequent and interesting spectacle (of which details are given in the *Nautical Almanac*) and are of considerable astronomical interest. Historically they are important inasmuch as they provided one of the earliest proofs of the finite velocity of light. It is possible to calculate with considerable precision the times of disappearance and reappearance of one of the satellites undergoing eclipse (as I.) and it was found by Romer that there were discrepancies between the observed and calculated times that could be explained if we supposed that we saw the eclipse a little early or a little late depending upon whether the earth was at a point in its orbit nearer to or further from Jupiter than the sun; the difference between the extreme variations being the time needed for light to travel the distance across a diameter of the earth's orbit.

III. ECLIPSING BINARY STARS

Eclipsing Binaries are stars which vary in brightness periodically. The most famous of these is Algol or β Persei, and the explanation of the changes is that there are two stars revolving round one another in an orbit whose plane intersects the earth, or does so very nearly. Thus from time to time one star passes in front of or behind the other as seen from the earth and the light from one of them is temporarily lost to us. From the way in which the light from the double systems varies it is possible to calculate the shapes and relative sizes of the components of the binary system and to obtain certain other information (see STAR).

IV. CALCULATION OF ECLIPSES OF THE SUN

We can divide our calculations into two parts. In the first part we seek to determine if an eclipse can occur and in the second to determine its circumstances (*i.e.*, whether or no it is visible at a given point on the earth's surface, its type [total or partial], duration, etc.). It is most convenient to suppose the earth fixed and the sun and moon revolving around it.

We will suppose first that the observer is situated at the centre of the earth. Then the state of affairs can be represented on a "celestial sphere" as in fig. 3. In this diagram PP' is the earth's axis and the position of celestial objects is marked on the general sphere of the sky in the same way as countries are marked on an ordinary globe of the earth, looking at the celestial sphere from the "outside" as we do at the countries on a globe. Thus O the centre of the sphere (MEQM'E'Q') is the observer, the circle QQ' is the equator. The motion of the sun can then be described thus. It moves round a great circle QQ′ called the ecliptic, which is inclined at $23\frac{1}{2}°$ nearly to the equator, once in a solar or ordinary year. The moon likewise describes once a lunar month an orbit represented by the great circle MM′ which is inclined to the ecliptic at about 5° (instead of being the same circle EE' as it would be if the orbits were coplanar). The daily motion is represented by a revolution of the whole sphere and everything on it round P'P once a sidereal day. The sun can be represented by a small circle X centre on EE' about $\frac{1}{2}°$ in diameter, and the moon by a small circle Y, nearly the same size, centre on MM′. The sizes and distances of the sun and moon are such that they subtend very nearly the same angle (about $\frac{1}{2}°$) at the earth, but their apparent sizes are not constant. The earth goes round the sun not in a circle but an ellipse, and the sun is further from us in summer (in the northern hemisphere) than in winter, thus its apparent size (the circle X) varies and also its speed of motion around EE' is faster in winter than in summer. The moon also moves around the earth in an ellipse and so its distance and speed vary so that the apparent size (*i.e.*, the circle Y) varies. It is for these reasons that the duration and magnitude of an eclipse vary. For an eclipse to occur the sun and the moon must be so situated that the circles X and Y overlap. Clearly since they are only about $\frac{1}{4}°$ in radius and the circles EE' and MM' are inclined at about 5° this can only happen when the moon and sun are near one of the two points ☊ and ☋ of intersection of EE' and MM' called the node; of the moon's orbit. The moon's nodes revolve in the ecliptic from east to west once in about 19 years. The interval of time between two successive passages of the sun through one of the nodes is termed an "eclipse year" and since the moon's node moves to meet the advancing sun this interval is about 18·6 days less than a tropical (or ordinary) year. Nineteen eclipse years (6585·7806 days) are very nearly the same as 223 ordinary months (6585·3211 days). This interval of 18 years 11 days (or 18 years 10 days if February 29 has occurred five times) is termed the Saros, and is the simplest relation useful in predicting eclipses. After this interval the moon and sun come very nearly to the same relative position again. Thus the eclipse of 1923 (September 10) was a repetition of that of 1905 (August 30). The coincidence of the two periods is not exact and so while there is an eclipse again after a Saros the circumstances of it will be different. If a new moon fell exactly at a node then after 18 years 11 days the new moon occurs before the node is reached. The difference between the two periods is 0·4595 days and so the moon is 28′ farther west. If new moon happens within 18" of the node an eclipse of the sun may take place; if it is an ascending node the eclipse will be visible in high northern latitudes on the earth; at the next return the new moon will be 28′ nearer the node and the eclipse will be visible a little south of the first position. When the new moon is within about 11° of the node the eclipse becomes central (*i.e.*, there is a line on the surface of the earth from any point of which the centres of the sun and moon appear coincident) and may be annular or total depending on the distance of the moon and sun from the earth. Total eclipses now occur every 18 years 11 days passing south each time till the limit of 11° is passed on the other side of the node and there remains a series of partial eclipses tailing off to the south pole. In such a series there are from 68 to 75 eclipses of which abbut 18 are total.

One other important relation is that 239 returns of the moon to perigee are 6585.5574 days, so after 223 lunations the moon returns not only very closely to its original position with respect to sun and node but also with respect to line of apsides so that the distance from earth to moon is nearly the same. Thus the duration is altered but little and the perturbations of the moon's orbit are almost unchanged with but little effect then on the time of the eclipse. The fraction ·3211 days in the period of the Saros has the effect of making each eclipse occur about 110° of longitude further west and after three Saroses it has nearly returned to its original position but farther N. or S. Since there are two nodes the sun will come into a region where eclipse is likely twice a year. giving the two "eclipse seasons" each about one month in duration, in which at least one eclipse or possibly two small partial

eclipses may happen. Generally, but not necessarily, one eclipse of the moon will occur in a season. There is possible as a maximum five eclipses of the sun in a year. Solar eclipses occur oftener than lunar ones, but since a solar eclipse is visible only over a very limited region of the earth and a lunar one over a whole hemisphere, lunar eclipses are more often seen at any one place.

Having determined that an eclipse will take place it remains to find its circumstances at a given place on the earth's surface. For this purpose we make use of the conception of the moving shadow cones. A plane passing through the centre of the earth and perpendicular to the axis of the moon shadow is chosen as a plane of reference and termed the fundamental plane, and the co-ordinates x and y of the point in which the axis of the shadow cones cuts it are determined and also the declination d and the hour angle μ of the axis. The radii l_1(penumbra) and l_2 (umbra) of the section of the shadow cones by the fundamental plane are then found. and all these quantities together with the angles of the cones and the rates of change of x, y and μ are given in the Ephemerides. These quantities (termed the Besselian elements) can be used to determine the circumstances at any place in the following way. Knowing the position of the observer on the earth we have his co-ordinates referred to the fundamental plane at any instant and so can find the position relative to him of the shadow cones. If he is always outside them the eclipse is invisible to him. If he be nearer the central line there will be a time when he just touches the circle formed by the penumbra. The moon is then just beginning to touch the sun (1st contact), and if he be near enough there will also be a moment when he just touches the umbral circle and totality commences (2nd contact). The moon now touches the sun internally at one point and later he will be just on the edge of the shadow circle as it is leaving him (3rd contact) and totality ends. The end of the eclipse is when the further rim of the penumbra reaches him and the other edge of the moon is just touching the edge of the sun externally (4th contact). Likewise the bearings of the points of contact may be found and so the position in the sky of the points of the crescents during the partial phase can be calculated. Thus it is possible to determine the form of the shadow cast on the earth's surface and the path over which it moves. In the Ephemerides maps are given showing the part covered by the shadow as it moves over the earth's surface and the region within which the eclipse is total if anywhere (*i.e.*, if there are any points on the earth's surface near enough to the moon to fall in the cross-hatched region in fig. 1), and lines are drawn joining those places where the eclipse begins and ends at certain times, *e.g.*, sunrise or sunset. The most important information is the track of the line of central eclipse (the locus of the intersection of the line of centres of the sun and moon with the surface of the earth) and the northern and southern limits of the region of totality. Since the moon moves through its own diameter in about an hour there will be about an hour between the 1st and 2nd contacts and also between the 3rd and 4th. The duration of totality (the interval between the 2nd and 3rd contacts) is greatest on the central line and may be anything up to about $7\frac{1}{2}$ mins. The longest duration will clearly occur when the moon is near perigee and the sun near apogee and also if the eclipse occur near mid-day on the earth's equator for then the surface of the earth is nearly perpendicular to the shadow cones and their rate of motion over it is slowest. It is possible with the aid of modern tables to predict eclipses a few years ahead with an accuracy of a few seconds. The chief difficulty lies in the uncertainty of the moon's motion.

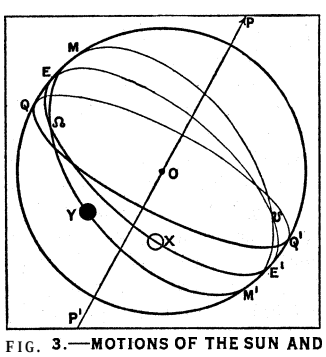


FIG. 3.—MOTIONS OF THE SUN AND MOON ON THE CELESTIAL SPHERE
P-P¹ is parallel to the earth's axis, Q-Q¹ is the celestial equator. X, the sun, moves around E E¹ the ecliptic, once a year Y, the moon, moves around MM¹, its orbit, once a month. The intersections (nodes) Ω—℧ of the moon's orbit and the ecliptic rotate once in 19 years. The black circle Y and the clear circle X must overlap to produce an eclipse; thus X must be near a node, and the moon new

Eclipses can of course be "predicted backwards" as well as forwards, and the calculation of ancient eclipses has been of value in historical research in fixing the dates of certain events. The main difficulty is in identifying an eclipse with certainty since often details such as the time of day of the eclipse, or even the season, are lacking. The earliest date thus accurately determined is the year 911 B.C., from an eclipse in Assyria. The eclipse mentioned in Amos viii., 9 seems to have been the one in 763 B.C. There was no eclipse visible in the neighbourhood of Samaria in 787 B.C., the date set down opposite this passage in some Bibles.

V. PHENOMENA AND INFORMATION YIELDED BY OBSERVATION OF SOLAR ECLIPSES

In general little or nothing of astrophysical importance can be learnt from a partial eclipse of the sun, but during the few minutes of totality of a total eclipse much information about the physical nature of the sun has been obtained that is not available under any other circumstances. The observation of the times of occurrence of the various phases of any eclipse is useful in improving our knowledge of the motions of the sun and moon and of the figure of the earth, but the value of a total eclipse is that we can then observe the solar atmosphere and surroundings which are invisible to us ordinarily on account of the great brilliance of the general sky-light, *i.e.*, sunlight scattered by the molecules of the earth's atmosphere. The moon acts as a screen outside the earth's atmosphere and cuts off the direct light of the sun and the scattered light at the same time, thus for instance the Corona (*q.v.*) has never been seen or photographed except during an eclipse.

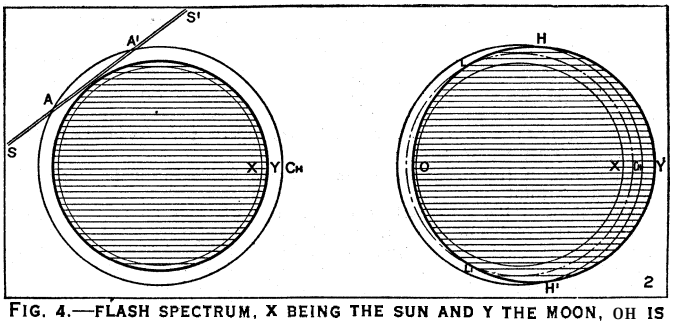


FIG. 4.—FLASH SPECTRUM, X BEING THE SUN AND Y THE MOON, OH IS THE TOP OF THE CHROMOSPHERE. WHICH IS LEFT WHOLLY OR PARTLY UNCOVERED AFTER THE DISC OF THE SUN IS COVERED BY THE MOON
1. shows the slit, SS¹, of a spectroscope placed to measure the wave lengths of the flash spectrum
2. Shows the way in which the "crescents" of the flash are formed and that the length of the crescent HOH¹, formed by an element high in the chromosphere, is greater than the crescent LOL¹, formed by an element low in the chromosphere

The apparent diameter of the sun is very roughly 1,800 sec. of arc and its atmosphere, or the Chromosphere (*q.v.*), extends about 10 sec. only above the surface (photosphere); that is to say the sun as seen from the earth is a disc surrounded by a narrow ring of atmosphere somewhat over $\frac{1}{2}\%$ of a solar diameter in thickness. This atmosphere consists of many elements in the gaseous condition at a high temperature. We cannot in ordinary circumstances see it although it is very bright, but during a total eclipse the moon covers up the disc of the sun, and when the last crescent of the disappearing sun has vanished the narrow ring or crescent of chromosphere becomes visible. It is found that this atmosphere yields an emission spectrum which is the reversal, or counterpart of the ordinary solar absorption spectrum. On account of the fact that this spectrum flashes out at the instant totality commences it is termed the "flash spectrum." The study of it is one of the most important aims of eclipse observers. First of all it is of prime importance to have an accurate knowledge of the wavelengths of the lines in this spectrum. For this purpose an image of the sun is focused on the slit of a suitable spectrograph, and a suitable comparison spectrum may be photographed alongside the flash spectrum. In this way the bright lines in the flash spectrum are identified line for line with the dark lines in the Fraunhofer spectrum.

Date at noon point	Duration of totality minutes	Node and series	Regions swept by shadow
1900 May 28	2·1	D 5	United States, Spain, N. Africa.
1901 May 18	6·5	D 6	Sumatra, Borneo.
1904 Sep. 9	6·4	A 7	Pacific Ocean.
1905 Aug. 30	3·8	A 8	Canada, Spain, N. Africa.
1907 Jan. 14	2·3	D 9	Russia, Central Asia.
1908 Jan. 3	4·2	D 10	Pacific Ocean.
1911 Apr. 28	5·0	A 1	Australia, Polynesia.
1912 Oct. 10	1·8	D 2	Colombia. Ecuador. Brazil.
1914 Aug. 21	2·1	D 3	Scandinavia, Russia, Asia Minor.
1916 Feb. 3	2·5	A 4	Pacific Ocean, Venezuela, West Indies.
1918 Jun. 8	2·4	D 5	British Columbia, United States.
1919 May 29	6·9	D 6	Peru, Brazil, Central Africa.
1922 Sep. 21	6·1	A 7	E. Africa, Australia.
1923 Sep. 10	3·6	A 8	California, Mexico, Central America.
1925 Jan. 24	2·4	D 9	United States.
1926 Jan. 14	4·2	D 10	E. Africa, Sumatra, Philippines.
1927 Jun. 29	0·7	A 11	England, Scotland, Scandinavia.
1929 May 9	5·1	A 1	Sumatra, Malacca, Philippines.
1930 Oct. 21	1·9	D 2	Pacific Ocean, Patagonia
1932 Aug. 31	1·5	D 3	Canada.
1934 Feb. 14	2·7	A 4	Borneo, Celebes.
1936 Jun. 19	2·5	D 1	Greece to Central Asia and Japan.
1937 Jun. 8	7·1	D 6	Pacific Ocean, Peru.
1940 Oct. 1	5·7	A 7	Colombia, Brazil, S. Africa.
1941 Sep. 21	3·3	A 8	Central Asia, China, Pacific Ocean.
1943 Feb. 4	2·5	D 0	China, Alaska.
1947 May 20	5·2	A	Argentina, Central Africa, Paraguay.
1948 Nov. 1	1·9	D 2	Central Africa, Congo.
1952 Feb. 25	3·0	A 4	Nubia, Persia, Siberia.
1954 Jun. 30	2·5	D 5	Canada, Scandinavia, Russia, Persia.
1955 Jun. 20	7·2	D 6	Ceylon, Siam, Philippines.
1958 Oct. 12	5·2	A 7	Chile, Argentina.
1959 Oct. 2	3·0	A 8	Canaries, Central Africa.
1961 Feb. 15	2·6	D 9	France, Italy, Austria, Siberia.
1962 Feb. 5	4·1	D 10	New Guinea.
1963 Jul. 20	1·5	A 11	Alaska, Hudson's Bay Territory.
1965 May 30	5·3	A 1	Pacific Ocean.
1966 Nov. 12	1·9	D 2	Bolivia, Argentina, Brazil.
1970 Mar. 7	3·3	A 4	Mexico, Georgia, Florida.
1972 Jul. 10	2·7	D 5	N.E. Asia, N.E. America, and Atlantic Ocean.
1973 Jun. 30	7·2	D 6	S. America, Africa and Atlantic Ocean.
1974 Jun. 20	5·3	D 12	S.W. Australia and Indian Ocean.
1976 Oct. 23	4·9	A 7	Africa, Australia, Indian and Pacific Oceans.
1977 Oct. 12	2·8	A 8	Venezuela, Pacific Ocean.
1979 Feb. 26	2·7	D 9	United States, British America, N. Polar Sea.
1980 Feb. 16	4·3	D 10	Africa, Atlantic and Indian Oceans, India.
1981 Jul. 31	2·2	A 11	Pacific Ocean, Asia.
1983 Jun. 11	5·4	A 1	Java. Atlantic Ocean.
1984 Nov. 22	2·1	D 2	Pacific Ocean, Patagonia.
1987 Mar. 29	0·3	A 13	Atlantic, Equatorial Africa.
1988 Mar. 18	4·0	A 4	Indian and Pacific Oceans, Sumatra.
1990 Jul. 22	2·6	D 5	Finland, N. Atlantic.
1991 Jul. 11	7·1	D 6	Pacific Ocean, Hawaii, Central America.
1992 Jun. 30	5·4	D 12	S. Atlantic.
1994 Nov. 3	4·6	A 7	Pacific Ocean, S. America.
1995 Oct. 24	2·4	A 8	Pacific and Indian Oceans.
1997 Mar. 9	2·8	D 9	N.E. Asia, Arctic Sea.
1998 Feb. 26	4·4	D 10	Pacific and Atlantic Oceans, Central America.
1999 Aug. 11	2·6	A 11	Central and Southern Europe, touching England.

From fig. 4 (1) it is clear that the length of the line in the spectrum, *i.e.*, the length of slit (SS') illuminated (AA') depends on the height of the chromosphere. This method has also been used to estimate the heights to which the elements concerned reach in the chromosphere since the intensity diminishes as the height increases, but it is open to serious objections. Firstly there exist lines of any one element of greatly different intensities at any one level and the length of a line in the spectrum will depend on whether or not the light is strong enough to produce any effect during the exposure given. Secondly the scale of image possible renders it almost impossible to make a really accurate setting of the slit at a given height, and as a corollary of this it is usually entirely unknown to what extent the moon has cut out the central part of the line during the exposure. Lastly the slit is by no means narrow compared with the chromosphere itself and the optical definition obtainable may be such as to confuse the image seriously.

The chromosphere is so narrow that its spectrum can be obtained with an objective prism spectroscope (*i.e.*, one without slit of collimator). Fig. 4 (2) shows the way in which the moon leaves a crescent of chromosphere uncovered at a given instant. The lengths of the crescents again depend on the height of the element concerned. This method is used to determine heights in the chromosphere. It is open to the first objection raised against the slit method, but not to the others, and enables us at any rate to fix a minimum height. It is found that most elements extend to a height of about 500 km. (310 miles) but some, *e.g.*, H and Ca are found as far up as 14,000 km. (8,700 miles). The best method for investigating the variation of intensity with height is undoubtedly that known as the "falling plate method." For this purpose an objective prism or grating is used giving in the usual way a spectrum of crescents, but a part of this only is used, namely a narrow strip of it which is allowed to pass through a slit running along the spectrum area placed close to the plate. The plate is caused to move uniformly during the period of exposure and thus each small piece of crescent (virtually a dot) is spread out into a long line perpendicular to the direction of dispersion in the spectrum. Since as the exposure proceeds the chromosphere is gradually covered up at a known rate from the bottom by the moon (or uncovered if third contact be used) the variation of intensity along the line so produced can be used to determine accurately the law of variation of intensity of the radiation of the wave-length concerned with height.

It is only recently that modern spectro-photometric methods have been applied to the study of the flash spectrum, but the results are most promising and photometric investigations will form an important part of future observations. One serious difficulty is to compare the intensities of lines that are not so close together that the variation of the absorption of light in the earth's atmosphere can be neglected. since the precise value of the absorption at different wave-lengths is unknown. It should be remarked that the method of obtaining flash spectra with a slit can be used

when the eclipse is not total, by setting the slit on a part that will be covered by the moon.

There appears to be a faint general continuous background to the flash spectrum, but near the head of the Balnier series there is a marked continuous spectrum due to the capture of free electrons by the ionized hydrogen atom. The Balmer series of hydrogen is extraordinarily well developed in the flash and if the lines be numbered in order taking H_α as H_1, H_β as H_2 and so on we can detect lines as far as H_{36}. This confirms our ideas of the very low density in the chromosphere.

Prominences. — When totality commences an irregular fringe of crimson flame-like objects is often seen around the limb of the sun. These are the prominences, and are found to consist of masses or clouds of gas mainly hydrogen (hence the red colour) and calcium in rapid motion above the solar surface. They vary very much in size and profusion, being found mostly in the sun-spot zones and in greatest profusion and usually largest near a time of maximum sun-spot activity. During a long eclipse changes may be found in the prominences, but the study of their behaviour is carried out mostly with the spectroheliograph, an instrument which allows them to be photographed without an eclipse. Pl. II., in the article SUN shows a prominence photographed in 1919. The same prominence was observed with the spectroheliograph at the Solar Physics Observatory, Cambridge, on the day preceding the eclipse and was photographed at intervals of an hour throughout the day of the eclipse whereby remarkable changes were observed and it was found that this giant prominence reached a height of 150,000 miles above the solar surface, attaining a velocity of over 55,000 miles per hour and a maximum length of 361,000 miles.

The Deflection of Light by a Gravitational **Field.**—One of the most famous, and the first, of the tests of Einstein's theory of relativity was that of observing the bending of a ray of light passing close to the sun. During a total eclipse the brighter stars are visible to the naked eye and many more can be photographed near the sun. If Einstein's theory be true the stars near the sun should be found not in their true places but displaced away from the sun by a small, but measurable, amount varying inversely as the distance from the centre of the sun. This test was first carried out in 1919 and has been repeated since with results on the whole in favour of the theory (see RELATIVITY).

Other Phenomena. — Baily's Beads. — It is found that totality does not begin or end quite suddenly as it should were the sun and moon of perfectly smooth outline, but that there exists for a moment or two a crescent of minute gleaming points of light, called Baily's Beads. These are due to the irregular outline of the moon (*i.e.*, its mountains and valleys) whereby the sun is left uncovered here and there for a moment after the disc representing the size of the moon if smoothed out would have covered it.

Shadow Bands. — When totality is nearly due and there remains but a small crescent of sun left there can often be seen on the ground or on the walls of buildings striations of light and shade, not very definite in outline but something like a sheet of corrugated iron, moving moderately rapidly perpendicular to their length. These are termed the shadow bands and are due to corrugations introduced into the nearly plane waves of light reaching us from the sun owing to irregularities in the refraction of the earth's atmosphere.

VI. ECLIPSES OF THE MOON

The phenomena attending eclipses of the moon are not of great astrophysical interest nowadays. Owing to the earth's atmosphere there is never complete darkening of the lunar surface. Even at mid-eclipse there is sufficient light refracted to make it visible as of a dull ruddy hue. The reddening is due to the absorption of the blue rays in our atmosphere. The brightness of the moon in eclipse varies considerably presumably owing to the variability of our atmospheric conditions, cloudiness and suspended dust, etc.

VII. TABLE OF THE PRINCIPAL TOTAL ECLIPSES OF THE SUN IN THE 20TH CENTURY A.D.

We omit those eclipses which are visible only in polar regions or are of excessively short duration. The first column gives the date of the eclipse, the next the duration of totality, the third the node near which the eclipse occurs and the number of the Saros series to which it belongs, repeated eclipses having the same number. The last column states where the eclipse is visible.

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ANCIENT ECLIPSES

It is not surprising that, in ancient times when eclipses were regarded as portents, a large number of eclipses should have been mentioned in history or in literature, in addition to those which are recorded in astronomical treatises or on astronomical tablets.

The value of these records may be classified as follows: (1) Literary *and* historical, depending on the interest which they aroused, the notice taken of them, and their connection with events. (2) *Chronological,* in so far as they enable us, by computing their dates, to verify chronological systems resting on other evidence and to supply dates for events connected with the eclipses. (3) Astronomical, including the determination by ancient astronomers of the periods and motions of the sun and moon, and by modern astronomers of the mean rate of change of those motions, which, in astronomical terminology, is called secular acceleration.

Literary and Historical References. — (I) Chinese. In the *Shu* King or Book of Historical *Documents* it is stated that Hsi and Ho (the hereditary astronomers) had neglected the duties of their office and were abandoned to drink in their private cities. The king, Chung K'ang, placed the marquis of Yin in command of an army with instructions to punish them. The marquis issued a florid address to his troops in which he referred to Hsi and Ho having neither heard nor known anything on a recent occasion when "the sun and moon did not meet harmoniously in Fang." The phrase is taken by all Chinese scholars. ancient and modern, to mean an eclipse. It would therefore appear that a military expedition was sent to punish the two astronomers for failing to observe an eclipse. There are good reasons for believing that this part of the *Shu* King is a literary restoration, made to take the place of books that were burned by imperial order in 213 B.C., but sufficient is found in a quotation made by Tso before that disaster and in the statements in the Bamboo Annals also made before that date, to prove that the reference to the eclipse is authentic, though its relation to the supposed offence of Hsi and Ho is doubtful. Attempts have been made to identify this eclipse, but the necessary data are wanting. It may easily have been a small eclipse, and the number of the month is given differently in different texts. The received Chinese chronology places the accession of Chung Kang in 2159 B.C. The Bamboo Books, where chronology is probably nearer to the truth, place that event in 1952 B.C.

The Shih King, or Book of Poetry, contains a lamentation caused by an eclipse of the moon, followed by an eclipse of the sun. The dates are clearly defined and are found to agree with the lunar eclipse of Aug. 21 and the solar eclipse of Sept. 6 in 776 B.C.

The eclipses recorded in the Spring and *Autumn Annals* possess a chronological and astronomical rather than a literary interest.

(2) Assyrian. — The Assyrian eponym canon, which preserves the names of the annual magistrates who gave their names to the years, records under the year which corresponds to our 763–762 B.C.:—"Insurrection in the city of Assur. In the month Sivan the sun was eclipsed" The reference must be to the eclipse of the sun on June 15 in 763 B.C. A reference to the same eclipse has been found in Amos viii. 9, "And it shall come to pass in that

day, saith the Lord God, that I will cause the sun to go down at noon, and I will darken the earth in the clear day."

(3) Greek.—In the Odyssey Homer twice makes the unrecognized Odysseus predict that Odysseus will return "as the old moon wanes, and the new appears," that is, at new moon, when alone an eclipse of the sun is possible. In one of these passages he predicts vengeance on his wife's suitors. On the day when Odysseus was to become known and slay the suitors, the seer Theoclymenus notes among other portents of gloom that "the sun has perished out of heaven, and an evil mist has spread over all." This was interpreted by Plutarch and Eustathius as a total eclipse of the sun. Some modern scholars have regarded it as merely a vision of the seer. Schoch (the Observatory, xlix. [1926] pp. 19–21) has suggested an identification with the solar eclipse of April 16 in 1178 B.C., which was total in or near Ithaca. But it is not improbable that the story of the eclipse belongs to legend rather than to history.

In a fragment of a lost poem by Archilochus occur the words:—"Nothing there is beyond hope, nothing that can be sworn impossible, nothing wonderful, since Zeus, father of the Olympians, made night from mid-day, hiding the light of the shining sun, and sore fear came upon men." According to Aristotle the words come from a passage, abusing a lady, probably Archilochus's former *fiancée* Neobule, who is supposed to have belonged to Paros. The life of Archilochus was divided between Paros and Thasos. The phenomenon described has been identified as the total eclipse of the sun on April 6 in 648 B.C.

Small fragments survive of other poetic descriptions of eclipses. and the ninth paean of Pindar, addressed to the Thebans, takes an eclipse of the sun as its theme. Sandys translates the opening lines as follows:—

"Beam of the sun! O thou that seest afar, what wilt thou be devising? O mother of mine eyes! O star supreme, reft from us in the daytime! Why hast thou perplexed the power of man and the way of wisdom, by rushing forth on a darksome track?"

Pindar then proceeds to speculate on the meaning of the eclipse as a portent. The poem probably refers to the solar eclipse of 463 B.C., April 30, which was nearly total at Thebes.

The most fampus of ancient eclipses was a total eclipse of the sun which happened according to Herodotus during a battle between the Lydians and Medes. The portent induced them to cease from fighting and conclude peace. Herodotus further informs us that Thales of Miletus predicted this eclipse to the Ionians for the very year in which it happened. Babylonians were certainly predicting eclipses about this time by means of the 18 years' cycle known as the Saros. But, as that cycle gives eclipses for every year, the statement about Thales must, if true, mean that he predicted that an eclipse of the particular year would attain a great magnitude. Such a prediction can be made by the 18 years' cycle without any mathematical computation. The eclipse was certainly that of 585 B.C., May 28, and must have been predicted by means of the eclipse of 603 B.C., May 18. Several ancient writers have preserved 585 B.C. or some neighbouring year as the date of the eclipse.

Thucydides comments on the frequency of eclipses during the Peloponnesian war. The most interesting of these were the solar eclipse of 431 B.C., Aug. 3, when, we are told, "the sun assumed the shape of a crescent and became full again, and during the eclipse some stars became visible," a statement that agrees well with modern computation, and the lunar eclipse of 413 B.C., Aug. 27. That date had been selected by the Athenian commanders, Nicias and Demosthenes, for the departure of their armament from Syracuse. All preparations were ready, but the signal had not been given, when the moon was eclipsed. The soldiers and sailors clamoured against departure and Nicias in obedience to the soothsayers resolved to remain thrice nine days. This delay enabled the Syracusans to capture or destroy the whole of the Athenian fleet and army.

The year 310 B.C., Aug. 15, is the date of a total eclipse of the sun, which, as we are informed by Diodorus and Justin, was seen by Agathocles and his men the day after he had sailed from Syracuse on his way to Africa. Modern computations of the eclipse track render it probable that he sailed to the north of Sicily.

In Plutarch's Dialogue on the Face which appears in the Orb of *the* Moon, one of the characters, called Lucius, deduces from the phases of the moon and the phenomena of eclipses a similarity between the earth and the moon and illustrates his argument by means of a recent eclipse of the sun, "which, beginning just after noon, showed us plainly many stars in all parts of the heavens, and produced a chill in the temperature like that of twilight." A little further on Lucius refers to a certain brightness which appears round the moon's rim in total eclipses of the sun. Nicolaus Struyck identified this eclipse with that of A.D. 71, March 20, and the identification has been confirmed by Ginzel after a very exhaustive discussion. There are numerous other references to eclipses in Greek literature.

(4) Roman.—There is a very large number of eclipses recorded in Roman history. One which has attracted the attention of students alike of astronomy and of the Roman calendar is stated by Cicero to have occurred in the 350th year from the foundation of Rome and to have been described by the poet Ennius as follows:—"On the Nones of June the sun was covered by the moon and night." This would appear to have been the solar eclipse of 400 B.C., June 21, which reached a total or almost total phase at Rome a few minutes after sunset. It seems to show that in that year the calendar month of June began 16 days later than in the calendar as reformed by Julius Caesar.

The eclipse of the moon in 168 B.C., June 21, has attracted much attention. The Romans were at that time at war with Macedon, and Polybius informs us that the eclipse of the moon was interpreted as an omen of the eclipse of a king and thus encouraged the Romans and discouraged the Macedonians. Cicero states that Sulpicius Gallus explained the eclipse on the following day, while Livy states that the eclipse was predicted by Gallus and took place on the night before the battle of Pydna, which, according to him, was fought on Sept. 4 of the Roman calendar of that time. It seems clear that the story has grown with repetition and that there is no evidence that the eclipse was predicted or that it was on the night before the battle of Pydna.

Use of Eclipses for Chronological Purposes.—Although no continuous era has been used since ancient times, dates are frequently expressed in terms of regnal years, or are named after consuls or other officials of whom lists have been preserved. In these cases it is important to be able to equate certain specific years thus defined with years before the Christian era. This can be done whenever the date of an eclipse or other identifiable and calculable astronomical phenomenon is given in an ancient record.

The received Chinese chronology can be confirmed accurately by eclipses from 719 B.C. onwards. The chronology of Ptolemy's canon of kings, which gives the Babylonian series from 747 to 539 B.C., the Persian series from 538 to 324 B.C., the Alexandrian series from 323 to 30 B.C., and the Roman series from 30 B.C. onwards, is confirmed throughout by eclipses. The eclipse of 763 B.C., recorded in the eponym canon, enables us to carry the chronology back with certainty through the period covered by that canon, to 893 B.C. Assyrian, Babylonian and Persian chronology provide a stable chronology for the countries with which Assyria, Babylon and Persia came into contact, but there is no check from eclipses on Greek or Egyptian historical chronology before the Persian period. Identifiable eclipses recorded under named Roman consuls extend back to 217 B.C. The dated eclipses of Ennius and Pydna and one in 190 B.C. can be used to determine the position of Roman calendar months in the natural year, and occasionally eclipses help us to fix the precise dates of a series of events, such as those connected with the Athenian disaster at Syracuse.

Use of Eclipses for Astronomical Purposes.—(I) *In Ancient* Astronomy. It would appear that at least from the time of King Nabonassar (747 B.C.) a dated canon of astronomical observations was preserved at Babylon, including all eclipses. This rendered it possible to determine accurately the intervals between eclipses and must have facilitated the discovery of the 18 years' cycle, more exactly the cycle of 6,5853 days, which Suidas calls the saros, and its multiple, the 54 years' cycle of 19,756 days.

These cycles govern the recurrence of eclipses. It has been seen that Thales probably used such a cycle. In a Babylonian observation tablet of 568 B.C. mention is made of failure to observe a predicted eclipse of the moon. The eclipse is found by computation to have been real, but invisible at Babylon. It was doubtless predicted by cycle. Tables based on the saros go back to the 4th century B C. Eclipses of the moon give more accurately than any other kind of observation the actual time when sun and moon are in opposition. From an early date the Babylonian astronomers must have deduced from them not only the mean interval between two conjunctions, but the principal inequality in the motion of the moon and the similar inequality in the motion of the earth, or, as on their geocentric theory they conceived it, of the sun, and they were able to define the periods of these inequalities, which astronomers call the anomalistic month and year.

In the same way, since eclipses happen only when the two luminaries are stationed at intersections of their orbits called nodes, and since the path of the shadow in a lunar eclipse depends on the position of the centre of the sun in relation to the node, they were also able to determine the position and motion of the nodes. By assuming, what is approximately true, that the saros of 6,5853 days contained an exact number (a) of synodic months, or revolutions of the moon measured from the sun, (b) of anomalistic months, or revolutions of the moon measured from her apogee or perigee, that is, from her furthest removal from and closest approach to the earth, and (c) of draconic months or revolutions of the moon measured from her node, the early astronomers, perhaps in the 6th century B.C., computed the relative motions of the sun and moon, the lunar perigee and apogee, and the nodes. About 500 B.C. Naburiannu, apparently from a more accurate study of eclipse observations, obtained improved values which for the motion of the moon from the sun were 10″ per annum too small, for the moon from her perigee 20″ per annum too great, and for the moon from her node 5″ too small. Still more accurate values were obtained by Kidinnu about 383 B.C., from whom they passed to the Greek astronomer Hipparchus. In the system of Naburiannu the distance of the moon from her node was used for the prediction of the magnitude of lunar eclipses.

(2) *In Modern* Astronomy.—Ancient eclipses are of the highest value for the determination of "secular accelerations," that is, for the determination of the progressive, as distinct from the periodic, changes in celestial motions. Edmund Halley asserted in 1695 his belief that the moon's motion was subject to acceleration, but did not specify the amount of the acceleration. In 1749 Richard Dunthorne demonstrated from a comparison of the recorded with the computed times of eclipses distributed over 2,000 years that such an acceleration existed and assigned to it the value of 10″ a century. By this is meant that the effect of the acceleration is to produce an advance of 10″ in the moon's longitude in the course of a century. Laplace in 1786 discovered that such an acceleration should be the gravitational effect of the secular diminution in the eccentricity of the earth's orbit. But J. C. Adams showed in 1853 that the acceleration due to this cause amounts to 6″ only in a century. The residue must be explained by other causes.

The most recent values are 11″ a century acceleration of the moon, of which 5″ is unexplained, and about 1·5″ a century for an acceleration of the earth's motion suggested by P. H. Cowell in 1905. It is usual to regard the latter as an apparent effect of a retardation of the earth's rotation, which is our standard of time. This should produce an apparent acceleration of the Moon 13·4 times as great as that of the earth. But, since the unexplained acceleration of the moon is only about 3·3 times as great as that of the earth, it becomes necessary to suppose that there is a real secular retardation of about 15″ a century in the moon's motion. It is commonly supposed that tidal friction is the main cause of both retardations. (*See* MOON.)

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ECLIPTIC, in astronomy, is the great circle on the celestial sphere which forms the apparent path of the sun in the course of the year. The twelve constellations or signs of the zodiac are arranged along the ecliptic. The plane of the ecliptic is the plane of the earth's orbit, or more strictly the plane in which the centre of gravity of the earth and moon revolves round the sun; it meets the celestial sphere in the great circle above mentioned.

ECLOGITE, in petrology a typical member of a small group of rocks now recognized as including both igneous and metamorphic representatives, and of special interest on account of the variety of minerals they contain and their geological relationships. The eclogites (from Gr. ἐκλογή, a selection) are mostly coarse-grained and massive aggregates of green monoclinic pyroxene and red garnet, but some varieties possess green hornblende wholly or partly replacing the pyroxene, thus giving rise to the two important groups—the pyroxene and the hornblende eclogites. The minerals associated with these essential constituents include rutile, apatite and iron ores, and, less commonly, quartz, muscovite, zoisite, cyanite, albite, bronzite, olivine and chlorite. The eclogites correspond closely in bulk composition with the gabbros and dolerites, but are characteristically assemblages with high density (3·2–3·6 as compared with gabbro 2·9–3·0).

The pyroxenes show considerable variation in composition, and include both non-aluminous and aluminous varieties. The latter contain significant proportions of the jadeite and aegirine molecules and correspond to true omphacite. The red garnet is a pyrope-rich variety containing almandine and grossular, but is not so magnesia-rich as the garnet found in serpentines and peridotites. The hornblende is usually a green variety—smaragdite, or alkali-hornblende sometimes approaching glaucophane in composition.

Whether of metamorphic origin or considered as igneous rocks consolidating under excessive pressures, the almost complete absence of plagioclase felspar makes these rocks of peculiar interest. The omphacite-garnet assemblages have undoubtedly crystallized under high pressures, in place of augite, olivine and plagioclase in accordance with the principle of Van't Hoff and Le Chatelier. Magnesian garnet appears in place of the olivine-anorthite pair, and a jadeite-chloromelanite-bearing pyroxene in place of the augite-plagioclase combination of the heteromorphous gabbros.

Under the name griquaite, eclogites are found as blocks or boulders in the kimberlite "pipes" of the diamond fields of South Africa. This pyroxene-eclogite is of special interest inasmuch as diamonds have been found as enclosures of the garnet of the rock, and according to one prevailing view eclogite is the parent rock of the diamonds of the South African fields, the diamonds of the "pipes" being derived from the explosive disruption of deep-seated masses of diamantiferous griquaite.

That some eclogites are of metamorphic origin is clearly revealed by their geological associations and microscopic structures. Such often appear as lenses intercalated among crystalline schists and show unmistakable crystalloblastic structures.

Others, such as those of western Norway, occur as lenticular masses in granite gneiss or bands in olivine rocks (peridotites, dunites or their serpentine derivatives). These rocks possess no true crystalloblastic structure, and are believed to be unaltered igneous rocks. Probably some eclogites from other areas previously believed to be transmuted gabbros are of similar origin.

The amphiboles of the eclogites may represent either a direct crystallization from the magma, or arise by metamorphic processes from original pyroxene, and it is not improbable that many of the so-called "garnet-amphibolites" of archaean tracts are transformed eclogites. The clear recognition of eclogites as primary magmatic consolidations under high pressures has led to the conception of an eclogite zone in the earth's crust immediately below the more acid silicate shell. At depth magma of basaltic

or gabbroid composition may exist stable as solid eclogite, and it is possible that in this zone is to be discovered the source of the eclogite blocks of the kimberlite "pipes."

The chief localities for eclogites are archaean and palaeozoic metamorphic-igneous complexes. They are known from Sutherlandshire, western Norway, Saxony, Bavaria, the Alps, Austria, Greece and California. Glaucophane and jadeite-eclogites occur in Italy. The following analyses represent the compositions of some typical eclogites:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	TiO_2
	57·10	11·66	2.84	3.22	6.37	13·80	2·21	0·81	
	48·22	16·51	2.64	5.78	8.26	13·46	3·23	0·47	1·07
3	44·91	17·15	1·68	6·45	14·27	11·28	1·01	0·89	0·46
4	44·15	15·68	1·81	15·88	5·70	7.37	2·70	1·89	3·21

1. Cyanite-bearing eclogite, Eppenreuth, Fichtelgebirge, Bavaria.
2. Hornblende eclogite, Burgstein Otztal, Tirol.
3. Griquaite, Premier Mine, Kimberley, South Africa.
4. Glaucophane-bearing eclogite, San Martin, California.

(C. E. T.)

ECLOGUE, a short pastoral dialogue in verse. The word is conjectured to be derived from the Greek verb ἐκλέγειν, to choose. Another derivation traces it to αἴξ, goat, and λόγος, speech, and makes it a conversation of shepherds. The idea of dialogue, however, is not necessary for an eclogue, which is often not to be distinguished from the idyll. The grammarians, in giving this title to Virgil's pastoral conversations (Bucolica), tended to make the term "eclogue" apply exclusively to dialogue. The Eclogues of the Spanish poet Garcilasso de la Vega (1503–36) are still admired. See also BUCOLICS; **PASTORAL.**

ECOLOGY, ANIMAL. Animal ecology is rather a difficult subject to define, because it lies on the borderlines of so many other subjects, and also because comparatively little work has so far been done on it, so that its exact scope and limits still remain to be established. In a general way animal ecology seeks to give some definite form to the vast number of observations which have been accumulated during the last few hundred years by field naturalists and various other people interested in wild animals. It was Haeckel who first invented the word "oecology" in the year 1869; but, owing to the predominantly morphological and physiological interest which was taken in animals during the latter half of the 19th century, the subject that he so named was largely ignored by zoologists. It was the botanists who developed further the idea of studying scientifically the relations between the plants and their environment, and when American botanists, and later, American zoologists, began to produce a great deal of important work in ecology during the beginning of the 20th century, the "o" was gradually dropped and the word was adopted in its present form, although the older spelling is still widely used on the Continent. "Ecology" corresponds to the older terms "Natural History" and "Bionomics," but its methods are more accurate and precise, and, while much of the earlier work was centred upon the study of adaptations with the idea of proving the theory of natural selection, the modern trend is in a different direction. Ecology is now concerned more with an attempt to reduce and co-ordinate into some scientific scheme the existing information (which is enormous, but appallingly scattered) on the habits, life histories, and numbers of all the different animals, with a view to solving some of the urgent practical problems which are cropping up everywhere as a result of man's becoming civilized and interfering with the animal and plant life around him. Professor **J. A.** Thomson has rather aptly called animal ecology "the New Natural History," and has pointed out that, although it can never reach in its methods "the icy perfection of comparative anatomy" yet it has nevertheless an important gap to fill in biological work. To say that animal ecology deals with "the relations of animals to their environment" is to give a formal definition that conveys no idea whatever of the manifold and exciting problems with which the ecologist has to deal. Instead, therefore, of endeavouring to force the subject into a strait-waistcoat, it will be more to the point to begin by describing a few examples, selected more or less at random, of the type of problem which may confront the animal ecologist working in the field. We can then proceed to inquire what stock of information we possess at the present time; the uses which can be made of it; and then we may be in a position to suggest the most desirable methods of classifying this information, and the lines along which research upon the ecology of animals may best be directed in the immediate future.

During the winter of 1910–11, a deadly epidemic of pneumonic plague broke out in Northern China, and killed off about 60,000 Chinamen. This outbreak originated from a previous epidemic amongst the tarbagans or wild marmots (Arctomys bobac) which inhabit the semi-desert steppes of Mongolia, and are the most dangerous reservoir of plague in that region. We now know, through the researches of Wu Lien-Teh and others, that this marmot only suffers from really severe outbreaks of plague at comparatively long intervals (about every ten years), at times when the numbers of the animals have for some reason become too great, and the population in consequence too dense. This overcrowding favours the spread of the plague bacillus, and produces suitable conditions for epidemics in the marmots; when these occur, any accidental contact, causing infection to spread to a man, enables the bacilli to spread through the Chinese population, which in its turn is usually overcrowded. From this point, the epidemic spreads from one person to another by the breathing of infected air, after the manner of influenza. A climatic factor comes in here, for it is only in countries with a moist cool climate that widespread epidemics of pneumonic plague occur; in hotter and drier regions the bacilli of plague cannot be successfully carried about in the droplets of moisture breathed out by infected people. In these hotter countries, *e.g.,* India and South Africa, plague occurs in the bubonic form, and is transmitted by the bites of fleas, which in turn have become infected with bacilli from rats or other rodents.

The complete cycle of events in China is not, however, entirely to be explained by the marmots, for it is an interesting fact that before about 1890 severe epidemics of plague in man were much less frequent in that region. The increase in modern times has probably been due to two other factors: the arrival of a great many Russian immigrants from the west, partly as a result of the establishment of the Trans-Siberian railway, which runs for part of its way straight through the marmot country; and also the penetration of Mongolia in recent years by an increasing number of Chinese colonists from the south-east. These new arrivals, being ignorant of the deadly nature of sick marmots, appear often to have handled them carelessly or eaten them, and so contracted plague, in some cases starting huge epidemics in the human population, like the one mentioned above, or like that which took place in 1921 and killed about 9,000 Chinamen.

The example just given illustrates the varied nature of the knowledge required for the complete solution of problems in animal ecology. Here the problem touches on zoology, medicine, bacteriology, climatology, history, human population problems, ethnology—to mention only the most obvious subjects involved.

The example of plague in Chinamen also illustrates the fact that man's relation to his environment (especially to his animal environment) may become suddenly strikingly altered when he migrates to a new part of the world. Most primitive peoples have settled down into a more or less harmonious relationship with the animals and plants of their own country. The Red Indians of North America, or the natives of Siberia, usually took care not to kill too many of the animals upon which they depended for food, so that the stock would not become exhausted—any failure to follow this principle would result in starvation and extinction of the tribe; and according to Percival the Masai of Central Africa have long been aware that malaria is carried by mosquitoes—in fact, their word for catching malaria means literally "I have been bitten by a mosquito." In England we have been here long enough to have settled down into a fairly comfortable balance with the animal community of which we are privileged members; but in the newer colonies, we see the effect of man's interference

with the balance of nature demonstrated in very remarkable ways.

The Hawaiian islands afford a number of very interesting cases of this sort. The sugar-cane leaf-hopper (Perkinsiella *saccharicida*) was introduced by accident towards the end of the 19th century, and, having no natural enemies, it flourished greatly. It was first noticed as a pest about 1887, and by 1902 it had increased to an enormous extent, so that on one plantation the sugar production fell in three years from 19,000 tons to 7,000. Perkins and other workers studied the insect in its native haunts in Australia, and after trying several different natural enemies, succeeded in almost completely controlling the leaf-hopper by introducing into Hawaii a Chalcid wasp (Paranagrus *optabilis*) from Queensland, with an allied species from Fiji, both of which parasitize it. Eighteen months later the leaf-hopper damage fell to about half its former proportions, and next year about three-quarters of the plantations were under control. Later on, a Capsid bug (*Cyrtorrhinus mundulus*), which sucks the eggs of the leaf-hopper, was also successfully introduced from Queensland. There are now comparatively few sugar-cane leaf-hoppers left in Hawaii, although in some years revivals in numbers tend to occur, and these have to be checked again.

A third example of an ecological problem is that of the rype or willow grouse (*Lagopus lagopus*) in Norway. Of late years this bird has become increasingly scarce in Norway, and since it is an important game bird a number of people have investigated its ecology with a view to finding out why it has become so much reduced in numbers. It appears that in earlier times (until about 1900) the willow grouse used to be subject to very marked and at the same time very regular fluctuations in numbers, and that one of the factors producing this was a coccidian protozoan (*Eimeria avium*) which gave rise to epidemics among the willow grouse whenever the latter became overcrowded. Some other factors appear to have been at work in controlling the actual years of abundance also, since the willow grouse cycle coincided very closely with the similar three or four year cycle in lemmings and mice in Norway, which also have periodic epidemics, but of an entirely different nature. It appears that in recent years the epidemics in grouse have become much more frequent and severe, so that the population is kept permanently at a very low ebb, and increase up to the abundance of former "crown years" is no longer possible. The explanation of this state of affairs which has been put forward by Brinkmann is this: normally the number of sick individuals in the coveys of willow grouse is kept down by birds of prey, for the heavy infestation by the parasite has the effect of reducing the flying power of birds, so that the sick are more easy to catch than the healthy. In this way the proportion of heavily infected birds, even in epidemic periods was always kept below a certain level; but in recent years birds of prey have been persecuted and greatly reduced in numbers, owing to the damage they do to poultry, etc., on farms. In consequence it seems that the ground occupied by the willow grouse has become very heavily infected with the spores of *Eimeria*, and the density of the parasites has increased to such a point that the grouse have epidemics nearly every year, instead of every four years. Besides being interesting in other ways, this example illustrates how the obvious idea of enemies being hostile to their prey fails to hold good when we are dealing with the regulation of numbers. Here the hawks were by their actions increasing the density of the willow grouse, instead of merely tending to reduce it.

It would be possible to give an indefinite number of similar examples all tending to show the immense importance to mankind of a knowledge of the means by which the numbers of animals are controlled, or of the factors in the environment which affect the life histories and distribution of the various species. It is not surprising to find that man's inter-relations with other animals bulk very large in the picture, since man himself is only one animal in a huge community of other ones, and is still subject to many of the same influences as the wild species. Malaria and mosquitoes; sleeping sickness and tsetse flies; earthworms in the soil; the control of nitrogen bacteria by protozoa in the soil; the enemies of crops, of timber and of other resources; the conservation of the supply of game, or of marine fisheries; the ravages of hookworms among tropical peoples; rats as reservoirs of diseases such as plague and jaundice, or as the destroyers of produce; the control of insect pests by birds; the effects of climate upon man himself—all these are ecological problems, requiring for their solution a background of ecological principles, and an ordered and skilfully organized knowledge of animal ecology. Human civilization is faced in many parts of the world with grave economic and medical problems, which can only be solved successfully along ecological lines, and it seems quite possible that unless they are solved in time, the civilization will be in danger of sinking gradually and collapsing under the strain, or at any rate of becoming too unpleasant to be worth retaining. At the very least, animal ecology has an important and very urgent contribution to make towards the world's happiness. This is probably not widely realized: five years ago an eminent zoologist remarked that ecology was only playing with science, while an equally famous entomologist was heard to say that ecologists were an obscure sect of the followers of Lamarck.

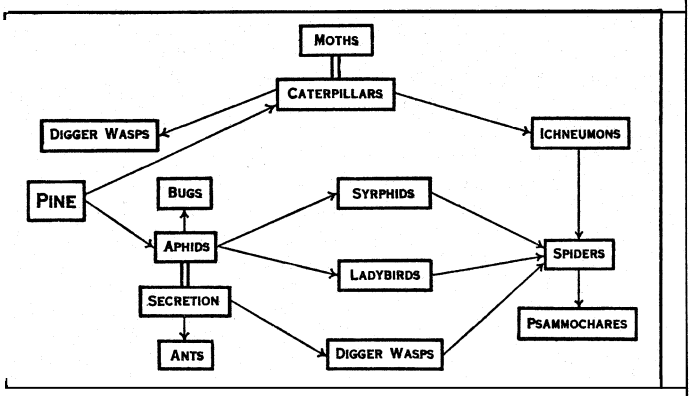
Having to some extent made clear the scope of animal ecology, we may now proceed to take stock of our general knowledge. What information is there about wild animals? Animal ecology is in rather a peculiar position, for there is an enormous amount of information in existence about the habits, distribution and numbers of wild animals, but much of it is either recorded in an unsuitable way and is therefore useless, or else only to be found in an extremely scattered form. A great many of the facts about animal life are never published at all, either because the observers have not the opportunity or training to describe them, or because they do not realize the value or significance of the data. The subject thus resembles a large nebula floating round in space: it will be some time before all the separate particles become condensed into a solid body. Another peculiarity of animal ecology is that many of the most interesting observations are made by people who are not scientifically trained at all—gamekeepers, fishermen, lighthouse keepers, clergymen, country gentlemen, amateur naturalists (but most of these are collectors only) or travellers; or if they are scientists, they are often not actually zoologists, but probably doctors, experts in forestry or agriculture, or travellers with an eye for the interesting and unusual. As a result, there exists, as we have said, a very large, but peculiarly diffuse body of facts about the life and manners of wild animals. There is hardly any journal which is not capable of being of some use to the ecologist. Periodicals on meteorology contain elaborate analyses of the behaviour of animals during thunderstorms, or the times of arrival of migrant birds in spring; the daily press often records "plagues" of animals like ants and mice, which pass unnoticed by more sober journals; engineering magazines may record examples of pests which attack marine timber works, or describe the animals found in water supplies, or cases of caterpillars holding up railway trains. The key fact for which the ecologist is looking may be firmly embedded in the middle of a work of travel mainly devoted to railway systems, or the songs of the Copper Eskimos, or the religion of the Bhotias. The immediate tendency (at any rate the immediate need) in ecology is for the co-ordination of these scattered facts, for the digestion of these gigantic boluses of unassimilated first-hand observations; and lastly, and most urgently of all, we require ideas, to link up all these stray facts into an effective whole. The proportion of facts to ideas in animal ecology is at present indigestibly high; the journals of ornithology and entomology are swollen fat and heavy with such valuable, but unassimilated matter.

What, then, are the lines along which this organization should proceed? In the following pages an attempt will be made to indicate the most promising of these lines, and at the same time to describe the more important principles which have already been established. The general thread running through this account is as follows. Animal ecologists doing pure research have carried out a number of ecological surveys, established the habitats of a number of animals, and gained some insight into the nature and workings of their environment, together with some idea of the ways in which environmental factors affect a few species. At

the other end of the subject, there are hundreds of economic entomologists and other zoologists, who are studying problems concerned with the number of animals, and who are in need of a basis of principles upon which to work. The gap between these two groups of ecologists will have to be bridged by professional ecologists studying the organization of animal communities. For it is found that by analyzing the lists of animals from different habitats and arranging the species according to their food-habits, it is possible to obtain just the kind of data required for the solution of the more practical problems connected with animal numbers and their control. One of the tasks of ecologists at the present time is to provide a system of basic principles which can be used by other people such as medical investigators, or evolutionists, or botanists, or economic zoologists working in the field.

ECOLOGICAL SURVEYS

The first step in the study and consideration of the animal ecology of any region is the carrying out of a primary ecological survey; this involves (a) the collection and listing of all the species of animals found in the district and (b) the description, in as accurate a way as possible, of the exact habitats of all the animals which have been collected. The first part of this task is more easy than the second. For many countries we now have a fairly clear idea of the species which occur there, and of the general distribution of each. In some countries (England among them) this sort of work has rather tended to run to seed, and has often degenerated into the accumulation of lists which refer to districts which may have quite arbitrary limits, bearing no relation whatever to the ecological habitats of the various animals. For instance, natural history societies frequently spend considerable energy in making lists of animals for counties, or for the country within a certain radius of some town. Such lists are almost, if not altogether, useless. They show how a means can easily be confused with an end. The second point is the importance of collecting, with all specimens, ecological notes about the habitats of the animals. In order to do this properly, it is of course necessary to have good topographical and geological maps, together with maps of, or at any rate organized information about, the plant associations, and also if possible meteorological and climatological data for the district. With such information at hand, it is possible to define in a rough, but useful, preliminary



FROM O. W. RICHARDS, IN THE 'JOURNAL OF ECOLOGY" (OXFORD UNIVERSITY)

FIG. 1.— DIAGRAM OF FOOD-RELATIONS ("FOOD-CYCLE") IN AN ANIMAL COMMUNITY LIVING UPON YOUNG PINE TREES, IN THE SOUTH OF ENGLAND

The arrows point from the organism eaten to that eating it, and the parallel lines indicate different stages or products of the same animal

way the general habitats and distribution of the different species of animals. Fortunately the necessity of recording the exact habitats of animals is becoming widely recognized, even among collectors of insects. Organized ecological surveys have been started in many places during recent years. The fine work of the American Bureau of Biological Survey, both in the U.S.A. and in Canada; Wesenberg-Lund's comprehensive studies of the freshwater animals of Denmark; the work of Annandale in India, and of Johansen in Arctic Canada and Greenland; these are examples of the movement for obtaining an organized knowledge of the ecological distribution of animals. In England, very few such surveys have as yet been carried out with anything approaching completeness, but we may mention the survey by Richards of animal communities living in various habitats on Oxshott common; that of freshwater Crustacea in the English lakes by Gurney; of freshwater animals in Welsh streams by Carpenter; and certain valuable work on marine plankton communities in the North sea, by Hardy and others. But the general ecological distribution of English animals has at present often to be left to the imagination, or to be deduced from analogy with what is known from the Continent. This applies more particularly to our knowledge of the *animal* environment (food, enemies, parasites, etc.) of species. The numerous local natural history societies (over 50 in number) which exist all over the British Isles, form a skeleton organization for this sort of enterprise, which, like the tides, has still to be harnessed and directed along the most useful lines. For details of carrying out surveys, and collecting animals, the reader is referred to the relevant sources at the end of this article.

When the preliminary stage of making lists has been reached and completed certain facts about the distribution of animals in nature begin to emerge. The first is that the habitats of animals —those various combinations of environmental factors which affect them and control their occurrence and numbers—can be classified and arranged in a large number of ways. Secondly, each different habitat possesses its own characteristic community of animals. The number of different habitats in which animals can be found living is at first sight bewilderingly great. Almost wherever one looks animals can be found in greater or less variety; on the bottom of the sea at a depth of several miles; in the throats of turkeys; in the baleen plates of a whale; in hot springs; on the snow of high mountains; living and feeding on the algae which, in turn live among the hairs of the sloth; on the bottoms of ships; in stores of food (there is a moth whose larva lives on tobacco and strychnine); on the surface film of water; in the pools of acid water found in tree-holes; in lichens on the surface of windswept rocks; not to speak of the vast number of more obvious habitats afforded by vegetation, soil, and water. How are we to classify these different habitats in a convenient way, so as to avoid the reproach usually levelled at ecologists, that the subject is nothing but a chaotic mass of unrelated facts? It is obviously imperative to have some scheme in order to provide a common system to which all the detailed records of animals by habitats can be referred, and in order to understand their distribution in nature. There are three useful ideas which help to reduce the chaos to order:

Gradients in the Environment.— There are a number of clearly marked gradients in important or controlling environmental factors which enable us to arrange some of the habitats, and therefore their animal communities, in definite series. A good example of this is the gradient in temperature and light which runs from the poles to the equator. Along this gradient the conditions change gradually through arctic, subarctic, and other zones to tropical conditions, and at the same time produce corresponding changes in the animal and plant communities. A fact which immediately emerges is the enormous influence that vegetation has upon the nature of the animals' habitats. Climatic factors do, of course, act directly on animals, but a great deal of their influence is felt indirectly through plants, which frequently change the whole character of the climate, as far as the animals are concerned. For instance, the light intensity inside a pine wood may be only about half that outside, with the result that animals living among pine needles occupy, in the daytime, conditions similar to those at dusk outside in the open. Another effect of plants is to create a much wider variety of "climatic" conditions (*e.g.*, humidity) than would otherwise exist, so that a more varied choice of habitats is open to animals, with consequent multiplication of the number of species. Again, plant associations are usually rather sharply marked off from one another, owing to the way in which dominant plants compete for light and food, so that the animal communities within them tend also to be rather more sharply separated from one another than they would otherwise be. This separation is well shown in the zones

found up the sides of mountains, where we find altitude corresponding to latitude—a phenomenon seen at its best in the Himalaya, where a traveller can sometimes listen to English and tropical birds calling at the same time in their different zones. These have been termed "life zones" by American ecologists, and the animal communities living in them have been more fully studied in North America than anywhere else, partly owing to the grand scale upon which they can be seen on the sides of the Rocky Mountains. In this connection the work of Grinnell and Storer on the life zones of the Yosemite region in the Sierra Nevada should be consulted, as one of the best examples of the way in which preliminary surveys can be carried out. The method of zoning animal communities with reference to some master factor in the environment is a useful one, and many such gradients can be found in nature. For instance, there is the vertical gradient in light and oxygen in the sea, or in freshwater lakes; the vertical gradient in salt content of water as we pass from alpine lakes down to the sea; gradients in water content of the soil, which are responsible for well-defined zones dominated by different species of plants; many more examples of this nature could be quoted.

Ecological Succession.—The second important idea which can be profitably used in arranging animal communities, is an extension of the one just described. This is the idea of ecological succession or orderly changes of the habitats from one into another. Important changes, usually rather slow ones, are continually taking place in the environment—rivers change their course, with corresponding destruction of existing land and formation of new; the climate changes from a temperate one to an arctic one, with the advance of an ice-sheet; the land rises or falls; valley lakes become silted up, or filled with vegetation and formed into marsh, and finally dry land. Such changes are happening everywhere, so that any one habitat seldom stays as it is for any length of time; but the most important kind of ecological succession is that caused by the "development" of vegetation. Ecological succession or development of plant communities occurs usually in a definite orderly, and predictable way, the changes being brought about mainly by the growth and decay of the plants themselves. These, by depositing humus, change the character of the soil, and are driven out and replaced by other species. There are other processes at work also (see PLANTS: Ecology *and* Distribution). The work of botanists has enabled plant communities to be arranged in series which represent their relationships both in space and time; and, in so far as animals also depend on the plants, these systems are of great importance to the animal ecologist and form a convenient means of classifying communities. The works of Tansley and Clements should be consulted in this connection. A number of papers and a few books on the classification of animal communities have been published; of the latter the most useful are Shelford's Animal Communities of Temperate America, and Haviland's Forest, Steppe and Tundra.

Communities at Different Times.—The third important principle to be used in the classification of animal communities is the fact that the character of the community in any place is always changing in a more or less periodic way. Thus in a birch wood or in a freshwater stream an almost entirely different set of species will be found active by day and by night. In the same way, the composition of the community changes according to the weather, or the tides (in the case of marine intertidal animals), or the passage of the seasons, and so on. This time-factor is an important one, and enables the field ecologist to simplify a great deal of his work, since the long lists of species with which he starts can be split up into smaller units—a great asset when he comes to work out the inter-relations of the animals. For instance, if one were studying the animals of a slow stream in England, one might find two common Crustacea, *Gammarus pulex* and *Asellus* aquaticus, living with several species of fish. The problems centring round the food supply of the different fish become simpler, when we find that Gammarus is mainly nocturnal, hiding by day under weeds and stones, while *Asellus* is quite active during the daytime.

THE FACTORS WHICH AFFECT ANIMALS

So far we have considered the surroundings of animals from a broad point of view, in order to reach a general orientation about them. It is necessary now to go a stage farther and try to analyze these general habitats (*e.g.*, "The Alpine zone," "an Oak wood," "the bottom of a lake") into their constituent factors. We are immediately brought up with a jerk against the fact already pointed out, that the animal ecologist requires a variegated and rather queerly assorted knowledge of subjects which are not biological at all, and many of which may never have been encountered during his training as a scientist. He is in the position of having to correlate the behaviour and occurrence of animals with botanical or inanimate phenomena which are studied by specialists, highly trained in their own lines of work. There is in existence a rather rich literature on the subject of the physical and chemical environments of animals, much of which has been accumulated by ecologists (see "Ecology" passim, and such works as Whipple's Microscopy of Drinking Water and Murray's Depths of the Ocean). The distribution and numbers of animals can be correlated with climatic factors, the gas content of waters, the soil temperature, and other such factors. Theoretically a very large amount of this work lies within the province of the meteorologist, the chemist, or the hydrographer, but unfortunately the data which are accumulated by these specialists are seldom exactly those required by the biologist. For this reason the animal ecologist is frequently delayed and even completely sidetracked on fundamental work which has little direct bearing on animals, although it is necessary for the ultimate solution of the problems upon which he started to work when he was younger. This obstacle is an important one from the point of view of progress in animal ecology; it explains the peculiar (and to the outsider, rather pointless and disconnected) nature of the literature upon the subject, the fact being that animal ecologists are really trying to do everyone else's work as well as their own, without realizing that such a feat is impossible. To attempt this is also undesirable, since there are specialists studying these other questions, while there is no one but the ecologist to study the equally urgent purely biological problems met with in the field. Progress in animal ecology will therefore probably lie along the lines of friendly co-operation with other specialists, so that ecologists themselves will have time left to study animals.

The factors which influence animals may be divided conveniently into three main groups (a) physical and chemical, (b) plants, (c) other animals. Any of these factors may affect the distribution or numbers of a species, and much scattered work has been done on different animals. This is often of great value in indicating the nature of the environment of animals and the processes going on in it, but, as far as the animals themselves are concerned, only one or two principles of importance have emerged, partly owing to a failure to appreciate the difference between ordinary factors and limiting factors. An example will make this difference clear. It has been shown that in certain parts of France the distribution of the freshwater crayfish is determined by the amount of calcium carbonate in the waters of the streams which form its habitat. This in turn is determined by the nature of the rocks which go to form the country through which the streams flow. Granite areas support few or no crayfish, while regions with enough calcium carbonate in the rocks are able to supply the material required by the crayfish for the formation of its skeleton. In this case calcium carbonate is the limiting factor to the distribution of the crayfish. No amount of work upon the oxygen requirements of the crayfish would have thrown any light upon its distribution, although it would tell us something about its physiology. Another example is that of the elf-owl (Micro*pallas* wkitneyi) which occurs in the deserts of California and Arizona This bird makes its nests exclusively in the holes made by two woodpeckers (Centurus *uropygialis* and *Colaptes chrysoides mearnsi*) in the stems of a giant cactus (Cereus giganteus). Its range in the desert is determined by these two biotic factors—cactus and woodpeckers. But the woodpeckers are not like the owl confined to the one cactus for nesting; they can also use other plants or trees, so that to them the cactus is not a limiting

factor. Returning to the owl, it will also be obvious that in part of its range it might be limited by the absence of cactus (even though woodpeckers were there); while, elsewhere, the cactus might be present but not available for nesting purposes owing to the absence of the woodpeckers. This idea of limiting factors is one of the most important ones which is used by ecologists in the course of field work; failure to realize its significance may often result (and has done in the past) in a great deal of work which is useless, ecologically speaking. (We owe the discovery of this idea to the plant ecologists.) It has often been the custom for animal ecologists to tabulate a list of the factors which act on animals, and then to pick out any one of them and study their exact quantitative mode of operation. From what has already been said it is clear that such a method will not necessarily throw any light upon the distribution of the animal under consideration. although it may reveal interesting facts about its physiology, and about the environment itself. After all, the object of ecology should be mainly to discover why animals occur in particular numbers at particular places: this can only be done by finding out the *limiting* factors and studying them.

At this point it is desirable to go back for a moment in order to reconsider the question of habitats and the best method of recording the data about them, when engaged on primary ecological surveys. What has just been said about limiting factors puts the idea of a habitat in rather a different light. Before, we were considering it as a complex one composed of numerous factors, all of equal importance or value to the animals living among them. But although all these factors exist, from the point of view of the animal's distribution and numbers the limiting factors are the ones which are of paramount importance, But in practice it is not possible to tell at a glance what are the limiting factors at work on each species, so that what actually happens is that we try to record any feature in the animal's environment with which it is constantly associated. This feature may or may not be the real limiting factor; usually it is only correlated with it. When we say that an aphid occurs on the under sides of oak leaves at a certain distance from the ground, we are only describing in a rough shorthand way the fact that it is confined to that place by, say, conditions of humidity or the nature of the plant juices produced in the leaves at that point. It should always be remembered, however, that the ultimate aim of ecological work of this sort is to be able to describe exactly the limiting factors acting on an animal, so that we may be in a position to predict what it will do under any given circumstances. It is at this point that ecology links up with physiology; for there is really no sudden break between the chain of causes leading from the soil to the oak tree, to its leaf juices, to the aphid digestion, and then to the utilization and excretion of the matter that it absorbs. Of course, in practice. it is not usually necessary to follow up the action of environmental factors upon animals any further than the rough correlation between the outer limiting factor and the animal's behaviour. Elaborate physiological explanations only become necessary in the case of man and his domestic animals, where we wish to apply medical measures. The confusion between physiological and ecological work is one of the many snags which have held up the progress of ecology a good deal during the last 20 years, and clear thinking on the matter is desirable.

We divided the environmental factors into three groups: the first two groups (physical and chemical, and plants) form great sciences of their own, and will not be treated here in detail. The influence of animals upon one another demands a much fuller consideration, and will, in fact, occupy most of the remainder of this article. The subject has been comparatively neglected by professional ecologists although it has been the chief interest of countless naturalists, especially of the older school, and more recently of a fairly considerable army of economic zoologists. The reason for this one-sided development of ecology appears to have been that plant ecology was made into a science before animal ecology had got properly under way, so that most of the earlier animal ecologists automatically followed the tendencies of plant ecology, and their interest came to be focussed upon the effects of soil, climate, and water upon species. and also upon the effects of plants, especially those due to succession. Hence, the centre of ecological interest drifted away from animal inter-relationships, which, however, carry with them the key to the understanding of animal numbers. Indeed, the subject of animal numbers has hardly figured at all in ecological literature until quite recently, although it was being intently investigated by biologists who did not term themselves ecologists, and who were working often in isolation, perhaps at some remote tropical station. It was Carr-Saunders's Population *Problem* (a study of the numbers in man) which helped to direct attention again to the regulation of numbers in animals and, of course, more particularly in man.

The fascinating problems presented by the inter-relations of animals have attracted naturalists since the earliest times. There has been in consequence a colossal amount of literature published on this subject, which has been approached from a great many points of view. Such work falls conveniently into two sections (1) the inter-relations of members of the same species (*e.g.*, the social habits of ants or of antelopes, the courtship of birds or of insects, co-operation in all its stages of evolution, etc.); (2) the inter-relations between animals belonging to different species (*e.g.*, food relations, parasitism, mimetic associations). We do not propose in this article to go over in any detail the work which has been done in the first sphere, although it comes quite logically under the heading of ecology. The fact is that with most animals, members of the same species do not act as limiting factors to one another's distribution, although in a sense they can act as limiting factors to numbers (see BIRDS, Reproductive Habits). Therefore much of the work on the subject bears very little relation to the questions of distribution and numbers with which the ecologist is mainly occupied. This statement applies to a great deal of the work on flock tactics, on the pairing habits of birds and insects, and on caste-systems in insects like ants and bees.

(a) It must be sufficient to mention some of the more important sources of information on these questions, and to indicate rhe points at which they illuminate general ecological problems. The problems concerning the inter-relations of animals of the same species again fall into two well-defined groups: (1) relations between the sexes, and (2) other relationships (flocking, co-operation, caste-systems, etc.). Most of these complicated inter-relationships have been brought about by the tendency of animals to evolve means of producing some division of labour which enables the species as a whole to maintain itself more effectively in the face of competition. The formation of two sexes with a suitable division of labour, is the most widespread example of this tendency, and since this division of labour has as its result the more successful production or upbringing of the young, we find that among many of the higher forms of animals the sexual relationship has become mixed up with more or less elaborate systems of territory which are required for the proper provision of a sufficient supply of food for the developing young. This phenomenon is especially well-marked in birds and mammals, and in some of the social insects. Eliot Howard (Territory in Bird Life) gives a good summary of the problem as seen in birds, and his theories have been criticized and developed further by Nicholson (How Birds Live). These two books give a clear idea of the ways in which sex relations may have a direct bearing on the population problems of a group of animals. The problems presented by the sex relations of insects have been fully reviewed from certain points of view by Richards, but it is at present uncertain what precise part is played by these relations in the other aspects of insect economics.

(b) Division of labour takes other forms in some of the more specialized social animals. Definite castes (workers, often soldiers, occasionally more remarkable types like living honey-pots, thread-spinners, etc.) occur amongst many ants, termites, and bees. This subject has been very fully treated by Wheeler (Ants; *Social Life* among Insects) and more briefly by Alverdes (Social Life in the Animal World). The division of labour may also take the form of temporary occupation of different jobs by different individuals (*e.g.*, sentries in antelopes and flamingos; crêche-minders in giraffes and penguins). The book by Alverdes sums up a number of facts bearing on these and other aspects of co-operation among

social animals. All these points are mentioned here because it has been shown (*e.g.*, by Wheeler, for insects) that increased co-operation and division of labour between members of the same species usually have the effect of enabling a denser population to exist on a given area, and this fact has, of course, a direct bearing on the problems concerning the numbers of animals, which we shall have to consider later on. Finally, it is worth mentioning that a perversion of the caste system has in certain cases resulted in the existence of robbers within the species. This is an ecological problem, to which little attention has been paid, but which has an important bearing upon the evolution of certain kinds of parasitism.

(c) We now come to the second type of animal inter-relation, that between members of different species. The inter-relations between different animals have been studied very intensively, but with the exception of work upon parasitism, organic symbiosis. mimicry, and colour adaptation, the facts discovered have been chiefly of a rather disconnected and unorganized nature. Also they have usually been recorded with one particular purpose in view—to prove or at any rate to illustrate Darwin's theory of adaptation through natural selection. In consequence, there has been a tendency to focus attention upon the strange and unlikely habit, the curious adaptation, the attractive resemblance, or the triumph of some successful parasite over its host. This tendency was a natural result of the wave of enthusiasm which followed the fruitful ideas of Darwin and Wallace, but at the present time ecological work upon the inter-relations of animals is tending in rather a different direction. It is being realized gradually that these remarkable examples of inter-relations between different species are only special cases of a very common phenomenon—the fact that animals frequently depend for their living upon their ability to catch other animals for food, a fact referred to by Darwin as "the almost universal law of 'consume or be consumed'." Animal communities are not simply unorganized assemblages of animals which happen to live in the same habitat—they are intimately connected together in a most complex manner, and the tie that binds them together is the tie of food. Food and eating are so familiar that it is possible to miss their enormous importance in ecology, and to forget that most of the problems which centre around animal numbers depend for their solution upon an adequate knowledge of the food-relationships of animals; since it is in this way that the numbers of one species are kept down by another. We shall not consider in any detail here the work which has been done upon animal coloration, commensalism, and symbiosis, since these subjects form only a comparatively small part of the whole study of food-relations among animals, and since, further, many of the conclusions which can be drawn from such work must be left in a rather indefinite state until a more settled idea is obtained of the exact way in which species arise and the part which adaptation really plays in this process.

THE STRUCTURE OF ANIMAL COMMUNITIES

An enormous amount of work has been done upon the food habits of animals, but scarcely half-a-dozen pieces of research upon the food-relations of a whole community. The complete food cycle for a community has only been worked out in one or two cases (very simple ones like those of arctic animals, or the community of animals living on one plant); but as a result of the work which has been done so far, several generalizations can be made. First, it is found that animals are usually arranged in "food-chains" leading from herbivorous or scavenging species up to terminal animals, through several stages formed by carnivores. For instance, in the sea, flagellated protozoa of various species are eaten by copepods, the latter by pteropod mollusca, the pteropods by herrings, and finally the herrings are preyed on by sea birds such as gannets, or by human beings. Again, in a pine wood, the young pine trees support a community of animals which are arranged in various food-chains, all radiating from herbivorous insects such as aphids and moth caterpillars; aphids are eaten by hover flies (syrphids), which are in turn eaten by spiders, and the spiders are preyed on by wasps, which use them as a food store for their larvae. In this community, there are also insectivorous birds, which are eaten by hawks. The part of this food cycle which refers to insects is shown in fig. 1, and it illustrates very well a typical animal community, containing a number of different food chains, all radiating from plants through herbivorous animals and several carnivores. This form of organization or structure of animal communities is universal, and it will be evident that the study of animals, as limiting factors to the distribution or numbers of a species, is an exceedingly difficult one. No animal can be said to be dependent upon only one other species, since all are bound up together by food connections into one complex organization. The result of this state of affairs is that any upset or interference with the existence or numbers of species may have, and usually does have, very unexpected effects upon other species which one would not at first sight expect to be affected at all. For instance, it is said that the increase of the manufacture of bicycles affected the walrus-hunting industry in arctic regions, and that any shortage of walrus leather (which is used in polishing metals) is in turn followed by an increase in the amount of tuberculosis in certain French factories, which are then compelled to use felt instead of walrus leather (the felt producing a noxious kind of dust). Or there is the case of two species of blue butterfly (Agriades coridon and *A. thetis*) which formed a local colony on one place upon the Downs, but were wiped out through a temporary over-increase in the numbers of rabbits, which ate up completely all the plants of the horse-shoe vetch (*Hippocrepis comosa*) upon which the butterfly caterpillars depended for food. Instances of this sort could be multiplied.

It is clear from what has been said, that in order to understand the way in which any animal is affected in its numbers or distribution by the other animals living with it, it is necessary to study the *whole* animal community living in one habitat, and that it is useless to treat the animal as if it were completely isolated and acting as a separate unit. A general knowledge of the complete food cycle of an animal community is accordingly of great value to anyone who is investigating the biology of a particular species belonging to that community, since, armed with such knowledge, he is enabled to see at a glance a number of the points at which that animal is connected with other ones amongst which it lives, and this in turn throws light upon the manner in which its numbers are kept down and controlled. Supposing one is studying some insect which is becoming a dangerous pest among crops or in timber, a knowledge of its food relationships, gained from previous work upon the food cycle of the community to which it belongs, makes it possible at once to try various experiments with counterpests (enemies or parasites) without it being necessary to wait for several years in order to work out these food relations—by which time the damage might have become colossal or possibly even uncontrollable. It seems clear, then, that the study of food relations of animals should form the next important step in any biological survey, after the first lists of species from different habitats have been made. It is at this point that the ways of animal and plant ecology part quite definitely: plants are living in communities where competition is usually for the same kind of food, whereas animals feed in infinitely more diverse ways than plants, and consequently have developed the complex communities which we find everywhere, and which require special methods for their study.

At present, only in a few cases have surveys of animal communities been carried to this further stage. The preliminary listing is in itself a long and formidable task, and furthermore, the systematics of many groups of animals have only been properly worked out within the last decade. Or, again, they have not been reduced to a simple and convenient system of reference which can be used by the ecologist, who is usually busy on other things. For this reason a number of the best ecological surveys up to date have been done by people who have paid attention mainly to one group of animals, in which they themselves are expert at identifying the different species (*e.g.*, birds or beetles or molluscs); but it is obvious that such surveys cannot, by their nature, apply the food cycle method of study at all widely, since any one group of animals usually has rather similar food habits (*e.g.*, butter-

flies). This kind of survey, although of very real value in many other ways, is yet of limited application to fundamental research upon the numbers of animals. It seems likely, therefore, that future ecological surveys, which attempt to carry their work beyond the preliminary phase which has now been reached in many cases, will either have to employ teams of experts in different groups (either in the field or by sending the material to be examined afterwards), or else will have to concentrate upon very simple communities, which contain few species and which have the minimum of complications in other respects. It is probable that the latter type of work will yield the most useful results, as far as the discovery of general principles is concerned.

Looking over the literature on the subject, one notes that food cycles have only been worked out with anything approaching completeness in a handful of cases: the land animal communities of arctic and high arctic regions (Elton); the animals of Calluna heath, pine woods, and associated habitats in the south of England (Richards), some of the land communities of temperate North America (Shelford); and the plankton community of the North Sea (Hardy). Otherwise, attention has been confined to single food-chains, or to the chains radiating from one species, followed out to a certain distance. (Of course, these, if followed farther, would give the food-cycle for the whole community, and this, as we have explained, is the whole point of doing such work.) There is, accordingly, a rather big blank space in our organized knowledge of the food relations of wild animals, and even if we examine the few cases in which the food-cycle has been made out at all, it is found that the food habits of the different animals are only slightly known and indicated in a very rough way, that quantitative data are usually lacking, and that all consideration of the parasites has had to be omitted. The value of this work, however, lies in certain ideas which have resulted from it, and which do reveal to some extent the way in which an animal community is constructed and how it works.

The first of these ideas is concerned with the size of animals and of their food. Every carnivorous animal is limited to a certain definite range of size in the matter of food, since on the one hand it cannot seize and overpower any animal above a certain size, while on the other hand it cannot find a sufficient number of animals below a certain size, to be worth while or provide it with enough food in the time available. Small spiders catch springtails, willow wrens eat caterpillars, the red-backed shrike attacks bumble bees, the merlin preys on the meadow pipit, and the eagle lives on ptarmigan—in all cases the size as well as the other qualities of the food comes into question. This rule applies also in many cases to herbivorous animals, but is less widely in operation, owing to the fact that plants are to a large extent defenceless. However, the lower limit of size often plays a part in determining the food of seed or fruit-eating birds. In all cases the abundance of food is also an important consideration, since a small animal, if very numerous, may be obtained in sufficiently large numbers to attract animals which usually feed on things of a greater size. The significance of this idea about the size of food is that it explains to a large extent why food-chains exist at all in animal communities. Each stage in the chain has the effect of turning small food animals into larger ones, and since there are wider limits to the sizes of animals than to the size of the food of any one animal, we usually find some three or four stages forming the food chain. Sometimes there are more, often fewer, but there seem hardly ever to be more than six or seven stages in a chain leading from a vegetarian animal to the terminal carnivorous species. This leads us to ask why there should be a limit to the number of stages in such a chain. The answer is partly that animals themselves have limits of size; but there is another important reason, which holds good for most animal communities. This depends upon the relative numbers of the individuals forming the various stages in a chain. For instance, suppose we take the chain of freshwater animals: copepod-insect-fish-bird. It will be found that the number of individuals in each species decreases very rapidly as we pass from the copepod to the bird. There might be, in a single lake, millions of copepods, many thousands of insects, several hundred trout, and half-a-dozen grebe. Another way of putting it is to say that one grebe requires so many fish to supply its food requirements, each fish needs so many insects, and each insect so many copepods. At the same time there must be a certain number of each animal produced to perpetuate its own species in the face of old age and of checks other than being eaten. Thus each species is supporting, in addition to itself, a very great burden in the form of enemies. The copepod is supporting all the rest, and therefore has to be the most abundant of them all; but this it is, in fact, enabled to be on account of its smaller size, and consequent ability to grow up and breed more quickly. It is clear that as each stage in this chain is reached a smaller margin of living matter is left over to support any further species. The amount of transmuted copepod gradually diminishes, like a suit of old clothes which passes from one person to another, losing its substance by degrees until there is nothing left but a single patch. It can be seen that the size limits to the food of animals produce food-chains, and that these chains are able to exist because the smaller animals, which have the greater burden to bear, are by their smaller size enabled to support it the more effectively. We have not at present the necessary data for solving in a quantitative manner these fascinating problems about the balance between size, rate of increase, and density of numbers; but presumably animal ecology will some day be in a position to present the phenomena of animal inter-relations in almost as accurate a form as those of chemistry. A beginning along these lines has been made by Chapman, who has worked upon populations of weevils kept at standard temperatures, and with controlled conditions of food and breeding rates.

We have dealt with food chains, the food cycle, and with the idea which may be conveniently termed the "pyramid of numbers" in animal communities. Another useful conception is that of niches. We can divide up animals into different classes according to their food habits, *e.g.*, herbivores, carnivores, etc. But it is possible to go farther than this, and divide the herbivores into those of different sizes, or belonging to different plants, *e.g.*, aphids, grasshoppers, mice, rabbits, grouse, sheep, cows, etc., or, on the other hand, aphids of grass, of trees, and so on. Then we can classify carnivorous animals according to the size and nature of their prey. When we begin to classify the food-habits of animals in some such manner it becomes gradually clear that there are in each animal community a great many different occupations, jobs, or niches (just as there are in a human community), and that each niche is filled by a particular species. If we now turn to another animal community, occupying a different habitat, we find that although many of the same niches occur there, the actual species filling them are different in most cases. For instance, there is one mouse (Microtus) in grassland, which is preyed upon by the kestrel; in woods there is another kind of mouse (*Apodemus*) which is preyed on by owls and weasels; while in houses there is a third kind of mouse (Mus) which is preyed on by the domestic cat and by human beings. In this example, the same niche (small mouse) is filled by three different species, whose habits and numbers, and size are to a large extent similar. The term "niche" is meant to be an elastic one, and it is hardly worth while attempting to define it exactly; but in spite of this, the idea is a useful one, since it emphasizes the fundamental similarity of all animal communities—a fact which is of some importance, since it is probable that any general principles which may be found out about the workings of animal inter-relations in any one community will be found to have a wide application elsewhere. It would therefore seem likely that intensive work, carried out completely on very simple communities such as those of arctic regions or deserts, would afford the strongest chance of discovering the fundamental laws governing the inter-relations of animals and therefore the regulation of their numbers. The fifth idea of importance in the study of animal communities is concerned with the significance and place of parasites in the general scheme. It has been customary in the past to treat parasites as if they were really different from carnivorous animals. In their morphology and in the fact that they get free transport on their host, they undoubtedly differ in many ways profoundly from the ordinary free-living animals. But the resemblances are really much more than

these differences; parasites feed in essentially the same manner as carnivores, and a complete graded series can be traced from typical parasites which are completely dependent upon their host for food, lodging and transport, leading to species which lead an entirely free-living, carnivorous existence. Fleas are a good case of the transitional type of animal, while mosquitos and lampreys and jackals are other examples. From an ecological point of view, the chief significant difference between these two classes of predatory animal is that a carnivore usually destroys its prey at once, whereas a parasite usually confines itself to abstracting little bits of its host, which are often scarcely missed by their owner. The principle followed is the same as that employed by a manufacturer who sells to an enormous number of people a very small article (like matches or pins) and by making a very small profit on each, amasses a huge fortune without harming his clients to any great extent. Another way of putting it is that a carnivore employs the method of a burglar, the parasite those of a blackmailer. In making out a complete scheme of the food relations in a community it is clearly necessary to include parasites as well as carnivores; but, in practice, it is often possible to manage without this, owing to the small absolute bulk of the parasites, and the fact that they are often eaten at the same time as their host, and so in a sense can be considered to be part of it. However, ecological work on numbers, especially medical work, has shown the profound inter-dependence of the two classes of animal, carnivore and parasite, especially where they carry any smaller parasite (bacterial or protozoan) which is capable of generating epidemics in the host species.

ANIMAL NUMBERS

Although the intensive study of the structure of animal communities has not so far been carried beyond the very earliest stages, yet it is obvious that farther research in this branch of ecology affords a good prospect of throwing light upon the mode in which the numbers of animals are regulated during normal times, and the reasons for the breaking down of this system of regulation—a breakdown which is quite frequent in nature, and which manifests itself in the form of plagues of animals (*e.g.,* mice, locusts or aphids), or, in the case of parasites, as epidemic diseases. Even in the present state of our knowledge of the social structure of the animal world, we are in a position to make certain suggestions along these lines. For instance, there is the fact that every animal community, whether it be living under the bark of a dead pine tree, on the shores of a mountain lake, or in the wainscot of an old house, seems to be constructed fundamentally in the same way. This fact enables us to conclude that the means by which animal numbers are regulated may be similarly uniform in their action in all habitats. It seems very probable that if a suitable team of ecologists settled down like locusts on one very small, simple animal community, and studied it intensively from every point of view for a good many years, they might discover almost all the important laws about animal numbers—laws which may elude one if the community studied is very complicated (*e.g.,* tropical rain-forest or marine plankton) or if observations are not carried out consecutively for a number of years.

Up to this point we have dealt chiefly with the relative numbers of different species in a community. Before proceeding farther, we must say something about the absolute density of numbers; in other words, it is necessary to inquire whether any censuses have been made of animal numbers. To carry out a census in practice is not at all simple, for a variety of reasons; but there have been a number of beginnings made in this direction during the last 20 years. The most successful and accurate census results have been obtained with marine or freshwater plankton animals, since these are the easiest to deal with. On the Continent and in America a number of quantitative surveys have been carried out, and these give an interesting and clear-cut picture of the density of various Crustacea, Rotifera, etc., in the water. On land a certain amount of census work has been done on soil animals, since these lend themselves to much the same sampling methods as are employed with aquatic animals. Otherwise, little progress has as yet been made with accurate censuses of land animals, except in the case of birds (Nicholson, Cook, Grinnell and Storer) and certain mammals; the work on the latter is of a sporadic nature, and chiefly applies to species which have some special economic or sporting interest (*e.g.,* an annual census is taken of the baboons on the Rock of Gibraltar, and a similar one of the fur seals on the Pribiloff islands of Alaska). In addition, census methods have frequently been applied, though usually in rather a rough way, to various insects which are of economic significance. In the present state of our knowledge, it is not possible to draw any very far-reaching conclusions from this side of ecology, except that it appears that most species are a great deal more numerous than one would expect. We must therefore confine ourselves to pointing out the importance of accurate figures for density of numbers of animals, and the fact that it is rapidly coming into prominence in ecological work.

In spite of this general lack of precise quantitative data about the actual numbers of animals in a given area, there are several important principles which have been discovered about numbers of animals. We shall conclude this article by giving an account of them. We have already noted that the number of individuals of a species is often extremely great in any given area—for instance, one acre of arable soil has been estimated to contain over two million springtails and about 800,000 earthworms. Now coupled with this is the fact that any species of animal is, in nine cases out of ten, endowed with powers of multiplication which are enormously greater than it can actually realize in practice, at any rate during normal times. If a species over-increases, it runs a definite danger of over-eating its food supply, but at the same time, if it does not produce a very large number of extra individuals in each generation it will be in danger of extinction through the operation of checks other than starvation, of which the most important are enemies. The position of nearly all animals is therefore this; they are always tending to increase enormously, but are prevented from doing so by various checks—mainly by carnivorous or parasitoid enemies ("parasitoids" meaning those Hymenoptera and other insects which have parasitic larvae but free-living adults). In this way the population is prevented from eating out its food supply; but the system also involves a dangerous tendency for the numbers to oscillate a great deal about their average density. If any species allows its numbers to fall below a certain density it is in danger of being blotted out by any unusually severe check such as occasional droughts or bad winters, or an unusually large number of enemies We find, therefore, that each species tends to approach an optimum density for its population; both below this optimum and above it the conditions become disadvantageous to the species. The limits of this optimum may be rather wide, thus differing to some extent from the rather precise optimum density which is found in a human population. Nevertheless the optimum exists for each species, and unless the latter is able to maintain its numbers somewhere near this, it is liable to become locally extinct. In fact, it is very probable that the limits to the range of any animal are often fixed by factors acting on its numbers, rather than directly upon the animal itself.

We have next to inquire whether animals do succeed in keeping their numbers at the density which suits them best. Anyone who has kept a watch on the animals in his own district continuously for a stretch of years must have noticed that there is a great variation in the numbers of most animals from year to year; often it is impossible to predict whether a species (a butterfly or a wasp or a slug or a bird) will be abundant or not. Notes of this sort are continually being made in a scattered way, such as that "this year we had very few long-tailed tits, but jays were unusually abundant" or that "this was a good year for *Vanessidae,* but not for other butterflies." A survey of a portion of the vast sea of literature bearing on this question leaves no doubt that the numbers of most species vary considerably from year to year, but that most of them do not usually become either extraordinarily numerous or extremely scarce. It is clear, then, that the conception of an optimum density as applied to animals, like that of niches in animal communities, must be an elastic one, and that in practice the desirable density is not a point, but ranges over a fairly good distance either way. Even then, it is not always realized

or even approached. One of the reasons for this is that what we call the optimum is itself varying, since the food supply varies, and the enemies and the climate and other factors also vary. The impression of anyone who has studied animal numbers in the field is that the "balance of nature" hardly exists, except in the minds of scientists; it seems that animal numbers are always tending towards some ideal stability and communities are always tending to settle down into a smooth and harmonious working mechanism, but that something always happens before this happy state is reached. This liability to upsets of the "balance of nature" is as much a property of animal communities as is that of a boiling pot of water to overflow if left unattended. It is not merely a phenomenon characteristic of regions or habitats which have been interfered with by man. Even in places completely untouched by civilization, *e.g.*, in the barren grounds of arctic Canada, or in a tropical forest, the occasional unbalance of animal communities is a normal thing, and the numbers of animals are found to vary to a greater or less extent—witness the periodic flights of sandgrouse from the Gobi, or of painted lady butterflies from the Sahara, plagues of mice and lemmings in the barren grounds, or of aphids in the northern coniferous forests of Europe. Perhaps the most striking account of this kind of thing is that given by Cabot in the appendix to his book on Labrador, where he describes the extraordinary cycle of events accompanying a year of mouse abundance in the interior of that country; after reading that account no one can remain in doubt about the natural variability of animal communities in places almost untouched by man except as a rare native animal. Are these fluctuations in numbers, these failures of the regulating mechanism of animal increase, caused by internal changes, after the manner of an alarm clock which suddenly goes off, or the boilers of an engine blowing up, or are they caused by some factors in the outer environment—weather, vegetation, or something like that? It appears that they are due to both, but that the latter is the more important of the two, and usually plays the leading part.

The environment of animals is so exceedingly unstable itself that it would be surprising if some of its irregularities were not reflected in animal communities, which form such delicate indices of any changes in the outer world. We cannot describe the various rhythms which are going on in the weather, in the tides, or the various accidental circumstances which play a part in causing upsets in nature. But it may be worth while to examine a little more closely what actually happens when a plague of animals occurs, since this is one of the most important practical ecological problems met with in the field. The trouble usually starts with an excessive increase of some herbivorous animal, which is favoured in a particular year by unusual conditions of food or climate or some other factor. Now, the carnivore, which is nearly always larger than its prey, is in normal times able to destroy all the extra herbivores which are produced; that is the ordinary balance of numbers in a community. But we have to remember all the time that the smaller animal is increasing at a faster rate than the large carnivore, so that if the herbivore once gets out of control of its enemies, the latter are never able to catch up by increasing themselves, since their powers of increase are relatively so much less. For instance, if there is a plague of field mice in progress we should find that while the mice were having about four or five litters in a year, the foxes which prey on them could not have more than one or two, and the young foxes would not be in a fit condition to breed until the following spring, whereas the mice, which had been born in the previous spring would already be producing young by the autumn, and adding to the total numbers. So, if unusually favourable conditions have enabled the herbivore (mouse, sandgrouse, aphid, crossbill, or oakmoth) once to escape from the control of its carnivorous enemies, increase goes on at a rapidly faster and faster rate, and the conditions of a "plague" are reached. In the summer of 1924 enough aphids were blown from the spruce forests of northern Europe, over 800 miles of sea, to cover in a broad belt the whole ice-cap of North-East Land, an arctic island about as big as Wales. With them were found the syrphid flies which are among their most important enemies. but these were very much less abundant. This gives some idea of the scale attained by a really big plague of animals. It is obvious that, as enemies are no longer a serious check to numbers, starvation will follow, unless something else happens to avert this disaster.

Examination of the cases of plagues about which we know anything, shows that the situation is met by animals in several different ways, some animals doing one thing, and some another. In mammals and game birds, and also in certain birds and insects, the increasing density of population favours the spread of parasites-bacteria (as in the case of the marmot plague described earlier), or Protozoa (as in the willow grouse), or tapeworms (as in certain fresh-water fish). When the numbers of the host reach a certain point, the rate of circulation of the parasites increases and speeds up very suddenly, and the infestation of the host animal becomes serious, and usually leads to death. Just as the herbivore can increase faster than its enemies, so can the parasite, owing to its smaller size, increase faster than its host. The parasite in this case acts as a sort of emergency check on numbers, and we see therefore that it is absurd to consider the enemies and parasites of an animal as hostile, for the whole association stands or falls together as one unit. If the mouse is wiped out, the foxes and weasels, the tapeworms and the protozoa and bacteria will be wiped out also. It is difficult to imagine exactly how natural selection acts on such a unit; if the argument be carried to its logical conclusion, it would seem that natural selection either acted on everything from bacteria and mice to thunderstorms and sunspots or upon nothing. This case of mammal fluctuations in numbers illustrates very well how ecology throws light on, or at any rate raises problems in connection with, evolution and adaptation. The increase in numbers resulting from a breakaway from control by enemies is sometimes partly relieved by migration, but this does not necessarily do any more than transfer the problem elsewhere. However, migration usually implies concentration of the animals into swarms or flocks, and so favours the generation of epidemics, and also makes it more likely that enemies will kill more of them. During "lemming-years" in Norway, the migrating animals are eaten by all manner of unusual enemies including reindeer, trout in lakes, and cod out at sea. Migration may also lead to other kinds of destruction, as in the aphids which were blown on to the ice-cap of North East Land but perished in a blizzard three days later. Migration and epidemics seem to be the usual check when enemies fail; where these in turn cannot control the numbers, starvation occurs, but so numerous are the ways in which animal communities react to variations in their environment that starvation seems to occur curiously seldom, although plagues of animals on a greater or lesser scale are quite common in all communities.

It is impossible to treat the various problems of animal numbers in any detail here, since apart from the general ideas outlined above, our knowledge is mostly unorganized and empirical, and the literature on the subject immense. It may be noted however, that the question of numbers has an intimate connection with migration and with the spread of species, since at the limits of their range animals are always fluctuating in numbers in a very marked way, and problems of distribution often turn out to be really problems in numbers. Dispersal is another subject which cannot be treated fully here, and we shall merely point out that the psychology of animals comes in and assumes great importance in connection with dispersal, and that the manner in which animals actually find the habitat suited to their needs is a subject which has not been adequately studied. It would seem that this is the most natural field for people working upon the instincts and tropisms of animals.

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ECOLOGY OF PLANTS: *see* PLANTS.

ECONOMIC ARTICLES. The large subject economics is dealt with in this work under many headings. The article ECONOMICS is a general survey of the development of economic theory. Further discussions of different branches of the subject will be found in the articles entitled CAPITAL, CAPITALISM, LAND, LAND TENURE, LAND NATIONALIZATION, LABOUR, RENT, SUPPLY AND DEMAND, DEMAND, VALUE, PRICE, PRICES, UTILITY, WEALTH, PROFIT, DISTRIBUTION, WAGES, WAGE SYSTEM IN INDUSTRY, MINIMUM WAGE, DIMINISHING RETURNS, ECONOMIC MAN, ECONOMIC FREEDOM and COMPETITION.

Various schools of economic thought are treated in the articles which are entitled MERCANTILE SYSTEM, LAISSEZ FAIRE, SOCIALISM, SOCIALISM (PRINCIPLES AND OUTLOOK), COLLECTIVISM, COMMUNISM, CO-OPERATION, COPARTNERSHIP, MUNICIPAL TRADING, PROFIT SHARING, ANARCHISM, BOLSHEVISM, SYNDICALISM and SINGLE TAX. A special article is devoted to FASCISM in its economic aspect.

For a key to the many articles relating to banking, money, finance and taxation, *see* the conclusion of the article FINANCE.

The department of fiscal policy is treated under the headings FREE TRADE, PROTECTION, FAIR TRADE, RECIPROCITY, TARIFF, TARIFF REFORM, IMPERIAL PREFERENCE, SAFEGUARDING OF INDUSTRY, CUSTOMS, CUSTOMS UNION and COMMERCIAL TREATIES.

For related articles of importance *see* SOCIOLOGY, RURAL DEPOPULATION, URBANIZATION, HOUSING, USURY, COST OF LIVING, LUXURY, TRADE CYCLE, PROFITEERING.

There is a group of articles relating to industrial and commercial combinations under the headings TRUSTS, COMBINES, COMBINATION IN INDUSTRY, COMPETITION, PRICE-MAINTENANCE, MONOPOLY, etc. For associations of traders *see* TRADE ORGANIZATION, ASSOCIATIONS (INDUSTRIAL), INTERNATIONAL TRADE ASSOCIATIONS AND CONGRESSES and IXTERNATIONAL CHAMBERS OF COMMERCE. The organization of labour is treated under TRADE UXIONS and THE INTERNATIONAL. For the relations of capital and labour, *see* INDUSTRIAL RELATIONS.

The problems of poverty are dealt with in the articles POOR LAW, VAGRANCY, WORKHOUSE, CHARITY, UNEMPLOYMENT, SWEATING SYSTEM, SLUM and POVERTY LINE. Under INSURANCE ARTICLES will be found reference to various methods of insuring.

As to economic practice and the actual production and distribution of wealth, reference should be made to the economic sections under the heading of each country, and in addition, to the articles COMMERCE, TRADE (WORLD STATISTICS), AGRICULTURE, (a special key will be found under the heading AGRICULTURAL ARTICLES), RAW MATERIALS, IMPORTS, EXPORTS, MANUFACTURES (COMMERCE IN), RATIONALIZATION OF INDUSTRY, SCIENTIFIC MANAGEMENT, RESEARCH (INDUSTRIAL), INDUSTRIAL RELATIONS, STANDARDIZATION, SALESMANSHIP, STORE and AGENTS IN BUSINESS.

For the discussion of questions of population, in which all economic endeavour may be said to be summarized, *see* the articles POPULATION, BIRTH RATE, DEATH RATE, MARRIAGE RATE and BIRTH CONTROL.

ECONOMIC FREEDOM, in economics, **a** term applied to a condition of society in which free competition obtains. The term connotes the emergence of society from slavery and serfdom. In complete economic freedom, every man is at liberty to work as he will, unfettered by law or regulation, and uncontrolled by any customary obligation to an overlord; at liberty to enter into contracts, to sell his services or his products, to move about freely, and to engage in the enterprise of his choice.

For the rise and modification of the concept of economic freedom the history of ancient and modern states should be consulted, and in particular the articles SLAVERY; SERFDOM; FEUDALISM; INDUSTRIAL REVOLUTION; ECONOMICS; TRADE UNIONS; CO-OPERATION; INSURANCE; NATIONAL INSURANCE; COMBINATION; TRUSTS, etc.

ECONOMIC MAN. The term *homo economicus* has often been employed, with an ironical significance, by critics of political economy, and has been especially directed against the English economists who founded the Classic school, such as Ricardo and Senior. Critics reproach them with having based a science of economics on the conception of an "abstract man," a creature moved solely by exclusively economic motives. The German economists, in particular, have opposed to this conception a rival method, the so-called "historical" or "realist" school, which studies *men* (not man) under the sundry aspects evolved in different ages and countries. They maintain that this method alone is fruitful and capable of indefinite renewal, while the conception of the *homo economicus* can lead only to a few general formulae devoid of any practical application.

It must, however, be admitted that the science of economics could never have been developed, had it not seen men as something more than different individuals; had it not first regarded the characteristics common to all. Long ago Aristotle said, "there is no science except of the general"; individuals, objects, facts, being, so to speak, merely accidents, deviations from the true type. The existence of a science of economics implies that men generally, if not invariably, behave in the same fashion when placed in the same circumstances. If they are purchasers, they will always prefer the cheaper of two products of equal quantity, or, if price is equal, that of better quality. If they are workers, they will seek the kind of work which is least laborious and best remunerated. If they are owners of an object, they will not part with it or lend it without return.

The real failing of the early economists was their habit of too wide generalization. The French economists of the late 18th and early 19th centuries, such as the physiocrats and Jean Baptiste Say, declared that political economy is possible only if every distinction of time and nationality is suppressed. The historical school was right in protesting against this conception of a universal and eternal national order, and substituting for it that of economic systems differentiated by time and circumstance. It does not study the "typical man," but the man of the 20th century or of the first; the bourgeois or the workman; the man of the west or him of the east; the town-dweller and the country-dweller, and restricts its concentric circles progressively to approach reality through successive approximations. Nevertheless, these remain generalizations, although increasingly narrow ones. The individual case, the conduct of John or William, so far as it is isolated, "excentric," as it has been well termed, is of no interest for the economist, unless this individual case, by generalizing itself, becomes the starting-point for a new generalization, and inaugurates a new column to a statistical table.

The dispute between the economists of the *homo economicus* school and those of the realist and historical school is a revival of the great conflict which divided the mediaeval scholastics for several centuries, between the "Universals" and the "Nominalists," the former affirming, with Aristotle, the reality of abstract and general ideas, the latter seeing in them nothing but words, names, categories, corresponding to no reality.

The Nominalists were ultimately victorious, and founded modern science, the product of observation and experimentation. The latter is directed towards the particular, and, indeed, the most minute facts, which were considered negligible by the Universals, are most highly prized by the students of to-day. It has been said that the domain of discovery begins beyond the fourth decimal point; which is to say that it is only at this point that a universal law can be shaped, unless a sagacious observer sees a new vista open before him. Only when observations, pressed to the last limit of precision, revealed certain discordances in the movement of luminous rays, could Einstein's theory be formulated.

Nevertheless, the rôle of deduction in physical science is far from played out; for while students struggle to relate phenomena to unity, others work unceasingly to discover divergences in that unity. It is the same in the science of economics.

The Abstract Man.—The general expression "homo economicus" has, hcwever, a further signification. It is not merely the individual, the "average man"; not merely the typical man who unites within himself all the characteristics of the human race. On the contrary, it is man stripped of all characteristics other than the purely economic, that is to say, impelled by no motive other than that of interest. It is here, above all, that this view of the science of economics lends itself to criticism, and seems to merit Carlyle's virulent description of "the dismal science." This criticism is, however, misplaced, for it is obvious that after having reduced man, *ex hypothesi,* to a skeleton, one cannot expect to find in him a heart.

Here, too, we must grant science, even in the case of a social science, the right, even the necessity, of elimination. If a physicist studying mechanics must eliminate all phenomena capable of affecting the motion, such as friction, so much the more may the economist, to clear his way in the tangle of social facts, simplify them by eliminating from his field of vision everything not concerned with the desire of gain.

In the introduction to his "Theory of Political Economy," Stanley Jevons said:

"The theory which follows is entirely based on a calculus of pleasure and pain, and the object of Economics is to maximise happiness by purchasing pleasure, as it were, at the lowest cost of pain."

This was the origin of the so-called "hedonist" school. Thus political economy becomes a sort of mechanical science, and can even be expressed in mathematical formulae.

Pure Economy.—Attempts have been made to constitute an exact science, known as "pure economy," which was promoted by Cournot and Walras in France, Stanley Jevons in England, Gossen in Germany, and to-day has a certain number of adherents. This method appears to us to have a perfect right to a place in instruction, although we cannot think that it has yet enriched knowledge by any very important contributions, except, perhaps, Leon Walras's theory of economic equilibrium.

Pure economy cannot, however, claim to exhaust all political economy. These social mechanics can but give a schematic representation of political economy which is a science as living and as complex as man himself. As in the vision of the Prophet Ezekiel, who saw dry bones live, these skeletons must have restored to them the flesh and blood removed by elimination. Man is not a creature governed solely by his interests, but also by his feelings, his convictions, his passions. Besides, it must be remarked that his so-called "interests" include very various motives; for there is not only pecuniary interest, the desire of profit; there is also the desire of leisure, that factor which has proved so potent in the struggle for the limitation of the working day; there is the desire for independence, which revolts the working class against the wage-system; there is the desire for security, which creates in every country the immense apparatus of social insurance. Personal interest expands progressively, and becomes family interest, corporative interest, class interest, national interest, and even, reaching its last limit, the interest of humanity.

It is impossible to explain economic evolution if no factors outside egoism are considered, and the action of altruism is not also regarded. The so-called institutions of social service, solidarity, and mutual assistance—communal conditions inspired by collective interest—grow more numerous every day. Family allowances, for example, supplementary to the wage, occupy a growing place in modern economy. Consumers' co-operatives transform commerce by eliminating all purposes of profit.

If demography is admitted as part of political economy, then the sexual interest must be placed beside and above the personal interest. It is not "economic man" that begets children, for his individual and class interests often conflict with his sexual interest.

Most economists, however, consider that this progressive extension should not pass beyond the limit which should divide political economy from ethics. Their provinces should remain separate; in the one case interest, in the other duty; in the one utility, in the other justice. We think, however, that it is neither possible nor desirable to respect this dividing-line, which we consider to be arbitrary. No doubt, from the point of view of classification, it may be well to distinguish the two provinces, just as in a library it is proper to separate the books dealing with the two sciences. Yet neither can be ignored in explaining social facts. Study of modern economic questions—social questions, as they are called—shows that one almost always arrives at an *impasse* where political economy fails, and only ethics can afford a solution. The ethics of political economy are justice.

According to pure economy, any price, any wage is just if it has been determined by the interplay of supply and demand under conditions of unrestricted competition. This is the tenet of the hedonist school, and they are right, if the word "just" be taken as meaning "exact," as when one says that a weight "just balances" when the two scales are in exact equilibrium. But what sort of political economy is that which in determining prices and wages eliminates "justice" in its true, ethical sense, and how can it give any solutions to the problems of the present generation, the problem of high prices, or of the remuneration of labour? When the authors of the Treaty of Versailles solemnly proclaimed in art. 427: "labour should not be regarded merely as a commodity or article of commerce" (one of the principles of which the International Labour Office is the embodiment), they meant that labour conditions cannot be treated solely by the principles of pure economy. When the governments of every country endeavour to limit the rise of prices and lower the cost of living, this is because they believe that there is a conception of a just price which stands above that evolved from the blind caprice of the law of supply and demand, and that this higher law ought to prevail.

If we consider the history of labour, we see that it has passed through many stages. Formerly it was impelled by constraint, when slavery was current; later in the stage of wage-labour, this constraint still exists, on account of the necessity imposed on the proletariat of earning its bread; but by degrees, as the working class becomes stronger and better organized, forced labour is replaced by interested labour—already a great progress, not only from the moral point of view, but also from that of the return. Yet another stage may be foreseen—a stage already reached in the liberal professions—where interested labour becomes a social service, a public function, in the noble sense of this term; that is to say, its motive will be duty.

Similarly, as regards consumption, how can the economist set aside every moral consideration regarding the use of wealth; refuse to distinguish between that whose only aim is pleasure, such as the consumption of alcohol, and that which meets the public interest, such as the education of children?

In conclusion, then, it must be said that *homo economicus* has a justification in existing, and may form the object of the abstract science of pure economics, but that the object of political economy is social man—a fact which is, indeed, sufficiently indicated by the very adjective "political." (C.G.)

ECONOMICS. Because economics has to do with the wealth-getting and wealth-using activities of men, it is often defined as "the science of wealth." This is not a wholly satisfactory definition, for the special characteristics of economics are determined not so much by its subject-matter as by the particular interests which have prompted the inquiries of economists and the particular questions which they have tried to answer. We define economics better, therefore, when we say that it is a science which is concerned with the communal problems of economic life. The ordering of the economic affairs of the household and the planning and management of business undertakings come alike under its purview, but its interests and problems are not the interests and problems of either household economy or business enterprise. How men acquire wealth and how they use it are matters of fundamental importance for economics. but its principal concern is with the intricate interrelations of various wealth-getting and wealth-using activities and with the ways in which these activities affect the welfare of the community. The attention which economics

gives to the general or social aspects of the interplay of economic activities is born of its central interest in the wisdom or unwisdom of measures which governments take or which conceivably they might take with a view to regulating, controlling or participating in them or to directing them into one channel rather than another. The older name, "political economy," still gives a right impression of the kinds of problems with which economics is mostly concerned.

Like every science, economics proceeds upon the assumption that there is some sort of order in the phenomena with which it deals. Just as and because the economic activities of men are not altogether aimless or directed wholly by chance, so the economic life of the community, viewed as a whole, is not sheer confusion, but has a discernible ordered pattern, showing itself in dependable "laws" or "tendencies" which are discoverable by means of careful observation and analysis. That there is some measure of regularity and predictability in economic phenomena is a commonsense assumption, one upon which men act in the daily conduct of their affairs. But there was only a very small field for economic science so long as the economic order, in its larger features, merely reflected the social or political order—so long, that is, as men's different economic activities and their economic relations were determined largely by their political status, by the position in the general institutional structure of society into which they were severally born or which they might be able to attain. Under such circumstances economic problems appeared in the guise of juristic and ethical problems. Economic activities were rated good or bad, not so much by their ultimate effects upon the economic welfare of the community as by their consistency with some supposedly rational or "natural" view of the general structure of society. Thus Aristotle's conclusion that trading for gain, as contrasted with trading to exchange goods, is "unnatural" was merely a corollary of his views of the nature and the functions of the family and the state. In the middle ages economic matters were discussed by some of the patristic writers and later by the schoolmen, but both groups were concerned almost wholly with the ethics of trade and of money-lending, and their criteria were drawn either from authority or from their own systematic philosophies.

The New Economic Order and Its Problems.—What made the development of a science of economics possible was that transformation of the economic structure of society which, better than anything else, marks off the modern period from the mediaeval. This transformation is referred to, with emphasis upon one or another of its aspects, as the rise of modern capitalism, or of the competitive system, or of the system of free business enterprise. The dominating factor in it was the growth of trade, especially the growth of inter-town and inter-regional trade. With the growth of trade and the widening of markets the advantages of the division of labour and of local and regional industrial specialization became more and more pronounced. With the increasing ramifications of the market men were brought into a new nexus of relations, more intricate and more impersonal than the mediaeval system of prescriptive rights and duties, and giving the individual man more freedom of choice and action than that system had given him. Men became more dependent upon one another, not in any direct personal way, but in the sense that with the expansion of markets and the progress of the division of labour the welfare of each became intricately related to the activities of an increasing number of others. They came to realize that they had common economic interests and oppositions of economic interest as well. What were these interests and how best cauld the interests of the community or of a particular group or class within the community. be furthered? Such questions created problems of public policy for the new national states which the transformation of economic life had helped to bring into being, and out of the discussion of such problems the new science of political economy was born. There was need of such a science, because the mechanism of economic life had become so intricate that the deeper-reaching as contrasted with the surface effects of particular economic policies were difficult to discern. The task of eronomics was that of finding whatever dependable ordered relations might lie beneath the baffling complexity of the surface of economic life, so that public policies might be based upon knowledge and understanding.

Long before there was anything deserving the name of economic science, however, there was much writing, mostly controversial, as there has been ever since, about such matters as the monetary, fiscal and commercial policies of governments. Among the participants in these early controversies were some of the ablest men of their time—philosophers, public administrators and successful men of affairs. At one point or another the best of them probed deeply into the mysteries of the world's economic mechanism and reached conclusions which the economists of a later day have reaffirmed. For the most part, however, the early writers were too heavily handicapped by the lack of a scientific organon. They had no consistent general view of economic processes taken as a whole, so that their views of particular issues were likely to be partial and short-sighted. Take for example the writings which had the purpose of expounding or defining the principles of that general system of governmental economic statecraft known as "mercantilism," which flourished from the 16th century down to the 19th, and which was exemplified in the restrictive policies of such statesmen and rulers as Colbert, Burleigh, Cromwell and Frederick the Great. Whether mercantilistic measures met the immediate needs of the times, whether they helped or hindered the task of nation-building, are disputed questions; but there can be no doubt respecting the weakness of the grounds upon which the case for such measures was commonly supposed to rest. It is not quite true that, as their critics have often said, the mercantilists held that money alone is wealth; but as a group they concerned themselves largely with the ways in which a country might secure and maintain a favourable balance of trade so as to conserve and increase its stock of money. They identified the economic interests of the nation with the interests of its merchants and they looked mostly at the immediate rather than the enduring interests of the mercantile classes themselves. The things which they thought conducive to national welfare were those they thought would stimulate trade and increase profits: plentiful supplies of money. low interest rates and low wages. Some of them appear to have thought of the nation as though it were itself a great trading firm, profiting from the excess of its foreign sales over its foreign purchases. Mercantilism, as the reader may have observed, is even now not wholly dead, but its errors were exposed long ago.

The Beginnings of Economic Science.—Sharply contrasted with the mercantilists' naïve confusion of economic welfare and money profits were the conceptions employed by a small but influential group or philosophical sect which flourished in France in the second half of the 18th century. They called themselves *les Économistes*, but the world now calls them the Physiocrats. Compared with the tracts of the mercantilists, who used the language of the world of trade, their writings seem abstract and doctrinaire. Their principal tenets were erroneous, and the modern economist finds less that has permanent value in their work as a whole than in that of some of their predecessors (*e.g.*, Richard Cantillon, whose *Essai sur le* commerce was written between 1730 and 1734). But though they saw the processes of economic life imperfectly, they saw them as a whole. Not the buying and selling of the marketplace, but the continuing flow of goods through various channels from producer to consumer, was what they fixed their attention upon. The welfare of the community, in their view, was measured, not by the profits of trade. but by the excess of the community's annual product over its cost. In commerce and manufactures, they thought, there is no net product or surplus, for those activities add no more to the aggregate product than is required to support the people who are engaged in them. But in agriculture more is produced than is required to support the cultivators, and the surplus, which goes to the landowners as rent, is the only true net product which the community reaps from its efforts. Upon this disposable surplus the burden of all public expenditures, through the shifting of taxes from one producer to another, must inevitably fall. The Physiocrats were mistaken, for there were inconsistencies in their ways of measuring product and costs; they are important in the

history of thought, not because they gave the right answers, but because they asked important questions,—questions which in themselves were a challenge to the naïve assumptions of mercantilism; and they had a considerable influence upon thoughtful men of their own day and of the period immediately following. Turgot, renowned for his courageous but abortive economic and fiscal reforms, fell just short of discipleship. His work, *Reflexions sur la formation et la distribution des richesses* (1766), is an exceedingly able treatise.

In 1776 Adam Smith published *An Inquiry into the Nature and the Causes of the Wealth of Nations,* a work in which wisdom, learning and power of analysis were joined as they are in few books. Sharing the physiocratic prejudices ("in agriculture nature works with man"—as though she did not work with him in his every pursuit!) and holding that the interests of business men, as a class, are more often opposed to the interests of the community than the interests of landowners are, Adam Smith nevertheless gave the world a new interpretation of the advantages of trade, a new "philosophy of commerce." But he saw in commerce a means to welfare, not an end, and his book was, in effect, a formidable tract directed against mercantilism. Money, from the communal point of view, he held to be merely an instrument, a "wheel of trade." The real source of a country's wealth, he said is its "annual labour," and its wealth could be increased only by making its labour more effective and by husbanding and accumulating the products of labour. The division of labour, *i.e.,* the specialization of tasks, is the principal factor in its effectiveness, and the degree in which the division of labour is practicable depends upon the extent of the market. These were Adam Smith's fundamental principles. We elaborated them with extraordinary skill, always discussing concrete problems, showing unusual powers of fresh observation in his selection and use of illustrative material, and passing large sections of economic history and the whole range of the contemporary commercial and fiscal problems of Great Britain under survey. Although the book is the most powerful brief ever formulated for unimpeded trade, neither hampered nor coddled by governments, its greatest importance is not to be found in that circumstance, but in the general picture, at once simple and comprehensive, which it gives of the economic life of a nation. The apparent chaos of competition, the welter of buying and selling, are resolved or transmuted into an orderly system of economic co-operation by means of which the community's wants are supplied and its wealth increased. This general picture has been in the minds of economists ever since, whatever their opinions with respect to the efficiency of the competitive system. Despite some sweeping phrases which invite a different interpretation, Smith's real concern was for the establishing and maintaining of competitive conditions rather than for a vigorous observance by governments of a hands-off policy in respect of economic matters. He was discussing a special set of problems. He was opposed to monopoly, to exclusive combinations, and special privileges of all kinds, quite as much as to the type of legislation which aims at fostering a country's prosperity by restricting its trade. Often styled the "apostle of self-interest," he took no pains to conceal his dislike for some of the forms in which self-interest manifests itself in trade and industry. What his attitude would have been under the later conditions of the 19th and 20th centuries towards the factory acts, social insurance, and measures intended to help onward equality of competitive opportunities, we cannot tell. But there is very little in these newer types of legislation which runs counter to his principal contentions or is inconsistent with his general economic philosophy.

The Older Political Economy.--Adam Smith's work had a profound influence, not in Britain alone, but in almost every part of the western world. It was probably partly responsible for some radical changes in the commercial policies of governments, although one cannot be certain about this, for the current of the times was moving in a direction favourable to Smith's contentions. Its effect upon scientific thought and upon the character and quality of public discussions of economic questions was unmistakable. Men like J. B. Say in France and K. H. Rau in Germany based their own work very largely on Smith's and helped to diffuse his influence. Say, however, was more than a mere popularizer. He had some clear-cut views of his own, and developed Smith's work in directions other than it took in the hands of Smith's British successors. In the United States, Say's work came to be about as widely read as Smith's.

The particular trend which the development of economics took in Great Britain was determined very largely by the character of the economic problems which confronted the nation, partly by reason of swiftly progressive changes in its own industrial structure and partly in consequence of the Napoleonic wars. The rapid growth of population, the extension of agricultural cultivation and the rise of land rents, the expansion of industrial activities, the depreciation of the currency, the variations of prices, of interest rates and of profits, and, after the wars, the depression in both agriculture and industry, were phenomena at once conspicuous and important. Some of these developments commanded the attention of Parliamentary committees; all of them attracted the interest of thoughtful men. With Adam Smith's impressive picture of the mechanism of organized economic life in their minds, it was natural that men should think of such phenomena as interrelated and as susceptible of being explained in some consistent and comparatively simple way. At any rate, out of the discussions of the period, out of the pamphlets and the controversial tracts, there emerged a coherent system of political economy, owing much, of course, to Adam Smith, but putting stress on matters to which he had given little or no attention, and emending his views at a number of important points. This newer political economy was more formal and systematic than Adam Smith's, and was concerned more largely with abstract general relations, but it dealt with real problems and dealt with them in what was intended to be a practical way. There is an appearance of paradox, but only an appearance, in the circumstance that the particular type of economics which grew out of attempts to deal intelligently with the problems of a period of economic storm and stress should be one which gave particular attention to "normal tendencies" and to the conditions of economic equilibrium rather than to the causes of economic maladjustments. A parallel may be found in the way in which the study of pathology has contributed to men's knowledge of normal physiology.

For convenience the period of which we are now speaking may be taken as having definitely begun when David Ricardo's *Principles of Political Economy and Taxation* was published (1817) and as having culminated with the publication of John Stuart Mill's *Principles of Political Economy* (1848). One who compares the economic tracts and the systematic treatises of that period with the *Wealth of Nations,* will be impressed with the increased importance given to a group of problems which have remained ever since among the principal concerns of economics, problems now commonly grouped under the head of "the theory of value and distribution." The theory of value, of course, has to do with the explanation of why goods exchange at particular ratios, why some goods are expensive and other goods are cheap. The theory of distribution is really an extension of the theory of value so as to explain the magnitude of the shares of the total national product which are secured by those who contribute either their own services or the use of their property to the communal task of production. With the problem of personal distribution, the problem, that is, of why some men are rich and some are poor, economic theory, of the type which we are now discussing, has not directly concerned itself. Its problem has been that of the distribution of the product among the so-called factors of production. These factors and their respective shares were classified as labour and its wages, capital and its profits, and land and its rent. Later on the conception of a fourth share, the profits of enterprise, or of the successful direction of production, was taken over from the French economists, the earnings properly imputable to capital, as distinct from enterprise and direction, being put down as interest. But British economists, more than those of other countries, still continue to speak, in realistic fashion, of "the profits of capital," and there is no general agree-

ment among economists anywhere that enterprise should be treated as a separate factor in production, even though the profits of enterprise be conceded to be a separate distributive share. The three-fold, or four-fold, classification of factors is in some respects arbitrary. Some economists use a two-fold classification, treating land as a particular form of capital, while others hold that a really adequate classification would take account of many different kinds of capital and of various grades or qualities of labour. The truth is that the three-fold classification is adequate in the analysis of some problems (the simple contrast between labour and capital, taken as including land, is all that is needed to bring certain important problems into clear relief), and inadequate in the analysis of others. It has been suggested that the three-fold classification was in its origins merely a reflection of the actual political and social structure of the society of the day. Be that as it may, the classification still corresponds very closely to the way in which some of the most important of communal economic problems present themselves.

An element in the theory of value which for a long time was stressed to the comparative neglect of almost everything else was the tendency for the exchange values or relative prices of goods produced and sold under competitive conditions to be equal or at any rate proportionate to the respective costs of producing them, as a result of the continuous shifting of productive resources from less profitable to more profitable channels. By costs were meant not the money outlays of employers but "real" or communal sacrifices. At first these real costs were conceived to be measured by or proportionate to the amounts of labour required to produce different goods, but later the "abstinence" or waiting involved in accumulating capital by using resources so as to get a larger future product instead of using them in providing for immediate wants was held to be a distinct and separate cost. This innovation was first suggested by N. W. Senior in 1836. At this point, it may be observed, the economic theory of the "scientific" socialists, including the predecessors as well as the followers of Karl Marx, branches off from that of the more orthodox economists, for the socialists refused to adopt the innovation.

The distribution of the product was held also to be determined in considerable part by costs. Thus the doctrine that in the long run the standard of living of the labouring people determined their wages was in effect a cost-of-production theory of the value or price of labour. This doctrine rested upon the theory of population generally associated with the name of T. R. Malthus, and particularly with the revised form which Malthus gave his theory in the second edition (1803) of his famous Essay *on* Population. In its revised form the theory was to the effect, not that population would normally increase faster than the means of subsistence could be increased, but that it would normally increase at least as fast as the means of subsistence would permit. For "means of subsistence" read "standard of living," understanding by that term the general scale or standard which labourers think must be maintained if a family is to be supported, and the essential basis of the standard-of-living theory of wages is obvious. If wages fall below that level, it was thought, the rate of growth of the population will fall off, the supply of labour will be relatively smaller, and wages will rise. If wages rise above that same fixed point, the increase of the population will be quickened (except so far as a better standard of living may become effective) and wages will fall.

The rent of land, however, was held not to be governed or determined by the principles of cost. This was because (1) the supply of land is fixed, so that a rise of rents does not tend to counteract itself by stimulating supply, and because (2) the prices of agricultural products cover the costs of cultivation on lands which, prices and wages being what they are, are barely worth using, and hence yield no rent. Rent, from the communal point of view, was held to be neither determined by cost nor itself a determining element in the prices of commodities, but to be a surplus arising from the circumstance that the value of the produce of the better lands is more than enough to pay the cost of cultivating them. Closely connected with the doctrine of rent — although in point of historical fact preceding it instead of deriving from it — was the law of diminishing returns. With the growth of population and the extension of cultivation, the theory ran, resort must be had to poorer lands, or lands already in use must be cultivated more intensively, or more probably both things must occur. In any case the increase of product would not be proportionate to the increase of the amount of labour required. In manufactures, it was thought, increasing returns were normally operative, because a larger population, with a larger demand for goods, affords larger opportunities for the economies of the division of labour, and for the inventions and the applications of the fruits of scientific progress to industry which the division of labour facilitates. Agriculture, too, benefits by technical progress, but here the possibility of improvements in methods were thought to be somewhat smaller and to be more than counterbalanced by the increasingly disadvantageous proportioning of labour and land which comes as an inevitable result of the growth of population. Some of the older economists, including both Ricardo and Mill, went so far as to hold, in what is perhaps the most vulnerable part of their analysis, that with the increase of the amounts of labour required to produce the labourer's own subsistence, coupled with advance of land rents, the profits of capital must decline. This would dampen men's desire to accumulate capital, and finally the growth of population and of wealth would come to an end. In the law of diminishing returns, taken as a statement of a tendency, there was nothing fallacious. Taken as a prophecy, however, it was, or has been thus far, mistaken. The possibilities of improvements in agricultural technique were underestimated, and the rapid extension of the cultivation of new lands of good quality, brought nearer to the world's industrial centres by cheap transport, was unforeseen.

It was recognized, of course, that at any given time the prices of goods and of productive services might be considerably out of line with the norms established by long-run tendencies. But these deviations were held to be self-correcting, and for the most part the older economists were content to attribute them to "variations of supply and demand." In some instances, however, they pushed their analysis of the factors which control the temporary state of the market a little further. Thus, for the time being, the supply of labour is determined by the present numbers of the working population. The demand for labour was held to be determined, not by the demand of final consumers for the products of labour, but (since most labour has to be paid for and the labourers supported before their products are ready for the market) by the amount of capital that can be devoted to the making of "advances" to labour. This was the famous wages-fund doctrine. It was found to be so misleading, however, that it has been pretty generally abandoned, the elements of truth which it contained being taken account of in other ways. Again, the equally famous doctrine (which has withstood criticism better) that the value or purchasing power of money at any given time depends, other things being equal, upon its quantity as compared with the volume of production and trade, may be regarded as a supply-and-demand theory of money. It was supplemented by the doctrine that the "normal" value of money, *i.e.*, its value in the long run, is determined, when gold or silver is the monetary standard, by the marginal costs of mining, that is, by the costs of producing that portion of the supply which would not be produced if the metal were a little less valuable. Similarly, and quite naturally, short-lived fluctuations of the rate of interest were ascribed to temporary changes in the supply of and demand for loanable funds.

It would be an error, however, to think of these earlier economists as altogether preoccupied with theories of value and distribution, and it would also be an error to fail to recognize that their interest in those theories was born of their interest in practical problems. In general moreover they were not such uncompromising opponents of any sort of interference by the government in industry as some of their critics and some of the lesser writers who pretended to expound their views might lead one to think. Their attitude towards legislation intended to improve the condi-

tion of the working classes was sometimes sceptical but rarely hostile.

The Critics.—Before reviewing the later progress of economics it will be helpful to look at the principal types of criticism which have been directed against the older political economy and which are still maintained as against some of the newer developments of economics. In the first place, romanticists like Adam Müller and John Ruskin and their followers disliked the new modern economic mechanism, into the workings of which the economists were trying to probe, and they also disliked the economists' conception of communal welfare, which, one might say, involves no challenge of the particular conception of individual economic welfare which prevails in a competitive society, but merely substitutes the point of view of the community for that of the individual. They preferred an ordered society with economic subordinated to religious, moral or aesthetic values—such as some of them thought was implied, even if not fully realized, in the social structure of the later middle ages. Work, some of them insist, is not merely a means to an end, particularly when the end is what is commonly called wealth, for good work is worth doing for its own sake and for its effect upon the character of the worker. What the romanticists offer is a moral or aesthetic creed, not a science. They do not impugn the fitness of economics to serve as an instrument of attack upon its own problems, but they belittle its problems.

Another group of writers, for whom there is no better general descriptive name than "the critical school," come much closer to meeting the economists of the orthodox line upon their own grounds. One of the earliest and easily the most influential of them was Sismonde de Sismondi (*Nouveaux principes d'économie politique*, published in 1817, and other works). Other able writers, often without any conscious discipleship, have taken a position much like Sismondi's. These critics urge that insufficient attention is given to the defects of the existing economic mechanism, even if it be viewed merely as a means of providing for the material needs of the community. They suggest that the economists, in their contemplation of such things as "long-run" or "normal" tendencies, the advantages of the division of labour, and the seeming perfections of the automatic processes by means of which the things men do in the pursuit of their own economic interests become knit together into a vast scheme of communal economic co-operation, forget how often the mechanism breaks down and the "normal" progress of the community's economic life is interrupted by a crisis; how unemployment, partly chronic and partly epidemic, is a persisting disease of the present economic order; how unequally the aggregate product is distributed among the members of the community; and how many of the things which men do in pursuit of their own economic advantage are, in point of fact, inimical to the economic interests of the community. As some contemporary critics put the matter, men to-day are interested first of all in making money, and only incidentally in making goods. To look at the activities of a competitive, acquisitive, society as though such activities constituted, in their entirety, a communal process of wealth production, requires, it is urged, rather more rationalizing and sophisticating of the facts than the orthodox economists and their followers realized. Such criticisms undoubtedly go too far. They give an incorrect impression of the place of the more abstract parts of the older economics in the general view of the community's economic activities which one finds in the works of the economists. No economist of the first rank has ever been a devotee of the "economic harmonies." The critical school, nevertheless, has had a wholesome influence upon the progress of the science. This school, it may be observed, occupies a position midway between that of the economists of the more orthodox line and that of the socialists who denounce the parts of economics that are inconsistent with their tenets as being merely an apologetic for and a product of the existing economic order.

Another angle of attack was adopted by the "historical school"—using that term broadly so as to include critics who might easily be put into several different groups. This school has had and still has adherents in all countries, but it has been especially influential in Germany. The most important of the early exponents of its views were Friedrich List (*Nationales* System der *politischen* Oekonomie, 1841) and Wilhelm Roscher (Grundlagen der Nationaloekonomie, 1854, and other works). The structure of a nation's economic life, said these critics, is a "historical category," something peculiar to a given nation at a given time, a product of its past, and to be understood, therefore, only by the study of that past. The wisdom of particular economic policies is relative to place and time, and the general or supposedly universal "laws" of abstract economics need to be supplemented by or even subordinated to an analysis of the concrete facts of each nation's economic growth. If they had gone no further these critics would have found many to agree with them. But the founders of the school (Karl Knies, whose work, Die *politische Oekonomie vom Standpunkte* der *geschichtlichen Methode,* appeared in 1853, is a notable exception) made of what they called the historical method something peculiarly arbitrary and doctrinaire. Instead of looking to history for the particular antecedents of those concrete differences of economic structure in which they professed to be interested, they proposed to derive from history universal and binding laws, akin to the laws of the physical sciences. In naming certain stages of economic development through which they thought every nation must pass they were really elaborating suggestions which they got, not from historical research, but from the Greeks. Like some of their followers, they regarded the forms which economic life has taken in the past as inevitable products of historical forces, while at the same time they contended for a rather heavy-handed control of economic activities by the state. The French and British economists had looked upon the way in which the economic life of the community is organized as being shaped and determined by the interplay of the activities and interests of individual men, and they had treated the state as though it were an instrument of men's purposes, a utilitarian device. The spokesman of the historical school, on the other hand, strongly influenced by Hegel, ascribed a prior and independent value to the state, and looked upon the economic activities of individuals as though moving in grooves determined by the general structure of society and expressing at the same time the controlling purposes of the state. Despite the extremes to which they pushed their contentions, the historical economists gave a needed emphasis to what may be called the institutional as contrasted with the free or contractual aspects of economic activities. Their work and that of their successors has made economists more mindful of the way in which institutions are the masters as well as the servants of men. and less ready to asume that the particular economic order with which their analysis is mostly concerned is inevitably permanent or final. The historical economists also gave a needed impetus to the study of economic history—a most valuable complement to the study of economic theory. With the growth of careful and painstaking historical research the old dogmatism of the historical economists has pretty generally given way to a realization of the variety and complexity of the fabric of economic history, and the new schools of historical economics under the leadership of such scholars as Gustav Schmoller in Germany and George Unwin in Great Britain (to name only men who are no longer living) are, as they should be, schools of historical research.

The Methods of Economics.—Not only its critics but also some of its expounders have held that economics (*i.e.,* analytical economics, allied in its methods and its aims, even if not in all of its findings, to the older political economy) is essentially abstract and deductive, proceeding from the premise that men's activities are prompted mostly by self-interest, and that it posits an "economic man," whose behaviour under given circumstances is completely rational or predictable. Economics is indeed abstract, as any science must be, but it has never been in any real sense deductive or a *priori,* and the "economic man" will be found upon scrutiny to be a fairly complex sort of person, whose behaviour is taken to be strictly self-regarding only in respect of certain aspects of the relationships into which he enters as buyer or seller, borrower or lender. In fact it might be urged plausibly that the older political economy, of which the Malthusian theory

of population was an integral part, erred by underestimating the part which the rational prevision and weighing of economic consequences plays in human conduct. When we say that economics is abstract, we mean merely that economists do not pretend to take account of all of the factors which, in their entirety, might be supposed to account completely for every happening and every outcome in economic life. Their principal interest is in uncovering factors and relationships which are so general and important that the community cannot afford to remain in ignorance of them.

Economics makes use of two general classes of data: (1) observed facts respecting the behaviour of men in their various economic activities and relationships, including all classes of activities that have economic consequences; (2) such economic phenomena or events as movements of population, production, trade, incomes, prices, wages, profits, interest rates, etc. The most trustworthy evidence respecting the characteristics of human behaviour is often supplied by its results, and so the second class of data has often been drawn upon for knowledge respecting the first class. In the actual processes of constructive thought men doubtless pass forward and backward from one sort of knowledge to the other. The earlier economists, however, presented their findings in such a manner as to show that the known phenomena of the second class could be explained by (*i.e.*, were consistent with) the known facts of the first class—the known characteristics of human behaviour. This circumstance undoubtedly accounts for the mistaken impression that they "deduced" their findings, including the second class of facts, from the first. What they really did, of course, was to examine such experience as was at hand and seemed relevant to their problems, with a view to discerning the systematic relationships which ran through it and to explaining the more puzzling or apparently more complicated happenings in terms of their relationships to what was familiar or more easily understood.

The growing accumulations of precise numerical information covering a wide variety of economic facts, coupled with the advance of statistical technique, bids fair to accomplish a notable change in the character and content of economics. More and more it is found that records of measurable economic phenomena, carefully interpreted, may be used to provide a basis for more reliable and in some respects more sensitive accounts of the economic activities of the community than can possibly be derived from even the most careful observation of how individual men conduct their affairs. The economic science of the immediate future, it is safe to say, will give a relatively larger place to the study of the movements of averages and aggregates. It should not be supposed, however, that this means that economics will be or can be altogether statistical—a new kind of "political arithmetic." Every average or aggregate is in some measure unique, the resultant of the play of a particular combination of circumstances, such as may never be encountered again. In order that me may know just how dependable and how significant the variations of these statistical magnitudes are, we need to analyse them so that we can explain them. That is, we need to weave them into the general texture of our knowledge, so as to relate them to other things which we know. In short, although economics is beginning to utilize new materials effectively, and although some of these new materials call for the use of a new technique, it cannot change its general logical method, for outside the field of the experimental sciences there is no other method of getting useful and reliable knowledge.

The Progress of Economic Theory.—"Economic theory" is the rather misleading name now commonly given to the more general and abstract parts of economics. These more general parts are no less practical than what is sometimes called "applied economics," but the problems with which they have to do are less immediate and particular. The general problems of value and distribution, referred to above, have continued to hold a place among the central concerns of economic theory, but there has been a notable change in the general character of the analyses. The older economists, as we have seen, had a special interest in the long-run relations between value and costs, and, save in a few notable instances, were content to dispose of the other factors governing the variations of prices and values by invoking the formula of supply and demand. One of the tasks which a newer generation of economists set for themselves was the careful examination of the mechanism of supply and demand, with special emphasis on what had been the relatively neglected factor of demand. One of the most important steps in the new analysis was taken independently but almost simultaneously (towards the end of the third quarter of the 19th century) by W. S. Jevons (England), Carl Menger (Austria) and Léon Walras (France and Switzerland), although it came to be known later that they had been anticipated by some earlier but forgotten writers. Adam Smith, in a famous passage, had contrasted "value in use" (high for water and relatively low for diamonds) with "value in exchange" (high for diamonds and low for water). The new analysis found a definite relation between value in use (or "utility") and exchange value. The point was that neither use value nor exchange value is an attribute of things conceived generally or abstractly, but only of specific units or increments. Water, for example, has a variety of different uses, and its exchange value at a particular time and place is directly related to the importance of its marginal uses, *i.e.*, the uses which would have to be foregone if the supply of water were just a little smaller. Under conditions of scarcity the value of water might be exceedingly high, but only because its marginal uses were exceedingly important. In this way many an ingenious theory of value was built up by the economists whom we have named and their followers in Europe and America. Some of these writers also took another and more doubtful step. Having explained values by relating them to the choices and preferences of consumers, they pictured the economic behaviour of men, including the choices which they make as consumers, as governed by the aim of maximizing pleasure and avoiding pain, so that the fullest possible satisfaction of consumers' wants was held to yield "maximum happiness." This, it is now pretty generally agreed, is dubious psychology.

Starting with this new way of explaining the values of the goods and services which consumers buy and use, a new type of explanation of the distribution of the aggregate product among the various productive factors was developed. The central point in this new analysis was the thesis that the value of productive agents, including labour, capital and land, is derived from or, we might say, merely reflects the value which consumers attach to the final products of such agents. The problem of distribution, viewed from this particular angle, is the problem of discovering the general relations between the values of the final products of trade and industry and the values of the productive agents. If the demand of consumers for finished products could be construed to be a demand for definite quantities of land, labour and instruments, combined in fixed proportions, the problem would be relatively simple. But because, in fact, goods can be produced in different ways, and because, within limits, one factor can be substituted for another (as a given amount of agricultural produce can be grown by using more labour and less land or more land and less labour, or as simple and direct or highly roundabout methods, requiring small or large amounts of capital, may be used in industry) the problem is really exceedingly complex.

One general principle which has been found to help towards clarifying the problem is nothing more than an extension or generalization of a principle which the older economists had taken account of in their doctrine, previously noted, that the expansion of agricultural production is attended by diminishing returns. It came to be seen that if it is true that the amount of product dependent upon the efforts of any one labourer or any one day's labour becomes smaller when the amount of labour "applied" to or combined with a given amount of land is increased, it must also be true that the amount of product dependent upon the use of any one particular acre of land becomes smaller when the available supply of land of equal quality and accessibility is increased more rapidly than the supply of labour. Similarly, the larger the supply of capital as compared with the supply of labour and land, the smaller is the amount by which the product would be decreased if any one unit of capital were not available. How

much of the aggregate product will have to be assigned to any one labourer or to the owner of a certain productive instrument or a certain piece of land will be determined, if competition is free and frictionless, by the extent to which the product really depends upon the work of that particular labourer or the use of that particular productive agent. The individual labourer, for example, counts for more, and indeed produces more, when there is a plentiful supply of productive agents other than labour. He produces less — for less depends upon his own efforts — when labour is relatively plentiful and other productive agents relatively scarce. What he earns will depend, of course, upon the value of what he produces, and his real wages — what he is able to buy — will depend as well upon the values of other products. But — assuming again that competition is unimpeded and frictionless — labour, like capital and land, will move or be moved away from employments where the value of its product is relatively small, and will move or be moved into employments where the value of its product is relatively large. There is thus a tendency — effective in a measure, though never working itself out completely — towards an equality of the values of the products attributable in different employments to labourers of comparable efficiency and to other productive agents of comparable kinds. The significant outcome of this newer analysis is not the doctrine that everyone who contributes to the communal product tends to get as his allotted share an amount equal to "what he produces." It must be remembered that differences in respect of training and of opportunity still affect men's productive capacities; that institutions, such as inheritance, help to determine how the products imputed to capital and land shall be distributed; that the swift process of industrial change often robs men of the advantages of acquired skill; that impediments of one kind or another often prevent men from transferring their labour to employments in which its product would have a higher value; that capital once fixed or invested in permanent forms is generally irretrievably committed to the fortunes of a particular type of enterprise, whatever those fortunes may prove to be. No, the doctrine that "rewards tend to be proportionate to products." taken by itself, has no particular significance, except as a corrective to the even more misleading notion that rewards are in no manner related to or dependent upon productivity. The real significance of this new way of sketching the outlines of the problem of distribution is that it brings clearly into view the general form, at least, of some very important relations between production and distribution and between one distributive share and another. Relations such as these have to be kept in mind when analysing the probable repercussions of almost any projected scheme for economic betterment.

Any short summary is bound to make economic theories appear thinner and more remote from the concrete facts of economic life than they are. The structure of abstract general relations which constitutes the framework of modern economic theory has been built up, not like pure geometry, by a wholly intellectual process, but by a patient and persistent scrutiny of the complicated facts of economic life. In what is generally called "mathematical economics," however, one finds a comparatively high degree of abstraction. The one great advantage of the use of mathematics in economics is that in that way alone is it possible to depict the variety, the complexity and most of all the interdependence of the factors which determine prices, costs, supply, demand and distributive shares. Elaborate mathematical formulations of the conditions of "general economic equilibrium" have been devised, notably by Léon Walras (*Éléments d'économie politique pure, 1874,* and later editions) and Vilfredo Pareto *(Manuel d'économie politique,* 1909, and other works). The principal value of these elaborate and highly abstract systems is that they put the enquirer on his guard against over-simplifying his problems, as for example, by forgetting that a change of almost any economic variable has its indirect as well as its direct effects. Other writers, notably Alfred Marshall *(Principles of Economics,* 1890, and later editions) have shown that it is possible to put a proper emphasis upon the interdependence of economic phenomena while yet examining more closely and realistically into the operations of the different parts of the cionomic mechanism, and while taking account of factors which make for change as well as of factors which make for stability.

Among the economic phenomena to which a largely increased amount of attention has been given are interest and profits. In connection with interest two different though related types of questions present themselves. First, is interest a necessary or in any sense an "earned" income? For what sort of productive service or sacrifice is it a payment? Is there any perceptible relation between the amount of the payment and the amount of service or sacrifice? Second, what factors govern the fluctuations of interest rates, and what determines their general level or their movements, upward or downward through longer periods of time? The first of these two types of problems was brought into prominence by the attacks of the socialists upon the private receipt of income from capital. Profits, as the term is used in the world of affairs, are generally a mixed form of income, containing elements of interest and sometimes of wages (as for superintendence or managerial direction) along with a special element (which may be positive or negative) of what the economist calls "pure profits." The distinguishing characteristic of profits is that they are not paid in accordance with any contract or agreement, but are contingent upon the success of particular undertakings. Pure profits are what is left after allowance is made for the interest and wages which would have to have been paid for capital and management upon a contractual instead of a contingent basis. Pure profits, therefore, are determined by all of the factors which make for the success of an undertaking, such as foresight, fortune, quickness to see opportunities for gain and to take advantage of them. In a completely stationary and unchanging economic order, it is pretty generally agreed, the advantages of different employments of capital and of managerial ability would be so completely equalized by competition that there could be no pure profits.

The Problems of Modern Economics. — The more general and abstract parts of economics cannot be taken to be completely true and adequate accounts of the mechanism of modern economic life. They are at best serviceable approximations to partial, though important, aspects of truth. There are other true generalizations which might be made. Some of these are obvious but unimportant; others, doubtless, are important, but require further scrutiny of the facts or a more penetrating insight to bring them to light. But even in their present imperfect and incomplete state the generalizations which the economist has at his hand constitute an organon of proved effectiveness, an instrument by means of which some of the results of economic changes, whether planned or not planned, may often be predicted with a fair degree of certainty. The practical problems of communal economic life are many and various. At any given time they appear to fall into a number of fairly well defined groups or classes, but as new problems challenge attention and new interests emerge, new groups appear and some of the old problems fall into new relations. Each group or class of problems has its special literature, and each engages the attention of a corps of specialists.

Among the classical problems of economics are such subjects as the mechanism of money and credit and its proper management, the incidence and the effects of various kinds of taxation, the nature of international trade and the economic consequences of protective tariffs and other devices for controlling it. In none of these fields is the ground completely explored or all of the issues definitely settled. But in each field important findings have been reached which appear to have permanent value. The outcome of the various fiscal and monetary measures to which governments resorted during the World War, and the results of the various restrictions imposed at that time upon trade and industry were in general just about what competent economists predicted they would be. Post-war experience, too, in respect of such problems as reparations and monetary stabilization, were such as to give new confirmation of some long-established economic principles.

The general form which economics took at first was determined very largely by its preoccupation with certain special types of problems, notably problems of national commercial policy. But as new types of economic problems have forced themselves upon

the attention of the community, economics has had to deal with them, and in the process not only its scope but its general pattern has inevitably been altered. The way in which a new group of "labour problems" has emerged from the labour movement of the 19th century is a case in point. Up to the last quarter of that century there was very little careful analysis of those problems, apart from discussions of the general theory of wages. Now, however, there is hardly a field of economic inquiry which is more thoroughly cultivated. The trades union movement and its significance, the possible gains of collective bargaining, the length of the working day, factory legislation, profit-sharing, the organization of control within the factory and its administration, labour turnover, the minimum wage, the prevention and settlement of industrial disputes, compulsory arbitration, the causes and possible cures of unemployment and social insurance in its various forms are subjects which suggest the increasing range of this new field of economic interest. It is important to observe that the attention now given to these subjects marks a change of interest rather than a change of attitude. The earlier economists, interested as they were in the exploding of popular fallacies with respect to the ways in which the prosperity of the community can best be secured and (with that end largely in view) in showing how the economic activities of individuals are so inter-related that they constitute, in their entirety, a great communal economic mechanism, often give the impression—an impression which careful study of the writings of the ablest of them will dispel—that they regarded that mechanism as self-sufficient, needing neither interference nor any sort of direction on the part of the community. They concerned themselves more with what governments could not do than with what they could wisely attempt. Modern economics strikes a different note. Its tone is less negative; it is more insistent in its search for and scrutiny of possible ways of altering the organization of the community's economic life for the better. Almost every gain has its cost, and accordingly almost every such problem resolves itself into a question of a balance of advantage. The advantages and disadvantages are hardly ever purely economic, and no purely "scientific" analysis, therefore, can completely dispose of such questions. The economist, however, may be able to gauge the general character of the probable effects of a specific change upon the production of wealth or its distribution, so that the wisdom of proposed changes can be discussed upon the basis of some knowledge of their probable consequences.

Questions associated with monopoly—its roots, its various types, its effects, its possible advantages in some circumstances, the ways in which it may be controlled—are matters with which economics have long been concerned. Economists have learned, for one thing, to distinguish between the types of monopolies which are inevitable, and have to be recognized and treated as such, and the types of monopolies which might be prevented or suppressed, in so far as the maintenance of competitive conditions in fields where competition is feasible is held to be a sound public policy. Changing methods of business organization and particularly the rise of the limited liability company have created new problems for economics. On the one hand there is a new opportunity for large numbers of people, not merely to put their savings out at interest, but to participate in the profits (and losses) of large undertakings. On the other hand, along with this larger diffusion of industrial ownership, there are new opportunities for the concentration of industrial control. This situation gives rise to new communal problems, and these, in turn, create new fields for economic inquiries. The general theory of economic equilibrium, which includes an analysis of how exchange values and distributive shares "tend" to be determined under the operation of the forces which make for a general balancing of supply and demand, retains its importance in economics. But in recent years economists have come to give increased attention to the factors which make for economic change and to the persistence of maladjustments in the mechanism of production and trade. The recurring phenomena known as industrial fluctuations or business cycles, with their attendant costs and wastes, are receiving a very much larger amount of study than was formerly given to them.

The most striking and possibly the most important characteristic of the newer work in economics, as contrasted with the older, is its greater realism. Not that it manages to do without abstract conceptions, but that it takes its conceptions, so far as it can, from the world of affairs. The older economists, for example, in their efforts to dig beneath that surface view of economic life which had deceived the mercantilists, held that money was merely a convenient instrument or tool. From their point of view, which remains a significant point of view, they were right. They also held that money prices were "exchange values" expressed in terms of money, making value the basic and price the derived conception, and thus inverting their real relation. This procedure, again, was not without reason, and in some special types of economic analysis it remains convenient to assume that trade is conducted by barter, without the use of money. In general, however, modern economists find it better to deal with money prices rather than with "exchange values." They have observed that modem processes of price-making and distribution depend upon the use of money and credit, not only in the sense that processes so complex would be unthinkable otherwise, but also in the further sense that the use of money and credit has certain special and discernible effects upon the outcome. Reliable records of economic activities—or at any rate of their results—are now brought together and published by governments or made public by business organizations on a scale, in respect of both volume and variety, which would have excited the envy of the older economists. A much wider range of economic experience is now available for study and analysis. In dealing with this new material—virtually a by-product of the activities which it records—economics again has to accommodate itself to a more realistic view. It has to deal with economic events in the forms in which they really occur, and it has to search for the systematic relations which run through these masses of real events. But although the interests of economics have become more varied and concrete, and although its conceptions have become better adapted to the handling of the facts of economic life in the form in which those facts present themselves, economics remain a communal or political science. Particular findings or tenets have been discarded, and new ones have been set up in their stead But the general picture of a scheme of communal economic life, sufficiently ordered to make an analysis of it possible, and imperfect enough to give point and purpose to such an analysis in spite of changes of view-point and method, remains.

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ECONOMICS, PRIMITIVE. Comparatively little is known about the economic organization of savage peoples. Being apparently one of the simplest and least interesting aspects of their social life, it has been the last to receive attention from the anthropologist, though in reality it presents complex problems of vital concern for native welfare. Most of our knowledge of the principles of savage economic life is due to the work of German scholars. The earliest studies in economic anthropology were largely of an evolutionary nature, attention being concentrated on the somewhat barren aim of fitting phenomena into schemes of stages of progress and constructing theories of development from one stage to another. Best known of all is the *Dreistufenschema,* the three-stage scheme of society by which mankind, having first lived as hunters and fishers, advanced through the pastoral grade of existence to attain the state of agriculture, which represented the final achievement of primitive industry. This scheme of the economist Friedrich List persisted for several decades, though the idea of a universal course of evolution for all mankind soon disappeared. Rival theories, as that of the barter, money, credit periods of development of Bruno Hildebrand, were also advanced. In time the old three-stage pattern of economic progress was abandoned, owing to the destructive criticism of geographers such as Friedrich Ratzel and anthropologists like Eduard Hahn. Other schemes of classification of culture, associated with the names of Hahn, Ernst Grosse, Alfred Vierkandt and Heinrich Schurtz, came in rapid succession, but the value of such work lay in the collection of data and the incidental analysis of native economic conditions — as in Hahn's distinction between hoe-cultivation and agriculture proper with plough and domesticated animals — rather than in the actual theories propounded.

The writings of Karl Biicher, by drawing the economy of primitive man into relation with that of our civilization, have done much to provoke interest in the subject. His classification, however, of all savage economic life as being either a selfish individual hunt for food or at best a sharing of goods within the closed circle of the household, does not conform to the facts as now known, nor do his theories of the development of exchange from the custom of giving presents and the origin of work in play find much modern support.

Exponents of the *kulturhistorische* method in anthropology, notably Wilhelm Koppers, have also laid due stress on the economic factor as a prime determinant of culture. But their study of economic life is made subservient to their attempt to establish certain theories regarding the history of mankind which involve a hypothetical scheme of *kulturkreise* or stages of culture. This interest in the problematical origins of native custom has led to a neglect of its real place in native life.

Studies by such writers as M. Marcel Mauss, Prof. Richard Thurnwald and Dr. Bronislaw Malinowski have done much to retrieve the position. The attempt to establish evolutionary sequences has been discarded, and the imagined history of institutions left on one side. Primitive economic organization is studied for its relation to the existing social mechanism, for the ends which it serves in the present, not for what it may have been in past ages. In short, the "functional method" of inquiry is employed. The institution of the exchange of gifts, for example, is shown to be part of the native economic system, not in virtue of being a transition stage from gift-making to trade, but because it satisfies certain practical needs and allows for the expression of social sentiments — ideas of rank, prestige, liberality and fulfilment of obligation. Recent work of this type in primitive economics has thrown light upon such questions as the character of leadership in native labour, the social stimuli involved, the part played by co-operation, the nature of economic reward, the action of the principle of reciprocity in exchange, the value of magic in industry, and the influence of wealth upon chieftainship and rank.

Such problems are concerned with vital issues, and the investigator here is grappling with the reality which lies at the foundation of the life and work of the native. Such study, apart from its interest *to* the economic historian in throwing light on the nature of less developed forms of institutions, has also a practical value. An adequate knowledge of the economic organization of a native people is essential before we can govern them, trade with them, utilize their labour, secure their co-operation in political affairs, or preserve them from the worst effects of contact with white civilization.

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ECONOMIZER. An important adjunct to a steam-generating plant. Instead of being allowed to escape to the chimney direct from the furnaces, the waste gases are led through passages in which are placed sets of vertical tubes. Water passes through the tubes and the heat of the gases raises it to a useful temperature for various purposes, not merely to supply the feed for the boilers, but also for supply where a large quantity of hot water is required, as in laundries, hotels, breweries, dyeworks and so on. At the same time, strains on the boiler plates and parts through exposure to an inflow of cold water are prevented. Scale trouble in the boiler is also greatly reduced, because the scale forms instead inside the economizer tubes, and these are readily cleaned. Some 15% to 20% of coal is saved on the installation of an economizer. Evidence of this is the fact that if the gases leave the boiler at 650° F, the feed-water entering the economizer at 100° F will leave it at 272° F, reducing the temperature of the gases to 330° F. The Green economizer consists of a number of vertical cast-iron tubes, $4\frac{9}{16}$ in. external diameter, made up in sections, and connected with branch pipes at top and bottom. The outside of each tube is kept clean by encircling scrapers, which travel slowly up and down all the time, actuated by automatic mechanism at the top. The soot falls into a pit for convenient removal. There is also a horizontal type of economizer which is mounted above a water-tube boiler. In some designs of economizers tubes with gills are used, to obtain the maximum heat transference, and the soot is cleaned off by steam blowers.

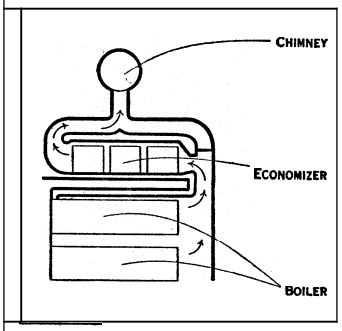


DIAGRAM TO SHOW PASSAGE OF WASTE GASES FROM BOILERS WHICH ARE MADE TO HEAT WATER IN ECONOMIZER BEFORE ESCAPING BY CHIMNEY

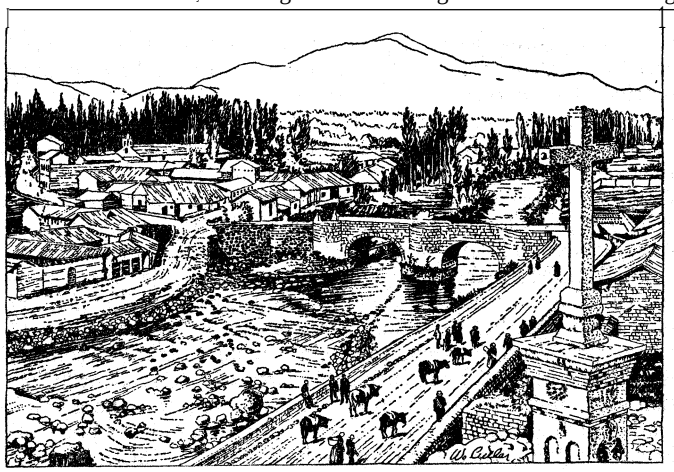
ECONOMY, the thrifty management of the financial resources of a household or of an individual, hence a "saving," not only of money, but of time, labour or effort, and generally, the least expenditure of means to attain a required end. "Economy" is also used in theology in such expressions as "Mosaic" or "Christian economy" as a synonym of "dispensation," for the administration of the world by God at particular times or for particular races. From the meaning of organization or administration of a house or State the word is applied more widely to the ordered arrangement of any organized body, and is equivalent almost to "system"; thus the "economy" of nature or of animal or plant life may be spoken of. "Political economy" is the science dealing with the production, distribution and consumption of wealth *(see* ECONOMICS).

ECORSE, a village of Wayne county, Michigan, U.S A., on the Detroit river, 7m. S.S.W. of Detroit. It is served by the Detroit, Toledo and Ironton, the Michigan Central and the New York Central railways. The population was 3,394 in 1920 (81% native white) and was 13,209 in 1940 by the federal census. It is a rapidly growing industrial suburb, manufacturing steel, castings salt and motor engines. The village was founded about 1812 and incorporated in 1902.

ECOSSAISE, in music, the French name, which has also been adopted in Germany, for a certain Scottish dance and corresponding music. Originally this dance was a slow one in duple time, but the term nowadays signifies one of a quicker and livelier character in 2-4 time. Beethoven and Schubert both left examples. The écossaise, it should be noted, is not the same as the schottische (*q.v.*), although the names might suggest that it is.

ECSTASY, a term applied to an abnormal mental condition, in which the mind is entirely absorbed in the contemplation of one dominant idea or object, and loses for the time its normal self-control (Gr. ἔκστασις, from ἐξίστημι, put out of its place, alter). With this there is commonly associated the prevalence of some strong emotion, which manifests itself in various ways, and with varying degrees of intensity. This state resembles in many points that of catalepsy, but differs from it sufficiently to constitute it a separate affection. The patient in ecstasy may lie in a fixed position like the cataleptic, apparently quite unconscious, yet, on awaking, there is a distinct recollection of visions perceived during this period. More frequently there is violent emotional excitement which may find expression in impassioned utterances, and in extravagant bodily movements and gesticulations. Ecstasy usually presents itself as a kind of temporary religious insanity. and has frequently appeared as an epidemic. It is well illustrated in the celebrated examples of the dancing epidemics of Germany and Italy in the middle ages, and the *Convulsionnaires* of St. Médard at the grave of the Abbé Paris in the early part of the 18th century, and in more recent times has been witnessed during periods of religious revivalism. (See also INSANITY and NEUROPATHOLOGY.)

ECUADOR (officially **La** *República del* Ecuador), a republic of South America, bounded on the north and north-east by Colombia and Peru, on the east-south-east and south by Peru, and on the west by the Pacific Ocean. The northern boundary (about 680 m.) begins on the Pacific coast at the mouth of the Rio Mataje, 1° 30' N. and ascends this stream to about 1° 18' N. where it crosses the ridge into the Rio Mira. The boundary ascends this stream to the confluence with the Rio San Juan, ascends the latter to its source, crosses the summit of the Andes in about 0° 45' N. and then descends the east slope of the Andes via the Rio Carchi, crossing to the Rio Aguarico and descending



BY COURTESY OF THE PAN AMERICAN UNION

THE BRIDGE OF EL VADOR Y SAN ROQUE. AT CUENCA. ECUADOR

this to 0° 23' N. where it crosses to the Rio San Miguel and descends this stream to the confluence with the Rio Putumayo in long. 75° 52' W. of Greenwich. It then turns south-west overland to the top of the divide between the Rio Putumayo and Rio Aguarico, about 0° 4' S. and 76° 15' W. a surveyed distance of about 310 m. from the Pacific. From this point the boundary follows the divide between the Rio Putumayo and Río Napo to the source of the Ria Ambiyacu which river it follows to the Amazon at 3° 19' S. and 71° 50' W. The boundary along the divide between the Putumayo and the Napo is not surveyed, but the approximate distance from the Pacific to the Amazon is about 680 miles.

In 1927 Colombia ceded to Peru a narrow strip of territory, about 430 m. E. and W., just N. of the Ecuador boundary as established by Colombia and Ecuador in 1916. The southern boundary follows the centre of the main channel of the Amazon from the mouth of the Rio Ambiyacu, to that of the Rio Huancabamba 78° 38' W. (about 520 m.). It then ascends the Rio Huancabamba to its source and crosses the Andes at 4° 40' S. to descend the Macara to the Catamayo. It then descends this river to the confluence with the Alamor which it ascends to the Quebrada de los Pavas. Ascending this the line then crosses *a* divide into the Rio Túmbez which it follows to the Pacific. This boundary is undisputed by Peru from the Pacific at the mouth of the Rio Tumbez to the headwaters of the Rio Huancabamba.

The area of Ecuador (not including the Galapagos islands, *q.v.*, with approximately 3,028 sq.m.), is variously estimated. Official Ecuadorian claims are 337,392 sq m., but well over 100,000 sq.mi. is in dispute with Peru (q v.). Attempts to settle the boundary question with Peru, in existence since colonial days, have failed. In 1894 the dispute was referred to the King of Spain as arbiter, but no results came. Since 1924, and especially since 1934, through the good offices of the President of the United States. negotiations have been carried on intermittently at Washington. In 1936 and 1937 especially, and to a less degree since then, relations between the two countries have been quite strained.

PHYSIOGRAPHY

Andean Region. — Ecuador is largely mountainous. It is traversed from N. to S. (500 m.), by the Andes Mountains (maximum elevation: Chimborazo, 20,j76 feet). The lowest divide in the cordillera, 6.888 ft., is on the Peruvian boundary.

The Andes are narrowest in Ecuador, which is divided into three regions: the Andean highlands, the coastal region between the Andes and the Pacific, and the Amazon region, or Oriente, on the east of the high Andes. The Andean region ends on the west in elevations of about 1,500 ft. above the sea. In the south, around the gulf of Guayaquil there is only a narrow belt of low coastal region. From a point a few miles east of Guayaquil, however, to just south of the Equator, the Andes terminate along the east side of the Guayas basin. **A** line from the head of the Guayas basin at Sto Domingo de los Colorados on the Rio Toachi north to a few miles east of San Lorenzo terminates the western boundary of the Andean region in Ecuador. On the east, however, the base of the Andes may be taken at points such as Macas (3,580 ft.) and Mera (3.808 ft.). In general the 4.000 ft. unbroken contour from the Colombian to the Peruvian border bounds the Andean region on the east.

The width of this mass from base to base varies from a minimum of 73 m. (Bucay to Macas), to a maximum of 183 m. (Zapotello and Santiago). The average width is about 100 m. (Sto. Domingo de los Colorados-Tena, 1,680 ft.). The longitudinal profile of the Andean summits from north to south, coinciding with the watershed between the Atlantic and Pacific varies from 20,576 ft. in Chimborazo to about 6,900 ft. in the south near the Peruvian boundary.

That portion of the Andes from about 2" S. to the Colombian frontier is characterized by lofty, volcanic peaks, many covered with perpetual snow and ice, some active. Beginning with Cumbal (15,711 ft.) and Chiles (15,678 ft.) just north of the Colombian boundary, the most important are Yanaurcu (14,881), Cotocachi (16,328), Imbabura (15,028), Mojanda (14,038), Cayambe (19,186), Saraurcu (15,502), Pichincha (15,918). Antisana (18,715), Cotopaxi (19,613), Corazón (15,871), Iliniza (17,405), Quilindana (16,174), Carihuairazo (16,51j), Chimborazo (20,-576), Tunguragua (16,690), Altar (17,730) and Sangay (17,464). These are irregularly distributed on a basal plateau and viewed from a great distance each volcanic unit is only a small mass having a prominence of but 3.000 or 4,000 ft. above the general level of the upland. Antisana, for example, can be described as a mass about 4 m. in diameter at its base and rising from an elevation of 15,000 ft. to 18,715 ft. above the sea.

In the volcanic part of the Ecuador Andes the streams flow in old valleys often several miles wide filled with hundreds of feet of ash and lava. The streams arc therefore rejuvenated and

flow in narrow canyons with steep walls.

The streams of the Andean highland region are all torrential and flow both to the Atlantic and Pacific. The largest drainage basin on the Andes is the Pastaza system, which is composed of the south-flowing Patate and the north-flowing Chambo. The longitudinal valley in which these flow is about 100 m. long. The two streams unite at the middle of this section near Baiios (6,000 ft.) to form the Pastaza and eventually reach the Amazon. To the north of the Patate-Chambo basin, about 40 m. of the upper part of the Guallabamba is in a valley which has the same north-south trend as its neighbour to the south. These two units, totalling a length of 140 m. in the most populous part of Ecuador and separated by an east-west divide of an elevation of only 11,650 ft. form a strikingly narrow, longitudinal depression and it has been customary to refer to the higher portions of the Andes to the east and west of this as the eastern and western cordillera. But the Andes are so narrow in Ecuador that it seems best to recognize them as one mountain mass. The Mira in the north flows to the Pacific and has a considerable portion of its drainage on the Andean highlands. This is often referred to as the Ibarra basin.

The Andes of southern Ecuador are pretty well and irregularly cut up by both Pacific and Atlantic tributaries whose headwaters are interlocked. Among the main streams of the former class are the Paute, the Zamora and the Chinchipe. To the latter belong the Naranjal, the Jubones, the Tumbez and the Catamayo. There are no large lakes in Ecuador.

All of the Andean highlands with the exception of the eastern and western slopes are treeless and highly suitable for agriculture. The forests of the east and west slopes are nearly uninhabited. The central part of the Andes which is also the most elevated and has the best climate has such cities as Ibarra (*q.v.*), Quito (*q.v.*), Latacunga (*q.v.*), Ambato (*q.v.*), Riobamba (*q.v.*), Cuenca (*q.v.*) and Loja.

Pacific Coastal Region.—The coastal region forms an area in places 115 m. wide extending from the Andes to the Pacific and from the Peruvian boundary in lat. 3° 30′ S. to Colombia, 1° 30′ N. This is mostly lowland formed of the basin of the Guayas and the coastal plain but in the south-east is a mountainous ridge called the cordillera de Colonche which is narrow and in the form of a half circle extends from near Guayaquil where it is named "cordillera de Chongón," to just south of Puerto Viejo where it is called cordillera de Puca. It is about 84 m. long and sometimes reaches 2,600 it. altitude.

The "montaiias de Cojimies" in the western part of the province of Esmeraldas, lie between the Pacific and the Rio Quinindé. These "mountains" are a narrow ridge about 35 m. long and reaching 1,000 ft. altitude. Just south-east of the town of Esmeraldas is a narrow ridge called "montaiias de Atacames." It is about zo m. long and its summits attain an elevation of nearly 1,000 ft. above the sea.

Scarcely anything is known of the coastal region between the rivers. Esmeraldas province is supposed to be a tableland having summits of about 1,000 ft. elevation and valleys dissected to nearly sea-level. The Guayas river and its tributaries form a large part of the coastal region. The river is in part an estuary extending north from the gulf of Guayaquil and is the largest navigable stream on the Pacific coast of South America. At Guayaquil to which sea-going vessels ascend it is about 2 m. wide. The river rises near the equator, and its main tributaries are the Daule, the Vinces, Rio Zapotal and Rio Chimbo, all navigable on their lower courses and having extensive swamp areas. Steamboats go regularly from Guayaquil up the Rio Bodegas to Babahoyo 80 m. above Guayaquil and for 40 m. up the Daule. The navigable channels of the Guayas and its tributaries are computed to be 200 m. long; the drainage basin is said to cover about 14,000 sq. miles. The second large river system of the coastal region is the Rio Esmeraldas, which like the Guayas has tributaries whose sources are in the snows of the Andean highlands. The Rio Esmeraldas is formed by the Guallabamba and Blanco about 42 m. from its mouth and discharges into the Pacific at 1° N. and 79" 40′ W. through a narrow and precipitous gorge. The most northerly important coastal river system is the Santiago, formed by the Cayapas and the Santiago. The Cayapas is navigable by canoe for a long distance, the Santiago for only a few leagues above its junction with the Cayapas. Below La Concepción, the Santiago is a broad, deep stream. Near its mouth it divides and forms many islands, chief of which are La Tola, Santa Rosa and San Pedro. The Mira, north of the Santiago, forms for a part of its course the boundary between Colombia and Ecuador.

Bays.—The coast extends from about 1° 30′ N. and 78° 52′ W. to lat. 3° 30' S. and curves west ard to 81° W. Most prominent headlands are La Puntilla, Cabo de San Lorenzo, Cabo Pasado and Punta Galera. The bays are commonly broad indentations with the exception of the gulf of Guayaquil, and the rivers discharging into them are generally obstructed by bars so that the small ports of the coast do not afford much protection to shipping. The most northerly of these bays is Ancón de Sardinas, lying south of the Mira delta. The head of the bay is fringed with islands and reefs behind which is the mouth of the Mataje, the boundary between Colombia and Ecuador, and that of the Santiago. The small bay of San Lorenzo would form an excellent port terminus for Quito. The coast for about 80 m. E. and W. of the mouth of the Esmeraldas consists of rocky promontories and of high cliffs broken here and there by short river ravines. The Esmeraldas has a wide mouth with islands and shoals constantly altered by the swift current. The port of Esmeraldas is on the left bank of the river. As the mouth is obstructed by a bar and the river current is swift, the anchorage for ships is outside in an open roadstead with slight protection. Between Cabo Pasado and Cabo de San Lorenzo is a broad indentation in which is the Bahía de Caráquez, a small bay, now the terminus of a railway which runs inland 473 m. to Chone. The southern portion of the broad indentation is called Bahia de Manta and on this is a small port served by a railway extending inland 37 m. to Santa Ana. The Bahia de Santa Elena is formed by a broad curve from Punta Ayangue to La Puntilla. At Salinas a small settlement on the end of the point "La Puntilla" is the landing place of the All-America cable. A pipe line terminates on the shore east of Salinas bringing petroleum from the wells of the Anglo-Ecuadorian Oil Co., situated on the south coast of the peninsula. Ships anchor with little protection in the roadstead between Salinas and Ballenita. The gulf of Guayaquil is the largest on the Pacific coast of South America. Its mouth is 140 m. wide between La Puntilla on the N. and Cabo Blanco on the S. and it penetrates the land eastward with a slight curve northward at its head for a distance of about 100 m., terminating in the Guayas estuary and river on which is the port of Guayaquil. The upper end of the gulf and its northern shores are fringed with swamps through which numerous estuaries penetrate for some distance inland. Of these, the Estero Salado, W. of the Guayas, formed of many shallow tide water channels penetrates as far inland as Guayaquil, but is used only by canoes Near Guayaquil in the Estero Salado is good bathing. The upper end of the gulf of Guayaquil is filling up with the silt brought down from the Andes. It is divided midway by the large island of Puná, at the eastern end of which is the anchorage for steamers too large to ascend the Guayas. The steamship channel passes between this island and the Peruvian coast and is known as the Jambeli channel. The Morro channel, west of Puná, is obstructed by shoals and dangerous for shipping. In the Jambeli channel on the south-east shore of the gulf is the small port of Puerto Bolivar, serving Machala and the Zaruma mining district. A railway runs inland to Machala and thence to Paraje. Another is being built from Puerto Bolivar via Santa Rosa to Zaruma.

Islands.—There are few islands off Ecuador, and only one of any considerable size, that of Puná in the north-east part of the gulf of Guayaquil. This is 29 m. long by 8 to 14 m. wide. Puná generally is low and swampy and its shores, except on the east, are fringed with mud banks. It is densely wooded, in marked contrast to the opposite Peruvian shore and is unhealthy the greater part of the year. It has a population of about 3.000, about 800 living in the village of Puná at its north-east extremity. Pilots are taken on here to ascend to Guayaquil. Twelve miles south-

west of Puná island and 80 m. from Guayaquil is Amortajada (or Santa Clara) island, whose resemblance to a shrouded corpse suggested the name which it bears. It rises to a considerable elevation, and carries a light 256 ft. above sea-level. There are some low, swampy islands, or mud flats, covered with mangrove thickets, in the lower Guayas, but they are uninhabited. On the coast N. of the Gulf of Guayaquil there are only two small islands of more than local interest. The first of these is Salango, in 1" 35′ S., which is about 2 m. in diameter and rises to a height of 524 feet. It is well wooded, and has a well-sheltered anchorage formerly frequented by whalers in search of water and fresh provisions. The next is La Plata, in 1° 16′ S., which rises to a height of 790 ft., and has a deep anchorage on its eastern side where Drake is said to have anchored in 1579 to divide the spoils of the Spanish treasure ship "Cacafuego." The Galápagos islands (*q.v.*) belong to Ecuador, and form a part of the province of Guayas.

The Amazon Region.—The region east of the Andes mountains or the Amazon region is called the "Oriente" and is entirely forested. It begins at the eastern base of the Andes mountains which may be taken at about 4,000 ft. above the sea and extends to the eastern boundary with Peru (see above on boundaries).

The land surface in general slopes eastward, at first rapidly until at about 850 ft. above the sea it becomes a part of the Amazon lowland. Very little is known of the interstream areas. Immediately east of the Andes the general surface is deeply dissected by rivers, but in a measure as one proceeds eastward the land surface tends in general to meet the level of the rivers. Near the Andes are here and there mountainous masses like the volcano Sumaco (12,700 ft. above the sea) and the cordillera Galeras which in reality belong to the Andean region for they are connected to the Andes by the 4,000 ft. contour. A few detached mountain masses such as the Lumbaki mountains on the equator in longitude 77" 20′ west of Greenwich are known to exist and doubtless others will be discovered later.

The main rivers of the Oriente originate on the Andes. All flow into the Atlantic and those whose sources are in the Andes emerge in great gorges on to the Amazon lowland. They are torrential and not navigable till they reach a low elevation when they suddenly become navigable, not only for canoes, but for launches and steamers.

This uppermost point of navigation, or "fall line" is clearly marked. The streams for about 100 m. east of the Andes are torrential and full of rapids. Their courses in this part are usually "braided," *i.e.*, choked with debris from the Andes so that there are many channels and islands. The beds are of boulders which decrease in size eastward. At the "fall line" which on the Río Napo for example, is 850 ft. above the sea, in longitude 77° 00" W. of Greenwich, and about 3,000 m. from the Atlantic, the braided character disappears and the rivers become deep, sluggish and wide, with low mud banks.

Tributaries.—The streams are all tributaries of the Amazon (*q.v.*), divided into two classes, those which rise in the Andes and those which have their entire courses east of the mountains. In the first class are the Rio Napo, Rio Pastaza, Rio Santiago and Rio Chinchipe. To the second subdivision belong the Rio Tigre and the Rio Morona. The Rio Napo, the tributaries of which rise on the Andean slopes from Cotopaxi north to Tulcán, is the largest of these rivers. Its total length is about 700 m. and it enters the Amazon at about 385 ft. above the sea, in latitude 3° 20′ S. and 72° 40' W. of Green ich. From the village of Napo near the base of the Andes where it has an elevation of 1,580 ft. above the sea, it descends in 90 m. to an elevation of about 900 ft. above the sea, at the mouth of the Rio Coca. From here it drops 515 ft. in about 464 m. or about one foot per mile In the stretch between Napo and the mouth of the Rio Coca, the river is shallow and canoes can be used, but going upstream against the current and with bad rapids, it is slow work, about 1½ m. per hour. The descent from Napo to the mouth of the Coca is done by canoe and by shooting the rapids, in two days, *i.e.*, at the rate of about 5 m. per hour. At the mouth of the Coca, the Napo is about 1,500 ft. wide; at its mouth it is nearly one mile wide. Steam launches can ascend to a point several miles above the mouth of the Rio Coca. The principal tributaries of the Napo are the Aguarico and the Coca from the north, and the Curaray from the south. The Coca unites with the Napo in lat. 0° 30' S. and 77° 00′ W. of Greenwich and is about 150 m. long. This river has been recently explored by Sinclair who finds that at Papallacta it is about 10,333 ft. above the sea and at Baeza 20 m. farther east, 5,863 ft. having a fall of about 223 ft. per mile in this distance, a total of 4,470 ft. About 50 m. farther east the Coca debouches from deep canyons on to the lowlands and for the remainder of its course, 54 m. it is a shallow, braided stream of strong current with many islands and channels. Its average fall in the lower 54 m. is 18 ft. per mile and although the current is swift and there are many dangerous rapids, canoes can be poled 50 m. above the mouth.

The Rio Aguarico joins the Napo about 312 m. from its mouth and about 590 ft. above the sea, and is about 200 m. long. Little is known about its course or the country through which it flows. A part of the river near its source forms the boundary between Ecuador and Colombia.

The main tributary of the Napo from the south is the Rio Curaray. This stream rises east of the Andes 18 m. north of Canelos, in hills about 2.000 ft. above the sea. It is about 400 m. long and joins the Napo about 143 m. from the Amazon. Near its headwaters it is a creek with a very serpentine course and it is described as having this feature all the way to its mouth. It is said to be navigable on account of its sluggish current as far as Canónico, about 300 m. from its confluence with the Napo. Sinclair crossed it in 1921 in long. 77° 40' W. of Greenwich and gives its elevation there as 2,000 ft. above the sea with a fall of about 5 ft. per mile.

The Rio Pastaza which is about 450 m. long enters the Amazon at a point 76" 20′ W. of Greenwich and about 4" 55' S. lat. The upper portion of this river, 127 m. long lies on the Andean highlands and has been described above as far as Mera, 3,808 ft. above the sea where the river enters the Amazon lowland. From Mera the river drops at the rate of 40 ft. per mile to the mouth of the Rio Pindo (2,700 ft. above the sea), where it is still a very torrential stream. Apparently the river is not navigable for canoes above Andoas, a settlement about 68 m. below the Pindo, for the usual route of Indians and travellers eastward leaves the Pastaza near the mouth of the Pindo, to proceed overland to Canelos (1,690 ft. above the sea, in lat. 1° 35′ S. and 77° 45' W. of Greenwich) on the Rio Bobonaza where canoes are taken to its confluence with the Pastaza at Andoas, a point about 216 m. from the Amazon. It is said that boats of a draft not exceeding 4 ft. may ascend about 110 m. from the Amazon.

The Tigre is an affluent of the Amazon and rises east of the Andes. Its length is a little over 400 miles. It joins the Amazon in 73° 55′ W. of Greenwich and in 4" 20′ S. lat. It is navigable for boats drawing 6 ft. at high water from the confluence of its tributaries, the Cunambo and the Pintuyacu, to its mouth, a distance of about 400 m. About 104 m. from its mouth it receives the Rio Corrientes, an affluent from the west which is navigable for about 100 miles. The Rio Pucacuru joins it from the north about 152 m. from its mouth and this latter stream is navigable it is said for about 37 m. above its mouth. The width to the mouth of the Corrientes is 650 to 980 ft. and its depth from 25 to 30 feet. The current is said to flow at about 1½ m. per hour. The ascent of 400 m. can be made in about 67 hours, there being only two bad places, the Island of Tacuma and at Piedra Lisa.

The Morona is an affluent of the Amazon, whose course is also entirely on the lowlands east of the Andes. Its sources are said to be in the Rio Cumasi and other streams north of Macas at elevations of about 4,000 ft. above the sea. Its length is about 340 m. It joins the Amazon at 485 ft. elevation in longitude 77° 02′ W. of Greenwich and 4° 45′ S. lat. It is a very meandering river and at 243 m. from its mouth is only 660 ft. above the sea; 203 m. farther down its elevation is 515 ft. and the fall is thus only 144 ft. in 203 miles. From here to the mouth, 41 m., the drop is only 30 feet. It is navigable from its mouth to the Manhauasisa, 310 miles upstream at all times and for two-thirds of its length by steam launches drawing 4 feet. Its depth is from 40 to 50 feet and its width from 260 to 490 feet.

The Rio Santiago empties into the Amazon in 77° 38' west of Greenwich and 4° 25′ S. lat. at an elevation of 580 ft. above the sea. Its mouth is just above the Pongo de Manseriche. Its total length following the tributary, Rio Zamora is 281 m., the Rio Zamora being 150 m. long. From Macas, 3,580 ft. above the sea, on the Rio Upano, to the mouth of the Santiago, 580 ft. elevation, the distance is about 182 m. and the drop 3,000 ft., *i.e.*, about 16 ft. per mile.

The Rio Chinchipe is about 88 m. long and is almost entirely in the Andes. It joins the Amazon in 5° 27' S. lat. and 78° 32' west of Greenwich at an elevation of about 1,209 ft. (J. H. SR.)

Geology.—The Andes reach great heights in Ecuador, where they include several lofty volcanic peaks. The volcanoes are of Tertiary or later origin and are most numerous in the northern half of the country. Cotopaxi, Chimborazo, and Cayambe are volcanoes that rise more than 19,000 ft. above sea-level, and these and other snow-covered and ice-capped peaks form the culminating points of the mountain mass. This has been divided into the Eastern Cordillera, composed of gneiss, mica schist and other old crystalline rocks, and the Western Cordillera, composed of porphyritic eruptive rocks of Mesozoic age and of Mesozoic sedimentary beds, mainly Cretaceous. Between these ranges are recent deposits that contain plant remains. Northward this depression is in large part filled with lava, tuff and agglomerate from the volcanoes, which stand either upon the folded Mesozoic beds of the Western Cordillera, on the old rocks of the Eastern Cordillera or on the floor of the depression. The lavas and ashes are mostly Andesitic. Ecuador is more subject to volcanic disturbances than any other South American country, excepting, perhaps, Chile.

The mineral resources of Ecuador have been only slightly developed. Gold, mercury, copper, iron, and lead are mined. Silver deposits have been found, but are not worked. Platinum has been discovered in the Santa Elena peninsula, north of Guayas Gulf. The largest development is that of gold, centring around Zaruma in the province of El Oro. Some sulphur deposits exist in the Pichincha and Chimborazo districts, and in the Galapagos islands. Coal in the interior of the republic is as yet unmined.

Ecuador has three important petroleum fields: the coastal region of the Santa Elena peninsula, the Amazon country in the east, and the Andean plateau. Only the first-named has been developed, although concessions in both the other areas were granted in 1938. (G. McL. Wo.; X.)

Climate.—Were it not for its lofty mountains and the Humboldt current the climate of Ecuador would be entirely tropical, for it is traversed by the equator. But, inasmuch as the elevations extend from sea-level up to 20,576 ft., the climates vary from the tropical of the lowlands east and west of the Andes, through the temperate of the higher slopes, to the Arctic climate of the peaks of Chimborazo, Cayambe, Antisana, etc.

The tropical lowlands are along the Pacific coast and the tributaries of the Amazon, east of the Andes. The former are comparatively dry; the latter extremely humid because of the Atlantic trade winds in their south-west course across the low and extremely wet basin of the Amazon.

The Pacific coast is one of transition between the arid climate of the coast of Peru to the south and the northerly humid one of Colombia. The former climate is caused mainly by the presence of the Humboldt current which flows from the coast of Chile north, and the latter by the warm south-flowing waters of the Central American current. These two currents, with a difference of temperature of from 6 to 8° F, meet off the coast of Ecuador and flow west to the Galapagos islands. Only at rare intervals is their relative strength altered, as in 1925 when the Central American current flowed farther south than had ever been known and the Humboldt current appeared to be missing entirely. Consequently the deserts of Peru and of southern Ecuador were visited by large quantities of rain for the first time in many years. The Santa Elena peninsula, for example, received a rainfall in the period Jan. 21 to May 1, 1925 of 40 in. and this decreased in the period Jan. 11 to April 5, 1926 to 27 in. and in the 12 months of 1927 to nearly normal, viz., a total of 4 inches.

Under normal conditions, the inner shores of the gulf of Guayaquil, the island of Puná, the valley of the Guayas and all the coast of Ecuador north of Cape San Lorenzo have considerable rainfall, while the coast from the Santa Elena peninsula north to Cape San Lorenzo, including the island of La Plata, is a region of scanty rainfall. From Cape San Lorenzo south there appear to be four climatic provinces. In the Montecristi region the climate is normally semi-arid but the hills receive a typical heavy Scotch mist. In the cordillera de Colonche, a ridge about 1,800 ft. high south of the above region, there is more humidity and very thick vegetation. In the Santa Elena peninsula there are no hills and the climate is extremely arid. Finally along the shore of the gulf of Guayaquil south-east from Santa Elena the climate is tropical with luxuriant and profuse vegetation. The Santa Elena climate is characteristic of the arid type. In 1927 the maximum temperature averaged 86.3° F, the minimum 65.4° F. The hottest months were Jan., Feb., March and April. The total rainfall for the year 1927 amounted to 4 in. and took place in the months of February and March.

No rainfall data are available for the humid part of the coast north of Cape San Lorenzo. At Recreo, a humid region on the coast in 0° 27' S. there was (July 1893-June 1894) a mean annual temperature at 6 A.M. of 72.3° F, at noon 77.1° F, at 3 P.M. 77.1° F and at 8 P.M. 74½° F, the average for the year amounting to 75° F. At another point on the coast in the humid zone, viz., La Maria (2° 54' S.) on the east coast of the Jambeli channel, north of Machala, the averages for the period January to May 1892 were: 6 A.M. 74.4° F, noon 82.8° F, 4 P.M. 85.8° F, 8 P.M. 81.3° F, the average being 81.1° F. At Guayaquil, which is 33 m. above the entrance of the Guayas river into the gulf, the mean annual temperature varies between 82° and 83° F and the rainfall for February and March 1882 is reported as being 3.1 and 6.1 in. respectively.

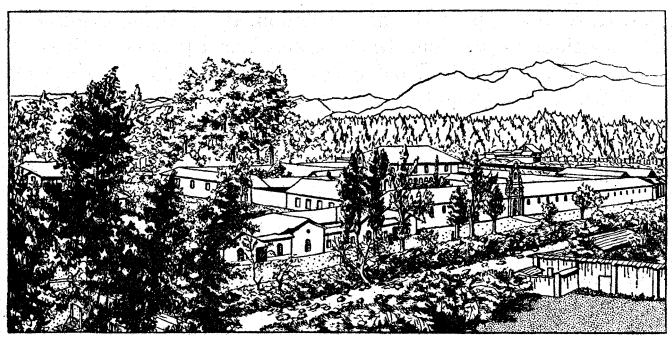
There seems to be a clearly marked division in the Pacific coastal region into cooler months from July to November and warmer months the rest of the year.

The tropical region east of the Andes is the zone of greatest rainfall. The average minimum temperature at Mera on the Pastaza (3,800 ft.) for the years 1923, 1924, 1926 and 1927 was 57.7° F; the average maximum 79.9° F and the mean annual temp. 68.8° F. The rainiest months were May in 1922, 1924 and 1925 and April in 1923 and 1927. The heaviest rainfall in any month was in April 1927 with 27 in. and the driest month was Feb. 1923 with 4.8 inches. There are few weather stations in Ecuador and figures of average, maximum and minimum rainfall through the whole country vary greatly in the different regions, coastal belt, the plateau and the eastern lowlands.

There does not appear to be any pronounced division into rainy and dry seasons. At Tena (1,700 ft.), another point east of the Andes, observations during 1925–27 show an average yearly minimum temperature of 65.3° F and an average maximum of 81.3° F. The mean annual temperature here is about 73.3° F. The rainfall in 1925 totalled 147.2 in. (12.2 ft.). Eleven months of observations in 1926 gave a total of 6.66 in. per month, which would be equal to a total of 80 in. for the year. But during the period Jan.–June 1927 there was a total of 107.2 in. averaging 18 in. per month, which if continued the entire year would amount to 201 inches. The best series of observations, and in fact the only ones available to show the climatic conditions in the temperate zone of the Andes is that for which we are indebted to Mr. J. W. Mercer of the South American Development Co., owners of the Zaruma mines, 2,500 ft. above the sea. These observations carefully made over a period of 30 years (1897–1927) show an average daily minimum temperature of 64.4°, an average daily maximum temperature of 81.5° F. In addition, the records for the hour 8 P.M. show for the 30 years an average temperature of 69.8° F. The hottest temperature recorded was 93° F, the lowest 51° F. The average temperature for the 30 years is 72.9° F. The rainfall takes place almost totally in the months from December to May. The average yearly total for the 30 years is 66.9 inches.

Flora.—The flora varies from that of the tropics to that of icy mountains; from vegetation characteristic of humid and arid

regions on the Equator to lichens on the snows at *18,400* ft. above the sea. Corresponding to the broad climatic divisions the vegetation is classified into five types: *(1)* that of the arid regions on the low-lying Pacific coast; *(2)* that of the humid regions on this same coast and in the low-lying Amazon region east of the Andes; *(3)* that of the forests on the east and west slopes of the Andes up to about 10,000 ft. altitude; *(4)* that of



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the so-called "cereal" zone, a treeless region on top of the Andean plateau; and (5) the *"páramo"* or Alpine region which terminates in the region of perpetual ice and snow. Because of this great diversity of climate, the flora of Ecuador is exceedingly rich, and species before unknown from this region are constantly being discovered. J. N. Rose has recently raised the number of known species of cacti from *12* to *30*. Hitchcock has extensively studied the grasses which extend in great diversity from the lowlands to the snow line. W. Popenoe has described about 100 species of fruits. Ferns are abundant and of many types ranging from the filmy ferns of the fog-covered forests to the giant tree ferns of the tropical valleys. The genus *Eupatorium* occurs in many forms, more than 50 species being reported. Numerous species of the heath family are found in the forested mountains and the high *páramos*.

Among the more common economic plants are the *corozo* or ivory-nut palm (*Phytelephas macrocarpa*), which furnishes vegetable ivory for manufacturing buttons; the cocoa tree (*Theobroma cacao*), from which the cocoa bean is gathered; the fibre plant *Carludovica palmata* (not a palm), used for making "Panama" hats, the balsa tree or corkwood *(Ochroma lagopus)*, furnishing the lightest timber *(30* lb. per cu.ft.) in the world; and the cinchona tree which yields quinine. Wheat grows at elevations of from 4,500 ft. to *9.800* ft. and barley up to 11,500 feet. More than 100 kinds of useful woods have been described.

Mammals.—While in general mammals are comparatively scarce, according to Tate they are represented by a very wide range of species. In the forests east of the Andes the Primates are numerous, but on the west coast only three genera occur: spider-monkeys, howlers and capuchins. The Carnivora include the jaguar, puma, ocelot, foxes, weasel, *Tayra*, otter, skunk, grison, racoon, coatimundi and kinkajou. The Ungulates comprise the tapir, two kinds of deer and two sorts of peccaries. Among the rodents are the amphibious capybara (east of the Andes), paca, agouti and the rare *Dinomys;* the smaller forms include squirrels, rabbits, cavies and numerous rats and mice. There are numerous species of bats, including the blood-sucking vampire. Representatives of the sloths, anteaters and armadillos are not rare. The opossums, with half a dozen genera, include the web-footed *Chironectes*, and the curious little *Caenolestes*, the so-called "living fossil," of the high Andes.

The chief governing factor in the distribution of these animals is the Andes Mountains which run north and south through the country causing wide variations in the climate. Broadly speaking the climates are tropical from sea-level up to 5,000 ft.; sub-tropical from 5,000 to *11*,000 ft.; and temperate, from *11*,000 ft. up to snow-line. These conditions, modified by rainfall, act directly upon the vegetation and the animal life within the several zones, resulting in the evolution of specially adapted forms. The only indigenous animals under domestication are the llama and alpaca. Neither is abundant. But horses, cattle, sheep, goats and pigs are now raised everywhere. In the high plateaux, sheep and cattle thrive particularly well. A whaling enterprise, the Compañia Ballenera del Ecuador, operating from Santa Elena, was started in 1925. In *1926*, according to a report of the U.S. Consul, a catch of 370 whales was made which yielded 9,500 barrels of oil.

Remains of extinct vertebrates, such as mastodons and horses, are found in the Pleistocene deposits of the highlands and also of the Pacific coast. The natives at the time of the arrival of Pizarro, in 1527, ascribed these to a race of giants which formerly inhabited the country.

Birds.—Dr. Frank Chapman states that about 1,500 species of birds have been found in Ecuador. This is approximately one-fourth of the South American avifauna and is doubtless a larger number of birds than has been recorded from any other area of similar size. Ecuador owes its exceptional abundance of bird-life primarily to the extent and altitude of its mountains, which add to the lower or Tropical Zone, three additional zones, each of which has species that are restricted to it (endemic). They are the Sub-tropical Zone (alt. from *3,000* or 4,000 ft. to 9,000 ft.) with *237* species, the Temperate Zone (alt. 9,000–12,000 ft.) with 142 species and the Páramo Zone (alt. 12,000 ft. to snow line) with 33 species. These endemic zonal species have been derived from the Tropical Zone at the base of the Andes and also from both the south Temperate and the north Temperate Zones. Their existence affords an admirable illustration of the stimulating effects of change of environment on the evolution of species. For example, Ecuador is known as the land of humming birds, but it is not generally realized that only *66* of its 147 species are found in the Tropical Zone, while *81* are confined to the upper life zones and in large part at least, have therefore been evolved since the latter part of the Tertiary when the mountains they occupy were elevated.

The brilliantly coloured Tanagers (*Tanagridae*) are also commonly considered as characteristic of the American tropics, but of the 106 species found in Ecuador only *52* are known from the Tropical Zone, while *46* are confined to the Sub-tropical, and *18* to the Temperate Zone. Other families of birds with numerous species in Ecuador are the Pigeons *(Colztmbidae)* 26 species; Parrots *(Psittacidae) 38* species; Toucans (*Rhampastidae*) 19 species; Woodpeckers *(Picidae)* 37 species; Antbirds (*Formicariidae) 114* species; Woodhewers (*Dendrocolaptidae*) *31* species; Flycatchers *(Tyrannidae) 160* species; and Wrens (*Troglodytidae) 32* species.

Sixty-six species of birds that nest in North America visit Ecuador in winter. Among this number are the Carolina Rail, or Sora *(Porzana carolina)*, Blue-winged Teal *(Querquedula discors)*, Kingbird (*Tyrannus tyrannus*), Barn Swallow (*Hirundo erythrogaster)*, Red-eyed Vireo *(Vireosylva olivacea)*, Redstart *(Setophaga ruticilla)*, Rose-breasted Grosbeak (*Zamelodia ludoviciana*) and Scarlet Tanager (*Piranga erythromelas)*.

Fishes.—When compared with the Amazonian fauna, the freshwater fish fauna of the Pacific slope of Ecuador *(see* C. H. Eigenmann, *Mem*. Carnegie Mus., vol. ix., pp. 1–350), is relatively meagre, only about *60* species being included. The fishes of the eastern part of Ecuador are as yet practically unknown. Although the species and many genera are now different, all of the fishes of the Pacific slope streams are similar in character to their Amazonian relatives and were evidently derived from them before the uprising of the Andes. This Pacific slope fauna is characterized by the lack of certain usual Amazonian types such as the electric eel and the piranha. One of the most remarkable of Ecuadorian fishes according to Dr. Henn of the Carnegie Museum is the "raspabalza" *(Plecostomus spinosissimus*), which is a sort of plated catfish, so well protected by its spiny covering that, if care is taken not to frighten it, it may be picked up by hand from the sandbars. In the same waters, the Guayas system, occurs a blind catfish, the "ciego" (*Cetopsis occidentalis*), the eyes of which are covered with thick skin.

Another celebrated Andean species found in Ecuador is the so-called volcano fish *(Astroblepus grixalvii)*, which, by means

of its disk-like, sucking mouth and prickly fins, is enabled to live in torrential mountain streams. Formerly this fish was erroneously said to be thrown in great quantities during eruptions from subterranean lakes within volcanoes.

Reptiles. — All the major groups of reptiles are known. According to Ruthven there are fresh-water and land turtles, crocodilians, lizards and snakes. Among the lizards, the beautiful "fan-Iizards," "American chameleons" or Anoles are conspicuous for their delicate changeable colours and flashing throat fans. Other interesting lizards are the *Ameivas,* active and conspicuous on bright warm days; the blind lizard, *Amphisbaena,* frequently found in ant and termite nests; the spiny Echinosaura; and several geckos. The snakes of Ecuador vary in size from thread-like *Helminthophis,* which burrows in decaying wood, to the large boa *(Constrictor constrictor).* There are fresh-water snakes, sea snakes, tree snakes, ground snakes and burrowing snakes. Many are harmless, but there are numerous venomous species. Among the latter are several opisthoglyph snakes. several protoglyph snakes, coral snakes (*Elaps* or *Micrurus*) and the dangerous solenoglyph pit-vipers, notably the *fer de lance* (*q.v.*). There are also various tree snakes, such as *Oxybelis,* interesting for their attenuated form and habit of resembling vines. The crocodilians are represented by a true crocodile and the broad-snouted caiman. A few fresh-water turtles and the large land tortoise *(Testnrdo denticulata)* are known.

Insects.—While the insect inhabitants of Ecuador embrace numerous genera and species representing the most important orders, no comprehensive survey has been completed. Campos enumerates some 1,550 known species, chiefly butterflies and moths (*Lepidoptera*); beetles *(Coleoptera);* grasshoppers and their allies (*Orthoptera*); and bees and ants (*Hymenoptera*). Of beetles alone there are estimated to be 8,000 species. In general it may be said that for each 1.500 ft. of elevation there is a new province of insect life. *Lepidoptera* have been collected on the slopes of Antisana at 16,000 ft. altitude. A giant beetle (*Dynastes hercules*) attains a length of five inches. Certain click beetles and fireflies are noted for their phosphorescent light. Among the *Diptera* is found or rather was found the mosquito *Aedes argenteus,* the carrier of the yellow fever germ, known also as *Stegomyia fasciata.* Below 1,500 ft. elevation also occurs the mosquito (*Anopheles albimanis*), carrier of the malaria germ. Numerous parasitic insect pests abound among the Indians.

POPULATION, GOVERNMENT, ETC.

Population. — No complete census of Ecuador has ever been made. The total population is variously estimated from two to four millions. An official estimate in 1941 gave 3,011,062. Probably 60% or even more is pure Indian, 25 to 30% mestizo, and at most 15% white There are a few Negroes on the coast. Guayas is the most populous province, with Manabí, Pichincha, Chimborazo, Azuay and Tungurahua following in order. The language of the whites and mestizos is Spanish; that of most of the Indians is Quéchua, although some speak Spanish; in the forest region to the east of the Andes the Jibaro language is spoken among the wild Indians.

Some attempts to attract European immigration have been made, but with little success. In the early 1930s some Jewish colonists entered the country. All in' all, however, there has been probably a smaller proportion of new blood brought into Ecuador since independence than into any other country of South America.

Government. — Under the constitution of March 29. 1929, Ecuador is a centralized republic with the customary legislative, executive, and judicial branches of government. Freedom of worship and of the press is granted, and the civil rights of women assured. Public credit is guaranteed, and funds set aside for payment of the public debt cannot constitutionally be diverted to other purposes. The Congress, consisting of a senate and a chamber of deputies, meets, in theory, on August 10 of each year. The senate is composed of one senator for each of the 15 interior and coast provinces, one for the eastern provinces jointly, and 15 functional senators representing groups, as the universities, the journalists and scientific academies and societies, industry. labour etc. The chamber of deputies is composed of one deputy for each 50,000 inhabitants in each province. Senators are elected for four years, deputies for t o. Suffrage is granted all literate men and women over 21 years of age.

The president, elected by popular vote, serves four years and cannot be re-elected. In addition to a cabinet appointed by the president, there is a council of state which comprises various high functionaries. The cabinet comprises seven members: the ministers of Government and social welfare, foreign relations, education, public works, agriculture and promotion, finance and public credit, national defence. The supreme court is the highest tribunal and consists of 10 justices and an attorney general elected by congress for a term of six years. Eight superior courts have regional jurisdiction. In actual practice during recent years the Government has been a dictatorship under one individual or a group, and constitutional guarantees have been suspended. In 1937 a constituent assembly met at Quito to draw up a new constitution, but was dissolved after a dispute with the provisional president.

There are 17 provinces, 67 cantons, and 498 parishes. Each province is ruled by a governor, each canton by a *Jefe Politico* and each parish by a *Teniente Politico.* The Galápagos islands are under a Territorial Chief. The Oriente is divided into the two provinces of Napo-Pastaza and Santiago-Zamora.

Army, **Navy,** and Aviation. — In 1935 the army consisted of 702 officers and 6,833 men. Military service is compulsory for one year for men on reaching the age of 20. Lots are drawn to determine who undergoes special training at that time. All men from 18 to 50 years of age are part of the reserves. There is, in addition, a national police force, with a personnel of 3.433, charged with maintaining internal order. One military hospital is at Quito, another at Guayaquil. The 1939 budget allotted 29,414,000 sucres, or 22% of the total, to national defence. The Ecuadorian Government maintains at the aviation base at Guayaquil a school of aviation where young Ecuadorians are trained as pilots and in the mechanics of ground air service. It is here that numbers of men have become proficient in the various branches of air service. The navy has one cruiser, with a personnel of 394 officers and men.

Religion. — Of the pre-Inca religions the only one remaining is possibly that of the Jibaro Indians of eastern Ecuador, which Karsten says is wholly unaffected by Christianity. In this there is no notion whatsoever of a supreme being and creator of the Universe, but it is by no means a pure demonology. The Inca religion has apparently entirely disappeared *(see* INCA**).**

The Spaniards made the conquest of Peru not only a territorial extension of their power but a means of conversion of the aborigines to the Roman Catholic religion. The capitulation of July 26, 1529 made Hernando de Luque bishop of Peru. and Pizarro, when he returned from Spain after having made this contract, took with him a number of Dominican priests, among them,, Fray Vicente de Valverde. Soon more priests, this time Mercedarians, arrived and the campaign to convert the Indians was well started. Luque never went to Tumbez to take over his charge but Valverde was made bishop at Cuzco over all of Peru. González Suárez states that by the end of the 17th century there were in Ecuador alone 42 convents belonging to the Dominicans. Franciscans, Augustinians, Mercedarians, Jesuits, and barefooted Carmelites. The number of priests was very large, Quito alone having, as he states, about 1,000 priests. Great discord reigned and "great damage was caused to the moral advancement of the people by the bad example not only in lack of virtue among the priests, but by their lack of good manners." González Suárez concludes, however, that the convents were the cradle of culture. It is certain that. by the end of the 17th century. no part of the Andean region remained unvisited by the missionaries In 1767 the Jesuits were expelled from all the Spanish dominions in America.

The opposition to the official religion was intended to restrict clerical influence in political affairs. The growth of liberalism resulted in 1889 in the church tithes (10% of the value of the production of the farms) being abolished; a tax of 3 per mill on the value of the farms was substituted In 1902 civil marriage was permitted and in 1904 the Church was placed under State control,

the foundation of new religious orders was forbidden and new religious communities were denied entrance. In addition all members of the episcopate had to be Ecuadorians. The State took over the landed property of the religious orders and administered it under a board of charities which now gives a pension to the friars. The excuse for this latter action was stated to be the great wealth of the church, gained largely through participation in legacies and by labour which received no "earthly" pay.

In recent years a few Protestant missionaries have penetrated the country and are at work among the Indians east of the Andes (Tena and Macas). There is now absolute freedom of religion in Ecuador. The Catholic Church has an archbishop at Quito and bishops in Ibarra, Riobamba, Cuenca, Guayaquil and Puerto Viejo.

Education. — The Ministry of Public Instruction exercises supervision over all educational institutions whatsoever. Higher education is provided at the Central university of Quito, the University of Cuenca, the University of Guayaquil, and the Junta universitaria of Loja, all of them Government-supported. The Central university has faculties of law and social sciences, physical and natural sciences, philosophy and letters, and medicine. The national veterinary school, a school for nurses, and a vaccination institute come under the last; a school of agronomy under the faculty of physical and natural sciences, and a section of pedagogy under that of philosophy and letters. The University of Cuenca has faculties of medicine, and of law and political and social science, along with a school of painting and art, and the superior school of mining engineering. Faculties of law and social science, medicine, pharmacy, and odontology, and physical sciences and mathematics, and a school for nurses come under the University of Guayaquil. The Junta universitaria has only a faculty of law and political and social sciences. Teacher training is provided in four normal schools, two in Quito, and one each in Cuenca and Guayaquil. In addition, short elementary normal courses have been established in seven cities. Despite the financial vicissitudes which the country has gone through in recent years, valiant efforts have been made to improve educational facilities.

A committee consisting of experts in educational methods, school architecture, public health, etc., known as the National Council on Education, was appointed by the Government in 1935 to reorganize primary and secondary educatiop along modern lines, by issuing pamphlets to interpret the ideals of the new type of school, by building experimental schools, organizing demonstration schools for Indians, and establishing welfare centres for underprivileged children of pre-school age. Some of the results of the increased emphasis on education are already evident.

The national appropriation for education in 1938 was $1,211,800 U.S., about 13.6% of the total budget. In 1937 there were 2,580 elementary schools, with 209,000 enrolment, and 17 secondary schools, with 5,124.

The 1937 enrolment figures showed a 6% increase in attendance over 1936 and 17% over 1935. To provide necessary funds for education the Government is requiring municipal governments to increase their contributions toward defrayment of school costs. Revolutionary changes in secondary school requirements were made during 1937 and 1938, with radical changes in the curricula which break down the rigidity of the old system and its excessive pre-requisites and, through enlargement of the number of elective courses, makes for flexibility. Further efforts at school improvement are being made by encouraging teachers to improve themselves. In 1938. over 50% of the Ecuadorian teachers held no diplomas or certificates of any sort, and only 16% had adequate professional training in normal schools. In a campaign against illiteracy the Government has attempted to impose a fine upon landowners for each illiterate person over 21 years old working on the property. These fines, under the law, would be reimposed each two years.

In addition to the National Library at Quito are municipal libraries at Quito. Guayaquil, and Riobamba.

TRANSPORTATION AND FINANCE

Transportation.—Guayaquil, situated on the Guayas river some 40m. from the ocean, is the chief port. Almost all of the country's foreign commerce flows through it. The Guayas is navigable for 40m. above Guayaquil. Several other small rivers are navigable, as is the Marañón (the upper Amazon) in the eastern part of the country.

Railways. — Slightly over 600m. of railway are in operation. the most important being the Guayaquil and Quito railway, 297m. in length, which connects the capital with the coast. Its construction. completed in 1908, is regarded as having been one of the most difficult ever attempted. Its cost was in excess of $19,000,000, averaging $68,345 per mile.

Originally a private enterprise, it is now under Government control.

With the exception of the Guayaquil and Quito Railway Company's telegraph and telephones, all the mail service, telegraphs, wireless and telephones of Ecuador are directed by the Ministry of Public Instruction.

Highways. — During recent years new highway construction and rehabilitation of old roads has been pushed extensively. In the single year 1936, the automobile highway mileage increased from 2,428 to 2,710m. or 12%. In 1938 695km. of the Inter-American Highway were open to traffic, and 395km. under construction.

Aviation. — Ecuador has external communication by air with all parts of America, to the north through Colombia, and to the south through Peru. Aviation facilities were materially improved in 1938, when Quito became a regular port of call for north-south aeroplanes.

Revenues. — Revenues and expenditures for the year 1938 were estimated at 120,700,000 and 127,300,000 sucres respectively, a deficit of 6,600,000 sucres for the year. The ordinary budget for 1939 was estimated to balance at 130,950,000 sucres, 9% over the 1938 budget, and nearly 50% in excess of the original budget for 1937.

Decline of the sucre in international exchange was partially responsible for the increase in terms of sucres.

Revenues for 1939 were estimated to come from the following sources: taxes on State monopolies, 25%; import duties, 24%; consular fees, 6%; petroleum taxes, 5%; substitute for sales tax, 5%; income tax, 5%; port duties, 4%; postoffice, 4%; stamp tax, 3%; rural property tax, 3%; telephone and telegraph, 1%; miscellaneous, 15%. Expenditures mere allotted in the following proportions: national defence, 22%; public works and communications, 15%; education, 15%; treasury, 9%; interior, 9%; social welfare. 7%; public debt, 6%; foreign affairs, 5%; general expense, 4%; State pensions, 4%; judiciary, 2%; others, 2%. Three extraordinary budgets for 1939 were also authorized: 4,745,590 sucres for the State railways, which were placed on an autonoinous basis; 2,800,000 sucres for the construction and maintenance of highways, to be financed by special taxes; and 495,000 sucres for the maintenance of rural schools.

Public Debt. — The public debt of Ecuador includes $12,262,700 in dollar bonds; £71,300 railway bonds, guaranteed by the Government; 8,974,500 francs of Government-guaranteed railway bonds; and 26,800,000 sucres in internal debt. Ecuador has the longest present record of default of any Government in South America, dating back as far as 1915. Overdue interest on some bonds now equals the principal.

Currency-exchange. — Ecuador was on a gold standard, adopted in 1898, until 1912, when payments in gold were stopped by decree. Although the bank-note circulation increased to a considerable extent after 1914 (41,698,991 sucres on Aug. 10, 1927) the exchange rate was maintained with very light fluctuations at about the legal parity of $0.4867 to the sucre, until in the middle of 1918 it declined in value to 35 cents U.S.A. This situation was due to the effects of the war and to the passage of the "law of the inconvertibility of bank notes" which was really a moratorium. This law probably saved the banks, particularly the Banco Comercial y Agricola of Guayaquil as it absolved them from paying gold for their notes, but certainly did great injury to the country at large. In Nov. 1918, the sucre suddenly rose in value to 45 cents and held this to the beginning of 1920 when it was quoted at 47½ cents. The exchange market then broke suddenly

and the sucre depreciated in value until it reached 18½ cents, when. by executive decree of Nov. 16, 1922, the Government took over the monopoly and complete control of all foreign bills of exchange, fixing the rate of exchange at about 47 cents. This official rate was subsequently reduced to approximately 33 cents and, eventually, to 25 cents, remaining at the latter level until official control was abolished in Oct. 1924.

Meanwhile, in the open market, the sucre had fallen as low as 17 cents; following abolition, however, it rose as high as 25.6 cents before beginning a slow decline which carried it to approximately 16 cents.

On the recommendation of the American Commission of Financial Advisers, the sucre was stabilized at 20 cents gold U.S.A. The monetary system was fundamentally reformed by a law treating a central bank and by a monetary law, both of which were approved and issued on March 4, 1927. Under these provisions the sucre was placed on a gold basis, at the rate of five sucres to the then current U.S. dollar. In Feb. 1932, however, due to world-wide depression conditions, the gold standard was abandoned, and the sucre began a steady decline. Attempts at exchange control, made in 1935, were abandoned the following year, resumed, and again abandoned in July 1937. The system of import permits was then used for a while, suspended for a time, and again placed in operation toward the middle of 1938 in order to arrest the country's mounting import balance. The sucre was then controlled at approximately 15 to the dollar until May 1940, when the ratio was changed to 18 to 1.

By executive decree of Dec. 30, 1937, the Central Bank of Ecuador was reorganized on a more conservative basis than formerly. Its function is to control credit in the country by restricting the credit flow to member banks, by limiting credit to the Government, and through use of flexible rates of rediscount and interest.

Production and Commerce. — Ecuador's chief product is cocoa, in which it is third in world production. Cocoa beans were exported to Europe as early as the 16th century, and until the present century Ecuador was the world's leading producer. By the second decade of the century, however, it had been exceeded by Brazil, and more recently by the Gold Coast of Africa as well. This relative decline is due not only to increased production elsewhere, but to local difficulties as well. especially to the ravages of the fungous witchbroom disease and of the monilia disease. By 1936 production had fallen from a former high of 16% of world output to 2·7%. Nevertheless, in 1937 cocoa accounted for 30½% of the country's exports. and the country's prosperity still depends primarily on cocoa.

Coffee now ranks second among exports of the country, accounting in 1937 for 15% of all exports. Bananas have been exported since 1931, and comprised 3·4% of the total exports in 1937. Most of the banana holdings are in foreign hands, but a Government decree of July 8, 1938 restricted the holdings of a single company to 80,000 hectares, and required the sale of any excess to Ecuadorian citizens within five years.

Another industry of Ecuador is the production of tagua, or vegetable ivory, a palm fern whose fruit is used as a substitute for the elephant tusk product. The toquilla, or "Panama" hat, so called because exports enter world trade through Panama, is made from the straw of a native plant (*Carludovica palmata*). Exports of tagua comprised 11·1% of all exports in 1937, of toquilla 4·9%. Sugar and cotton are also produced, but have not been developed to the extent that the soil and climate permit.

Mineral Production. — Gold production has, in recent pears, been stimulated by the decline of the sucre, but is still small. In 1938 it aggregated 824,207 grams.

Development of petroleum resources began in 1925. In that year 144,943bbl of crude petroleum were produced, and the output has steadily increased until it is between two and three million barrels annually (2,249,740bbl. in 1938). Around 95% of the production is in the hands of one British company, whose royalties and other payments to the Government averaged £39,544 annually from 1927 to 1936 inclusive. The rate of payments was increased by agreement in 1938. These receipts are an important part of the national revenues, but the country gets little benefit from the oil industry otherwise. Approximately a sixth of production is refined in the country, sufficient to supply domestic needs.

Petroleum aggregated 10·5% of exports in 1939. Cyanide precipitates, exported entirely to the United States, accounted for another 11%. Because these two commodities and gold are produced almost exclusively by foreign interests and their export does not provide exchange, they are reported separately from other exports.

Foreign Commerce. — In terms of sucres, Ecuador's foreign commerce has been on the increase in recent years, but actually this has been due to the fall of the sucre. Exports and imports in recent years (expressed in dollars) were as follows:

	1936	1937	1938	1939
Exports . .	13,493,000	14,928,000	12,614,000	11,341,000
Imports . .	10,857,000	11,980,000	11,064,000	10,173,000

The principal countries of origin and destination during those years, with the percentage going to each, were as follows:

	Exports				Imports			
	1936	1937	1938	1939	1936	1937	1938	1939
United States .	23·0	21·7	37·5	49·1	22·5	25·2	34·6	48·7
Great Britain .	21·8	19·6	4·6	3·7	17·1	15·7	7·7	5·5
Germany . .	8·3	9·2	17·5	6·8	16·6	16·4	24·1	18·1
France . . .	5·5	4·4	8·0	6·5	3·5	3·1	4·4	5·0
Italy . . .	2·3	3·8	1·5	2·2	2·6	2·9	3·2	3·0
Japan . . .	2·1	1·9	2·4	3·9	3·1	2·8	7·4	5·2

The rise in trade with Germany has been due primarily to the use of aski marks, but considerable friction has arisen over what Ecuador has regarded as bad faith in re-exporting the goods purchased and selling in competition with Ecuador.

Imports are foodstuffs, machinery, textiles, and other manufactured goods.

HISTORY

Archaeology and Antiquities. — All that is known about human life in Ecuador up to a few years before the arrival of the Incas, *i.e.*, about two or three generations before the arrival of the Spaniards in 1527 is contained in archaeological and linguistic remains, for writing of any kind mas not only unknown to the earliest inhabitants but even to the Incas themselves.

At various places in the western lowlands, in the central highlands and even in the forests east of the Andes are found archaeological remains, which prove the existence at certain times of a considerable culture. Although objects have been found which according to Uhle point to a relationship with the Maya civilization in Central America. which was flourishing as early as A.D. 68 and probably much earlier, other objects indicate the presence of man in Ecuador several thousand years ago.

The pre-Inca archaeological remains of Ecuador are of three non-related types of culture. One, peculiar to the high Andean valleys, a second. to the Pacific coast lowlands, and a third, to the forested region east of the Andes. The first two types prove, says Uhle, that two, perhaps independent, migrations from Central America took place, and that the emigrants were profoundly influenced afterward by a widely different environment. The region east of the Andes has furnished little archaeological material, but this shows a close affiliation with objects found in the great forest area along the upper Amazon, whose inhabitants Uhle believes migrated from Central America, but turned eastward from the isthmus of Panama to follow the north coast through Colombia, Venezuela and the Guianas to the mouth of the Amazon, which they ascended Perhaps at the same time there was a contemporaneous filtration of people south by way of the numerous waterways which drain into the Caribbean sea. The first type of remains, *i.e.*, those peculiar to the high Andean valleys of Ecuador, may be subdivided into three minor classes in each of

which the remains show a more or less centralized development. Remains of the first subdivision are found in the three northern provinces, Carchi, Imbabura and Pichincha. Those of the second class come from the region near the volcanoes, Tungurahua and Chimborazo, and those of the third subdivision from the provinces of Cañar, Azuay and Loja in southern Ecuador.

The most noteworthy features of the ceramic art of the first subdivision are long slender vessels found in large numbers in the deep, well-like tombs at Angel and vicinity, and bowls painted with many motifs of great interest in aboriginal decoration. The second subdivision is characterized by vessels with thin walls, ornamented with straight or wavy parallel lines. This is the most important of all the ancient culture centres of the Andes because of the stratified sequence revealed in excavations, where six horizons have been recognized, according to Uhle. The lowest of these, which is called the Proto-Panzaleo, no. 1, shows profound Central American influence, as Uhle has declared. The Proto-Panzaleo, no. 2, which overlies the first, is a continuation of the first but with marked traces of a new influence from the north. The Tuncahuán overlying this is thinner and therefore indicates a period of shorter duration than the others, but it is more widespread, being found over almost the entire Andean region of Ecuador. It is marked by the disappearance of tripod vessels, by abundance of negative painting, and by the first white pottery ornamentation. Here also appear objects of copper. The next, or San Sebastián layer, contains new types of pottery vessels, and here progress was made in architecture, as shown by the ruins near Guano. In the fifth horizon from the bottom the art of Chimborazo reached its highest development. Negative and positive painting of earthenware flourished, and jars with conventional human faces and arms, placed in low relief on the necks and upper body parts of the vessels are characteristic. In this restricted region there is much pottery of this style, but none has been discovered beyond. Human bones and innumerable small shell beads have been found in some vessels, while in others yellow powder reveals Chicha sediment showing that they had been filled with liquid for the refreshment of the deceased with whom the receptacles had been buried. Many copper ornaments are in this horizon. This is the art of the Puruha who lived as late as the time of the Spanish conquest. The sixth horizon, *i.e.*, the most recent, is called the Huavalac and is characterized by "lost colour" ware.

CENTRAL AMERICAN INFLUENCE

Near Cañar, Azuay and Loja, a high degree of culture is revealed, of marked Central American influence. says Uhle. Here architecture reached a high plane as the ruins of splendid fortresses and other edifices attest. A wealth of gold ornaments and implements has been found in tombs at Chordeleg and Sigsig. In the second great cultural area, viz., that of the Pacific coast, climatic conditions were very different from those in the highlands, for the region is comparatively low and almost entirely covered with forests. This zone contains two cultural centres, one extending from what is now Esmeraldas south 150 m., and the other in the province of Manabi with its alternate arid and humid climatic conditions. These two cultures, says Saville, prove the existence of two distinct peoples whose occupancy extended over a considerable period, and whose highest development seemingly mas reached long before the coming of the Spaniards. Their cultures differ widely from those represented by the artifacts of the highlands, and apparently there was no connection between the two

In some respects the most interesting culture in Ecuador is that of Esmeraldas. Prominent features are the surprising advancement it shows in modelling clay figures and the great progress in gold working. A dominant feature is the almost microscopic character of many of the objects fashioned in filigree; another is the occurrence of jewels of pure platinum or of platinum and gold filigree. Many pieces are so closely allied to Mayan artefacts as to be almost indistinguishable. The type of culture in general is intermediate between the Mayan and that of the Peruvian coast.

Of the Manabi culture, the outstanding feature is the development of stone architecture, almost entirely unknown in the interior highlands and entirely on the Esmeraldas coast. The Manabi sculptures are unique in South America, says Saville, and have been found in the ruins of houses in hilltop villages and in a few town sites on the arid plains of Manabí. These sculptures include stone seats, believed to have been used ceremonially in household sanctuaries, sculptured slabs of stone, or bas-reliefs, representing female deities, etc., columns recalling those of Costa Rica, birds, animals and human figures in stone. A few pieces of copper and some ornaments of gilded copper are the only examples that have been discovered thus far of the metal work of the ancients of Manabi. In their towns the dead were buried in bottle-shaped tombs cut into the solid rock as well as in mounds or "tolas."

The third great zone of culture east of the Andes, has not been studied. It is represented by a few remains in the Napo region which distinguish it from that of the neighbouring highlands and the Pacific coast; it is apparently related to one farther east near the mouth of the Amazon.

Writing was unknown before the Spanish conquest. At the time of the arrival of the Incas in Ecuador, a number of languages were spoken. Several of these survived the super-position of the Inca language, *i.e.*, the Quéchua, to the time of the arrival of the Spaniards. One, the Esmeraldas, has died out only in recent years, while two, the Cayapa-Colorados and the Jibaro still survive owing to their existence in inaccessible regions. On the basis of geographic names as well as the vocabularies of the three known pre-Inca languages above mentioned, the following languages are recognized as having been in existence at or shortly before the arrival of the Incas:

Quillacingas, Pastos, Caranquis (or Imbaburas or Cayapa-Colorados), Tacungas or Panzaleos, Puruhaes, Cafiaris, Paltas and Jibaros, Bolona (Rabona and others), Esmeraldas, Manabitas or Mantenos and Mochica (or Yunga).

Sefior Jijón y Caamafio thinks that the oldest types represented in Ecuador were the Cayapa-Colorados, the Jibaros and the Chimús and that the others represent modern elements in Ecuadorian ethnology. For Inca history see INCAS.

SPANISH CONQUEST

Spaniards' Arrival. — In 1526 Bartolomé Ruiz, the pilot of Francisco Pizarro, having been sent south from the main base of the second expedition for the conquest of Peru, at that time situated at the mouth of the San Juan in what is now Colombia, rounded Cape Pasado to 1° S. and returned. He was thus the first European to cross the Equator on the Pacific coast of South America, and to see the shores of what is now Ecuador. Ruiz first reached the Esmeraldas where the present town of Esmeraldas is situated and discovered there three large settlements of Indians who received him in a very friendly manner. They wore jewels of gold and three of the Indians who came out in canoes to receive Ruiz, wore golden diadems on their heads.

Ruiz on his return to the San Juan informed Pizarro of his discoveries, and then, joined by Pizarro and Almagro, made a second voyage as far south as Atacames, discovering more large towns, much cultivated ground and a formidable array of well-armed Indians. Returning to the island of Gallo, in 1° 57' N., they sought reinforcements. Early in 1527 Pizarro sailed to the gulf of Guayaquil opposite the town of Tumbez where they saw the undoubted signs of a great civilization, confirmed by a cruise as far south as Santa (9° S.). Pizarro returned to Spain where, by the contract between himself and the Crown, dated July 26, 1529, he was appointed captain general and "adelantado" of the region. He returned, this time with a large retinue, among them his four brothers, his young cousin Pedro Pizarro, the future historian, and several Dominican priests. He sailed from Panama on Dec. 28, 1531, with three small vessels carrying 183 men and 37 horses, and in 13 days arrived at the bay of San Mateo, in northern Ecuador, where he landed his forces and commenced a devastating march along the entire western coast to the gulf of Guayaquil. He crossed this in boats to Puná, where a destructive war was waged with the unfortunate natives. After subjugating them Pizarro crossed over in ships to the mainland where now is

situated the town of Thmbez. Pizarro and his forces left Thmbez on May 18, 1532, founded the city of San Miguel, marched onward in search of the Inca Atahuallpa, made him prisoner and massacred his forces. Atahuallpa was executed in the square of Caxamarca on Aug. 29, 1533, and the Inca empire came to an end.

Pizarro, desirous of forbidding the entrance of adventurers into Peru to make discoveries on their own account, sent Sebastián de Benalcázar as his representative to govern San Miguel which was at that time the key to Peru. In Nov. 1533, Benalcázar learned that Pedro de Alvarado, one of the conquerors of Mexico, had sailed from Guatemala to take the kingdom of Quito, which was famous for the riches of Atahuallpa. Benalcázar collected a few Spaniards and Indians, marched from San Miguel in the last days of 1533 and crossed the cordillera of the Andes to the great highway of the Incas in the province of Loja, now Ecuador, at that time inhabited by peaceful tribes of Palcas. Following this north without opposition, he reached the pueblo of Tomebamba in the country of the Cañaris and persuaded these tribes to join forces with him against their enemies to the north. He then marched north through the "province" of Azuay, defeated the Indians at Riobamba and finally in May or June 1534 arrived at the "city of Quito" which he found in ruins. He then continued north to Cayambe where he received word that Almagro had been sent by Pizarro to join forces with him in opposing the expedition of Pedro de Alvarado, which had landed at Puerto Viejo March 1534 and which was proceeding with frightful hardships straight east from the coast through unknown forests to ascend the west slope of the Andes where no trails even existed. Returning to Riobamba, Benalcázar met Almagro and they founded the "city of Santiago de Quito" on Aug. 15, 1534, as an evidence of formal possession of the territory by Pizarro. This then was the first "city" to be founded in Ecuador. Alvarado when he finally reached the summit of the Andes, after one of the most extraordinary expeditions of the Spanish conquest, found that he had been outmatched. On Aug. 26, 1534, Alvarado agreed to retire from Peru.

Pizarro then proceeded to pacify Ecuador. The city of Santiago de Quito, founded near the present site of Riobamba, was moved to the present site of Quito, on Aug. 28, 1534 and the name changed to San Francisco de Quito. The territory embracing the most northern limits of the Inca empire was soon conquered and finally the conquest continued north into what is now Colombia. It was then continued east of the Andes. Lured by the account of fabulous riches, Francisco Pizarro appointed his brother Gonzalo, Governor of Quito on Dec. 1, 1540, and the final conquest of Ecuador took place. Leaving Quito in Feb. 1541, Gonzalo Pizarro crossed the Guamani pass of the Andes, 13,350 ft. above the sea, wandered in the forests east of the Andes many months and finally, after a feat of exploration which brought him to the Amazon and permitted Orellana, one of his lieutenants, to descend it to its mouth, returned to Quito in rags and with but 97 men, leaving his companions in unmarked graves in the forests east of the Andes.

Conquerors' Discords.—The period of conquest was followed by civil war among the conquistadores. Diego de Almagro and Francisco Pizarro perished by assassination and Gonzalo Pizarro rebelled against Spain. All the new possessions in South America were now erected by the Crown into the "viceroyalty of Peru" and in this governmental body was concentrated the executive power. To this was added a judicial body, the audiencia, and the first viceroy was the president of the first *audiencia* of Lima. In addition, Roman Catholicism, the State religion, was put in charge of a bishop; the first bishopric embraced practically all the viceroyalty. The first viceroy, Blasco Núñez Vela, arrived in Ecuador en route to Peru, but was defeated by Gonzalo Pizarro at the battle of Inaquito, near Quito, Jan. 18, 1546 He himself was killed and his head exhibited at Quito. Gonzalo Pizarro, however, did not long enjoy the fruit of his rebellion, for a new royal representative, Pedro de la Gasca, met and defeated him at Jaquijaguana, Peru, on April 9, 1548. Surrendering, he was executed almost forthwith.

The Government by viceroys continued for 274 years. For the first few years after the establishment of the Viceroyalty of Peru, the territory now known as Ecuador was ruled by its representatives in the "cities" of Quito, Guayaquil, Puerto Viejo, Loja and Cuenca. In 1545, the bishopric of Quito was formed of that portion of the bishopric of Cuzco extending from Payta north into what is now Colombia, and on Aug. 29, 1563, the audiencia of Quito was established with judicial authority over the region from Carchi on the north to Buenaventura on the Pacific and to far east of the Andes, covering all the explorations of Gonzalo Pizarro in 1541, south as far as the latitude of Payta, thus embracing the bishoprics of Quito and Popayán. Because of the isolation of the region from viceregal authority and the presence of the governor as president of the *audiencia,* that body came to be not only judicial in nature but administrative as well.

The audiencia, or presidency, of Quito, as it was almost interchangeably called, remained a part of the viceroyalty of Peru until, by royal edict of May 27, 1717, it was transferred to the newly created Viceroyalty of Nueva Granada, whose seat was at Bogotá. Six years later, the new viceroyalty was abolished, and Quito returned to the authority of the viceroy of Peru, but in 1740, when the viceroyalty of Nueva Granada was restored, Quito was again put under its jurisdiction, where it remained until the end of Spanish domination.

Independence.—The ultimate phase of colonial history, viz., the movement for independence, had its birth in the activities of Espejo (born in Quito, 1747), Antonio Ante, Juan Pio Montufar, and others. The first blow was struck in Quito on Aug. 10, 1809 but the new revolutionary government established soon perished and on Aug. 2, 1810. most of the leaders responsible for it were massacred in Quito. A second attempt on Oct. 11, 1810 set up the "Eight Provinces of the State of Quito" which fell in Dec. 1812. The royalists then maintained their power until May 24, 1822 when, with the assistance of Sucre sent by Bolivar the republican forces defeated the royalists at the battle of Pichincha and two days later Aymerich, the last president of the *audiencia,* capitulated. Ecuador, under the name of "department of the south," now joined with Venezuela and Colombia in the confederacy known as the republic of Colombia.

RULE OF THE PRESIDENTS

The efforts of Bolivar to maintain this greater republic were unsuccessful. Although Bolivar defeated Peru in 1829, fixing the limits between Peru and Colombia as those of the old viceroyalties of Lima and Bogotá, Venezuela soon after withdrew from the confederacy (Nov. 29, 1829) and at a constitutional convention in Riobamba (Aug. 14 to Sept. 28, 1830) the three departments of Azuay, Guayas, and Quito formed themselves into an independent State called "Estado del Ecuador en Colombia" and adopted the first constitution of what is now Ecuador.

The history of Ecuador since its separation from Bolivar's great State has been very largely that of its great dictators, of whom three stand out most prominently: Juan José Flores, Gabriel Garcia Moreno, and Eloy Alfaro. Its course has been complicated by internal struggles of Liberals against Conservatives, of sections against sections, and, particularly in the 20th century, by economic factors.

The first president of the new republic was General Juan José Flores, a Venezuelan by birth, who had identified himself with Ecuador and had led the movement for separation. President Flores represented a Conservative group, whose stronghold was inland Quito, conservative, aristocratic, and devoutly loyal to the Roman Catholic Church, in politics as well as in religion. There were, however, particularly in Guayaquil, elements in whom the liberal ideas of the 18th century ran strong. Coupled with this was sectional rivalry between Guayaquil and Quito.

By 1833, opposition to Flores, headed by Vicente Rocafuerte, became formidable, and soon revolt broke out. After over a year of indecisive civil war, the two rival leaders effected a compromise whereby Flores agreed to acquiesce in Rocafuerte's election as his successor in 1835. Four years later (1839) Flores returned as president, but soon had difficulties with congress, and after further disorders accepted exile in 1845, going to Spain. where he involved himself in plans for restoration of Spanish control. In

1851 he made an unsuccessful attempt to return to power.

Meanwhile, president had followed president, with only the exceptional one serving his full term. In Jan. 1860, while Ecuador was torn by internal dissensions, Peruvian warships blockaded Guayaquil and forced acceptance of a treaty recognizing Peru's boundary claims. This treaty was repudiated shortly, however, when the Government signing was overthrown in Sept. 1860 by a revolution headed by Gabriel Garcia Moreno, son-in-law of Flores, and one of the most distinctive figures in Ecuadorian history.

Gabriel Garcia Moreno (1821–1875) whose length of service amounted to 10 years and nearly 5 months (two terms), held power longer than any other president. He was starting a third term when he was assassinated on Aug. 5, 1875, thus having the second distinction of being the only president to die by assassination while in office. His period of power brought the Church Party to its zenith in Ecuador, so much so that Garcia Moreno's presidency was often referred to as a Jesuit Government. He perhaps did more for Ecuador than any other president, for he gave it the greatest blessing one can bestow on Ecuador—a strong government and peace. He caused the Roman Catholic Church to send out from Europe a number of Jesuit priests, eminent in science, to become teachers. Among these were Theodor Wolf, the geologist, Sodiro, the botanist, Menten, the astronomer, Dressel, the chemist and Kolberg, mathematician. He was a great patron of science, a man of extraordinary energy and a strict ruler. The reaction from his policy carried successive governments to greater and greater "liberalism" and finally to the deprivation of the Catholic clergy of their extensive landed properties, to the establishment of civil marriage and to freedom of worship.

The years following Garcia Moreno's death were marked, initially, by a reaction against the extreme clericalism of his time, but not for long. The issue of separation of Church and State continued to be bitterly fought, amid nearly constant internal disturbance. Not until the rise to power of Eloy Alfaro in 1895 did order and relative stability return to Ecuador. During his presidency (1895–1901) various restrictions upon clerical activity were enacted into law, comparable in most respects to those exercised by Spain during the colonial régime. His successor, Leónidas Plaza Gutiérrez, went further, and under him civil marriage and divorce were legalized and control of education taken from the hands of the church.

In 1906, former President Alfaro returned to power, and was elected president for a second constitutional term. Under him a new constitution was promulgated. It made the Government more centralized, forbade immediate re-election of a president, and set forth various liberal reforms. This constitution, the country's 12th in 86 years, lasted for 22 years, longer than had any of its predecessors. Under Alfaro, too, the railway from Guayaquil to Quito, first in the country, was completed (1909). In 1911, during a revolution against Alfaro's successor, the former president was arrested, and a few months later was dragged from his prison and murdered by a mob (Jan. 1912).

At the outbreak of the war of 1914–18, Ecuador proclaimed her neutrality, but after entrance of the United States into the conflict, relations with Germany were broken off and German shipping in Ecuadorian harbours seized.

A coup d'état in 1925 brought into power a "Junta" which dissolved Congress. Subsequently a military board assumed control and made Dr. Isidro Ayora president. In 1929 constitutional forms were resumed and Ayora's authority was confirmed by election. His administration, however, lost its army support by its budgetary policy and in 1931 Ayora resigned. Factional strife and minor uprisings, partly due to economic depression thereafter prevailed. In Aug. 1935, President Velasco Ibarra was deposed by the army, and a junta set up, with Federico Páez as its nominal head. The new government sternly repressed adverse criticism but, as internal unrest continued, Páez was forced to resign (Oct. 24, 1937), being succeeded by his war minister, Alberto Enriquez. Enriquez served until a constituent assembly, meeting Aug. 10, 1938, chose Dr. Manuel Maria Borrero and, subsequently (Dec. 1), Dr. Alberto Mosquera Narváez. Narváez, fourth president in 14 months, was able to retain his position only by force, crushing a revolution with artillery after two days' fighting, and died in office Nov. 17, 1939. His successor, Dr. Carlos Arroyo del Rio, resigned in favour of Andrés F. Córdova (Dec. 11) to run at the Jan. 1940 presidential elections. Elected, he took office Sept. 1940. Meanwhile, a serious revolution in January, headed by former President Jose Maria Velasco Ibarra, opponent of Dr. Arroyo del Rio in the elections, was suppressed, but unrest continued.

Behind the political unrest—aside from generally unsatisfactory world economic conditions, which hit Ecuador especially hard—was popular dissatisfaction over the lack of progress in settling the acute boundary dispute with Peru. Further complicating the situation was the fact that no one political leader could command general support from the country.

Despite political instability, the country has, since 1931, put into effect many reforms, most of them looking toward State control of resources and toward improvement of education. At the outbreak of the European war in 1939, Ecuador declared her neutrality, and collaborated closely with the United States in its policies of hemisphere defence.

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(J. H. SR.; L. W. BE.)

ECZEMA, a common and important inflammation of the skin originating without visible external irritation, and characterized in some stage of its evolution by a serous exudation. For an attack of eczema two conditions are necessary; a predisposition or special irritability of the skin, and a directly exciting cause. The first condition is usually inherited or depends on some underlying constitutional state. The number of such states inculpated and their diversity are expressions of our ignorance of the real causation, but there is an undoubted relationship between eczema and certain forms of functional neurosis, particularly asthma. Sufferers from rheumatism and gout are also prone to eczema, though the exact relationship is much disputed. Eczema is not contagious, though when complicated by pyogenic micro-organisms (impetigo), it is both auto-inoculable and contagious. Females (except when menstruation is becoming established, and at the menopause) are less liable to be attacked than males. In old age the sex influence is lost.

An attack of eczema is usually described as acute or chronic, but the only distinction lies in its greater or less intensity at the time of description; it has nothing to do with the length of time that the disease has lasted. It usually begins with local itching and burning and an erythematous blush, on which numerous tiny vesicles form. The vesicles grow larger, run together, and either burst or are broken by the patient's scratching, a clear fluid exuding which stiffens linen. The discharge does not dry up at once, but continues to exude—hence the name of "weeping eczema" when this is a prominent symptom. In some cases papules predominate, in others, especially when the face is attacked, erythema is more marked. The general health seldom suffers appreciably, unless the itching is so bad as to make sleep impossible. The irritation and local heat may be out of all proportion to visible changes in the skin, and in neurotic patients the nervous excitement may be extreme. The attack may affect any part of the body, but it usually begins at one of the following sites: the bends of the elbows or knees, the groins, between the buttocks, the groove behind the ears, the scalp, the palms or the soles, and the breasts of women. According to its position the form of the eczema is somewhat modified. On the front of the legs and arms, there is uniform redness. On the scalp it is generally seborrhoeic, and in children, especially when pediculi are present, it will become pustular. On the palms and soles it brings about thickening of the epidermis and the formation of cracks.

Treatment is unsatisfactory. Some cases are benefited by X-rays, others by alkaline bicarbonates or calomel, but the condition seems to wax and wane, or even disappear in an arbitrary way and the last treatment employed is given the credit. The only safe statements are *(a)* that the inflamed area should be protected from air and irritation and (b) that highly seasoned foods should be avoided.

EDAM, a town in the province of North Holland, close to the Zuider Zee, about 13 mi. NNE. of Amsterdam. It is connected with the Zuider Zee by a fine canal protected by a large sea-lock (1828). Pop. (1940) 8,941. Germany occupied Edam in 1940.

Edam took its name and origin from the dam built on the Ye, which joined the Purmer lake close by. Free access to the Zuider Zee was obtained by the construction of a new dock in 1357, when the town also received civic rights from William V. of Bavaria, count of Holland. Owing to the danger of the extension of the Purmer and Beemster lakes, Philip II. of Spain caused a sluice to be built into the dock in 1567. In the next century Edam was a great shipbuilding centre, and nearly the whole of de Ruyter's fleet was built here; then the harbour began to get silted up, and commercial and industrial activity slowly waned. The Great Church (St. Nicholas) probably 14th century, was largely rebuilt after a fire in 1602, which destroyed nearly the whole town. It contains some fine stained glass and carved woodwork of this period. The Little Church (15th century) was demolished in 1883, except for a portion of the nave and the old tower and steeple. The town hall dates from 1737, and there is a museum founded in 1895. Cheese making is important and Edam gives its name to the "sweet-milk cheese" *(zoetemelks kaas)* made throughout North Holland.

EDDA, the title given to two very remarkable collections of old Icelandic literature. Of these one bears that title from the middle ages; the other is called *Edda* by a comparatively modern misnomer. The word is first met with in *Rígspula,* a fragmentary poem dating from the first half of the 10th century, where it is introduced as the name or title of a great-grandmother. From the 14th to the 17th century, this word—but no one has formed a reasonable conjecture why—was used as a synonym for the technical laws of the Norwegian Court-metre, *Eddu regla,* and "never to have heard or seen Edda" signified "never to have learned the art of poetry." The only known work by the name in the middle ages was the miscellaneous group of writings composed by Snorri Sturluson *(q.v.;* 1179–1241), the greatest name in old Scandinavian literature. It is believed that the *Edda,* as he left it, was completed about 1222. Whether he gave this name to the work is doubtful; the title first occurs in the Uppsala Codex, transcribed about 50 years after his death. The collection of Snorri is now known as the *Prose* or *Younger Edda,* the title of *Elder Edda* being given to a collection of mythological and heroic poems, discovered by the Icelandic bishop of Skblaholt, Brynjólfr Sveinsson, in 1643 and erroneously named by him the *Edda of Saemundr.*

The Prose Edda.—Properly known as *Edda Snorra Sturlusonar,* this was undoubtedly written by Snorri Sturluson. It is divided into five parts, the Preface or *Formáli, Gylfaginning, Bragaroebur, Skáldskaparmál and Hdttatal.* The Preface bears a very modern character and simply gives a *résumé* of the biblical story of the creation and the flood, with a brief account of the rise and spread of paganism. *Gylfaginning,* or the Delusion of Gylfi, on the other hand, is the most precious compendium which we possess of the mythological system of the ancient inhabitants of Scandinavia. The *Bragaroeður,* or sayings of Bragi, are further legends of the deities, attributed to Bragi, the god of poetry. The *Skáldskaparmál,* or Art of Poetry, commonly called *Skdlda,* contains the instructions given by Bragi to Aegir, and consists of the rules and theories of ancient verse, exemplified in copious extracts from Eyvindr Skáldaspillir and other eminent Icelandic poets. The fifth section of the *Edda,* the *Hdttatal,* or Number of Metres, is a running technical commentary on the text of Snorri's three poems written in honour of Hákon, king of Norway. Affixed to some mss. of the *Younger Edda* are a list of poets and a number of philological treatises and grammatical studies. These belong, however, to a later period than the life of Snorri Sturluson

The three oldest mss. of the Prose *Edda* all belong to the beginning of the 14th century. The Wurm ms. was sent to Ole Wurm in 1628; the Codex Regius was discovered by the indefatigable bishop Brynjólfr Sveinsson in 1643. The most important. however, of these mss. is the Uppsala Codex, an octavo volume written probably about the year 1300. There have been several good editions of the *Edda Snorra Sturlusonar,* of which, perhaps, the best is the edition published by the Arnamagnaean Society in Copenhagen in 1848–52, edited by a group of scholars under the direction of Jón Sigurðsson, and the more recent Danish (1900) and Icelandic (1907) editions of Finnur Jónsson. There are English translations by T. Percy, *Northern Antiquities,* from the French of P. H. Mallet (1770); by G. Webbe Dasent (Stockholm, 1842); by R. B. Anderson (Chicago, 1880); by A. G. Brodeur (1916). The last-named version contains the whole of the *Prose Edda,* with the exception of the very technical and

practically untranslatable *Háttatal.*

The Elder Edda, Poetic Edda or *Saemundar* Edda *hins* frdda was entirely unknown until about 1643, when it came into the hands of Brynjolfr Sveinsson, who, puzzled to classify it, gave it the title of *Edda Saemundi multiscii.* Saemundr Sigfússon, who was thus credited with the collection of these poems, came of an old and distinguished Icelandic family, and lived from about 1056 to 1133. The poems themselves are many of them only fragments of longer heroic chants now otherwise entirely lost. They treat of mythical and heroic legends of an early Scandinavian civilization, and are composed of the simplest and most archaic forms of Norse verse. They present many difficult problems upon which scholars have expended an inexhaustible but not always conclusive erudition.

It may be said with some confidence, however, that the 34 poems usually included in the Edda were composed between the 9th and 12th centuries, and that they were the composition of poets, whose very names are unknown, but who were certainly Norwegians by birth or descent and shared the same religious and poetic convention. These poets were not uncultured; they were affected by the beliefs of the Christianized peoples of western Europe; they used as material for their art Danish and German legends; they were influenced by the Anglo-Saxon and Irish literatures. Irish influence is marked in *Rígspula;* to what extent it affected the Edda as a whole is debatable. The honour of having been the home-land of the Edda has been claimed in turn for Norway, Iceland, the British Isles and Denmark. The two Atli poems can be assigned with certainty to Greenland; *Grímnismál* appears from internal evidence to have been composed in Norway, and *Grípisspá* in Iceland; *Rígspula* may have been composed in Ireland or in northern England. The meaning of the title "Edda" is still in doubt; it has been variously explained by scholars as "Tales of a Grandmother," "Poetics," "The Book of Oddi"—Saemundr resided at Oddi—"Poems of Death and Destruction," from the Irish word aitte, signifying "deaths." The poems appear to have been collected from oral tradition and committed to writing in the 12th century, probably in Iceland and possibly by Saemundr.

The most remarkable of the poems in this priceless collection is the *Völuspá,* or prophecy of the Völva or Sibyl. In this chant we listen to an inspired prophetess, "seated on her high seat, and addressing Odin, while the gods listen to her words." She sings of the world before the gods were made, of the coming and the meeting of the Aesir, of the origin of the giants, dwarfs and men, of the happy beginning of all things, and the sad ending that shall be in the chaos of Ragnarok. The melodies of the verse, exquisite in their extreme and severe simplicity, are wholly rhythmical and alliterative, and return upon themselves like a solemn incantation.

Hávamál, the Lesson of the High One, or Odin, follows; this contains proverbs and wise saws, and a series of stories, some of them comical, told by Odin against himself.

In *Hyndluljóð,* the Lay of Hyndla, the goddess Freyja rides to question the volva Hyndla with regard to the ancestry of her young paramour, Ottar. With this poem, the first or wholly mythological portion of the collection closes. What follows is heroic and pseudo-historic. The Volundarkviba, or Song of Völundr, is engaged with the adventures of Volundr, the smith-king. during his stay with Nidudr, king of Sweden. Volundr, identical with the Anglo-Saxon Wêland and the German Wieland (O.H.G. *Wiolant*), is sometimes confused with Odin, the master-smith. This poem contains the beautiful figure of Svanhvit, the swan-maiden, who stays seven winters with Volundr, and then, yearning for her fatherland, flies away home through the dark forest. Helgakvida *Hjörvarðssonar,* the Song of Helgi, the Son of Hjörvarð, celebrates the wooing of Helgi of Svava, who, like Atalanta, ends by loving the man with whom she has fought in battle. Two Songs of Helgi the Hunding's Bane, Helgakvida *Hundingsbana,* open the long and very important series of lays relating to the two heoric families of the Volsungs and the Nibelungs. A very curious poem is the Song of the Sun, *Sólarljóð,* which forms a kind of appendix to the Poetic Edda. In this the spirit of a dead father addresses his living son, and exhorts him, with maxims that resemble those of *Hávamál,* to righteousness of life. Though found only in the 17th century copies of the Edda, *Sólarlióð* appears from internal evidence to have been written in the 11th century, and to have been the composition of a Christian mystic who had not completely shed heathen modes of thought and expression.

The principal ms. of this *Edda* is the Codex Regius in the royal library of Copenhagen, written continuously, without regard to prose or verse, on 45 vellum leaves. This is that found by Bishop Brynjólfr. Another valuable fragment exists in the Arnámagnaean collection in the University of Copenhagen, consisting of four sheets, 22 leaves in all. These are the only mss. older than the 17th century which contain a collection of the ancient mytho-heroic lays, but fragments occur in various other works, and especially in the *Edda* of Snorri. The text of the *Poetic Edda* has been edited by Mobius, Sophus Bugge, Hildebrand, Sijmons and Gering, Finnur Jónsson, Neckel, Detter and Heinzel (1903), and Sievers (1923). Twelve poems from the *Poetic Edda* were translated into English verse by Amos Cottle in 1797; the poet Gray produced a version of the *Vegtamskvistra;* but the first translation of the whole was that published by Benjamin Thorpe in 1866; the most recent English versions are those of Olive Bray (1908) and H. A. Bellows (1923).

The Eddic poems were rearranged, on *a* system of their own, which differs entirely from that of the early mss., by Gudbrand Vigfússon and F. York Powell, in their *Corpus poeticum boreale* (1883). This is a collection, not of *Edda* only, hut of all existing fragments of the vast lyrical literature of ancient Iceland.

(X.; R. P. Co.)

EDDINGTON, SIR ARTHUR STANLEY (1882–), British astronomer, was born at Kendal, England, Dec. 28, 1882. He mas educated at Owen's college, Manchester, and Trinity college, Cambridge, where he was Senior Wrangler in 1904 and Smith's Prizeman in 1907. In the latter year he was elected fellow of his college. From 1906 to 1913 he held the post of chief assistant at the Royal observatory at Greenwich; and in 1913 he became Plumian professor of astronomy at Cambridge. In 1914 he was made director of the observatory at Cambridge, and in the same year was elected fellow of the Royal Society.

He is a member of many British and foreign scientific societies and was awarded the Hopkins prize of the Cambridge Philosophical society (1918–21), the Pontécoulant prize of the French academy (1919), the gold medal of the Royal Astronomical society (1924), the Bruce medal of the Astronomical Society of the Pacific (1924), and others. He was knighted in 1930 and was awarded the Order of Merit in 1938.

Eddington's principal researches are on the motions of stars, stellar evolution and relativity. His first published paper in 1906 was on the systematic motion of stars; this was followed during the next nine years by a series of papers on the structure of the heavens. "The Systematic Motions of the Stars of Professor Boss's Preliminary General Catalogue" appeared in 1910; in this paper Eddington analyzed this catalogue of 6,188 stars and some of his later researches are based on this analysis. In 1916–17 he published papers on "the radiative equilibrium of the stars," dealing with the interior of a star. Eddington grasped the significance of the theory of relativity at an early stage of its development, and, by means of articles, books and lectures, gave a clear exposition of the theory. His own contribution to this theory is embodied in a paper published in 1921 on "a Generalisation of Weyl's Theory of the Electromagnetic and Gravitational Fields." He collaborated in the preparation of this *Encyclopædia.*

His published works include *Stellar Movement and the Structure of the Universe* (1914), *Report on the Relativity Theory of Gravitation* (1918), *Space, Time and Gravitation* (1920), *The Mathematical Theory of Relativity* (1923), *Stars and Atoms* (1927), *The Expanding Universe* (1933). *(See* ASTRONOMY.)

EDDIUS or **AEDBI,** a Kentish choirmaster, was employed by Wilfrid (c. 634–709), bishop of York, to organize services in Northumbria. His Life of Wilfrid is the earliest extant work of an Anglo-Saxon author. It is invaluable for its period, though strongly partisan in feeling, and was used by Bede for his *Historia.*

See Eddius, *Vita Wilfridi* (Rāine, *Historians of Church* of *York,* London, 1879–94, 14); ed. with trans. and notes by B. Colgrave (Cambridge, 1927); Bede, *Hist. Eccl.* (edit. Plummer, Oxford, 1896), iii., 2.

EDDY, MARY BAKER (1821–1910), the founder and leader of the Christian Science movement, was born on July 16, 1821, at Bow, near Concord, New Hampshire, U.S.A. She was the youngest of the six children of Mark Baker and Abigail Ambrose Baker. Her father was a man of local prominence, first at Bow and later at Tilton, New Hampshire; a landowner, a justice of the peace, a member of the committee having charge of the public schools and a deacon of the Congregational Church. Her mother was the daughter of Deacon Nathaniel Ambrose, of Pembroke, New Hampshire, who also represented the same type of citizenship.

In 1843 Mary Baker married Major George W. Glover, a native of Concord, New Hampshire, but a resident of Charleston, S.C. By occupation a contractor and builder, he had an honorary title "by appointment to the staff of the governor of South Carolina." Major Glover died six months after their marriage while they were at Wilmington, N.C. Her only child (also named George W. Glover) was born three months later, after she had returned to New Hampshire. During the next nine years she lived at Tilton, New Hampshire, with her father, or with her sister Mrs. Abigail Tilton, and occupied herself to the extent allowed by delicate health in caring for her child and in teaching. For a time she conducted a private school for young children; at other times she was an extra teacher in a New Hampshire Conference Seminary.

In 1853 Mrs. Glover married Dr. Daniel Patterson, of Franklin, N.H., a dentist. This marriage proved to be extremely unfortunate. After ten years of alternate care and neglect, he finally deserted her at Lynn, Mass., whither they had removed from New Hampshire. Ten years later (at Lynn, in 1873) she obtained a divorce from him for desertion following after adultery. In 1877 Mrs. Glover (Mrs. Patterson having resumed this name) married Asa Gilbert Eddy, of Lynn, an ardent Christian Scientist and the first of her followers to engage in the public practice of Christian Science. After his death (at Lynn, in 1882) Mrs. Eddy continued as a widow until she died at Chestnut Hill, Mass., near Boston, on Dec. 3, 1910.

Considering that educational facilities for women were limited when Mrs. Eddy was young and that her attendance at school was interrupted by delicate health, the education she obtained was exceptionally liberal. In addition to attending ordinary schools, she attended the Academy at Tilton and received instruction from tutors. An extensive reader of good literature, she also wrote acceptable poetry and prose which appeared frequently in New England publications long before her discovery of Christian Science. After her discovery of Christian Science, she contributed the principal literature of this subject, employing for this purpose a distinctive literary style, as well as a notable ability to elucidate metaphysical and religious topics.

As a child and as a young woman, Mrs. Eddy showed an exceptional interest in religious subjects. In the development of this interest she was aided by her devout and intelligent mother, as well as by the Congregational pastors at Bow and Tilton and by other ministers whom her parents frequently entertained. At the age of 12, she had the courage and independence to dispute a point in theology when she was examined for church membership. Between then and her first marriage, she often discussed religious topics with her parents and with ministers, exhibiting a comprehension which they regarded as remarkable. Shortly before her first marriage, one of her pastors who also tutored her for six or seven years (Rev. Enoch Corser) predicted for Mrs. Eddy a great future and spoke of her as "an intellectual and spiritual genius."

The beginning of Mrs. Eddy's interest in religious or spiritual healing can be traced to an incident which occurred when she was 12 years old, immediately before her examination for admission to the Congregational Church. During a fever her mother commended prayer to God. Then, as Mrs. Eddy has related, "I prayed; and a soft glow of ineffable joy came over me. The fever was gone, and I rose and dressed myself, in a normal condition of health" (*Retrospection and Introspection*, p. 13). This incident, together with others of an extraordinary nature, is believed to have contributed to the observation and study which resulted ultimately in Mrs. Eddy's discovery of Christian Science.

Mrs. Eddy regarded her discovery of Christian Science as resulting directly and immediately from an incident which occurred at Lynn in 1866. While returning from a meeting of Good Templars, she fell on an icy street and was injured severely. Carried to a nearby residence, she was attended by a physician and cared for during the night. The next day she was removed to her home, as a local newspaper reported at the time, "in a very critical condition." On the third day after this injury, having obtained little or no relief, Mrs. Eddy asked for her Bible, opened it so that she read an account of Christian healing (Matt. 9:2) and again experienced an immediate recovery.

Concerning the study which then ensued, Mrs. Eddy has written: "The Bible was my textbook. It answered my questions as to how I was healed; but the Scriptures had to me a new meaning, a new tongue. Their spiritual signification appeared; and I apprehended for the first time, in their spiritual meaning, Jesus' teaching and demonstration, and the Principle and rule of spiritual Science and metaphysical healing,—in a word, Christian Science."

Mrs. Eddy's published works on Christian Science began with a pamphlet copyrighted in 1870, entitled *The Science of Man*, of which only one small edition was printed. In this pamphlet she said, "In the nineteenth century I affix for all time the word *Science* to *Clzristianity;* and *error* to *personal sense;* and call the world to battle on this issue." Her principal work, the Christian Science textbook, first entitled *Science and Health* but afterward entitled *Science and Health with Key to the Scriptures*, was issued in 1875. Occasionally revised by the author, "only to give a clearer and fuller expression of its original meaning," and finally revised in 1907, this book continues to be the fundamental and standard statement of Christian Science. Other published works by Mrs. Eddy include *The People's Idea of God* (1886), *Christian Healing* (1886), *Unity of Good* (1891), *Rudimental Divine Science* (1891), *Retrospection and Introspection* (1891), *No and Yes* (1891), *Church Manual* (1895–1910), *Miscellaneous Writings* (1896), *Christ and Christmas* (1897), *Christian Science versus Pantheism* (1898), *Pulpit and Press* (1898), *Messages to The Mother Church* (1900; 1901; 1902), *The First Church of Christ, Scientist, and Miscellany* (1913).

Naturally, Mrs. Eddy was the first practitioner and the first teacher of her religion. As a practitioner, she demonstrated her religion by healings in many cases, until duties which could not be left to others required all of her time. As a teacher, she taught students until she was obliged to leave class teaching to students whom she selected for this work. She began to organize the Christian Science movement in 1876 when she and a few of her students formed the Christian Science Association. After three years she and a selected number of her followers organized the Church of Christ, Scientist, into which the earlier Association was merged. In 1892, she and a selected number of her followers organized the Christian Science mother church, the First Church of Christ, Scientist, in Boston, which succeeded the earlier church. The Mother Church, together with the branch churches or local congregations throughout the world, constitutes the present organization. In 1892 Mrs. Eddy also founded the Christian Science Publishing Society as an agency of her Church.

Next to what Mrs. Eddy did as the discoverer and founder of Christian Science, her greatest work was done as the leader of the Christian Science movement. Although living a rather secluded life (at Lynn until 1882; in Boston from then until 1889; at Pleasant View, near Concord, N.H., from then until 1908; and afterward at Chestnut Hill, near Boston), she initiated and either directed or supervised every important activity of her Church; and she formulated the plan, set forth in the *Church Manual*, by which its affairs are to be conducted permanently. From the general point of view, Mrs. Eddy was a remarkable woman, for it was no light task to propose a new system of religious philosophy which was at the time and is even now so radically at variance with much of prevailing orthodox beliefs. She was 57 when she founded the Church of Christ, Scientist, which in half a century extended its branches throughout the world totalling (1928) 2,370 churches and societies. She followed this with the founding of the *Chris-*

tian Science Journal, a monthly magazine which she edited for 11 yrs.; and 15 yrs. later she founded the *Christian Science Sentinel,* a weekly. In 1908, when Mrs. Eddy was 87, she established the *Christian Science Monitor,* a successful daily newspaper, giving news free from sensation and scandal. Nor did Mrs. Eddy, at these times, relinquish her other activities. Her own life illustrated and demonstrated her proposition that "prayer, watching and working, combined with self-immolation, are God's gracious means for accomplishing whatever has been successfully done for the Christianization and health of mankind" *(Science and Healtlz,* p. 1). *See* CHRISTIAN SCIENCE. (C. P. S.)

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EDE, a town in the province of Gelderland, the Netherlands, on the railway Utrecht-Arnhem. Pop. (1940) 34,567. Ede is the seat of the important Dutch Enka rayon-silk industry. At 3 mi. distance is the castle of St. Hubertus, containing the modern art collection of Rroller-Muller, which gained special fame for its outstanding collection of paintings by Vincent Van Gogh.

EDELINCK, GERARD (1649–1707), Flemish copper-plate engraver, was born in Antwerp on Oct. 20, 1649. He learned the rudiments of the art in his native town under Gaspard Huybrecht. He then went to Paris in 1665 and worked under de Poilly. On the recommendation of Le Brun, he was appointed teacher at the academy established at the Gobelins to train workers in tapestry.

Edelinck with Nanteuil and Masson formed the great triumvirate of the best period of French portrait engraving. He excelled in rendering light and shade, colour and the texture of surfaces. He was the first to execute prints in the lozenge shape. Among his works, which number 341, are a "Holy Family," after Raphael; a "Penitent Magdalene," after Charles le Brun; "Alexander at the Tent of Darius," after Le Brun; a "Combat of Four Knights" after Leonardo da Vinci; "Christ Surrounded by Angels"; "St. Louis Praying"; and "St. Charles Borromeo before a Crucifixn — the last three after Le Brun. Edelinck engraved portraits of Louis XIV, Le Brun, Rigaud. Philippe de Champaigne (which the engraver thought his best), Santeul, La Fontaine, Colbert, John Dryden, Descartes, etc. He died in Paris on April 2, 1707. His two brothers, Jean and Gaspard François, and his son Nicolas, were also engravers, but did not attain to his excellence.

See H. Delaborde, *Gérard Edelinck* (1886); Robert Dumesnil, Le *peintre-graveur français,* vol. vii (1835–71).

EDELWEISS (*Leontopodium alpinum*), a perennial plant of the composite familv (*Compositae*), native of the Alps and the Andes. It is a 'small herb reaching about 6 in. high, with narrow white woolly leaves, and terminal flowerheads enveloped in woolly bracts. The woolly covering is assumed to protect the plant, in the exposed situations in which it is found, by preventing its drying up through excessive loss of moisture. It is much sought after by some visitors to the Alps but although rather sporadic in its distribution it is not rare and grows readily in gardens under lowland conditions.

EDELWEISS. A HANDSOME WOOLLY PLANT, FOUND IN THE ALPS OF CENTRAL EUROPE, OFTEN GROWN IN ROCK GARDENS

EDEN, SIR ASHLEY (1831–1887), Anglo-Indian official and diplomatist, third son of Robert John Eden, third Lord Auckland and bishop of Bath and Wells, was born on Nov. 13, 1831, and entered the Indian civil service in 1852. In 1855 he helped to suppress the Santal rising, and from 1860 to 1871 was secretary to the Bengal government with an *ex officio* seat on the legislative council. Eden was (1871) the first civilian governor of British Burma; in 1877 he became lieutenant-governor of Bengal. He returned to England on his appointment (1882) to the council of the secretary of state for India, of which he remained a member till his death on July 8, 1887.

EDEN, though often used as the name of the garden in which, according to Gen. ii and iii, lived the first man created, is strictly the name of the region in which that garden was situated. The garden contained beautiful fruit trees providing food for the man whom God had appointed to till it. In it, too, were "the tree of the knowledge of good and evil" and "the tree of life," magical trees conferring upon those who ate of their fruit wisdom and immortality. The man and his wife were expelled from the garden because, having tasted, contrary to the divine command, of the fruit of the former, God feared that they might eat also of the other tree's fruit. The story blends many mythological conceptions which belong to the primitive age of Semitic religion. Close study of the story reveals that it is compounded of at least two traditions, one concerned with the tree of knowledge, the other with the tree of life. Prof. H. T. Obbink of Utrecht has suggested that the narrative has been generally misunderstood. His view is that the tree of life was really intended to furnish divine food by which the first man maintained his immortality, and that he was evicted from the garden to cut him off from this nourishment.

Many speculations have been made as to the site of the garden, which seems to be thought of as an oasis in a barren region According to Gen. ii 8 it was "eastward": verses 10–14 describe a river as flowing forth from it, and dividing into four streams One of these is the Euphrates, and another, "Hiddekel," almost certainly the Tigris. This would suggest a site north of Babylon. It is true that the Euphrates and the Tigris near Baghdad approach so closely together that the former discharges water through canals into the latter. Eut even if it be supposed that these two rivers might be regarded as coming from a common source no satisfactory explanation of the two reinaining rivers is offered. To define the site from these details is impossible; it is obvious, moreover, that verses 10–14 are a learned note intruded into the simple story. The attempt to locate a mythological garden is bound to be attended by considerable difficulty, and all that can be safely said is that the story in its present form combines two traditions, one of which placed the garden in the far east, the other in the far north, where, according to Babylonian tradition, the garden of the gods was to be found. Yet another tradition as to the garden, which underlies Ezek. xxviii 12–19, connects it with the mountain of God, placed by Isa. xiv 13 in the "sides of the north." (W. L. W.)

EDENBRIDGE, a market town in the Sevenoaks parliamentary division of Kent, England, 28½ mi. S.S.E. of London on the Southern railway, and 10 mi. W. of Tonbridge on the line to Redhill. Pop. of civil parish (1931) 3,254. It is pleasantly situated on the river Eden, an affluent of the Medway, in a valley between the Ragstone hills and the Forest ridges, on the Surrey border. The church of St. Peter and St. Paul is principally Perpendicular. The town has considerable agricultural trade and a chalybeate spring which is little used. Hever castle, 2 mi. S.W., is a beautiful moated mansion of the 15th and 16th centuries, but occupying the site of an earlier structure. This was rebuilt by Sir Geoffrey Boleyn, whose grandson, Sir Thomas, was father of Anne, second wife of Henry VIII, who here spent much of her life before her marriage and was visited by the king. There is a chapel of her family in the fine parish church of Hever. Not far distant is the modern Chiddingstone castle, on an ancient site. A block of sandstone in the park is called the "chiding stone," tradition asserting it to be a prehistoric seat of judgment.

EDEN HALL, LUCK OF, an old painted or enamelled glass drinking goblet preserved at Eden Hall, Cumberland, the seat of the Musgrave family, perhaps of the 10th century. It has the letters I.H.S. on the top. Round the vase is the verse given below. In the grounds of Eden Hall is a spring called St. Cuthbert's Well, and the story is that one of the early Musgraves surprised the fairies making merry at the well, and seized the goblet from the fairy king, who eventually acknowledged his

defeat and gave him the cup, but warned him:

> When this cup shall break or fall,
> Farewell the luck of Eden Hall.

Possessed of the cup, the knight of Musgrave is said to have at once prospered in a love-suit. There is a poem on the cup called "The Drinking Match at Eden Hall," by Philip, duke of Wharton, a parody on the ballad of Chevy Chase, reprinted in Edward Walford's *Tales of Great Families* (1877, vol. xi), as "The witty Duke of Wharton."

EDENKOBEN, a town of Germany, in the Bavarian Palatinate, 6 mi. N. from Landau, on the railway to Weissenburg. Population 5,218. It has a sulphur-spring. Its industries comprise iron orks, and the manufacture of machinery, furniture and cigars. It has also a large trade in wine, and is frequented for the grape-cure.

EDENTATA, an order of Mammalia (*q.v.*) comprising the sloths, ant-eaters and armadillos restricted to the warmer parts of America. But this name, meaning toothless, applies only to the ant-eaters. The teeth of sloths and armadillos, however, are abnormal in being of persistent growth, seldom differentiated, without enamel and invariably absent in the fronl of both jaws. A character distinctive of the order is the presence of accessory articular processes on some of the vertebrae. From this the name Xenarthra has been given to these groups to distinguish them from the pangolins and aard-varks of the Old World which were formerly associated with the American edentates as Nomarthra on account of the normal construction of the vertebrae. There is, however, no evidence of kinship between the ant-eaters of the Old and New Worlds, such resemblances as they exhibit being superficial adaptations to diet. The Pangolins and aard-vark are therefore dealt with separately in this article.

The existing edentates are divided into two sub-orders, the Pilosa or Anicanodonta and the Loricata or Hicanodonta.

Pilosa.—In the Pilosa the anus and external genitalia are close together on a common eminence or enclosed in a fold of skin, both the clitoris and penis being quite short, and there is no exoskeleton of dermal bones. There are two well defined tribes, the Tardigrada or sloths and the Vermilingua or ant-eaters. In the Tardigrada the jaws are short, strong and the wide mouth is provided with teeth and a short flat tongue; the tail is short or absent and the limbs are long and slender, the fore and hind feet are similar in being long and narrow and in having the two or three digits compactly united and furnished with long, curved, equal claws. In the skull the zygomatic arch is branched.

The existing sloths feed upon leaves and are entirely arboreal. Their limbs are especially modified to enable them to climb or hang back downwards on branches, and their long coarse hair harbours microscopical green algae which serve to conceal them in the trees.

The sloths are referred to two families, the Bradypodidae and the Choloepidae. In the Bradypodidae, or three-toed sloths, all the feet are furnished with three digits, and the soles are almost entirely hairy; there is a distinct tail; the hair on the head grows forwards, forming a frill round the face, the nostrils are small and the ears very simple. Sometimes known as aïs, they are found in the tropical forests of South and Central America. The few known species are referred to two genera, *Bradypus* and *Scaeopus*.

The Choloepidae or two-toed sloths, also known as unau, have only two digits on the fore foot; the soles are quite naked; there is no external tail, the hair on the head grows backwards, the nostrils have a thickened margin and the ear is provided with a valvular flap. The single genus *Choloepus*, represented by a few species, ranges from Nicaragua to Brazil.

In the Vermilingua or ant-eaters the snout is elongated and down-curved, the mouth has a very short gape, a long worm-like tongue and no teeth; the fore and hind feet are dissimilar and the digits of the fore foot are unequal in size, the third being the largest and armed with a great falcate claw and the tail is very long. In the skull the jaws are weak and the zygomatic arch is slender and unbranched. The ant-eaters are assigned to two families, the Cyclopedidae and Myrmecophagidae.

In the Cyclopedidae, containing *Cyclopes* (*Cycloturus*) *didactylus*, the silky or two-toed ant-eater, the limbs are adapted essentially for climbing. The fore foot has only two digits with strong claws which close upon a large cushion-like pad, the hind foot has four fused digits, each with a long claw, and capable of folding down on to the heel for grasping; the tail is prehensile and naked at the tip beneath but otherwise covered, like the head and body, with long silky hairs which on the head conceal the simple ears. The jaws and other parts of the skull are less specialized than in the next family. This little arboreal ant-eater, which is no bigger than a rat, is found in tropical South and Central America.

The Myrmecophagidae contain two very distinct forms, the great ant-eater (*Myrmecophaga jzcbata*) and lesser ant-eater or tamandua (*Tamandua tetradactyla*). The feet are adapted for progression on the ground, although in the tamandua they also serve for climbing. The fore foot has four clawed toes, and on its outer side a large supporting pad; the hind foot has five toes, with short claws, and is plantigrade; the hair is not silky and on the head is quite short so that the better developed ears are prominent. The skull differs from that of *Cyclopes* in having a weaker mandible and in the fusion of the pterygoids to prolong the narial passages. In the tamandua the tail is prehensile and covered mostly with small scales and short hairs, the hair of the body is short and smooth and the fore foot has a large carpal pad confluent with the ambulatory pad. This ant-eater, which is about the size of a cat, lives in the forests of tropical America.

The great ant-eater (*Myrmecophaga jubata*), standing over two feet high, is purely terrestrial in habits. The hair on the body and tail is long, shaggy and coarse, the tail is rigid and not prehensile, the fore foot has a very large ambulatory pad and a small isolated carpal pad and the snout is much longer than in the tamandua. It lives in the swampy savannahs and forests of tropical America, feeding, like the other ant-eaters, mainly on termites, the nests of which it rips open with the great falcate claws of the fore feet.

Loricata.—In the Loricata the external genitalia are long and not associated with the anus, as in the Pilosa; there is a dermal bony exoskeleton and the hairy covering is usually scanty. The Armadillos which constitute this sub-order are divisible into several families.

In the Dasypodidae the bony exoskeleton consists of a head-shield, one or more free bands on the neck, a large compact scapular shield encasing the fore quarters, followed by from 6 to 13 free dorsal bands and a large solid pelvic shield over the hind quarters, the scutes of these areas being tolerably alike in size and shape; the flexible tail tapers to a point and its bony rings never consist of more than two rows of scutes; the skin of the lower surface is scantily hairy and tubercular; the legs are scaly above and there are five toes on each foot, those of the fore foot being provided with fossorial claws, the fourth toe being the longest, while on the hind foot the third and fourth are subequal and all the claws are smaller; the ears are large, situated on the sides of the head some distance behind the eye.

There are two subfamilies, the Dasypodinae and the Cabassoinae. The Dasypodinae have from six to eight dorsal bands, one neck band; the scutes are coarsely sculptured, and the tail has jointed rings. To this sub-family belong the six-banded armadillo (*Dasypus sexcinctus*) of Paraguay and Brazil, and many related species. A remarkable Brazilian species (*Scleropleura bruneti*) has the dermal scutes defective, especially on the back. These armadillos are active animals of small or medium size, ranging in length of head and body from about six inches in the pichi to a foot or rather more in the six-banded armadillo.

In the Cabassoinae there are from 11 to 13 dorsal and from three to four neck bands, the scutes are often polished; the scutes of the tail are not arranged in distinct rings and may be defective; and the fore feet are more fossorial, the claws of the third or third and fourth being specially enlarged. To this group belong the tatouay (*Cabassous unicinctus*) of Brazil and Surinam, and the giant armadillo (*Priodontes gigas*) of Brazil, which may reach a length of three feet.

The family Tatuidae contains the peba or nine-banded arma-

dillo (*Tatu* or *Tatusia*) which differs from the Dasypodidae in having the ears set close together on the top of the head, no bands on the neck, the scutes of the dorsal bands larger and differently shaped from the small scutes of the scapular and pelvic shields; the bands on the long tail are composed of three rows of scutes; in the fore foot the fifth toe is absent and the third is as large as or larger than the fourth, and the five toes of the hind foot are symmetrically arranged, the third being median. The genus ranges from Texas to the Argentine and is represented by a few species of which the best known is *Tatu novemcincta.* A rare species, the hairy peba (T. *pilosa*), is remarkable for having a coat of long hair concealing the scutes. It has been referred to a distinct genus *Cryptophractus.*

To the family Tolypeutidae belong the apars or ball armadillos, so-called from their power to roll up into a compact sphere. In adaptation to this protective habit there is beneath the very large pelvic and scapular shields a deep recess into which the limbs can be withdrawn. The tail is very short and rigid. They also differ from the Dasypodidae in having from two to four dorsal bands and in being more digitigrade, the second, third and fourth toes of the hind foot, which have broad hoof-like claws, and the tips of the long claws of the third and fourth digits of the fore foot resting on the ground during progression. The toes vary from five to three. A few species of the genus *Tolypeutes* are admitted. The best known is the common three-banded armadillo (T. *tricinctus*) from the Argentine.

The little silky armadillo or pichiciago (*Chlamyphorus truncatus*), the type of the family Chlamyphoridae, differs from all existing armadillos in having a continuous series of scutes, forming transverse bands, extending from the head-shield to the pelvic shield, the latter forming a vertical semicircular disc giving a truncated appearance to the hinder end of the body; in having the dorsal bands attached to the body along the middle of the back and overlapping its sides, which, like the ventral surface and legs, are clothed with silky hair, like a cloak; in the reduction of the ear to a tiny lobe close to the eye and in having the tail spatulate. The feet nearly resemble those of the Dasypodidae but have larger falcate claws. This armadillo, which is found in the sandy deserts of the Argentine, is an expert digger and largely subterranean in habits. A related genus, *Burmeisteria,* found in Bolivia, differs in having the shell adherent to the sides of the body and the bony scutes of the pelvic shield defective.

Extinct **Edentates.**—The fossile remains of edentates, found in abundance in Tertiary deposits of North and South America, show that the existing sloths, ant-eaters and armadillos are the widely divergent survivors of a great, and now waning, group represented in the past by large numbers of highly diversified genera, some of the species of which were colossal in bulk. Some of these fossils serve to link in a measure, not only the sloths with the ant-eaters, but the armadillos with both these groups.

Taking first the Pilosa, the discovery of sloths and ant-eaters, differing but little from existing species, in Pleistocene deposits of South America, needs only passing reference. Of far greater interest are the ground sloths, the Gravigrada, standing between the Tardigrada and the Vermilingua, with skulls and teeth as in the farmer and the rest of the skeleton more as in the latter. The known genera are grouped round three main types *Megatherium, Mylodon* and *Megalonyx.*

Megatherium had a longish, very strong tail, broad hips and very stout hind limbs, with a huge heel and only three toes, the third alone being armed with a large claw; the fore limbs were long and strong, and four-toed, the second, third and fourth toes being armed with claws, that of the third being exceptionally large; there were well developed collar bones; the skull had anteriorly protruding massive jaws, with a thick, branched zygomatic arch. There is no doubt that this great beast, measuring 18 ft. long, the skull being about two feet, fed upon foliage and twigs which he reached by rearing up against a tree trunk, supported on his hind legs and tail, and using his fore legs to pull down the branches, and a long flexible tongue to gather the leaves into his mouth. It also seems clear that in standing and walking on the ground he rested on the outer side of both fore and hind feet. The remains of *Megatherium* itself are found in Pleistocene deposits of the southern United States and South America. Related forms occur in the Pliocene of Argentina, and considerably smaller forms, regarded as ancestral, occur in Miocene beds of Patagonia.

Mylodon, although smaller, with the skull about a foot and a half long, closely resembled *Megatherium* in general form, but had weaker, short jaws, differently shaped, smaller teeth, and five toes on the fore foot and four on the hind, but evidently walked on the outer side of both feet, like *Megatherium.* Its remains are found in Pleistocene beds of North and South America. There are many related genera, also Pleistocene. Of particular interest was *Glossotherium* on account of the presence of bones in the skin beneath the hair, recalling the exoskeleton of the armadillos. Supposedly ancestral forms of *Mylodon* and its allies are found in Miocene deposits of Patagonia.

Megalonyx, with the skull a foot or more in length, found in Pleistocene and Pliocene deposits of North America, is distinguished from the preceding genera by having the first of the five upper teeth large, tusk-like and isolated. A large number of related genera from Miocene deposits in Patagonia are smaller and less specialized.

It is amongst the earlier Miocene forms of Gravigrada that we find evidence of convergence between the sloths and ant-eaters. Not only are they smaller than the later evolved forms but their limbs are more slender and their feet more normal, in the number and size of the digits, and in the hind feet being plantigrade, as in the great ant-eater.

With regard to the Loricata, many existing genera occur in the Pleistocene of Argentina and Brazil; and Pleistocene and Pliocene beds have yielded remains of a huge armadillo (*Chlamydotherium*), comparable to a rhinoceros in size and with teeth less simplified than in surviving species. A large number of genera approximating to existing forms have also been found in Miocene and earlier deposits in Patagonia. One of these, *Stegotherium,* is of particular moment from possessing long, narrow jaws with a few minute, simple teeth at the back of the mouth, thus approaching the long-jawed toothless ant-eaters. But excelling all in interest are the Glyptodonta, a tribe of extinct, highly specialized armadillos distinguished by having the entire body encased in an unjointed bony cuirass, in the fusion of the vertebrae of the back, the peculiar jointing of the neck so that the head could be withdrawn into the shell, and in the structure of the skull which was remarkably like that of *Megatherium,* in general appearance. To support the great weight of the cuirass the feet were short and broad with hoof-like nails especially on the hind feet; and the long tapering tail was jointed, with bony rings in its basal portion and encased in an unjointed sheath at the end. Some of these armadillos, like *Glyptodon* and *Panochthus,* from the Pleistocene of South America, were eight or nine feet long and about four feet high and they moved about slowly, grazing on herbage like huge tortoises. They died out in the Pleistocene; but the group is traceable through the Pliocene back to Miocene deposits of Patagonia.

Another group of extinct mammals, shown by the structure of their vertebrae to belong to the edentate stock, is the Taeniodonta or Ganodonta whose remains occur in Lower and Middle Eocene deposits in North America. In the structure of the skull and of the massive limbs this sub-order shows considerable resemblance to the Gravigrada; but although the median incisor teeth, both above and below, seem to be missing, the rest of the dentition is quite unlike that of typical edentates in being heterodont, with large canines and cusped, usually rooted cheek-teeth, all more or less covered with enamel. The best known forms are *Conoryctes, Psittacotherium* and *Hemiganus.*

The Lower Eocene of North America has yielded yet another group, the Palaeonodonta (*Palaeonodon, Metachiromys*), which has been claimed to be ancestral to the edentates. It is said to resemble the Loricata in the structure of the feet and other respects, such as the absence of incisor teeth, but differed in the absence of dermal bones and of cheek-teeth and the presence of large cutting canines. Since, moreover, the vertebrae were normally constructed and there was no union between the poste-

rior part of the pelvis and the anterior vertebrae of the tail such as is found in all typical Edentata, it is difficult to justify this classification.

PHOLIDOTA

The pangolins (*q.v.*) or scaly ant-eaters of Africa and tropical Asia were at one time associated with the Edentata mainly on account of their likeness to the South American ant-eaters in the absence of teeth, the weakness of the jaws, the enlargement of the salivary glands, and the length of the vermiform, extensile tongue; and to the armadillos in the possession of a hard dermal exoskeleton. But the resemblances to the former group are adaptive and due to similarity of diet and the exoskeleton is of a totally different type from that of the armadillos, since it consists of large, erectile, overlapping horny scales, composed of cemented hairs, there being no trace of bony matter in the skin. They show, indeed, no resemblances to the cdentates of any systematic importance and differ from them fundamentally in many characters, such as the absence of extra articular processes in the spinal column, the presence of a bicornuate, instead of a globular, uterus, of a diffused, non-deciduate, instead of a dome-shaped deciduate, placenta, etc.

The head is short and conical, with functionless facial vibrissae and a moist normal rhinarium as in *Myrmecophaga;* the ear sometimes has a distinct pinna but may be represented by a vertical slit only. The legs are short but the feet vary in structure according to habit. The fore foot has five toes of which the second, third and fourth are always armed with large claws, the largest being on the third; the first and fifth digits are very variable in size and are usually small clawed. The hind foot also has five toes which vary in size and in the size of the claws. The tail is also variable, sometimes being excessively long and prehensile, sometimes comparatively short and forming, with the hind legs, a kind of tripodal support; at other times it is intermediate in structure. The anus and external genitalia are situated close together on an eminence formed mainly by the enlarged anal glands, and the anus is sunk in a depression into which the ducts of the glands open; both the penis and clitoris are quite small.

Pangolins range in Asia from north India and south China to Ceylon and Borneo and in Africa from Sierra Leone and Uganda to the Cape. There are several different kinds. Some are almost entirely arboreal, some purely terrestrial, while others which live in the main on the ground also climb trees as well. Otherwise their habits are very similar. They feed mostly on termites, ripping open the nests of these insects with the strong claws of the fore feet. Their means of defence are the emission of a repulsive odour from the large anal glands and rolling into a compact ball with the hard, often sharp, erected scales presented to the enemy and protecting the soft-skinned hairy underside of the body from injury.

There are several species and genera, all referred to the family Manidae. But this is divisible into three sub-families. In the Asiatic species, the Maninae, the hinder end of the sternum or breast-bone is shaped like the blade of a spade, having a convex posterior edge and two forwardly directed spiniform angles. To this group belong the north Indian and Chinese eared pangolin (*Manis pentadactyla*), the Indian and Ceylonese thick-tailed pangolin *(Phatages crassicaudata)* and the Javanese and Bornean pangolin *(Paramanis javanica)*, which differ in many external characters.

In the African pangolins the end of the breast-bone is prolonged into two long rods running back to the posterior ribs. There are two well defined sub-families differing in habitat and correlated structural characters. The Smutsiinae, containing the genus *Smutsia* with the two species *temminckii* and *gigantea,* are terrestrial with the feet and tail adapted for ground life; and the Phataginae, containing the two small west African pangolins, *Phatagginus tricuspis* and *Uromanis longicaudata,* which differ from all other pangolin; in being adapted to arboreal life, their tails being exceedingly long and prehensile, and the feet with only four functional toes, the upper side of the fore foot being without scales.

Extinct Pangolins. — Bones of a large pangolin, indistinguishable from the African giant pangolin, have been found in a cave in Madras; in Lower Pliocene deposits of Samos occur *Palaeomanis* and earlier still are *Leptomanis* and *Necromanis* from the Upper Eocene phosphorites of Quercy.

TUBULIDENTATA

To the order Tubulidentata belongs the aard-vark (*q.v.*) or African ant-bear, *Orycteropus,* representing the family Orycteropodidae, which was formerly associated with the Ameriean edentates and the scaly ant-eaters because, feeding on termites, it has a longish snout, a long, extensile tongue, a small gape, no teeth in the fore part of the jaws and cheek teeth defective in enamel and of persistent growth. In no other respects does it resemble the edentates; and although it is like the scaly ant-eaters (Pholidota) in having normally articulated vertebrae and a bicornuate uterus, these are characters common to many orders of mammals. The aard-vark is a burrowing, heavily built animal, about six feet long, scantily covered with hair, with a long narrow head carrying huge rabbit-like ears and ending in a swollen mobile snout with terminal valvular nostrils closed with long hair. The tongue, although long, is not vermiform. The feet are powerful and very much alike except that the fore foot has no first toe; the toes are long, armed with huge flattened claws, and the second and third, which are the longest, are united by a deep and wide web; the fore foot is plantigrade, the hind digitigrade. The tail is long, stout and tapering; and the external genital organs are situated on a preanal eminence containing a pair of scent glands opening at the sides of the short penis and of the vulva, which is provided with a cordate flap-like clitoris. The teeth of the permanent set are unlike those of other mammals in being traversed by many tubules radiating from a central pulp cavity. They represent molars and premolars, the latter having milk predecessors; but in the newly born young traces of incisors and canines which never cut the gum have been discovered. There is evidence indeed that the ancestor of *Orycteropus,* before degeneration of the teeth set in, had no fewer than three incisors, one canine, five premolars and five or six molars on each side above and below, a larger number than is found in any order of mammals with typical heterodont dentition.

Aard-varks are found in Africa south of the Sahara both in deep forest and in the open. There are only two or three species known to be in existence.

Extinct **Aard-varks.**—A species, **O.** *gaudryi,* nearly allied to the living forms, occurs in Lower Pliocene deposits of Bessarabia and Samos; and a distinct genus, *Palaeorycteropus,* has been recorded from the Upper Eocene phosphorites of Quercy. Finally, it may be added, certain bones from the Miocene of Europe have been claimed to indicate a common ancestry for the armadillos, scaly ant-eaters and aard-varks; but the indications ard too doubtful to be trusted. **(R. I.** P.)

EDENTON, a city of north-eastern North Carolina, U.S.A., on an inlet of Albemarle sound, near the mouth of the Chowan river; the county seat of Chowan county. It is served by the Norfolk Southern railroad and river transportation. The railroad bridge across Albemarle sound is 4·8 mi. long. The population was 3.563 in 1930; in 1940, 3,835. Shad and herring fisheries are an important industry. and there is a U.S. Fish hatchery near by. The city is a large peanut and watermelon market. Edenton has some fine old homesteads and many historical associations. It was settled about 1658, and through the 18th century was a place of considerable social and political importance. The legislative assembly met here occasionally, and here lived the royal governors and various prominent citizens of the province, including Joseph Hewes, James Iredell, father and son, and Samuel Johnston. St. Paul's church was built in 1736; the court-house in 1767. In a house facing the court-house the "Edenton Tea Party" was held on Oct. 24, 1774, by 51 ladies, who signed resolutions that they would refrain from using tea or anything manufactured in England until the tax on tea should be repealed. On May 5, 1864, a naval engagement was fought near Edenton between the Confederate ram "Albemarle" and the Union "Sassacus," a wooden side-wheeler, resulting in favour of the Confederate ironclad.

EDESSA, the ancient capital of Macedonia (an older name is Aegae), situated 46 m. W. of Thessalonica on a beautiful stream in the centre of the kingdom, commanding the approaches from the coast to the interior. It was the original residence of the Macedonian kings; and after the seat of government was removed by Philip II. to the more accessible Pella, it continued to be the royal burial-place. At the celebration of his daughter's marriage here, Philip II. was murdered by Pausanias in 336 B.C. Though Alexander was buried at Alexandria the bodies of Eurydice and her husband Arrhidaeus were removed by Cassander to the ancestral sepulchre. On the occupation of the town by Pyrrhus the royal tombs were plundered by Gallic mercenaries. Owing to its position commanding the Via Egnatia, the town retainedits importance during the Roman and Byzantine periods. For its present condition, see VODENA.

EDESSA, the Greek name of an ancient city of N. W. Mesopotamia (in 37° 21′ N. lat. and 39° 6′ E. long.), suggested perhaps by a comparison of its site, or its water supply,[1] with that of its Macedonian namesake. It still bears its earlier name, Urhāi, modified since the 11th century (by the Turks?) to Urfa.

The oldest certain form is the Aramaic *Urhāi* ("Western" pronunciation Urhōi), which appears in Greek as an adjective as Ὀρροηνή,[2] -νοι[3] (perhaps also as a fortress with spring, as Ὀρρά[4]), and in Latin as *Orr(h)ei*,[5] and (in the inscription on Abgar's grave) *Orrhenoru(m)*.[6] The Syriac Chronicle ascribed to Dionysius of Tell-mahrē derives the name from a first king Urhāi, son of Hewyā (*i.e.* "Snake"), but neither this nor any other derivation hitherto suggested is satisfactory. The district name Osroēnē (for Ὀρροηνή) is in Syriac Bēth-Urhāyē. The Arabs pronounced the name er-Ruhā, and that form prevailed till it gave place to Urfa in the 15th century.

According to Pliny, v. 86, Edessa was also called Antioch, and coins of Antiochus IV. Epiphanes with the legend "Antioch on the Callirrhoe" may imply that he rebuilt and renamed the place (so Ed. Meyer in Pauly-Wissowa, Realencyclopadie, col. 1933, 66). Pliny indeed seems to call the city itself Callirrhoe, but K. Regling (Klio, i. 459, n. 1) may be right in his emendation which applies the title in Pliny to the sacred spring.

History.—Edessa-Urhāi is important mainly as the earliest seat of Syriac-speaking Christianity. About 132 B.C., when the Hellenistic empire of the Seleucids was breaking up, a native non-Greek dynasty succeeded in establishing a more or less independent State with Edessa as its capital on what came to be the frontier between the Roman and the Parthian dominions. The names of some 30 local kings survive, but little is known of its history, and the true tale of the planting of Christianity in this region is lost in the mists of legend. In A.D. 114 king Abgar VII. entertained Trajan on his way back to Syria (Dio Cass. xviii. 21), but in 116 after a general rising the Consul L. Quietus sacked the city and made the State tributary. Hadrian, however, restored the dynasty of Edessa, but made it a dependency of Rome. When L. Verus (163–165) recovered Mesopotamia from Parthia, it was not Edessa but Harriin that was chosen as the site of a Roman colony and made the metropolis by Marcus Aurelius (172). The fact that these decisive events have left no trace in the Christian traditions suggests that Christianity had not yet arrived at Edessa. The native religion of Edessa, according to Christian tradition, was connected with the Planets. In the *Doctrine* of Addai 24 Venus appears to be called Bath Nikal, a name for Ishtar of Babylonian derivation ("daughter of Nin-Gal": see C. Winckworth in J. *Th.* St. xxv. 402). One or both of the pools below the citadel containing sacred fish may have been sacred to Atargatis (*q.v.*), an Ishtar-Venus deity. In the citadel itself are still standing two pillars—there may once have been more—both 50 ft. high; on one of them is a pre-Christian Syriac inscription, which states that it was set up for Shalmat the queen, daughter of Ma'nu the viceroy (paṣgrība), together with a bas-relief or statue, now effaced. The fact that this inscription is in Syriac is a testimony to the Semitic tone of the culture of the little state; "Syriac," in fact, is the dialect of Aramaic then spoken in Edessa and its neighbourhood.

Before Christianity arrived at Edessa the more important parts of the Old Testament had been translated into Syriac by Jews, either at Edessa itself or in Adiabene under the encouragcinent of the then reigning house (Josephus, Bell. Jud. ii. 19, 4). This translation, slightly revised and supplemented, is still used by the Syriac-speaking churches and is known as the Pĕshīttа (*i.e.* the Simple version). Tradition connects the founding of Christianity in Edessa with Addai, a missionary sent by St. Thomas himself, who converted Abgar the king and many of the inhabitants. As, however, he is also said to have brought the Gospel in the form of the Diatessaron, and we know from Epiphanius (Haer. 46) that Tatian, the author of the Gospel Harmony called Diatessaron, returned to his Mesopotamian fatherland about 170 as a missionary, it seems reasonable to identify "Addai" with Tatian himself (see J. *Th.* St. xxv. 128–130). About the end of the 2nd century Edessene Christianity seems to have made a fresh beginning: the ordination of Palūt by Serapion of Antioch may mean that things ecclesiastical took a westward trend, and it is possible that a complete version of the Four Gospels (the "Old Syriac") was now introduced. Mention should here be made of Bardaiṣān (*q.v.*; Bardesanes) known as the Aramaean philosopher. He became a Christian, and is famous for his cosmological speculations (see C. W. Mitchell, *Ephraim's* Refutations, p.cxxii. ff.), but was reckoned heretical. He was a contemporary of Abgar IX., at whose court Iulius Africanus stayed for a while. A Syrian official record from this reign, preserved in the *Edessene* Chronicle, gives a somewhat detailed account of a violent flood (Nov. 201) of the Daiṣān river which did much damage, destroying amongst other things "the palace of Abgar the Great," rebuilt as a summer palace by Abgar IX., and "the nave of the church of the Christians." The form of this last statement shows that at the time of writing (206) the rulers had not adopted Christianity themselves. Abgar IX. is now commonly supposed to be the ruler to whom the famous legend was first attached (see ABGAR); but though he visited Rome there is no proof that he ever became a Christian (Gomperz, in *Archäologisch-epigraphische Mitteilungen aus Österreich-Ungarn*, xix. 154–157). It was at Edessa that Caracalla, who made it a military colony (Colonia Marcia Edessenorum), spent the winter of 216–17, and near there that he was murdered. The religious philosophical treatise known as the Book of the Laws of Countries was produced at this time by a pupil of Bardesanes. The Acts of *Thomas* in its original form may have followed not long after: this work contains the finest Syriac poem extant, commonly called the "Hymn of the Soul." Bardesanes has been conjectured to have been its author on insufficient grounds (see Mitchell, *op. cit.*, p.cxxix.).

Sassanian Period.—In 226 the Parthian empire gave place to the new kingdom of the Sassanidae, whose claim to the ancient Achaeinenian empire led to constant struggle with Rome in which Edessa naturally suffered. The native State was restored by Gordian in 242; but in 244 it became again directly subject to Rome. The legendary Edessan martyrs Sharbēl and Barsamyā may have perished in the Decian persecution. In 260 the city was besieged by the Persians under Shapur I., and Valerian was defeated and made prisoner by its gates. Odaenathus of Palmyra (d.267), however, wrested Mesopotamia from the Persians; but Aurelian defeated his successor Zenobia at Emesa (273), and Carus, who died in 283 in an expedition against the Persians, and Galerius (297) carried the frontier again to the Tigris. During the Diocletian persecution Shmōna and Garia (Nov. 15, 309) and Habbib (Sept. 2, 310), the "Confessors of Edessa" were martyred; but the bishop Qōna, who laid the foundations of "the great church" by the sacred pool, somehow escaped. Edessa can claim no share in "the Persian Sage" Aphrahat (Aphraates); but Ephrem, after bewailing in Nisibis the sufferings of the great Persian war under Constantius and Julian, when Jovian in 363 ceded most of Mesopotamia to Shapur II., the persecutor of the

[1] So Appian, *Syr.* 57; *cp.* Steph. Byz., *s.v.* Ἔδεσσα· διὰ τὴν τῶν ὑδάτων ῥύμην.
[2] Steph. Byz., *s.v.* Βάτναι.
[3] Dio, passim.
[4] Isidore Charac. 1 (Müller, Geog. Gr. *Min.*, i. 246).
[5] Several times in Pliny, Nat. *Hist.*
[6] *CIL.* vi. 1797.

Christians, settled in Edessa, which as the seat of his famous school (called "the Persian") grew in importance, and attracted scholars from elsewhere. He taught and wrote vigorously against the Arians and other heretics, and although just after his death (373) the emperor Valens banished the orthodox from Edessa, they returned on the emperor's death in 378. Rabbtila, bishop of Edessa from 411 to 435, was a great organizer, but he won from the Nestorians the title of the Tyrant of Edessa. In particular he exerted himself to stamp out the use of the Diatessaron in favour of the four Gospels, of which he issued a revised Syriac translation, which is the final form of the Pĕshīttа. The sojourn in Edessa of the "Man of God" (Alexis) belongs to Rabbiila's episcopate, and the oldest surviving dated Syriac ms. was written in the year he became bishop. When Nestorianism was condemned at Ephesus (431) it began to gravitate eastwards, Nişībis becoming its eventual headquarters; but Edessa and the western Syrians refused to bow to the Council of Chalcedon (451) when it condemned Monophysitism.[1] Zeno's edict (489) ordered the closing of the school of the Persians at Edessa, and East and West drifted apart more and more; Narsai, the leading Nestorian teacher, fled to Nişībis about 489. Till about this time Syriac influence was strong in Armenia, and some Syriac works have survived only in Armenian translations. In the opening years of the 6th century the Persian-Roman War (502–506) found a chronicler in the anonymous Edessene history known till recently as the Chronicle of Joshua Stylites. Whether Edessa received from the emperor Justin I. the additional name of Justinopolis may be uncertain (see Hallier, *op.cit.* p.128); but it seems to have been renewed and fortified after the "fourth" flood in 525 (Procop. *Pers.* ii. 27; *De aedific.* ii. 7). About this time, according to Noldeke, an anonymous Edesserie wrote the Romance of Julian the Apostate, which so many Arab writers use as a history. Chosroes I. Anushirwān succeeded in 540, according to the last entry in the Edessene Chronicle, in exacting a large tribute from Edessa; but in 544 he besieged it in vain. A few years later Jacob Burd'āra (Baradaeus), with Edessa as his nominal bishopric, was carrying on the propaganda of Monophysitism, which won for the adherents of that creed the name of Jacobites (see JACOBITE CHURCH). The valuable Syriac Chronicle just referred to probably was compiled in the latter half of this century.

Islam. — In the first decade of the next century Edessa was taken by Chosroes TI., and a large part of the population transported to eastern Persia. Within a score of years it was recovered by the emperor Heraclius, who reviewed a large army under its walls. The prophet of Islam was now, however, building up his power in Arabia, and a few years later (636?) Heraclius's attempts, from Edessa as a centre, to effect an organized opposition to the victorious Arabs were defeated by Said, and he fell back on Samosiita. The terms on which Edessa definitely passed into the hands of the Moslems (638) under Riyād are not certain (Balādhurī). As it now ceased to be a frontier city it lost in importance. In 668 occurred another destructive flood (Theophanes, p. 537), and in 678 an earthquake which destroyed part of the "old church," which the caliph Mo'āwiya I. is said to have repaired. To the latter part of the century belongs the activity of Edessa's bishop Jacob, whose chronicle is unfortunately lost. It may have been the impulse given by the final supremacy of the caliphate to the long process which eventually substituted Arabic for Aramaic (which had now prevailed for a millennium and a half), that led Jacob to adopt Greek vowel signs for use in Syriac. Yet a century later Theophilus of Edessa (d.785), author of a lost history, translated into Syriac "the two books of the poet Homer on the conquest of the city of Ilion." When the Baghdad caliphs lost control, Edessa shared the fortunes of western Mesopotamia, changing with the rise and fall of Egyptian dynasties and Arab chieftains. In the 10th century al-Mas'tidi, writing in the very year in which it happened, tells how the Mohammedan ruler of Edessa, with the permission of the caliph, purchased peace of the emperor Romanus Lecapenus by surrendering to him the napkin of Jesus of Nazareth, wherewith he had dried himself after his baptism. The translation of the Holy Icon of Christ from Edessa is commemorated on Aug. 16 (Cal. Byzant). A few years later Ibn Haukal (978) estimates the number of churches in the city at more than 300, and al-Mokaddasi (985) describes its cathedral, with vaulted ceiling covered with mosaics, as one of the four wonders of the world. In 1031 the emperor recovered Edessa; but in 1040 it fell into the hands of the Seljuks, whose progress had added a large element of Armenian refugees to the population of Osrhoene. Maqrīzī tells us that the Armenian minister Badr al-Gamāli employed architects from Edessa to build three of the fine city gates of Cairo (1087–91). The empire soon recovered Edessa, but the resident made himself independent In 1098, in the First Crusade, Baldwin, brother and successor of Godfrey of Bouillon took possession of the town and made it the capital of a Burgundian countship, which included Samosāta and Sartig, and was for half a century the eastern bulwark of the kingdom of Jerusalem.[1] The local Armenian historian, however, Matthew of Edessa, tells of oppression, decrease of population, ruin of churches, neglect of agriculture. With the campaign of Maudud in 1110 fortune began to favour the Moslems. Edessa had to endure siege after siege. Finally, in 1144 it was stormed, Matthew being among the slain, by Imad ud-Din Zengi, ruler of Mosul, an achievement celebrated as "the conquest of conquests," for which an Edessan monk, John, bishop of Ḥarrān (d.1165) laid the responsibility not on God but on the absence of the Frankish troops. Edessa suffered still more in 1146 after an attempt to recover it. Churches were now turned into mosques. The consternation produced in Europe by the news of its fate led to "the second Crusade." In 1182 it fell to Saladin, whose nephew recovered it when it had temporarily passed (1234) to the sultan of Rum; but the "Eye of Mesopotamia" never recovered the brilliance of earlier days. The names it contributed to Arabic literature are unimportant. By timely surrender (1268) it escaped the sufferings inflicted by Hūḷākū and his Monguls on Sariig (Barhebraeus, *Chron.* Arab., Beirūt ed , 486). Mostaufi describes a great cupola of finely worked stone still standing by a court over a hundred yards square (1340). Ali b. Yazd in his account of the campaigns of Timūr, who reduced Mesopotamia in 1393, still calls the city (1425) Ruhā. In 1637, when Amurath IV. conquered Baghdad and annexed Mesopotamia, it passed finally into the hands of the Turks, by whom it is called Urfa.

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Modern City. — The city occupies an important position as one of a line of frontier forts which hold the entrance from the foothills to the plain. It is in addition an important point of transit along the northern and safer route from Mosul to Aleppo, being now on the railway. At this point the land routes westwards divide, one going south to Aleppo, another west to Adana. It is the centre of a wheat district but is not concerned in any industry. The population is uncertain; it probably numbers about 40,000 and includes Kurds, Turks and Armenians.

The town itself is of considerable interest. It is surrounded by a wall, with square towers at intervals. On the western part of the town lies the old citadel, with two great Corinthian columns, known as the "throne of Nimrod." Between the citadel and the town are the springs, from which it probably derived its name of *Callirhoë.* The water from these springs forms two ponds, on the edge of the larger of which is the great Mosque of Abraham. The largest mosque however is in the middle of the town, probably on the site of the once famous Christian church. The Kara Kuyun (Σκίριος) runs in a moat round the town, and this and the other streams serve to irrigate the gardens, vineyards and mulberry orchards. In addition to its stormy history in earlier times Edessa towards the end of the last century incurred an unfor-

[1] The oldest surviving *dated* ms. of *a* portion of the Bible in any language was written at Amid (Diarbekr) in A.D. 464.

[1] The counts were: Baldwin I. (1098), Baldwin, II. (1100), Joscelin I. (1119), Joscelin II. (1131–47).

tunate reputation as the seat of Armenian massacres.

EDFU, in Coptic *Atbō,* a town of Upper Egypt, 484 m. S.S.E. of Cairo by rail, on the W. bank of the Nile, the railway station being on the opposite side of the river. The inhabitants manufacture earthenware. which finds ready sale all through Egypt, The ancient Atbō (*Apollinopolis Magna)* was capital of the second nome of Upper Egypt. The great Ptolemaic sandstone temple is practically complete. The central part of the building, begun by Ptolemy III. Euergetes in 237 B C., was finished by his successor in 212; the portico, court, pylons and surrounding wall were added by Ptolemy Euergetes II., Soter II. and Alexander I.; but the decoration was not finished till 57 B.C. in the reign of Ptolemy XIII. Neos Dionysus. The god of Atbō was a form of Horus (Xpollo) as the sun-god; his most characteristic representation is as the disk of the sun with outspread wings, Population 15,000.

EDGAR (EADGAR), king of the English (944–975), was the younger son of Edmund the Magnificent and Aelfgifu. As early as 955 he signed a charter of his uncle Eadred, and in 957 the Mercian nobles, discontented with the rule of his elder brother Eadwig, made him king of England north of the Thames. On the death of his brother in Oct. 959 Edgar became king of a united England. Immediately on his accession to the throne of Mercia Edgar recalled St. Dunstan from exile and made him first bishop of Worcester, and then of London. In 961 Dunstan was translated to Canterbury, and throughout Edgar's reign he was his chief adviser, and to him must be attributed much of the peace and prosperity of this time.

The reign of Edgar was somewhat uneventful, but two things stand out clearly: his ecclesiastical policy and his imperial position in Britain. Edgar and Dunstan were alike determined to reform the great monastic houses, to restore them to their true owners, and to remove them from the lax discipline of the secular priests or *canonici.* The priests of the old and new monasteries at Winchester, Chertsey and Milton Abbas were replaced by monks, and the old rule of St. Benedict was strictly enforced.

The coronation of Edgar, delayed for some unexplained reason till 973, took place with much ceremony at Bath, and was followed shortly after by the submission of eight kings, including the kings of Scotland and Strathclyde, to Edgar at Chester. In 967 an outbreak against Edgar in Northumbria was put down by Thored, the son of Gunnere, steward of the king's household.

Edgar's death took place in the year 975, and he was buried at Glastonbury. By his vigorous rule and his statesmanlike policy Edgar won the approval of his people; the only fault ascribed to him is a too great love for foreigners and for foreign customs. Edgar strengthened the hands of the provincial administration, and allowed the northern Danes a certain degree of self-government.

Edgar is said to have formed an irregular union in 961 with Wulfthryth, an inmate of the convent at Wilton, who bore him a daughter Eadgyth but refused to marry him. He married Aethelflaed, "the white duck," daughter of Earl Ordmaer, who bare him a son, known as Edward the Martyr. Finally he was united (964) to Aelfthryth, daughter of Earl Ordgar, who became the mother of the Aetheling Edmund (d. 971) and of Aethelred the Unready.

See *The Anglo-Saxon Chronicle* (ed. Plummer, 1892–99), *sub. ann.; Vita Sancti Oswaldi (Historians of the Church of York,* ed. Raine, Rolls Series); William of Malmesbury, *Gesta regum* (ed. Stubbs, Rolls Series); Birch, *Cartulurium Saxonicum,* vol. iii. Nos. 1047–1319; F. Liebermann, *A.-S. Laws,* i. 192–216; "Florence of Worcester" *(Mon. Hist. Brit.)*; E. W. Robertson, *Historical Essays,* pp. 189–215.

EDGAR or **EADGAR** (c. 1050–*c.* 1130), called the Aetheling, was the son of Edward (the exile), a son of the English king Edmund Ironside, by his wife Agatha, a kinswoman of the emperor Henry II., and was born probably in Hungary some time before 1057, the year of his father's death. After the death of Harold in 1066, Eadwine and Morkere desired to make him king, but on the advance of William I, Edgar and his supporters made their submission. He took part in two unsuccessful risings in the north (1068 and 1069), afterwards taking refuge in Scotland, where his sister Margaret married the Scottish king, Malcolm Canmore. In 1074 he went to Normandy and made peace with William. In 1093 he made a successful attempt to set his nephew Edgar on the throne of Scotland, and in 1099 went to the crusade. He returned to England in Henry I.'s reign, but sided with Robert of Normandy against the king in their last war, and was taken prisoner at the battle of Tinchebrai in 1106. He was soon released. and lived in obscurity until his death, the date of which is uncertain.

EDGECUMBE or EDGCUMBE, the name of a celebrated west of England family, taken from the manor of Edgecumbe in Cornwall. One of its earlier members was Sir Richard Edgecumbe (d. 1489), who was descended from a Richard Edgecumbe who flourished during the reign of Edward I. Richard was a member of parliament in 1467; afterwards he joined Henry, earl of Richmond, in Brittany, returned with the earl to England. and fought at Bosworth, where he was knighted. He was richly rewarded and sent by Henry VII. on errands to Scotland, Ireland and Brittany; he died at Morlaix on Sept. 8, 1489. His son and successor, Sir Piers Edgecumbe (d. 1539) went to France with Henry VIII. in 1513. His son Sir Richard Edgecumbe (1499–1562), a cultured and hospitable man, is celebrated through Richard Carew's *Friendly Remembrance* of *Sir Richard Edgecumbe.* Sir Richard's eldest son, Piers or Peter Edgecumbe (1536–1607), was a member of parliament under Elizabeth for about 30 years.

Another famous member of this family was Richard, 1st baron Edgecumbe (1680–1758), a son of Sir Richard Edgecumbe. Educated at Trinity college, Cambridge, he was successively member of parliament for St. Germans, Plympton and Lostwithiel from 1701 to 1742, on two occasions served as a lord of the treasury, and from 1724 to 1742 was paymaster-general for Ireland, becoming chancellor of the duchy of Lancaster in 1743. He managed the elections for the Cornish boroughs in the interests of Sir Robert Walpole and his elevation to the peerage, which took place in 1742, was designed to prevent him from giving evidence about Walpole's expenditure of the secret service money. His son and successor, Richard, the 2nd baron (1716–61), was comptroller of the royal household, a member of parliament, and a major-general in the army.

Richard's brother George (1721–95), was a naval officer during the Seven Years' War. Succeeding to the barony on the and baron's death in 1761 he became an admiral and treasurer of the royal household, was created Viscount Mount-Edgecumbe in 1781 and earl of Mount-Edgecumbe in 1759.

EDGE HILL, an elevated ridge in Warwickshire, England, near the border of Oxfordshire. The north-western face is an abrupt escarpment of the Lias, and the summit of the ridge is almost level for nearly 2m., at a height somewhat exceeding 700ft. The escarpment overlooks a rich lowland watered by streams tributary to the Avon; the gentle eastern slope sends its waters to the Cherwell, and the ridge thus forms part of the divide between the basins of the Severn and the Thames. Edge Hill gave name to the first battle of the Great Rebellion (*q.v.*), fought on the 23rd of October 1642.

EDGE TOOLS. A general term which includes cutting and scraping tools, as distinguished from those of percussive type, as hammers, and of lever type, as spanners. Edge tools date from the remote palaeolithic age when rough axes were chipped from flints, to be improved by neolithic men who ground and polished their celts. The true chisel, thrust by hand, appears to have developed in the bronze age. The basic difference between an axe and a chisel is that the one is doubly bevelled, the other singly. The result is that the axe does not possess good guidance on the wood, while the flat face of the chisel acts as a guide, helping to cut true surfaces. An adze is of the chisel class, and is used by the carpenter and shipwright to true baulks and other large areas. The carpenter's plane gives still better control by means of the sole sliding along the wood, while in machine tools for wood and metal the guidance becomes perfect.

The keenness of an edge tool, or its "cutting angle" is nearest to that of the razor in the woodworker's chisels. gouges, carving-tools and plane irons, as well as in certain machine knives. Hard or tough wood tends to turn over a fine edge or break it, consequently the angle of the two faces meeting at the edge must be

increased. The same rule applies to cold chisels for metals. In the tools used in metal-working machines, as the lathe, drill, planer, shaper and slotter and the milling and sawing machines, the edges must be ground more keenly for the fibrous metals and alloys, as wrought-iron, mild steel and copper, but less keenly for the crystalline kinds, as hard steel, cast-iron and brass. Chilled cast-iron, for the rolls of rolling-mills, is very difficult to turn, and the tool faces meet at an angle of near 90°, the action being merely slow scraping. Nevertheless this tool is a wedge, in principle, just as much as the finest chisel for soft wood, penetrating and forcing aside the metal. (*See* also FILE; MACHINE KNIVES; MILLING-CUTTERS; PUNCHING AND SHEARING MACHINES; SAWS; TAPS AND DIES, and general article TOOL.)

EDGEWORTH, MARIA (1767–1849), Irish novelist, second child and eldest daughter of Richard Lovell Edgeworth (*q.v.*) and his first wife, Anna Maria Elers, was born in the house of her maternal grandparents at Black Bourton, Oxfordshire, on Jan. 1, 1767. She had ample opportunities for society among her father's neighbours in Ireland, among whom were the second Lord Longford, whose daughter, "Kitty" Pakenham, became later duchess of Wellington; Lady Moira at Castle Forbes; and Maria's aunt, Margaret Ruxton, at Black Castle. She gained a first-hand experience of the Irish peasantry by acting as her father's assistant in the management of the estate. The Edgeworths were in Ireland from 1793 onwards through that dangerous period, and Maria's letters, always gay and natural, make very light of their anxieties and their real perils.

It has been the fashion to regard Mr. Edgeworth's influence over Maria's work as altogether deplorable, but she undoubtedly derived a stimulus from his powerful mind. Her first publication was a plea for the education of women, *Letters to Literary Ladies* (1795), and in 1796 appeared *The Parent's Assistant* (2nd ed., 6 vols., 1800), a collection of stories which had been submitted as they were written to the juvenile critics of the Edgeworth nursery. They were therefore children's stories for children, even though the morals were Mr. Edgeworth's. *Practical Education* (2 vols., 1798) was written in conjunction with her father, who also collaborated with her in the *Essay on Irish Bulls* (1802). Miss Edgeworth's first novel, *Castle Rackrent,* appeared anonymously in 1800. It is the story of an Irish estate and its owners, the Rackrents, as told by Thady, the steward. Its success was immediate, and a second edition soon appeared with the author's name. The personages appear to be drawn immediately from the natives of Edgeworthstown, though Miss Edgeworth asserts that only Thady himself was an actual portrait. The book influenced Scott. In the "Postscript, which should have been a preface," in the original edition of *Waverley,* Scott describes his aim as being "in some distant degree to emulate the admirable Irish portraits of Miss Edgeworth, so different from the 'Teagues' and 'dear joys' who so long, with the most perfect family resemblance to each other, occupied the drama and the novel." *Belinda* (1801) is a society novel, and one of her best books. Saintsbury thinks that Miss Austen's heroines owe something of their naturalness to Belinda, who was one of the earliest to break with the tradition of fainting and blushing. *Moral Tales for Young People* (5 vols.) and *Early Lessons,* which included "Harry and Lucy," "Rosamond" and "Frank," appeared in 1801.

In 1802 the Edgeworths went abroad, first to Brussels and then to Paris. They had already connections in Paris through their kinsman, the abbé Edgeworth de Firmont, who was, however, then in exile. They met all the notabilities in Paris, and Maria refused an offer of marriage from a Swedish count named Edelcrantz. Although *Leonora,* not published until four years later, is said to have been written to meet his taste, she apparently remained then and always heart-whole; hut her stepmother thought otherwise and maintained that she suffered severely for her decision (*Memoir,* i. 144). Returning to Edgeworthstown, Miss Edgeworth resumed her writing, which was always done in the rooms commonly used by the whole family. *Popular Tales* was published in 1804, and *The Modern Griselda* in the same year; *Leonora* in 1806; and in 1809 the first series of *Tales of Fashionable Life,* three volumes containing "Ennui," "Madame de Fleury," "Almeria," "The Dun" and "Manoeuvring"; the second series (3 vols., 1812) included "The Absentee," one of her best tales, which was originally designed as a play, "Vivian" and the clever study of émigré life, "Émilie de Coulanges." In 1813 Maria and her parents spent a considerable time in London, and her society was much sought after. When *Waverley* was published, Miss Edgeworth received a copy from the publishers, and at once recognized the authorship. She wrote a long letter of appreciation (Oct. 23, 1814) to "the author of *Waverley,*" which she began with the phrase *aut Scotus, aut diabolus,* but the letter was merely acknowledged by the publishers. *Patronage* (4 vols., 1814), the longest of her novels, and *Harrington, a tale,* and *Ormond, a tale* (3 vols., 1817) complete the list of the works which received what her father called his *imprimatur.*

After his death in 1817 Miss Edgeworth occupied herself with completing his *Memoirs,* which were published in 1820. In 1820 she was again in Paris, and in 1823 she spent a fortnight with the Scotts at Abbotsford. In 1825 Scott went to Edgeworthstown, and their relations were always cordial. Miss Edgeworth's production was less after her father's death. Sequels to "Rosamond," "Frank," "Harry and Lucy" in the *Early Lessons* were published in 1822–1825. *Comic Dramas* appeared in 1817, and *Helen* in 1834. In 1846 she worked strenuously for the relief of the famine-stricken Irish peasants. She died on May 22, 1849.

Miss Edgeworth's novels are distinguished by good sense, humour and vivacious dialogue. She expressly calls some of her stories "Moral Tales"; but the freshness of her stories, her insight into character, lively dialogues, originality of invention and delightfully clear style render it quite possible to read her works in succession without any sense of weariness.

See *A Memoir of Maria Edgewortk, with a Selection from her Letters* (1867), by her stepmother, F. A. Edgeworth, privately printed. A selection from this was made by Augustus J. C. Hare, and printed under the title of *The Life and Letters of Maria Edgeworth* (2 vols., 1894). *See* also *Maria Edgeworth* (1883), by Helen Zimmern, in the "Eminent Women" series; Grace A. Oliver, *A Study of Maria Edgeworth . . .* (3rd ed., Boston, U.S.A., 1882); and *Maria Edgeworth* (1904), by the Hon. Emily Lawless in the "English Men of Letters" series. Also George Saintsbury in *Macmillan's Magazine* (July 1895), the preface supplied by Lady Thackeray Ritchie to Macmillan's edition of the novels (1895); C. Hill, *Maria Edgeworth and her circle* (1909); *The Black Book of Edgeworths Town* (1585–1817), ed. H. J. and H. E. Butler (1928).

EDGEWORTH, RICHARD LOVELL (1744–1817), British writer, was born at Bath. The greater part of his life was spent at Edgeworthtown, or Edgeworthstown, in the county of Longford, Ireland. He was educated at various schools in England and Ireland, and entered Trinity college, Dublin, in April 1761, but was transferred to Corpus Christi college, Oxford, in October of the same year. While still at college, he made a runaway match, marrying at Gretna Green, Anna Maria, one of the daughters of Paul Elers of Black Bourton, Oxon, an old friend of his father. Edgeworth devoted much of his time to scientific reading and experiments; and he made an attempt to establish telegraphic communication (*Memoirs,* 2nd ed., i. 144). In the pursuit of his mechanical inventions he visited Erasmus Darwin at Lichfield, where he met Anna Seward, and her cousin, Honora Sneyd. He kept terms at the Temple, and formed the greatest friendship of his life with Thomas Day, the author of *Sandford and Merton,* which was written at Edgeworth's suggestion. In 1769, on the death of his father, he gave up the study of law, and spent a considerable time in England and France, mainly in Day's company. He was summoned to England by the death of his wife (March 1773), with whom he had been far from happy. Edgeworth hurried to Lichfield, to Dr. Erasmus Darwin's, and at once declared his passion for Honora Sneyd, which had been the cause of his flight to France two years before. Miss Sneyd had been the object of attention from Thomas Day, but her views on marriage were not submissive enough to please him. She had other suitors, among them the unfortunate Major André. She married Edgeworth (July 1773), and after residing at Edgeworthstown for three years, they settled at Northchurch, in Hertfordshire. Honora Edgeworth died in April 1780, recommending her husband to marry her sister Elizabeth, and they

were actually married on Christmas day, 1780. She died in 1797.

Practical Education (1798) was written in collaboration with his daughter Maria, and embodied the experience of the authors in dealing with children. This book, generally regarded as old-fashioned, has a real value in the history of education. Their views had been inspired by Rousseau, and by Thomas Day. The Edgeworths brought a scientific method to their work. The second Mrs. Edgeworth (Honora Sneyd) began the collection of actual examples of conversations between the children and their elders. This was continued by the writers of the book, and their reasonings were thus founded on an accurate record of childish methods of thought. They deprecated especially any measures that interrupted the child's own chain of reasoning. The chapters on special subjects of study, chronology, geometry, etc., were written by Richard Lovell Edgeworth; those on toys, on rewards and punishments, on temper, etc., by his daughter.

In 1798 Edgeworth married Miss Beaufort, and was elected M P. for the borough of St. John's Town, Longford. During the formidable rebellion of that year the Edgeworths took refuge in Longford. The winter of 1802 they spent in Paris. In 1804 the Government accepted his telegraphic apparatus, but the installation was left incomplete when the fear of invasion was past. In 1806 Edgeworth was elected a member of the board of commissioners to enquire into Irish education. From 1807 till 1809 much of his time was spent on mechanical experiments and in writing the story of his life. He died on June 13, 1817, and was buried in the family vault in Edgeworthstown churchyard. Edgeworth's works include *Poetry Explained for Young People* (1802), *Professional Education* (1808); *Readings in Poetry* (1816).

See *Memoirs of Richard Lovell Edgeworth, Esq.,* begun by himself and concluded by his daughter, Maria Edgeworth (2 vols., 1820, 3rd and revised ed., 1844). *Richard Lovell Edgeworth* (1896), edit. Mrs. Lionel Tollemache, is a selection from the *Memoirs. See* also *The Black Book of Edgeworthstown . . . (1585–1817)*, edit. *H. J.* and H. E. Butler (1928).

EDGEWORTH DE FIRMONT, HENRY ESSEX (1745–1807), last confessor to Louis XVI., was the son of Robert Edgeworth, rector of Edgeworthstown in Ireland, his mother being a granddaughter of Archbishop Ussher. His father resigned his living and emigrated to Toulouse, where the boy was brought up by the Jesuits. On taking orders he assumed the additional surname of de Firmont, from the family estate of Firmount near Edgeworthstown. In 1791 he became confessor to the princess Elizabeth, sister of Louis XVI., and then to Louis himself. After Louis' condemnation he obtained permission to celebrate mass for him and attend him on the scaffold, where he recommended the king to allow his hands to be tied, with the words: "Sire, in this new outrage I see only the last trait of resemblance between your Majesty and the God who will be your reward." The abbé himself denied that at the moment of the execution he uttered the celebrated words: "Son of St. Louis, ascend to heaven." Edgeworth continued to correspond with Madame Elizabeth. In 1795, his mother having meanwhile died in prison, where his sister was also confined, he escaped to England, carrying with him Elizabeth's last message to her brother, the future King Charles X. He afterwards went with some papers to Monsieur (Louis XVIII.), then at Blankenburg in Brunswick, and was induced to accompany him to Mittau, where, on May 22, 1807, he died of a fever contracted while attending some French prisoners.

Edgeworth's *Memories,* edited by *C.* S. Edgeworth, were first published in English (London, 1815), and a French translation (really the letters and some miscellaneous notes, etc.) was published in Paris in 1816. A translation of the *Lettres de l'abbt Edgeworth avec des mémoires sur sa vie* was published by Madame Elise de Bow in Paris in 1818, and *Letters from the Abbt Edgeworth to his Friends, with Memoirs of his Life,* edited by T. B. England, in London in 1818.

EDGREN-LEFFLER, ANNE CHARLOTTE, duchess of Cajanello (1849–1892), Swedish author, daughter of the mathematician Prof. C. O. Leffler, was born on Oct. 1, 1849. Her first volume of stories appeared in 1869, but the first to which she attached her name was *Ur Lifvet* ("From Life," 1882), a series of realistic sketches of the upper circles of Swedish society, followed by three other collections with the same title. Her earliest plays, *Skådespelerskan* ("The Actress," 1873), and its successors, were produced anonymously in Stockholm, but in 1883 her reputation was established by the success of her comedies *Sanna Kvinnor* ("True Women") and *En Raddande engel* ("An Angel of Deliverance"). *Sanna Kvinnor* is directed against false femininity, and was well received in Germany as well as in Sweden. Anne Leffler had married in 1872 G. Edgren, but about 1884 she was separated from her husband, who did not share her advanced views. She spent some time in England, and in 1885 produced her play *Hur man gor godt* ("How Men do Good"), followed in 1888 by *Kampen for lyckan* ("The Struggle for Happiness"), a drama in which she had the help of Sophie Kovalevsky. Another volume of the *Ur Lifvet* series appeared in 1889 (both) volumes were reprinted in 1915; and *Familjelycka* ("Domestic Happiness," 1891), a drama in 3 acts, was produced in the year after her second marriage, with the Italian mathematician, Pasquale del Pezzo, duca di Cajanello. She died at Naples on Oct. 21, 1892. The masculine directness, freedom from prejudice, and frankness of her work gave her a high place in Sweden. Her last book was a biography (1892) of her friend Sophie (Sonya) Kovalevsky, by way of introduction to Sonya's autobiography. An English translation (1895) by A. de Furnhjelm and A. M. Clive Bayley contains a biographical note on Fru Edgren-Leffler by Lily Wolffsohn, based on private sources.

See also Ellen Key, *Anne Charlotte Leffler* (1893); *O.* J. Levertin, *Sveriges National-Literatur, 1500–1900,* vol. 18 (1907).

EDHEM PASHA *(c.* 1815–1893), Turkish statesman, of Greek origin, entered the Turkish government service and rose to high office, being successively minister of public works, grand vizier for 11 months (1878), ambassador at Vienna (1879) and minister of the interior. He left a reputation of unblemished honesty and uprightness.

EDIBLE BIRD'S-NEST, the nest of a species of swift of the genus *Collocalia,* composed chiefly of the saliva of birds. They are to be found in the East Indies and Australia and are valued by the Chinese as an article of food. *See* SWIFT.

EDICT, an order or proclamation issued under authority and having the force of law. The word is especially used of the promulgations of the Roman praetor (*q.v.*), of the Roman emperors, and also of the kings of France *(see* ROMAN LAW).

EDINBURGH (ĕd'in-brŭ), city and royal burgh, capital of Scotland, county town of Midlothian or Edinburghshire, south of the Firth of Forth, 393 m. by rail N.N.W. of London. The old Royal Observatory on Calton Hill stands in 55° 57′ 23″ N. and 3° 10′ 46" W. Edinburgh occupies a group of hills and valleys. In the centre is a bold rock, crowned by the castle, between which and the new town lies a ravine that once contained the Nor' Loch, but is now covered with the gardene of Princes Street. To the east rises Calton Hill (355 ft.) with the old prison and the Calton cemetery. On the south-east, beyond the Canongate limits, stands the hill of Arthur's Seat (822 ft.). Towards the north the site of the city slopes gently to the Firth of Forth and includes the port of Leith; while to the south, Liberton Hill, Blackford Hill, Braid Hills and Craiglockhart Hills roughly mark the city bounds, as Corstorphine Hill and the Water of Leith do the western limits. Its situation, general plan and literary, associations gave Edinburgh the name of "the modern Athens"; but it has a homelier nickname of "Auld Reekie," from the cloud of smoke (reek) over the low-lying quarters.

Chief Buildings.—In the castle, the oldest building is St. Margaret's chapel, believed to be the chapel where Queen Margaret, wife of Malcolm Canmore, worshipped, and belonging at latest to the reign of her youngest son, David I. (1124–1153). Near it the parliament and banqueting hall contains a fine collection of Scottish armour, weapons and regimental colours. The heraldic bearings of royal and other figures distinguished in national history are emblazoned in the windows. Other buildings in the Palace Yard include the apartments occupied by the regent, Mary of Guise, and her daughter Mary, queen of Scots, and the room in which James VI. was born. Here also are deposited the Scottish regalia ("The Honours of Scotland"), with the sword of state presented to James IV. by Pope Julius II., and the jewels

restored to Scotland on the death (1807) of Cardinal York, the last of the Stuarts. The remains of King David's tower, the ancient keep, were hidden by the Half Moon battery, but were revealed in 1912. In the armoury is a collection of arms of various dates; and on the Argyll battery stands a huge piece of ancient artillery, called Mons Meg, of which repeated mention is made in Scottish history. The large arsenal on the west side of the rock is modern; but the castle garrison was withdrawn in 1923. A war memorial, a shrine and gallery of honour, was unveiled in Crown Court in 1927.

Holyrood palace was originally an abbey of canons regular of the rule of St. Augustine, founded by David I. in 1128, and the ruined nave of the abbey church still shows parts of the original structure. Connected with this is a part of the royal palace erected by James IV. and James V., including the apartments occupied by Queen Mary, the scene of the murder of Rizzio in 1566. The abbey was sacked and burnt by the English under the earl of Hertford in 1544, and again in 1547. Recent excavation has revealed much of the early foundations. In a map of 1544 the present north-west tower of the palace is shown standing apart, and joined to the abbey by a cloister. Beyond this was an irregular group of buildings replaced later by additions more in accordance with a royal residence. The whole of this latter structure was destroyed by fire in 16jo while in occupation'by the soldiers of Cromwell; and the more modern parts were begun during the Protectorate, and completed in the reign of Charles II. by Robert Milne, after the designs of Sir William Bruce of Kinross. They include the picture gallery, with 106 mythical portraits of Scottish kings, and a triptych (c. 1484) containing portraits of James III. and his queen, believed to have formed the altar-piece of the collegiate church of the Holy Trinity, founded by the widowed queen of James II. in 1462, demolished in 1848, and afterwards rebuilt, stone for stone, in Jeffrey Street. The picture gallery is associated with the festive scenes that occurred during the short residence of Prince Charles in 1745; and in it the election of representative peers for Scotland takes place. Escaping from France at the revolution of 1789, the comte d'Artois, afterwards Charles X. of France, had apartments granted for the use of himself and his suite, who ccntinued to reside in the palace till August 1799. When driven from the French throne by the revolution of 1830, Charles once more found a home in the palace. George IV. was received there in 1832, and Queen Victoria and the prince consort occupied the palace on several occasions; in 1903 Edward VII., during residence at Dalkeith Palace, held his court within its walls; and King George V. and Queen Mary stayed there in 1927. The state apartments were redecorated under the queen's guidance. A fountain, after the original design of that in the quadrangle of Linlithgow Palace, was erected in front of the entrance by the prince consort. Iron gates enclosing the forecourt, and a statue of Edward VII., form the national memorial to that king. The royal vault in the Chapel Royal, which was dilapidated, has been put in order; Clockmill House and grounds have been added to the area of the parade ground, and the abbey precincts generally and the approaches to the King's Park have been improved. With the abolition of imprisonment for debt in 1881 the old privileges of sanctuary came to an end.

Parliament House, begun in 1632 and completed in 1640, in which the later assemblies of the Scottish estates took place until the dissolution of the parliament by the Act of Union of 1707, has since been the meeting-place of the supreme courts of law. The great hall, with its fine open-timbered oak roof, is adorned with a splendid stained-glass window and several statues, including one by Louis François Roubiliac of Duncan Forbes of Culloden, lord president of the court of session (1685–1747), and now forms the ante-room for lawyers and their clients. The surrounding buildings, including the court-rooms and the Advocates' and the Signet libraries, are modern. The Advocates' library is the finest in Scotland. It was founded in 1682 and presented to the nation by the faculty of advocates in 1924, endowed by Sir A. Grant with £100,000 for maintenance. It is one of the five entitled by the Copyright Act to receive a copy of every work puhlished in Great Britain.

The General Register House for Scotland, begun in 1774 from designs by Robert Adam, stands at the east end of Princes Street. It contains, in addition to the ancient national records, accommodation in fireproof chambers for all Scottish title-deeds, entails, contracts and mortgages, and for general statistics, including those of births, deaths and marriages.

The Royal Institution, in the Doric style, surmounted by a colossal stone statue of Queen Victoria by Sir John Steell, formerly accommodated the Board of Trustees for Manufactures and the Board of Fishery, the school of art, the Royal Society of Edinburgh (founded in 1783) and the Society of Antiquaries of Scotland (founded in 1780). In 1910 it was renamed and appropriated to the uses of the Royal Scottish Academy of Painting, Sculpture and Architecture, instituted in 1826, and incorporated by royal charter in 1838, on the model of the Royal Academy in London. It is situated on the Mound close to the National Gallery (1850). These collections are especially rich in Raeburn's works and include also Alexander Nasmyth's portrait of Robert Burns and Gainsborough's "The Hon. Mrs. Graham." The National Portrait Gallery and Antiquarian Museum are housed in Queen Street. St. Giles' cathedral, restored (1879–83) by the liberality of Dr. William Chambers, the publisher, has many historical and literary associations. The regent Moray, the marquess of Montrose, and Napier of Merchiston were buried within its walls and are commernorated by monuments, and among the memorial tablets is one to R. L. Stevenson. The choir (restored in 1873 by public subscription) is a fine example of 15th-century architecture, and the Gothic crown surmounting the central tower is a feature in many views of the city. Just outside the church in Parliament Square, the supposed grave of John Knox is indicated by a stone set in the pavement bearing his initials, and in the psvement to the west a heart indicates the site of the old Tolbooth, which figures prominently in Scott's Heart of *Midlothian*. The original Tolbooth was completed in 1501, but a new one took its place in 1563–1564. At first occupied by the parliament and courts of justice, it served later as a prison, and was removed in 1817. Other churches having historical associations are the two Greyfriars' churches, which occupy the two halves of .one building; Tron church, the scene of midnight hilarity at the new year; St. Cuthbert's church; St. Andrew's church in George Street, whence set out, on a memorable day in 1843, that long procession of ministers and elders to Tanfield Hall which ended in the founding of the Free Church; St. George's church in Charlotte Square, a good example of the work of Robert Adam. The United Free Church claims no buildings of much historic interest, but St. George's Free has many associations. The finest building belonging to the Scottish Episcopal Church is St. Mary's cathedral (1879). The mansion of East Coates (17th cent.), stands in the close, and is occupied by functionaries of the cathedral. The Catholic Apostolic church at the foot of Broughton Street has a set of mural paintings by Mrs. Traquair. The Central Hall at Tollcross testilies to Methodist energy. John Knox's house at the east end of High Street is kept in repair, and contains articles of furniture that belonged to the reformer. The Canongate Tolbooth adjoins the parish church, in the burial-ground of which is the tombstone raised by Burns to the memory of Robert Fergusson; here Dugald Stewart, Adam Smith and other men of note were buried. Almost opposite to it stands Moray House, from the balcony of which the 8th earl of Argyll watched Montrose led to execution (1650). The gaol (no longer used as such), is a castellated structure on the black rock of Calton Hill. Usher Hall (1914), a very fine meeting-hall in Lothian Road was built on the bequest of £100,000 by Andrew Usher (1826–98). The library of the solicitors to the supreme courts presents to the Cowgate a high frontage in red sandstone. The Sheriff Court Buildings stand on George IV. Bridge, and facing them is Andrew Carnegie's free library (1887–1889). At the corner of High Street and George IV. Bridge stand the County buildings. The Scotsman, the principal daily newspaper, is housed in an ornate office in North Bridge Street. Ramsay Gardens, a student's quarter fostered by Prof. Patrick Geddes (b. 1854), grew out of the "goose-pie" house where Allan Ramsay lived. The Outlook Tower on Csstle Hill houses collections, partly

illustrating town-planning, by Prof. Geddes. The old City Cross (restored at the cost of W. E. Gladstone) stands in High Street, adjoining St. Giles's. Several quaint groups of buildings have been carefully restored, such as the White Horse Close in the Canongate; the mass of alleys on the north side of the Lawnmarket, from Paterson's Close to James's Court have been connected, and here Lord Rosebery acquired and restored the 17th-century dwelling which figures in the legend of *My* Aunt Margaret's Mirror. It is used as a branch museum. Another model restoration of a historic close is found in Riddle's Close, which contains a students' settlement. The changes in the Old Town (many of a drastic nature) have been carried out with due regard to the character of their environment.

Monuments — The Scott monument in East Princes Street Gardens was designed by George Meikle Kemp (1795–1844). A column surmounted by a colossal figure of Viscount Melville, Pitt's first lord of the Admiralty, rises from the centre of St. Andrew Square. Burns's monument, in the style of a Greek temple, occupies a prominent position on the Regent Road, on the southern brow of the lower terrace of Calton Hill. It was originally intended to form a shrine for Flaxman's marble statue of the poet (now in the National Portrait Gallery), but it proved to be too confined to afford a satisfactory view of the sculptor's work and was converted into a museum of Burnsiana (afterwards removed to the municipal buildings). On Calton Hill is the national monument to commemorate the victory of Waterloo, originally intended to be a reproduction of the Parthenon. The plan was abandoned for lack of funds, after twelve out of the twenty-four Greek pillars had been erected, but it is perhaps more effective in its unfinished state than if it had been completed. The Nelson monument, an elongated turreted structure, stands on the highest cliff of the hill. Close by is the monument to Dugald Stewart, a copy of the choragic monument of Lysicrates. Sir John Steell's equestrian statue of the duke of Wellington stands in front of the Register House, and in Princes Street Gardens are statues of Livingstone, Christopher North, Allan Ramsay, Adam Black and Sir J. Y. Simpson, and a memorial to the Scots Greys who fell in the Boer War. In George Street are Chantrey's figures of Pitt and George IV., and a statue of Dr. Chalmers; the 5th duke of Buccleuch stands beside St. Giles's. Charles II. surveys the spot where Knox was buried; the reformer himself is in the quadrangle of New College: the statue of Sir David Brewster has been moved from the quadrangle of the university to the new buildings at West Mains; Dr. William Chambers is in Chambers Street, and Frederick, duke of York (1763–1827), and the 4th earl of Hopetoun are also commemorated. The Gladstone Memorial in St. Andrews Square was unveiled in 1917.

Cemeteries. — In Greyfriars' churchyard the Solemn League and Covenant was signed, and among its many monuments are the Martyrs' monument, recording the merits of the murdered covenanters, and the tomb of "Bluidy" Mackenzie. There are interesting memorials in the churchyards of St. Cuthbert's and the Canongate. In the Calton burying-ground are the Roman tomb of David Hume, the obelisk raised in 1844 to the memory of Maurice Margarot, and the graves of Thomas Muir (1765–1798), Thomas Fyshe Palmer (1747–1802), William Skirving and Joseph Gerrald (1765–1796), the political martyrs transported towards the end of the 18th century for advocating parliamentary reform. The Scottish dead in the American Civil War are commemorated in a monument bearing a life-sized figure of Abraham Lincoln and a freed slave.

Parks and **Open** Spaces. — The older open spaces are Princes Street Gardens, Calton Hill, the Meadows and the Bruntsfield Links. On the southern side is Blackford Hill with the Royal Observatory. Harrison Park is in the congested district of Fountainbridge. The park at Saughton Hall was opened in 1905, for the western district of the city, and Hillend Park on the Pentland slopes, in 1924. The fine zoological park of 74 acres is beyond Murray field. To the north of the Water of Leith lie Inverleith Park, the Arboretum and the Royal Botanical Garden which includes a herbarium, hot-houses, and a museum of economic botany. Near it is the Stevenson Memorial house in Howard Place. The most extensive open spaces surround Arthur's Seat (822 ft.). This is a basaltic hill, said to commemorate King Arthur, who from its height watched the defeat of the Picts by his followers. It is separated from the narrow valley in which lie the Canongate and Holyrood Palace by Salisbury Crags. Adjoining Nolyrood Palace is the King's Park, used as a parade ground Facing the crags on the south-west are the spots familiar to readers of The Heart of *Midlothian,* where stood Jeanie Deans's cottage, and between the crags and Arthur's Seat lies Hunter's Bog, used as a shooting range. Near here too are three small lakes, Duddingston, Dunsappie and St. Margaret's, the last overlooked by the ruins of St. Anthony's chapel.

Environs.—Leith (*q.v.*), the port of Edinburgh, was incorporated with the city in 1920. Newhaven, so called from the harbour constructed in the reign of James IV., had a shipbuilding yard of some repute in former times. The village has always been a fishing-place of importance, and the fishing population still live markedly to themselves. To the west lies Granton, where the 5th duke of Buccleuch constructed a fine harbour. Still farther west lies the village of Cramond, at the mouth of the river Almond, where Roman remains have often been found; Lauriston Castle is situated in the parish. Cramond Brig was the scene of one of the "roving" adventures of James V., when the life of the "Gudeman of Ballengeich" was saved by Jock Howieson of the Braehead. Here are Craigcrook Castle, where Lord Jeffrey spent many years, and Ravelston House, the home of the Keiths. To the south of the metropolis are Colinton, on the Water of Leith, and Currie, which was a Roman station and near which are Curriehill Castle (held by the rebels against Queen Mary), the ruins of Lennox Tower, and Riccarton. At Dalmahoy Castle, near Ratho (pop 1,672), the seat of the earl of Morton, are preserved the only extant copy of the Bible of the Scottish parliament and the original warrant for committing Queen Mary to Lochleven Castle in Kinross-shire. Craigmillar has a picturesque castle, part of which probably dates from the 12th century. Duddingston, once a quiet village, has become a centre of the distilling and brewing industries. Duddingston House is a seat of the duke of Abercorn. Restalrig, between Duddingston and Leith, was the home of the Logans, from whom the superiority of Leith was purchased in 1553 by the queen regent. Sir Robert Logan (d. 1606) was alleged to have been one of the Gowrie conspirators and to have arranged to imprison the king in Fast Castle. This charge was made three years after his death, when his bones were exhumed for trial. He was found guilty of high treason and sentence of forfeiture was pronounced. A small chapel adjoining the old church covers the healing well of St. Triduana. Liberton, a name that recalls the previous existence of a leper's hospital, is situated on the rising ground south of Edinburgh, the parish church being a conspicuous landmark. Portobello is a popular seaside resort within 3 m. of the centre of the city. Its beautiful sands are flanked by a promenade extending to Joppa. The town dates from the middle of the 18th century, when a cottage was built by a sailor and named Portobello in commemoration of Admiral Vernon's victory in 1739. The place does a considerable trade in the making of bricks, bottles, earthenware, tiles and paper and a large electric power station was opened in 1923. Joppa, which adjoins it, has salt works, but is chiefly residential. Lasswade, partly in the Pentlands, famous for its oatmeal, was often the summer resort of Edinburgh worthies. Melville Castle and Auchendinny are in the neighbourhood. Most famous among the environs of Edinburgh are Roslin and Hawthornden. Roslin Castle, on the beautifully wooded precipitous banks of the Esk, dates from the 12th century. The fine chapel, higher up the bank, founded in 1446 by William St. Clair, 3rd earl of Orkney, is believed to be the chancel of what was intended to be a large church; it suffered at the hands of revolutionary fanatics in 1688. The Gothic details, especially the wreathed "Prentice's pillar," are finely carved. The walk to Hawthornden, about 1½ m. distant by the river-side leads to the mansion of the Drummonds, on a lofty cliff ialling sheer to the stream. The caverns in the sides of the precipice are said to hsve afforded Wallace and others refuge in time of trouble, hut the old house is most memorable as the home of the poet William Drum-

mond. The Pentland range contains many points of interest and beauty; Habbie's Howe is some 2 m. from Carlops, and Rullion Green is noted as the field on which the Covenanters were defeated in 1666. Penicuik has paper mills and stone quarries.

ADMINISTRATION AND EDUCATION

Communications. — Both L.M.S.R. (Princes St. Station) and L.N.E.R. (Waverley Stationj serve Edinburgh. Besides Leith, Granton and Grangemouth serve as passenger seaports for Edinburgh. Tramways connect all parts of the city, including Leith, Newhaven, Portobello and Joppa; and a suburban railway, start* ing from Waverley station, returns by way of Restalrig, Portobello, Duddingston, Morningside and Haymarket. In summer, steamers ply between Leith and Aberdour and other pleasure resorts; and there is also a service to Alloa and Stirling.

Population. — In 1801 the number of inhabitants was 66,544; in 1851 it was 160,302; in 1881 it was 234,402; in 1921, the figure was 420,264. and in 1938, 469.448.

The area of the city has been enlarged by successive extensions of its municipal boundaries. In 1896 portions of the parishes of Liberton and Duddingston and the police burgh of Portobello were incorporated and in 1900 a further addition was made including Granton, Restalrig, and parts of South Leith and Duddingston. In 1920 Leith and the parishes of Corstorphine, Cramond, Libertan and Colinton, including many villages to the south and west of the city, were incorporated with it.

Government. — By the Redistribution Act of 1918 the city with Musselburgh, was divided for parliamentary purposes into five divisions, each returning one member. Leith also returns a member. The town council, which has its headquarters in the Municipal Buildings in the Royal Exchange, consists of 71 members, a lord provost, 10 bailies, a dean of guild, a treasurer, a convener of trades, seven judges of police, and 53 councillors. The corporation has acquired the gas-works, the cable tramways (leased to a company), the electric lighting of the streets, and the water-supply from the Pentlands.

May Meetings. — During the establishment of Episcopacy in Scotland, Edinburgh was the seat of a bishop, and the collegiate church of St. Giles became a cathedral. But the annual meeting of the General Assembly of the Church of Scotland at Edinburgh is now the public manifestation of the predominance of Presbyterianism as the national church. In May each year the sovereign appoints a representative as lord high commissioner to the General Assembly of the Established Church, who takes up his abode usually in the palace of Holyrood, and thence proceeds to the High Church, and so to the assembly hall on the Castle Hill when the lord provost and magistrates offer to him the keys of the city. The General Assembly of the United Free Church is usualiy held at the same time.

University. — Edinburgh University, the youngest of the Scottish universities, was founded in 1583 by a royal charter, dated 1582, granted by James VI. In 1621 an act of the Scottish parliament accorded to the university all rights and privileges enjoyed by other universities in the kingdom, and these were renewed under fresh guarantees in the treaty of union between England and Scotland, and in the Act of Security. Important changes were made in the constitution by acts passed in 1858 and 1889. It was one of the first universities to admit women and in 1916 three hostels for women were built. The students number about 4,000. As a corporation it consists of a chancellor, vice-chancellor, lord rector (elected by the students every three years), principal, professors, registered graduates and matriculated students. With St. Andrews, Glasgow and Aberdeen it sends three members to parliament. While the college, as such, bears the name of the College of King James, or King's college, and James VI. is spoken of as its founder, it really originated in the liberality of the citizens of Edinburgh. William Little of Craigmillar, and his brother Clement Little, advocate, along with James Lawson, the colleague arid successor of John Knox, may justly be regarded as true founders. In 1580 Clement Little gave all his books, three hundred volumes, for the beginning of a library, and this was augmented by other valuable benefactions, one of the most interesting of which was the library of Drummond of Hawthornden. The older buildings of the university occupy the site of the ancient collegiate church of St. Mary in the Field (the "Kirk of Field"), the scene of the murder of Darnley. The present structure dates from 1789. The Royal Scottish Museum is structurally united to the university and Minto House college and Hcriot-Watt college are practically adjuncts of the university. The medical school stands in Teviot Row, adjoining George Square and the Meadows. The magnificent M'Ewan hall is used for academic and public functions. Closely associated with the medical school, and separated from it by the Middle Meadow Walk, is the Royal Infirmary, designed by David Bryce, B.S.A. (1803–1876), removed from Infirmary Street. Its wards are lodged in a series of turreted pavilions, and cover a large space of ground on the margin of the Meadows, from which, to make room for it, George Watson's College — the most important of the Merchant Company schools — was removed to a site farther west, while the Sick Children's hospital was moved to the southern side of the Meadows. Since 1910 chairs have been established in bacteriology, chemistry, therapeutics, commerce, etc. In 1919 the university acquired 115 acres of land at Liberton, and the new King's Buildings of the university, containing chemical laboratories, etc., were opened at West Mains in 1924; a new zoological department also is planned.

Scientific Institutions. — The old Observatory, on Calton Hill, overlooks the district at the head of Leith Walk. The City Observatory stands close by, and on Blackford Hill is the newer building of the Royal Observatory.

The museum and lecture-rooms of the Royal College of Surgeons occupy a classical building in Nicolson Street, The college is an ancient corporate body, with a charter of the year 1505, and exercises the powers of instructing in surgery and of giving degrees. Its extra-academical courses are recognized, under certain restrictions, by the University Court, as qualifying for the degree of doctor of medicine.

The Royal College of Physicians is another learned body organized, with special privileges, by a charter of incorporation granted by Charles II. in 1681. In their hall in Queen Street are a valuable library and a museum of materia medica. But the college as such takes no part in the educational work of the university.

Educational **Institutions.**—After the Disruption in 1843, and the formation of the Free Church, New College was founded in connection with it for training students in theology. After the amalgamation of the United Presbyterian and the Free Churches, under the designation of the United Free Church of Scotland, New College was utilized by both bodies. The Royal high school, the burgh school par excellence, is an ancient foundation, and the Grecian buildings (1829) on the south of Calton Hill, are its third habitation. Edinburgh Academy was opened in 1825. Fettes Colliege and Merchiston Academy are organized on the model of the! great English public schools. For many geherations the charitable foundations for the teaching and training of youth were a conspicuous feature in the economy of the city. Foremost among them was the hospital founded for the maintenance and teaching of poor fatherless sons of freemen by George Heriot — the "Jingling Geordie" of Scott's *Fortunes* of *Nigel*—the goldsmith and banker of James VI. The quadrangular building in Lauriston, sometimes ascribed to Inigo Jones, is one of the noblest in the city. Even earlier than Heriot's hospital was the Merchant Maiden hospital, founded in 1605, which gave to the daughters of merchants similar advantages to those which Heriot's secured for burgesses' sons. In 1738 George Watson's hospital for boys was founded; then followed the Trades' Maiden hospital for burgesses' daughters, John Watson's, Daniel Stewart's, the Orphans', Gillespie's, Donaldson's hospitals, and other institutions founded by successful merchants of the city, in which poor children of various classes were lodged, boarded and educated. As the New Town expanded, the Heriot Trust — whose revenues were greatly benefited thereby — erected day schools in different districts, in which children received a free education, and, in cases of extreme poverty, a money grant towards maintenance. Public opinion as to the "hospital" system of board and education, however, underwent a revolutionary change after the Education Act of 1872 introduced school boards. The govern-

ing body was reconstituted in 1885, and the income of the trust is now applied for the upkeep of a day school at Heriot's hospital, and of the Heriot-Watt college as a technical school, and for the provision of scholarships here and elsewhere. The Church of Scotland has a training college; there is a large training college for teachers in Holyrood Road, and a Roman Catholic college (1920) in Colinton Road.

Besides the Royal Infirmary there are a considerable number of more or less specialized institutions, two of the most important being situated at Craiglockhart. Though Trinity hospital, the oldest charity in the city, no longer exists as a hospital with resident pensioners, the trustees disburse annually pensions to certain poor burgesses and their wives and children; and the trust controlling the benevolent branch of the Gillespie hospital endowment is similarly administered.

Industries.— Edinburgh is residential rather than manufacturing or commercial, but from 1507, when Walter Chapman set up the first press, to the present day, printing has enjoyed a career of almost continuous vitality. Publishing, on the other hand, has drifted away, only a few leading houses—such as those of Blackwood, Chambers and Nelson—still making the city their headquarters. Mapmakers, typefounders, bookbinders and lithographers all contribute their share to the prosperity of the city. Brewing is a strong industry, Edinburgh ale being proverbially good. The arts and crafts associated with furniture work, paper-making and coach-building may also be specified, whilst tanneries, distilleries, factories for india-rubber goods, electric fittings, rope, hosiery, soap and iron and brass-founding, are prominent. Stone quarrying is carried on, but the vast quarry at Craigleith, from which the stone for much of the New Town was obtained, is abandoned. Owing to the great changes effected during the latter part of the 19th century, some of the old markets were demolished and the system of centralizing trade was not wholly revived. The Waverley Market deals in vegetables and fruit and is used for meetings and concerts. Slaughter-houses, cattle markets and grain markets have been erected at Gorgie, thus obviating the driving of flocks and herds through the streets.

HISTORY

A fort or camp set up on the rock on which Edinburgh Castle now stands was probably the nucleus around which, in prehistoric time, grew a considerable village. Under the protection of the hill-fort, a settlement was established on the ridge running down to the valley at the foot of Salisbury Crags, and another hamlet, according to William Maitland (1693–1757), the earliest historian of Edinburgh, was founded in the area at the north-western base of the rock, a district that afterwards became the parish of St. Cuthbert, the oldest in the city. The Romans occupied the country for more than three hundred years. When they withdrew, the British tribes reasserted their sway. The southern Picts ultimately subdued the Britons, and the castle became their chief stronghold until they were overthrown in 617 (or 629) by the Saxons under Edwin, king of Northumbria, from whom the name of Edinburgh is derived. Symeon of Durham (854) calls it Edwinesburch, and includes the church of St. Cuthbert within the bishopric of Lindisfarne. Its Gaelic name was Dunedin. In the 16th century the latinized form Edina was invented. Long after Edwin's conquest the lowland continued to be debatable territory held by uncertain tenure, but at length it was to a large extent settled anew by Anglo-Saxon and Norman colonists under Malcolm Canmore and his sons.

In the reign of Malcolm Canmore the castle included the king's palace. There his queen, Margaret, grand-niece of Edward the Confessor, died in 1093. It continued to be a royal residence during the reigns of her three sons, and hence the first rapid growth of the upper town may be referred to the 12th century. The parish church of St. Giles is believedrto have been founded in the reign of Alexander I., about 1110, and the Norman keep of the castle, built by his younger brother, David I., continued to be known as David's Tower till its destruction in the siege of 1572. Soon after his accession to the Scottish throne David I. founded the abbey of Holyrood (1128), which from an early date received the court as its guests. But the royal palace continued for centuries to be within the fortress, and there both the Celtic and Stuart kings frequently resided. Edinburgh was long an exposed frontier town within a territory only ceded to Malcolm II. about 1020; and even under the earlier Stuart kings it was still regarded as a border stronghold. Hence, though the village of Canongate grew up beside the abbey of David I., and Edinburgh was a place of sufficient importance to be reckoned one of the four principal burghs as a judicatory for all commercial matters, nevertheless, even so late as 1450, when it became for the first time a walled town, it did not extend beyond the upper part of the ridge which slopes eastwards from the castle. So long, however, as its walls formed the boundary, and space therefore was limited, the citizens had to provide house-room by building dwellings of many storeys. These tall tenements on both sides of what is now High Street and Canongate are still prominent in the Old Town. The streets were mostly very narrow, the main street from the castle to Holyrood Palace and the Cowgate alone permitting the passage of wheeled carriages. In the narrow "wynds" the nobility and gentry paid their visits in sedan chairs.

The other three royal burghs associated with Edinburgh were Stirling, Roxburgh and Berwick; and their enactments form the earliest existing collected body of Scots law. The determination of Edinburgh as the national capital, and as the most frequent scene of parliamentary assemblies, dates from the death of James I. in 1436. Of the thirteen parliaments summoned by that sovereign, only one, the last, was held at Edinburgh, but his assassination in the Blackfriars' monastery at Perth led to the transfer of the court and capital from the Tay to the Forth. The coronation of James II. was celebrated in Holyrood Abbey instead of at Scone, and the widowed queen took up her residence, with the young king, in the castle. Of fourteen parliaments summoned during this reign, only one was held at Perth, five met at Stirling and the rest at Edinburgh; and, notwithstanding the favour shown for Stirling as a royal residence in the following reign, every one of the parliaments of James III. was held at Edinburgh. James II. conferred on the city various privileges relating to the holding of fairs and markets, and the levying of customs; and by a royal charter of 1452 he gave it pre-eminence over the other burghs. Further immunities and privileges were granted by James III.; and by a precept of 1482, known as the Golden Charter, he bestowed on the provost and magistrates the hereditary office of sheriff, with power to hold courts, to levy fines, and to impose duties on all merchandise landed at the port of Leith. Those privileges were renewed and extended by various sovereigns, and especially by a general charter granted by James VI. in 1603.

James III. was a great builder, and, in the prosperous era which followed his son's accession to the throne, the town reached the open valley to the south, with the Cowgate as its chief thoroughfare. After Flodden the citizens hastened to construct a second line of wall, enclosing the Cowgate and the heights beyond, since occupied by Greyfriars churches and Heriot's hospital, but still excluding the Canongate, as pertaining to the abbey of Holyrood. In the 16th century the movements connected with John Knox and Mary, queen of Scots, caused much activity at Edinburgh Castle. With the departure, however, of the sixth James to fill the English throne in 1603, the town lost its prestige for a long period. Matters were not bettered by the Act of Union signed in a cellar in High Street in 1707, amidst the execrations of the people, and it was not till the hopes of the Jacobites were blasted at Culloden (1746) that the townsfolk began to accept the inevitable. This epoch, when grass grew even in High Street, long lingered in the popular memory as the "dark age."

By the accession of George III. (1760), Edinburgh showed signs of revived enterprise. In 1763 the first North Bridge, connecting the Old Town with the sloping ground on which afterwards stood the Register House and the theatre in Shakespeare Square, was opened; a little later the Nor' Loch was partially drained, and the bridging of the Cowgate in 1785 encouraged expansion southwards. Towards the end of the 18th century the New Town began to take shape on the grand, if formal, lines planned by James Craig (d. 1795) and the erection of Regent Bridge in Waterloo

place (1819) gave access to Calton hill. The creation of Princes street led to further improvement. The earth and débris from the excavation of the sites for the houses in this and adjoining streets had been "dumped" in the centre of the drained Nor' loch. This unsightly mass of rubbish lay for a while as an eyesore, until it was converted into a broad may joining the new road at Hanover street with the Old Town at the Lawnmarket. Upon this street, which received the title of the Mound, were erected the National gallery and the Royal institution. Speaking generally, the New Town was resorted to by professional men — lawyers. doctors and artists, — and in its principal streets are found the head offices of the leading banks and insurance offices.

The progress of letters, science and learning manifested the recovery of the city. The names of Knox (d. 1572), Buchanan (1582), Alexander Montgomery (160j), Drummond of Hawthornden (1649), Allan Ramsay (1757), Smollett (1771), Fergusson (1774) and Burns (1796), carried on the literary associations of the Scottish capital nearly to the close of the 18th century, when various causes combined to give them new significance and value. The university was served by a body of teachers and investigators who won for it a prominent position among European schools. Then succeeded the era of Scott's *Marmion* and *The Lady of the Laka,* followed by the Waverley novels and the foundation of *Blackwood's Magazine* and the *Edinburgh* **Review.** The influence of the past survives in many ways, and strong local patriotism, together with certain old-fashioned traits in Edinburgh society, remain characteristic and no less admirable.

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EDINBURGHSHIRE: *see* MIDLOTHIAN.

EDISON, THOMAS ALVA (1847–1931), American inventor, born at Milan, O., Feb. 11, 1847, of Dutch ancestry on his father's side and Scottish on his mother's. His education was limited to three months in the public school of Port Huron, Mich. At 12 he became a railroad newsboy and after 1j earned his living as a telegraph operator in various cities, always studying and experimenting in his spare time. In 1868 he took out his first patent for an electrical vote recorder. During the next few years he devised stock tickers, duplex, quadruplex and automatic telegraph systems, and incidentally the electric pen, which developed into the mimeograph, for the multiplication of typewriting. His invention (1877–78) of the carbon transmitter, in which compressed lamp-black buttons were used to obtain the necessary variable resistance in the circuit, marked a real advance in the art of telephony and aided materially in bringing the Bell telephone into practical use.

Most modern inventions result from the contributions of many minds, and it is often difficult for the courts to determine priority, but when Edison made application in 1877 for a "phonograph or speaking machine," the U.S. patent office could discover no previous record of this sort. The original model, costing $18, was a cylinder covered with tinfoil and turned with a hand crank. Ten years afterwards he developed a motor-driven machine with cylindrical wax records which speedily became popular. Later he invented a disk form reproducing with a diamond point for music, and the "Ediphone" for office dictation.

On Oct. 21, 1879, after expending more than $40,000 in fruitless experiments, he succeeded in making an incandescent lamp in which a loop of carbonized cotton thread glowed in a vacuum for over 40 hrs. The following decade was devoted to the invention and exploitation of methods for the generation and distribution of electric light, heat and power, including three-wire system, underground mains, improved dynamos and motors, and an electric railway for carrying freight and passengers. From 1891 to 1900 he was chiefly engaged on a magnetic method of concentrating iron ores, and from 1900 to 1910 in the development of a new kind of storage battery, using an alkaline solution with nickel hydrate as the positive and iron oxide as the negative material. In 1891 he applied for a patent on a "kinetescopic camera" for taking motion pictures on a band of film to be viewed by peeping into a box, and later for projecting them on a screen.

In the *Scientific American,* Dec. 25, 1875, he described an unknown "etheric force," which manifested itself by sparks passing between carbon points at a distance from an interrupted current. In 1883 he patented what became known as "the Edison effect," the passage of electricity from a filament to a plate of metal inside an incandescent lamp globe (a forerunner of the radio tube), and in 1885 a method of transmitting telegraphic signals from moving trains or between ships by induction. During World War I he worked on naval problems for the government and on the production of phenol and other chemicals. In 1927 he was admitted to the National Academy of Sciences.

In his combined workshop and laboratory at Menlo Park and later at Orange, N.J., Edison had been incessantly engaged in various forms of invention for more than 50 years and had taken out 1,033 patents up to April 1928. He died Oct. 18, 1931.

See Frank L. Dyer and Thomas C. Martin. *Edison, His Life and Inventions* (1910, authorized biography with list of patents); W. H. Meadowcroft, *The Boy's Life of Edison,* Harper (1921); *A Popular History of American Invention,* edited by Waldemar Kaempffert, Scribners (1924). (E. E. SL.)

EDMONTON, a municipal and parliamentary borough of Middlesex, England, 79 mi. N. of London bridge, with four stations on the L.N.E.R. Pop. (1938) 103,200. Area 6.09 sq mi. Edmonton, consisting of Upper and Lower Edmonton, lies along the Old North road between Tottenham and Enfield, with the river Lea for its eastern boundary. It has grown very rapidly as an industrial area on account of its numerous factories, including gas meter and gas stove works. Market-gardening is also carried on there. The Church of All Saints, extensively restored, retains Perpendicular and earlier portions and some brasses of interest; in the churchyard is the memorial of Charles Lamb, who lived and died (1834) at Edmonton, and his sister. Cowper and Keats were also residents, and the Bell inn is famed through Cowper's poem *John Gilpin.* Open spaces in Edmonton include Pymmes park (53 ac.) and others. Among buildings are the town hall and public libraries, a technical institute (1912–13), Latymer's school (1624) and the county school (1931). Edmonton was incorporated in 1937 and returns one member to parliament.

EDMONTON, capital of the province of Alberta, Canada. Pop. (1901) 2,652; (1941) 93,817. The city takes its name from Fort Edmonton, a Hudson's Bay company post built in 1795, 20 mi. farther down the North Saskatchewan river, where the great rival fur company, the North West Fur company, also had a fort called Fort Augustus. Both forts were destroyed by the Indians in 1807 and the companies built new ones with the same names on the present site of Edmonton. The rapid Saskatchewan river, flowing, as is usual with rivers of the prairie provinces, in a wide trench, was navigable with difficulty up to Edmonton, which was near the southern limits of the wooded country, and became important as a supply and receiving point for the fur trade of the far northwest. The Canadian National railway, which reached the city in 1905, heads straight for the valley of the upper Athabasca, and the easiest of the Rocky mountain passes—the Yellowhead. The old northern fur trade connections have their counterpart in the line to Grande Prairie and the Peace river settlements, and that to the navigable Athabasca river at Ft. McMurray. Precipitation is heavier at Edmonton than in southern Alberta, and it is the centre of an important mixed farming area, extending as far north as the Peace river country. Both the provincial parliament buildings and the University of Alberta are situated there, the latter including departments in arts, agriculture, medicine and mining. The city is the centre of an important coal mining district but for domestic use the prevalent fuel is natural gas supplied from the immense deposits in the Viking, Kinsella and Fabyan fields to the east. With the rapid increase in the city's population, and that of its vast hinterland, manufacturing has developed to a marked degree, particularly in packing plants, which reached in 1942 the largest output of any city in Canada, supplying more than 20% of the total bacon quota for Britain. Adjacent to Edmonton an the Athabasca river at Ft. McMurray are the immense tar sand deposits, the largest known reservoir of oil in the British empire. These deposits are being developed on a large scale, and besides the production of gasoline, will supply the bituminous road surfacing material for western Canada. Other industries are milling, lumbering, furniture and bedding, men's and women's garments, egg powdering plant, cereals and biscuits. It is a large distributing centre both for the surrounding agricultural area and the extensive mining developments to the north, where the range of ore discoveries is remarkable, including precious metals and radium, also oil. Several railways radiate from this city, and two transcontinental lines. together with lines serving the north country, including the new Alaska highway. The city owns all its utilities including the production and distribution of electricity, waterworks, street railway and telephone systems. Edmonton with its strategical location on the great circle route to the orient has long been to the forefront in the matter of aviation, and was the first city in Canada to establish a municipal airport. There are seven air companies including five of the largest United States airways operating daily in every direction including Alaska, Northwest Territories, Transcontinental and the U.S.A. With the advent of the war and the completion of the Alaska highway and other large northern projects, air traffic has been stepped up enormously, and the twice enlarged air field is taxed to capacity. It is served with ten hangars together with machine shows and repair facilities for the largest modern aeroplanes.

EDMUND, SAINT [EDMUND RICH] (*c.* 1175–1240), English saint and archbishop of Canterbury, was born at Abingdon, near Oxford. His father was a merchant who retired, with his wife's

consent, to the monastery of Eynsham, leaving in her hands the education of their family. Edmund began his education in a grammar school at Oxford, and at the age of twelve took a vow of perpetual chastity in the Virgin's church at Oxford. After graduating at Paris, for six years he lectured in the liberal arts, partly in Paris and partly in Oxford where he was the first to lecture on Aristotle. He then returned to Paris for his theological studies. He again lectured at Oxford on theology until *c.* 1222 when he accepted the treasurership of Salisbury cathedral. Little is known of his life for the next ten years. But he attracted the notice of the Roman court, and was appointed in 1227 to preach the crusade in England.

In 1233 he was elected archbishop of Canterbury at the express suggestion of Gregory IX., after the monks of Canterbury had in vain suggested three other candidates for the pope's approval. Edmund at once leaped into prominence by the outspoken manner in 'which he rebuked the king for following the advice of foreign favourites. In common with the baronial opposition he treated Henry III. as responsible for the tragic fate of Richard Marshal, earl of Pembroke, and threatened the king with excommunication. The king bowed before the storm, dismissed the foreign counsellors, made peace with Marshal's adherents, and was publicly reconciled with the barons. But it was with the object of emancipating himself from Edmund's control that the king asked the pope to send him a legate (1 236). On the arrival of Cardinal Otho (1237) the archbishop found himself thwarted at every point. The marriage between Simon de Montfort and the Princess Eleanor, which Edmund had pronounced invalid, was ratified at Rome upon appeal. The king and legate upheld the monks of Canterbury in their opposition to the archbishop's authority. On all public occasions the legate took precedence of the archbishop. By the advice of his suffragans Edmund laid a protest before the king, and excommunicated in general terms all who had infringed the liberties of Canterbury. These measures led to no result, and after the papal encroachments of 1240, when the English clergy were required to pay a subsidy of a fifth for the war against Frederick II., and simultaneously three hundred Romans were "provided" with English benefices in return for their political services to the Holy See, Edmund withdrew to Pontigny. The state of his health drove him later to Soissy (near Provins), where he died on Nov. 16, 1240.

His canonization was at once demanded by his admirers, and only delayed (till 1247) through the opposition of Henry III. Edmund is one of the most saintly and attractive figures of the English church. As archbishop he showed no great capacity, but the purity of his motives and the loftiness of his ideals commanded universal respect. It was his misfortune to be placed at the head of the national hierarchy in a crisis for which he had not been prepared by practical experience.

Edmund's *Le Merure de Seinte Eglise* was last edited by H. W. Robbins (Lewisburg, 1925). *See* the Life printed by Martène and Durand in the *Thesaurus novus anecdotorum* (1717). Other lives exist in ms., at the Brit. Museum, in Cambridge univ. library and in that of St. John's college, Cambridge. The last-named is printed by W. Wallace in his *Life of St. Edmund* (1893). *See* also B. Ward, *St. Edmund* (1903); Baroness Faravicini, *St. Edmund of Abingdon* (1898), and the *Eng. Hist. Review*, xxii.

EDMUND, king of East Anglia (c. 840–870), succeeded to the East Anglian throne in 855 while yet a boy. According to tradition he was born at Nuremberg, and was the son of King Alkmund and Queen Scivare. Offa, king of the East Angles, visited Alkmund on his way to the Holy Land, and adopted Edmund as his heir. Edmund succeeded him in 855, landing at Hunstanton. His coronation took place in the next year at "Burna" (*i.e.*, probably Bures St. Mary, Suffolk), which was then the royal capital.

Of the life of St. Edmund during the next 14 years we know nothing. In 870 the Danes, who had been wintering at York, marched through Mercia into East Anglia and took up their quarters at Thetford. Edward engaged them fiercely in battle at Hoxne, but the Danes under their leaders, Ubba and Inguar, were victorious. The king himself was slain, whether on the actual field of battle or in later martyrdom is not certain, but the version of the story which makes him fall a martyr to the Danish arrows when he had refused to renounce his faith or hold his kingdom as a vassal from the heathen overlords, may be true. The king's body was ultimately interred at Beadoricesworth, the modern Bury St. Edmunds. The shrine of Edmund soon became one of the most famous in England, and the reputation of the saint was European. The date of his canonization is unknown, but churches dedicated to his memory are found all over England.

See *Asser's Life of Alfred*, ed. *W. H.* Stevenson; *Annals of St. Neots; Saxon Chronicle; Memorials of St. Edmund's Abbey* (Rolls Series), including the *Passio Sancti Edmundi* of Abbo of Fleury; and the *Corolla Sancti Eadmundi*, ed. Lord Francis Hervey (1907).

EDMUND I., king of the English (d. 946), was the son of Eadgifu, third wife of Edward the Elder, and half-brother to his predecessor Aethelstan. He succeeded to the throne in 940, but had already played an active part in the previous reign, and fought with Aethelstan in the great battle of Brunanburh.

In the first year of Edmund's reign Olaf or Anlaf Sihtricsson, called Cuaran, who had crossed from Ireland, had been chosen king by the Northumbrians. Anlaf took York, besieged Northampton and destroyed Tamworth, but was met by Edmund at Leicester. A peaceful settlement was made by the good offices of Odo of Canterbury and Wulfstan of York. Simeon of Durham's statement that the kingdom was now divided between Anlaf and Edmund and his story of the reconquest of Northern Mercia by Edmund probably refer to the compact with Anlaf, made as a result of the campaign. All Mercia south of a line from Dore (near Sheffield), through Whitwell to the Humber, was now in Edmund's hands, and the five Danish boroughs, which had for some time been exposed to raids from the Norwegian kings of Northumbria, were now freed from that fear. The peace was confirmed by the baptism of Kings Anlaf and Raegenald, Edmund standing as sponsor, but in 944 or 945 the peace was broken and Edmund expelled Anlaf and Raegenald from Northumbria.

In 945 Edmund ravaged Strathclyde, and entrusted it all to Malcolm, king of Scotland, "on condition that he should be his fellow-worker by sea and land," the object of this policy being apparently to detach the king of Scots from any possible confederacy such as had been formed in 937.

On May 26, 946, Edmund's brief but energetic reign came to a tragic conclusion when he was stabbed at the royal villa of Pucklechurch, in Gloucestershire, by an exiled robber named Liofa. Edmund, the "deed-doer" as the chronicle calls him, "Edmundus magnificus" as Florence of Worcester describes him, perhaps translating the Saxon epithet, was buried at Glastonbury, an abbey which he had entrusted in 943 to the famous Dunstan.

Edmund was twice married; first to Aelfgifu, the mother of Eadwig and Edgar; secondly to Aethelflaed "aet Damerhame" (*i.e.*, of Darnerham, Co. Wilts). Aelfgifu died in 944, according to Ethelwerd.

See *The Anglo-Saxon Chronicle* (ed. Plummer, 1892–99); *Simeon of Durham* (Rolls Series); *A. S. Laws*, ed. Liebermann, pp. 184–191; Birch, *Cartularium Saxonicum*, Nos. 745–817; *Dictionary of National Biography*, *s.v.*

EDMUND or **EADMUND** (c. 980–1016), called IRONSIDE, king of the English, was the son of Aethelred II. (the unready) by his wife Emma, or Aelfgifu. When Canute invaded England in 1015, Edmund was betrayed and deserted by the ealdorman Edric, who went over to Canute, and Wessex submitted to the Danish king. Next year Canute and Edric together harried Mercia, while Edmund with infinite difficulty gathered an army. His attack on the invaded districts of Northumbria was brought to an end by Canute's northward march, and he was forced to return to London. The death of Aethelred on April 23, 1016, was followed by a double election to the English crown. The citizens of London chose Edmund; the rest of the Witan meeting at Southampton elected Canute. In the warfare which ensued Edmund fought at the severest disadvantage, for his armies dispersed after every engagement. Canute besieged London, but the citizens successfully resisted all attacks. Edmund meanwhile received the submission of Wessex. At Pen in Somersetshire he engaged the Danes and defeated them. Canute now raised the siege of London and,

after beihg defeated by Edmund at Pen, came into conflict with him again at Sherston in Wiltshire. The battle was indecisive, but Canute left Edmund in possession of Wessex. Edmund hastened after him and relieved London, which Canute was besieging. He defeated the Danes at Brentford and at Otford, and drove them into Sheppey. He was now joined by Edric, with whom he followed the Danes into Essex, overtaking them at Assandun (or Ashington). In the battle which. ensued Edric again played the traitor, and the English were routed. Edmund retired into Gloucestershire, whither he was followed by Canute. Edric and the Witan then persuaded Edmund to accept a reconciliation, which took place at Olney. The kingdom was divided—Canute taking the north, Edmund the south. Soon afterwards Edmund died (Nov. 30, 1016), probably from natural causes, though later historians hint at foul play.

EDMUND (CROUCHBACK), king of Sicily and earl of Lancaster (1245–96), was the second son of Henry III. of England by Eleanor of Provence. At ten years of age Edmund was invested by Pope Alexander IV. with the kingdom of Sicily (April 1255); the pecuniary obligations which Henry III. undertook on his son's behalf were among the causes which led to the Provisions of Oxford and the Barons' War. Alexander annulled his grant in 1258, but still pressed Henry for the discharge of unpaid arrears of subsidies. In 1265, after Montfort's fall, Edmund received the earldom of Leicester, and two years later was created earl of Lancaster. He joined the crusade of his elder brother, the Lord Edward (1271–72), and supported him on his accession. In 1275, two years after the death of his first wife, Aveline de Fortibus, Edmund married Blanche of Artois, the widow of Henry III. of Navarre and Champagne. Although the county of Champagne was held by his wife in custody for her infant daughter, Joan, Edmund assumed the title "Count Palatine of Champagne and Brie." This he was compelled to renounce upon the marriage of Joan to Philip the Fair, the heir to the crown of France; but he retained the possession of his wife's dowerlands in Champagne. He was employed by his brother as a mediator with Philip the Fair in 1293–94. When Philip's court pronounced that the king of England had forfeited Gascony, Edmund renounced his homage to Philip and withdrew with his wife to England. He was appointed lieutenant of Gascony in 1296, but died in the same year, leaving a son Thomas to succeed him in his English possessions.

See W. E. Rhodes, "Edmund, Earl of Lancaster," in the *English Historical Review*, **vol. x. pp.** 19, 209.

EDMUNDS, GEORGE FRANKLIN (1828–1919), American lawyer and political leader, was born in Richmond, Vt., on Feb. 1, 1828. He began the practice of law in 1849. He was a member of the Vermont house of representatives (1854–59), acting for the last two years as speaker, and was a member and president *pro tem.* of the state senate (1861–62). In 1866 he became a member, as a Republican, of the U.S. Senate. where he remained until 1891, when he resigned in order to have more time for the practice of his profession. He took an active part in the attempt to impeach President Johnson, He was influential in establishing the electoral commission to decide the disputed presidential election of 1876, and became one of the commissioners. In the national Republican nominating conventions of 1880 and 1884 he was a candidate for the presidential nomination. From 1882 to 1885 he was president pro tern. of the Senate. As senator he was conspicuous on account of his legal and parliamentary attainments, his industry and his liberal opinions. He was the author of the so-called Edmunds Act (1882) for the suppression of polygamy in Utah, and of the anti-trust law of 1890, popularly known as the Sherman Act. He died in Pasadena, Cal., on Feb. 27, 1919.

EDO, a southern Nigerian tribe (sub-tribes: Bini, Esa, Kukuruku, Sobo), living in the provinces of Benin, Ondo, Owerri and Warri. Their language resembles Ewe. The tribe became a powerful kingdom in the 15th century and the chieftainship (Obba) became hereditary in the 17th. The chief is surrounded by high court functionaries, and the provinces are administered by territorial chiefs The extended family is disintegrated. Marriage is prohibited between members of the extended family group; descent is sometimes patrilineal, sometimes matrilineal. Inheritance passes to the son, whom failing, the brother. The son takes the wives of his father (his own mother excepted) if they are childless. The Edo are organized in age classes and in secret societies, and practise husbandry and arboriculture. They are animists and show traces of totemism.

See P. Amaury Talbot, *The Peoples* of *Southern Nigeria* (1926).

EDOM (Greek *Idumaea*), the district situated to the south of Palestine, between the Dead sea and the Gulf of 'Akaba, the inhabitants of which were regarded by the Israelites as a "brother" people (see ESAU). On the east it touched Moab, the tribes of the great desert and the northern part of Arabia; on the west its boundaries were determined by the Sinaitic peninsula, Egypt and Israel. Both Kadesh and Mt. Hor (perhaps Jebel Mādera) are represented as lying on its border (Num. xx 16, 22), and the modern Wadi el-Fikreh, in which the "Scorpion pass" was probably situated (Judg. i 36; Num. xxxiv 4), may have marked its limits from Jebel Mādera northwest toward the southern extremity of the Dead sea. The precise borders, however, must have been determined by political conditions: by the relations between Edom and its neighbours, Judah, the Philistine states, Moab and the restless desert tribes with which Edom was always very closely allied.

The early history of Edom is obscure; Egyptian references to it are few and do not give much light regarding the early inhabitants. In the early records of the Pentateuch, the country is often referred to by the name of Seir, the general name for the uhole range of mountains on the east side of the Jordan-Araba depression south of the Dead sea. These mountains were occupied by a cave-dwelling aboriginal race, the Horites. According to Old Testament tradition, the Edomites were a new race who drove out the Horites from Mt. Seir.

The occupants of Edom during practically the whole period of Biblical history were the Bedouin tribes which claimed descent through Esau from Abraham, and were acknowledged by the Israelites (Deut. xxiii 7) as kin. Among the peculiarities of the Edomites was government by certain officials known as אַלּוּפִים, which the English versions translate "dukes." The now naturalized word "sheikhs" would be the exact rendering. In addition to this Bedouin organization there nas the curious institution of an elective monarchy. A list of eight kings, who reigned before the Israelite monarchy is preserved in Gen. xxxvi. Saul. the first king of Israel, conquered Edom (1 Sam. xiv 47), as did David, the second king.

After David's conquest, the Edomite prince Hadad escaped to Egypt, where he remained until the death of David. If, as the narrative of Kings xi implies, he became a troublesome adversary to King Solomon, nothing is known of his achievements, and if Solomon's trading-journeys from Ezion-geber were maintained, Edom must have been weak. Edom aas under the rule of Jehoshaphat of Judah, who, with Israel held Ezion-geber (1 Kings xxii 47 sqq.; 2 Chron. xx 35 sqq.). Some catastrophe befell the fleet, and shortly afterwards Jehoshaphat's son Jehoram had to face a revolt in which Edom and the men of Libnah (the Philistines) were concerned. It was about this period that Israel had conquered Moab, thrusting it farther south towards Edom, and the subsequent success of Moab in throwing off the yoke, and the unsuccessful attempt of Jehoram of Israel to regain the position, may show that Edom was also in alliance with Moab. In the time of Adad-nirari of Assyria (811–782 B.C.) Edom is mentioned as an independent tributary with Eeth-Omri (Israel) and Palashtu (Philistia). The absence of Judah is noteworthy. Amaziah of Judah had gained a signal victory over Edom in the valley of Salt (2 Kings xiv 7), but after his defeat by Jehoash of Israel there is a gap and the situation is obscure. Consequently it is uncertain whether Edom was the vassal of the next great Israelite king Jeroboam II, or whether the Assyrian evidence for its independent position belongs to this later time. However, Uzziah, a contemporary of Jeroboam II, and one of the most successful of Judaean kings. overcame Edom and its natural allies (2 Chron. xxvi 6 *sqq.*), and at this stage Edomite history becomes more

prominent. It joined the great coalition in which Philistia and Israel were leagued against Assyria, and drove out the Judaeans who had been in possession of Elath (2 Kings xvi 6). On the events that followed see AHAZ; HEZEKIAH; PHILISTINES. In the middle of the 7th century both Edom and Moab suffered from the restlessness of the desert tribes, and later joined in the attempt made by Zedekiah of Judah to revolt against Nebuchadrezzar (Jer. xxvii 3).

Edom in alliance with the tribes along the trade-routes (Philistines, Moabites, etc.) was responsible for many attacks upon Israel, carrying away prisoners as slaves for Gaza and Tyre (Am. i 6 *seq.*, 9). As an ally or vassal Edom was in touch with the wealth of Arabia (Ezek. xxvii 16, read "Edom" for "Aram"), and Judah and Israel as well as Gaza and Damascus enjoyed the fruits of its commerce. Edomite and allied tribes were famed for their wisdom (Ob. 8, Jer. xlix 7 seq., Baruch iii 22), and besides the possibility of Arabian influence upon Israelite culture, the influence of Midian and related tribes is certain from the traditions of Moses and of his work (see JETHRO; KENITES; MOSES), and the Edomite district was a traditional home of Yahweh himself (Deut. xxxiii 2; Judg. v 4; Hab. iii 3). It should be added, however, that the Edomite names and other evidence point to the cult of other gods.

In the last years before the fall of Jerusalem many of the Jews found a refuge in Edom (Jer. xl 11), although other traditions throw another light upon the attitude of Edom during these disasters. It is said that Edomites burned the temple after the destruction of Jerusalem (1 Esd. iv 45, *cf. v.* 50), and naturally the weak state of Palestine invited attacks from the outlying tribes; but the tone of certain late writings implies a preliminary period of, at least, neutrality (*cf.* Deut. ii 4 *sqq.*, xxiii 7 *seq.*; the omission of Edom in xxiii 3; Neh. xiii 1; and in Ezra ix 1—contrast 1 Esd. viii 69). Edom is execrated for revengeful attacks upon the Jews, and its speedy destruction is foretold; but the passages appear to be later than the disaster of 586 B.C., and may even imply conditions after the restoration (Ob. 10 *sqq.*; Ezek. xxv 12–14; Jer. xlix 7; Ps. cxxxvii 7; Lam. iv 21 *seq.*, v 2 *sqq.*). Eventually the constant westward pressure of the eastern Arabs forced the ancient Edomites across the Jordan-Araba depression. With their name they migrated to the south of western Palestine. In 1 Maccabees v 65 they are at Hebron, and this is one of the first indications of the cis-Jordanic Idumaea of Josephus and the Talmud. *See*, for the later history, HEROD; JEWS.

Josephus used the name Idumaea as including not only Gobalitis, the original Mt. Seir, but also Amalekitis, the land of Amalek, west of this, and Akrabatine, the ancient Acrabbim, S.W. of the Dead sea. Jerome describes Edom as extending from Beit Jibrin to Petra, and ascribes the great caves at the former place to cave-dwellers like the aboriginal Horites. Ptolemy's account presents the last stage, in which the name Edom is entirely restricted to the cis-Jordanic district, and the old trans-Jordanic region is absorbed in Arabia.

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EDRED (EADRED), king of the English (d. 955), was the youngest son of Edward the Elder and his wife Eadgifu. He succeeded his brother Edmund in the year 946 and received the formal submission of the Northumbrians and Scots. In the next year Edred went to Tanshelf in Yorkshire, where he received from Wulfstan, archbishop of York, and the Northumbrian "witan" confirmation of their submission. Shortly after they threw their pledges to the winds and took the Norwegian Eric Bloodaxe, son of Harold Fairhair (Harald Harfagar), as their king. Edred recklessly ravaged all Northumbria in revenge, burning Ripon during his march. On his return home Edred's rearguard was attacked at Castleford, and he once more turned to ravage Northumbria, which was only saved by its abandonment of Eric and by compensation made to Edred. Archbishop Wulfstan seems to have been *a* centre of disaffection in the north, and in 952 Edred caused him to be imprisoned in the castle of "Judanburh," while in the same year the king, in revenge for the slaying of Abbot Eadelm, slew many of the citizens of Thetford. After the brief rule of Anlaf Cuaran in Northumbria, Eric was once more restored, probably in 950, only to be expelled again in 953 or 954, when Edred took the Northumbrian kingdom into his own hands. In the same year Wulfstan was liberated and appointed to the Mercian bishopric of Dorchester. Edred died on Nov. 23, 955, at Frome, in Somersetshire, and was buried in the old minster at Winchester. During the whole of his life Edred was troubled by ill-health, a fact which may help to explain some of the more passionate acts of violence attributed to him. The king was throughout his life on terms of personal intimacy with St. Dunstan, and his public policy was largely guided by that prelate and by his mother Eadgifu. It is not known that Edred married.

BIBLIOGRAPHY.—The *Saxon Chronicle* (ed. Earle and Plummer, 1899), *sub. nnn.*; *Memorials of St. Dunstan* (Rolls Series, ed. Stubbs); Florence of Worcester; Birch, *Cartularium Saxonicum*, vol. iii., Nos. 815–834 and 860–931; *D.N.B.*, art. *sub voce*. (A. M.)

EDRIC (or EADRIC), STREONA (d. 1017), ealdorman of the Mercians, was a man of ignoble birth who was advanced to high dignity through the favour of the English king Aethelred II. In 1007 he became ealdorman of the Mercians, and in 1009 married Aethelred's daughter Eadgyth. In the struggle between the English and the Danes he appears in the character of an arch-traitor. When Aethelred in 1009 proposed a great attack on the Danes, Edric dissuaded him from carrying it into effect. At the "witan" held in Oxford in 1015 Edric had Sigeferth and Morkere slain by treachery. In the same year Canute invaded England; Edric, who had joined Edmund Ironside, subsequently quarrelled with him and went over to Canute. After the battle of Otford he returned to Edmund, but only to secure the utter defeat of the national cause by his treachery at the battle of Assandun. After Edmund's death Canute restored to Edric the earldom of Mercia; but in 1017, fearing further treachery, he had him slain.

EDUCATION. The subject of Education is treated in this introduction under the following heads: I. Educational Theory. II. Psychology and Ancillary Sciences. III. Science of Education. IV. Educational Experiments, followed by sections on History and National Systems.

I. EDUCATIONAL THEORY

Definition.—Many definitions have been given of the word "education," but underlying them all is the conception that it denotes an attempt on the part of the adult members of a human society to shape the development of the coming generation in accordance with its own ideals of life. It is true that the word has not infrequently been used in wider senses than this. For example, J. S. Mill included under it everything which "helps to shape the human being"; and, with some poetic licence, we speak of the education of a people or even of the whole human race. But all such usages are rhetorical extensions of the commonly accepted sense of the term, which includes, as an essential element, the idea of deliberate direction and training. No doubt, all education is effected through the experiences of the educated, but it does not follow that all experiences are educative. Whether an experience is part of an individual's education or not, depends upon whether its form has been arranged by those who are concerned with the training of him whose experience it is. It follows that an education may be good or bad, and that its goodness or badness will be relative to the virtue, wisdom and intelligence of the educator. It is good only when it aims at the right kind of product, and when the means it adopts are well adapted to secure the intended result and are applied intelligently, consistently and persistently.

Education is, thus, a definitely personal work, and will vary between wide extremes of effectiveness and worth in any given society. For in all times and places there are wide differences in virtue, wisdom and capacity among those who have in their hands the care and nurture of the young. Yet, despite these differences every teacher expresses, more or less perfectly and clearly, the current conception and outlook of his age and country. The first essential for successful educative effort is, then, that the

community as a whole should have a true estimate of the nature and value of education.

Assuming, however, a well-inspired community and teachers capable of fulfilling its will, it is not possible to say, except in most general terms, how it will educate its children. For although looking at the individual to be educated, we may say with Plato that the aim of education is "to develop in the body and in the soul all the beauty and all the perfection of which they are capable," this leaves quite undecided the nature and form of that beauty and perfection, and on such points there has never been universal agreement at any one time, while successive ages have shown marked differences of estimate. Individual beauty and perfection are shown, and only shown, in actual life, and such life has to be lived under definite conditions of time, place, culture, religion, national aspirations and mastery over material conditions. Perfection of life, then, in the Athens of the age of Plato would show a very different form from that which it would take in the London, Paris or New York of to-day. Hence, so far as any conception of education can give guidance to the actual process it must be relative in every way to the state of development of the society in which it is given.

Education and **the** Community. — There is one respect in which the constitution and general outlook of a community are especially likely to affect the character of its education. Education aims at conserving and perfecting the life of the community, but that life is nothing other than the life of its individual members. In an ideal community there would be complete identification between the interests of every unit and of the whole; but history records no ideal communities. In practice there are always divergences, leading to exploitation here and sacrifice of development there. Societies in different times and places differ from one another, then, in their degree of success in reconciling the interests of the whole with the claims of individual development, or in their willingness to subordinate the latter to the former; and their educational conceptions naturally reflect these differences. The primitive tendency in communities is towards the complete subordination of the individual, but in the western peoples that tendency has, since the advent of Christianity, been checked and modified by an increasing valuation of the individual life. It is an apparently paradoxical, but easily intelligible, fact that the World War, by its startling revelation of the immense range, the intimate closeness and the vast complexity of modern social organization, actually stimulated the reaction against the primitive tendency and the educational ideas which expressed it. Educational theory must always be more or less "paidocentric"—that is, must focus its attention in the first place upon the single child and upon the gifts and powers which make him educable; but in its recent trend it goes beyond that, and tends to regard the perfection of the individual as the proper end of educational efforts. This does not imply a disregard of social claims or point towards social disintegration; the view is that the best forms of communal life will be fostered by an education which regards social activities as a necessary medium for the development of the higher stages of individual life rather than something to which the claims of individual development must be subordinated. This conception, held with more or less conscious clearness, has guided much of the typical development which, prominent in America *(see* EDUCATION: *Science of* and *History of Education, United States)* and to a less extent in Britain before the war, has since 1918 proceeded apace in most civilized countries.

The most striking sign of the change of view here in question is afforded by the reorganization of public education now going on in the more progressive lands. Its distinctive feature is the replacement of the old conception, in which elementary and secondary schools corresponded mainly to social stratification, by the idea that children of all classes should have the opportunity of a primary education, designed to meet the needs of childhood, followed by a post-primary or secondary education adjusted to the needs of adolescence. In the United States this idea is embodied in the system of primary schools (*q.v.*) followed by junior and senior high schools (*q.v.*) on the "six-three-three" principle. (*See* ELEMENTARY EDUCATION IN THE U.S. and SECONDARY EDUCATION IN THE U.S.) In England it underlies the proposals of the Report of the Consultative Committee of the Board of Education on the Education of the Adolescent (1926). It has also inspired the post-war changes in the State systems of the German *Reich.* In part these developments have no doubt come about because modern industry and forms of government demand in the average citizen a higher standard of knowledge and training than formerly sufficed. But the fundamental explanation is to be found in the conception that a community should place the best opportunities of self-development and realization within the reach of all of its members who are capable of profiting by them.

Curriculum. — (For *United States* see below.) From these considerations it is natural to descend to the curriculum. What ought boys and girls to learn at school? The principle underlying any sound answer to this question follows from what has already been said about the purpose of education. It is the function of the school, continuing, supplementing and (too often) correcting the influences of family life, to bring to bear upon the pupil the spiritual forces which are typical of the national *ethos* and to train him to take his part in conserving and developing the life of the community.

To perform that function a school must, in the first place, be a genuine society inspired by the best ideals of the national character and therefore able to transmit to and confirm in its pupils the traits which enter into those ideals. The so-called "public schools" (*q.v.*) of England have won their repute mainly because they are deemed to have been successful in this fundamentally important part of the work of a school. It is well-known that respect for physical vigour and prowess, good manners, public spirit, self-restraint and a training in the responsible use of freedom and self-government are the main ingredients fused in the powerful social ideals of those schools. All these are valuable elements in the formation of any citizen, and should, accordingly, find their place in the life of schools of every type.

In the second place the school must offer its pupils instruction in a number of "subjects." Here the principle we follow admits of a variety of interpretations. One may take either a short or a long view of the life and needs of the community. Upon the Short view the community requires at the moment certain kinds of knowledge and skill to carry on its economical and other activities; and it is the business of the schools to turn out young people equipped with such forms of knowledge and skill. Upon the long view it is less important to consider the utilitarian needs of the present day than to bring the pupil into fruitful contact with those elements which are deemed to have most enduring and vital significance in the historic life of the people. The contrast between these views develops in different ways into the antitheses between a "vocational" and a "liberal" education, between a "modern" and a "classical" education and, less directly, between an education that stresses the value of knowledge and one that emphasizes the importance of "mental training" or "discipline."

A well-based theory of the curriculum should find a place for all that is sound in the conflicting ideas involved in these antitheses. Such a theory must undoubtedly start from what was called above the long view. In other words its leading principle will be that the school society must include among its formative influences all those modes of intellectual, aesthetic and practical activity which have played a major part in the evolution of the human spirit and have shaped the mind of the present age. Letters and art, music and handicraft, mathematics and science, geography and history are thus indicated as necessary constituents of the complete curriculum; but not only may they enter into it in a variety of ways, they must do so if the principle is to be elastic enough to fit the varying needs of different types of scholars. For instance, training for a specific vocation conforms with the principle if it aims not merely at imparting skill in the use of tools or empirical technical knowledge, but at putting the learner to school in the ethical and scientific or aesthetic traditions of some essential occupation or profession which has played and continues to play an important part in our civilization. Thus conducted, a vocational training may be, for large sections of the population, the appropriate way af completing and rounding off

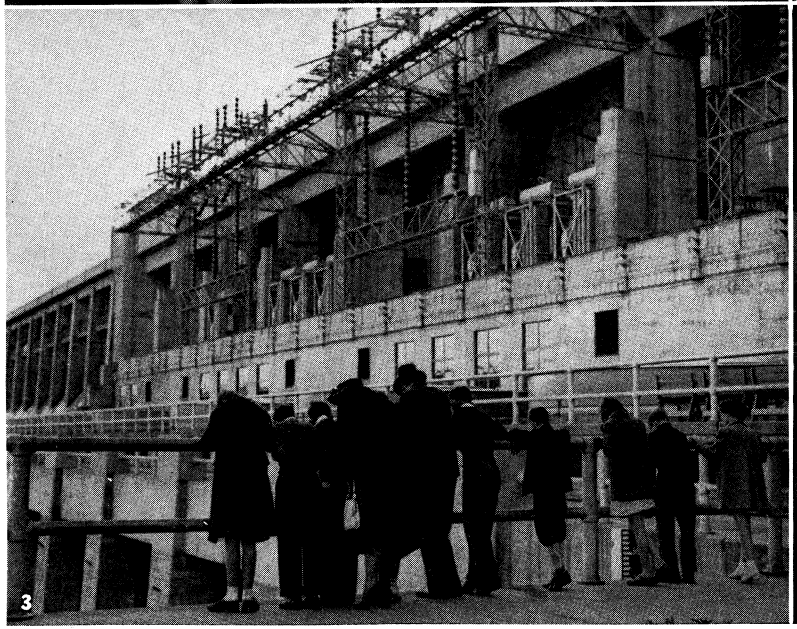
a truly liberal education. On the other hand a training based mainly upon the study of the ancient classics is not entitled to be called liberal unless given in such a way as to make the student a freeman of the modern world, sensitive to its ideas and awake to the significance of its intellectual and social movements.

The idea that the cultivation of mental training or discipline is one of the chief aims of education has played and continues to play so large a part in educational theory and practice that it needs careful analysis. It is expressed in a popular and epigrammatic form in the statement that a man's education consists in what he retains after he has forgotten everything he learnt at school. But the interesting question is: What does he retain? According to the cruder view school studies serve to develop certain faculties or powers of the mind, and that development is the real reason for pursuing them. For instance, the Latin verses a boy learns daily may all be forgotten soon after he leaves school, but (it is held) the learning has served to strengthen his memory, and that is its sufficient justification; he may never have occasion to use the knowledge of chemistry and physics he has acquired, but that does not matter if he has gained from those studies powers of observation and inference which are universally valuable and the habit of applying the scientific method to all subjects of discussion. Similarly, geometry is held to train one's reasoning powers and algebra to develop mental accuracy. The assumption made here is that the strength or training a faculty acquires by being exercised upon a particular kind of material fits it to deal competently with any other kind of material to which it can be applied. The weakness of the argument is that in the eyes of modern psychology this assumption is, to say the least, very questionable. It has, for instance, been shown clearly by most careful experiments that a person who "trains" his memory by (say) prolonged exercise in learning verse is no better able than before to remember the substance of a prose passage. Similarly there is no reason to believe that an acute observer in the field of botany or geology has acquired by his training a quickness and sureness of eye that will serve him usefully when he drives a motor-car through the streets of London. Ascertained facts and general considerations such as these have tended greatly to discount the idea of mental training; yet it is difficult to suppose that there is nothing in a notion which has been held not only by thinkers of the eminence of John Locke but also by a long line of able and experienced schoolmasters. The clue to the right view of the matter was given by Herbert Spencer who, in his famous work on Education, declared, in effect, that the antithesis between the knowledge-value and the training-value of school studies was a false one. If, said Spencer, we give our pupils the knowledge which is "of most worth" — that is the knowledge which has indispensable practical value in regulating the affairs of life—we shall at the same time give them the best possible mental training; for it is incredible that the pursuit of the best kind of knowledge should not also afford the best mental discipling. This interesting dogma must, as far as Spencer himself is concerned, be regarded as part of the faith of an evolutionist; but it may also be regarded as following from the general principle of the curriculum stated above. The most educative activities, it was said, are those which have made the most essential and enduring contributions to the tissue and growth of civilization. Those contributions have actually been brought about by the geniuses of the race: the great artists. craftsmen, poets and men of letters, musicians, men of science, statesmen. They have shaped and refined the activities to which they gave themselves and have thus created traditions of activity, intellectual, aesthetic, practical, having definite and characteristic forms. In this way the traditions of poetry and fine letters have grown up out of the universal habit of communication by speech, architecture and the crafts out of the universal needs of the physical life, science out of the universal gift of curiosity and the equally universal need of exact knowledge for endless practical purposes. and so with the other cardinal activities represented in the curriculum. In so far as a pupil's studies tend to affiliate him lo these traditions or to enable him to absorb them, so far his mind acquires the form and habit of the great minds that fashioned them and is *disciplined*. In short, the discipline of school life and studies consists in learning to become in a small way a brother-poet to the poets, a fellow-craftsman with the craftsmen, an inquirer looking out upon the world through the eyes of the men of science, and a citizen following the civic ideals of the great citizens. Discipline or training of this kind is concrete, not abstract, and is of universal value because the activities which give it are the fundamentally important activities of civilized life.

Nothing has hitherto been said about religious instruction as an item in the school curriculum. Little can be usefully said in a brief review, partly because the term religion embraces so immensely complicated a mass of phenomena, partly because men's attitudes towards religion are so varied and are often in such deeply felt opposition. Besides the adherents of warring creeds there are many (by no means necessarily disciples of Karl Marx) who would teach morality without religion because they hold religion to be a spiritual disease or at best an illusion of the childhood of humanity which should disappear from modern life. Persons who hold that extreme view would exclude religious instruction upon the principle which would normally be thought to make its presence in a school essential — for they deny that it represents a factor of vital and enduring value in the life of nations. It may nevertheless be maintained that even these intransigents live by a faith which sees supreme value in certain ideals, recognizes that those ideals rightly demand service, and has some influence in "cleansing the inward parts." If it be granted that any such faith must be called religious because it is of the essence of all true religion, then the doubt whether the general principle of the curriculum applies to religious instruction disappears; for it must be admitted that religion in this wide sense is one of the cardinal factors in the maintenance and development of human communities, and therefore that religious instruction must necessarily be a factor in the school society. But there remains the question of the relation between religious instruction, in the very general sense here given to the name, and the specific creeds, and this is one upon which agreement is not easily to be reached, even in principle. Probably the proposition that will be most widely accepted is one which seems to follow from what is now known about the general features of mental development: namely, that the credal elements in religion, being of the nature of an organized theory about the sources and objects of religious devotion, should at least be little emphasized until the age of adolescence. But even if this proposition be granted, its application leaves abundant room for controversy.

Coeducation. — A further general question arises in connection with the conception of the school as a society that aims at realizing an idealized epitome of the community of which it is a part and an organ. In the outer world the interactions between the sexes play a rôle of immense importance, and there is no *région* of life where it is more essential that the highest traditions should prevail. Does it not follow that both sexes must necessarily be brought up together at school? The advocates of coeducation (*q.v.*) base their affirmative answer to the question upon the grounds just indicated, and their arguments have in recent years made some headway in countries where, as in England, the custom has been, on the whole, to separate the sexes for education after infancy. On the other hand, defence of the customary separation upon theoretical as well as practical grounds is not lacking.

School Government. — Somewhat the same theoretical difficulty arises in connection with the broader question of school government. There is no ignoring the fact that the school society rests upon an artificial form of compulsion essentially different from the compelling forces which bear upon the citizen of the great society. In brief, the essence of the school polity consists in a regulation of the lives of the young by adults for purposes which the adults have selected Yet since the chief of these purposes is that boys and girls may learn to live worthily, as men and women, the common life of the great society, it would seem that the fundamental features of that life should in some form be represented in the school society. The uncertainty about the application of this principle is naturally greatest where the democratic faith still prevails. In recent years a good many attempts

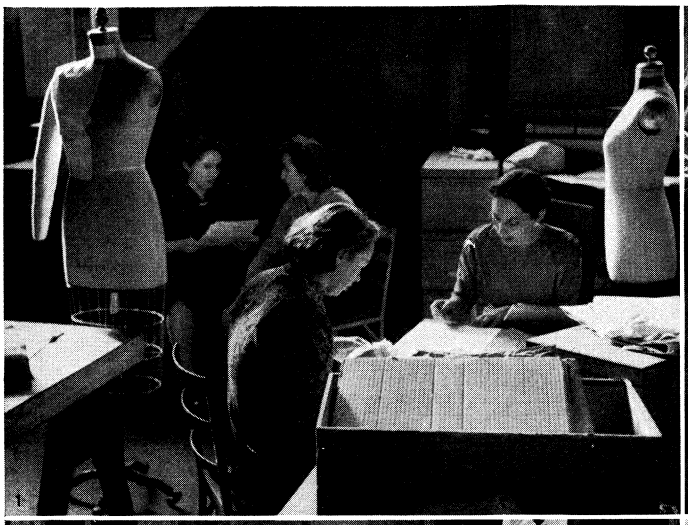


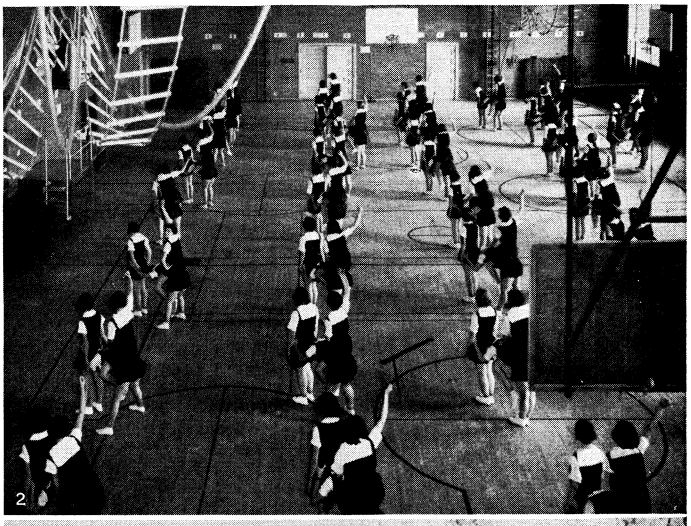
BY COURTESY OF THE SPRINGFIELD PUBLIC SCHOOLS, SPRINGFIELD, MISSOURI

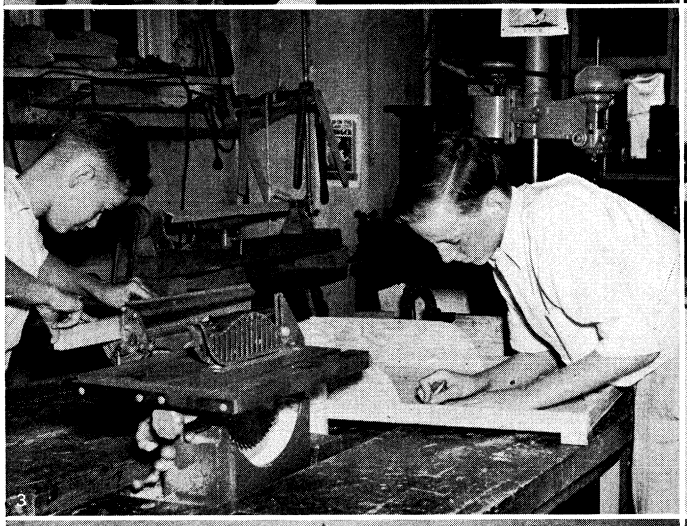
ACTIVITIES OF STUDENTS IN A MODERN ELEMENTARY SCHOOL

1. Children of the Springfield, Mo., public schools visiting a polling place as part of their study of local government
2. Studying the various sources of power and the effect of science and industry on group living
3. A visit to a dam supplements class-room experiments
4. Elementary students preparing tomato juice during a study of how people get ready for winter. Work proceeds according to plans the group makes, under the guidance of teachers

EDUCATION







BY COURTESY OF (1) SCHOOL OF THE ART INSTITUTE OF CHICAGO. (4) THE SWEDISH STATE RAILWAYS, (6) THE BOARD OF SCHOOL DIRECTORS, MILWAUKEE, WISCONSIN; PHOTOGRAPHS, (2, 3) EWING GALLOWAY, (5) PACIFIC AND ATLANTIC, INC.

CLASSES IN PHYSICAL AND VOCATIONAL EDUCATION

1. Class in costume designing at the School of the Art Institute, Chicago
2. Physical education class for girls in the Evander Childs High School gymnasium, Bronx, N. Y.
3. Boys making games in manual training shop of Neighborhood House, Washington, D. C. Classes for boys and girls in music, crafts, and painting are also held
4. Gymnastikuppvisning (Stockholm), a formal drill in Swedish gymnastics, demonstrated by a class of high school girls. The public schools in Sweden place special emphasis on physical education throughout the elementary and high school years
5. An art class working from casts in the Museum of Fine Arts, Boston
6. Class in basket weaving in Milwaukee, Wisconsin. Instruction is being given in the making of baskets and other articles from reeds

have been made in England, the United States, Germany and elsewhere, to conduct school government upon a thorough-going democratic basis, the pupils exercising, together with their teachers, the functions of the legislature and the judiciary in their little state. Experiments of this kind, opposed as they are to deeply engrained traditions concerning the upbringing of children and (some psychologists would add) to deeply rooted impulses towards the exercise of power, were bound to meet with great difficulties. They seem to have been most successful where it was a question of redeeming young delinquents whose faults were due less to corruption than to the misdirected actions of authority, Elsewhere authority has tended to slip back into the hands of the adult members of the school society by whom it was delegated, Nevertheless a comparison, at any rate in England, between schools to-day and the schools of the last generation shows that there has been a notable general advance in the direction which the bolder reformers may have followed too far. The autocratic attitude once generally characteristic of teachers has been sensibly modified; in effect they act not as absolutists imposing their will upon their subjects but rather as the natural guardians of an order which it is the interest of all to have maintained. And in addition to this implicit but very real appeal to the consent of the governed there is in schools of all kinds an increasing tendency to entrust authority and management to pupils who are old enough to understand and to bear the responsibilities involved. Here is a principle which goes a good deal farther than the oligarchical principle of prefect-government as Arnold (*see* ARNOLD, THOMAS) conceived it; for it recognizes that self-responsibility, exercised under adequate adult supervision, is highly educative at all stages in the growth of character.

Punishment. — An important change of attitude with regard to the theory of the government of children entails a change, equally radical, in one's attitude towards punishment; for punishment (whatever else it may be) is an instrument of government. It is scarcely if at all too much to say that it was once the main instrument of government in schools; but the schoolmaster no longer uses it, especially in its more violent forms, with the old confidence in its propriety and efficiency. This is not due merely to the humanitarianism of the age, for, with increasing understanding of the theory of his profession, the teacher feels with increasing discomfort that the necessity of punishment is often a symptom of discordance between the true needs of his pupils and the general conditions of school life—a discordance for which he is largely responsible. Accordingly he is less prone to turn to repression as a remedy for evil than to seek to amead those conditions. Such a policy is in conformity with the general principle that the function of the school is to encourage positive activities of a wholesome and valuable kind and that moral as well as mental discipline comes by learning to do the right thing in the right way. No doubt perversity will crop up in a school no matter how scientifically it may be conducted; for the schoolmaster has to reckon not only with his pupils' human tendency to err but also with the unwisdom of parents in their early dealings with that tendency; the elimination of wrong-doing and its correlative punishment is accordingly a consummation which no one is likely ever to see, however devoutly it may be desired. Nevertheless the treatment of youthful wrong-doing without sentimentality, along scientific lines, promises a vastly greater amelioration than blindly repressive methods ever secured.

II. PSYCHOLOGY AND ANCILLARY SCIENCES

By Plato and Aristotle the theory of education was considered in close connection with political theory and in the foregoing discussion the lead given by those great thinkers has again been followed; it was, however, not easy to exclude references to other sciences whose development has had to await modern times. Of these sciences ancillary to the theory and practice of education the most obvious is psychology. To psychology all writers on education have had to make some appeal, since all have been compelled to recognize that teaching and training cannot be effective in the absence of knowledge about the mind which is to receive them. It must nevertheless be admitted (though the criticism does not justly lie against Aristotle) that until recently the professional psychologists, owing to their preoccupation with the purely intellectual processes, have given less help than might have been expected in the elucidation of educational problems. The pedagogy of Herbart and his successors threw valuable light, it is true, upon the nature of interest, and prepared the way for the modern treatment of this centrally important topic; but academic psychology had, on the whole, comparatively little to give the educator until it was fertilized by contact with the conceptions of biology—especially with master-conceptions of growth and development and the notion that mental, like physical, behaviour is to be regarded as a reaction to environment. Herbert Spencer, whose *Principles* of *Psychology* first appeared in 1855, must receive credit for initiating the new orientation of psychology. In James Ward's famous article in this Encyclopædia (1886) there was effected a fusion between some of Spencer's ideas and the conceptions of Kant and the German school of psychologists, while in William James's unsystematic but vastly influential *Principles* of *Psychology* (1891) the influence of biological science was strong and apparent. The "child study movement" in America *(see* EDUCATION, SCIENCE OF) and elsewhere was a significant expression of the new tendency to look at human behaviour and development from the biological point of view; it produced in Stanley Hall's *Adolescence* (1904) a monumental work in which that tendency dominated almost every page. The same tendency was expressed more formally in William MacDougall's theory of instinct, first worked out fully in his Social *Psychology* (1908). The trend of the biological school of psychologists towards external observation as opposed to the introspection of the older school has in recent years reached its extreme limit in the "behaviourism" of the American psychologist J. B. Watson and his followers. Behaviourism rejects introspection as a means of gaining psychological knowledge, substituting observation of the reactions of human beings under clearly defined experimental conditions. The investigations in the laboratory of the reactions of very young children now being conducted by workers in this typically modern school may lead to interesting results. Meanwhile it is claimed, with some justice, that some of the most useful applications of modern psychology to education—especially the whole field of "mental tests" *(see* EXAMINATIONS)—are, in principle, applications of behaviourism, in as much as they consist in the study not of events supposed to occur in the child's mind but of his observable reactions to situations deliberately arranged.

Among the features in current educational psychology which derive from the influence of biology are the studies that have been made of the meaning and function of play, the rôle of imitation and suggestion in the genesis of individuality, and the exploitation of McDougall's theme that the complexities of adult human behaviour are developed from a moderate number of distinct sources of energy—the instincts—which, unlike the corresponding instincts in the animals, are indefinitely plastic and capable of entering into the permanent systems called by Shand "sentiments," and regarded by him as the main constituents of human character. From biology, again, came the "functional psychology" of John Dewey, his pragmatic theory of reasoning, and the applications of his doctrines in pedagogy (see below).

It may also be remarked here that hygiene, which must be included among the sciences ancillary to the theory and practice of education, has tended in recent years to be not merely a body of applications of human physiology but to derive from biology a broader outlook. It is, in brief, becoming a study of the best conditions and ideal development of the physical human life as a biological process.

In spite of a good deal of hostile criticism the movement which may be called comprehensively, if not very accurately, the psychology of the unconscious (*q.v.*), is now seen to have increasing importance for educational psychology. In this field the discoveries and doctrines of Freud attracted most attention, though those of Jung and Adler are not to be ignored. It is well known that Freud attached very great importance to the rôle of sexuality (defined in an extremely wide way) in the development of mind

and character, and referred most disturbances of that development to deviations from sexual normality in the earliest stages of life. It remains to be seen whether his interpretations will survive further knowledge and criticism without considerable modification; but there can be no doubt about the general truth of his conceptions of the influence upon behaviour of unconscious factors, of the early origin and persistent activity of some of these factors, of the harmful effect of unconscious mental repressions and conflicts, and of their profound bearing upon the happiness, conduct and mental efficiency of boys and girls as well as of adults. Further it can hardly be questioned that many of the perversities which bring young people into conflict with authority and many weaknesses and misdirected developments of character are first caused by unwise or wrongly motived parental treatment, or, in general, by abnormality in the relations between young children and those upon whom they are dependent. In his later works, too, Freud had begun to work out ideas upon the nature and growth ot the ego or self which seem likely to have much value for educators.

Experimental psychology, if it has not fulfilled the rather extravagant expectations of some optimists, has nevertheless made some useful contributions to educational science. It has thrown valuable light upon processes of memorization and learning and the nature of some of the higher intellectual processes; it has exploded some fallacies on the subject of mental training; above all it has given birth to the idea and guided the practice of mental tests. Possibly of more far-reaching importance than the practical applications of experimental psychology in education are the developments of theory to which it has led. Among them a prominent place must be given to Spearman's "two factor" theory of intellectual ability, his formulation of the three noegenetic laws in terms of which he analyses all mental processes, and the "form-psychology" of some recent German writers. All these have an important bearing upon general educational theory or upon the principles of teaching.

Comparative psychology is a science which throws useful sidelights upon educational problems, particularly through its studies of the growth of habits and of rudimentary reasoning in the higher animals. Mention must also be made of anthropology and the psychology of primitive races. These branches of learning, though still young, promise to illuminate not only questions concerning the education of the races for whose welfare the more civilized nations have accepted responsibility, but also to bring into relief principles that have importance for education wherever it is practised: for instance, the necessity of relating instruction to the actual needs and conditions of life of a people, and the influence of differing mental backgrounds upon the attitude of men towards their fellows and towards nature. (T. P. N.)

III. SCIENCE OF EDUCATION

The science of education is the systematic study by exact methods of all phases of the educative process, and is being rapidly extended. One of the earliest advocates was Herbart, the German philosopher and educator. He took the position that if education is to be scientific, it must be guided by psychology, the science of human nature, and by ethics, the science of social behaviour. The psychology and ethics of his day, however, were so theoretical and so deficient in scientific methods that he found it impossible to justify the practical suggestions which he made regarding educational methods. It remained for a later generation, and for the educators of America to develop a science of education.

One group of followers of Herbart did much to improve methods of teaching. Another endeavoured to improve the technique of scientific investigation of mental phenomena. As a result of the efforts of this second group empirical psychology was developed. Wundt, the founder of modern experimental psychology, frequently acknowledges his indebtedness to Herbart and the investigators who adopted Herbart's methods of psychological analysis. It was not, however, until empirical psychology was transplanted to America during the '80s, that it became possible to apply psychology to the study of school prwcedures and results. The schools of Europe were and are conducted under the direct supervision of the central Government, and are not readily subjected to critical examination by scientific methods. American schools, on the other hand, are locally controlled and are so variable in their practices that they encourage studies of their relative efficiency.

G. Stanley Hall, an American who had been trained in the psychological laboratory of Wundt, undertook in 1883 the study of education by methods borrowed from psychology. He initiated the "Child Study" movement and later worked toward the establishment of a scientific basis for education. His chief contribution was a treatise entitled, ***Adolescence*** (1904). In this he points out the biological and psychological changes which mark the transition of children from the period of elementary education to the period of secondary education. In securing information about children, Hall and his followers enlisted the co-operation of parents and teachers. Lists of questions were submitted without discrimination to all kinds of observers. The lack of scientific training on the part of many interested in child study and the extravagant and unfounded generalizations indulged in by the leaders of the so-called science soon discredited the whole movement and very few contributions to the science of education are directly traceable to it. The indirect influence of child study was, however, very large. During the late '80's and the early 'go's widespread interest was aroused in educational problems, and gradually better methods of investigation were evolved.

Systematization. — During the decade of the '90's a number of other influences operated to promote the rise in the United States of a true science of education. Four of these were of major importance. First, the effort was made by national agencies to define with precision the terminology and practices of education. A Committee of Ten, under President Eliot of Harvard university made a report in 1892 which defined the units of instruction in the high school. In 1895 the Committee of Fifteen, under the chairmanship of William T. Harris, U.S. Commissioner of Education, made an effort to define the functions and content of elementary education. Second, under the leadership of J. McKeen Cattell, at that time professor of psychology at Columbia university, the effort was made to develop tests of mental ability by means of which the differences between individuals could be compared and the changes through which individuals pass in the course of development measured. The early results of such tests, later designated as general intelligence tests, were relatively unsatisfactory; but the tests have been perfected to a point where they are now standard instruments of measurement both for psychology and education. Third, John Dewey, Col. Francis Parker and other educators initiated a movement for the socialization of education. These reformers emphasized the need, pointed out by Herbart, of regulating education in accordance with the laws of social evolution as well as in accordance with those of mental growth. The discussions of Dewey and Parker served to stimulate much wholesome thinking on educational problems. Fourth, J. M. Rice, at that time editor of the *Forum*, demonstrated late in the 'go's a highly important method of evaluating the results of education. He obtained permission to test pupils in a number of school systems with lists of words to be spelled and with series of arithmetical examples to be solved. In 1897 under the title, "The Futility of the Spelling Grind," he published an article which pointed out the necessity of exact scientific testing of school results. In 1901 he published an article on the results secured with tests in arithmetic.

Social influences were also stimulating education. The school population was increasing and the demand for more variety in the content of instruction was making itself felt. By the beginning of the 20th century the demand for a science of education was fully established and some of the methods of scientific investigation perfected far enough to render available exact information on which to base scientific conclusions. Since 1900 the development of a science of education has been comparatively rapid, but its progress has been less rapid than it might have been if parents and teachers were fully converted to the idea that education should be guided by science rather than by tradition.

STUDIES AND TESTS

Pupil-administration is one of the fields in which this science has been productive. It was discovered that a great many pupils make progress through the school more slowly than is normally to be expected. If pupils enter the first grade of the elementary school at six years of age, they ought to reach the beginning of the fourth grade at nine years of age. As a matter of fact, many pupils do not reach the fourth grade until they are 10, 11 or 12 years of age. Such pupils are said to be retarded. The facts of retardation were clearly pointed out and extensively studied and radical reforms were introduced in the organization of schools in order to remedy the difficulty. The technique of comparison which was developed by studies of retardation was the technique of statistical comparison. It is one of the most widely employed devices of scientific study of school problems.

The Binet Scale.—A second group of scientific studies employed tests of various types. Certain of these are designed to reveal differences in the abilities of individuals. Binet, the noted French psychologist, discovered that there are certain kinds of knowledge which the ordinary child of three normally possesses, such as the knowledge of the names of different parts of the body. The child of four years of age possesses additional items of knowledge and so on. By arranging the items found to be normally exhibited by children of various ages, it is possible to devise a scale by which normal intelligence can be determined. The so-called Binet scale was perfected in 1905. It was introduced in America and is now extensively used. To arrive at a simple expression for the results of measurements made with the Binet scale, the so-called *intelligence quotient,* usually written I.Q., was devised. The I.Q. is arrived at by dividing the score made on the Binet scale by any given child by his chronological age. Thus a child who passes the 10-year old standard test and is 10 years of age has an I.Q. of 100 per cent. The child who passes only the nine-year test and is 10 years of age has an I.Q. of 90. The child who passes the 11-year test and is 10 years of age has an I.Q. of 110.

Following the appearance of the Binet scale a large number of standard tests were devised. Series of examples in arithmetic were prepared and the rate and degree of accuracy with which these were solved by pupils in different grades were determined. The average achievement of pupils in different grades is a reasonable standard of expectation for all pupils of similar advancement in the school. In this way standards of achievement and standard tests have been produced in all the fundamental school subjects.

Thorndike and Ayres.—In addition to standard tests, scales have been devised in various fields. Thorndike devised, in 1910, a scale for judging specimens of handwriting. He collected a number of specimens of handwriting of varying degrees of excellence. Thorndike secured the judgments of expert teachers of handwriting and arranged specimens in a series of 18 steps. With the aid of this scale, scores can be assigned to any specimen of handwriting, progress measured and the writing of different individuals compared. Ayres devised in 1915 a scale of words to be taught in spelling. He secured exhaustive tests of the words used in correspondence, in the English Bible and in an edition of a newspaper. He then required the pupils in the various grades of a number of schools to spell the words found to be in common use. He was able at the conclusion of his tests to make lists of words in common use which should normally be mastered by pupils in the various grades. The preparation of this spelling scale has completely transformed the methods of selecting words used in spelling lessons in schools.

The World War gave a great impetus to the testing movement. The psychologists of the United States employed the experience which had been accumulated regarding methods of testing general intelligence and special abilities and devised series of tests by means of which they were able to select abnormal individuals and eliminate them from the service and to select for special forms of service those who were competent. So successful was the application of tests during the war that industry has adopted very similar methods, and schools have adopted tests for determining the grading and classification of pupils. In fact the measurement movement in education is regarded by some of its exponents as the essential part of the science of education.

A reaction has arisen against the testing movement on the ground that it has led certain educators to adopt a fatalistic or deterministic theory of education. It has been held by some extremists that a poor score on certain tests is sufficient indication of deficient mental ability to justify exclusion of the pupil making such a score from the advantages of a higher education. The opponents of educational determinism have adduced evidence to show that poor scores are often traceable to lack of educational opportunity rather than to native mental deficiency. It is contended on such grounds that even pupils with low scores in tests have a right to the opportunities of higher education.

Laboratory Experimentation is a type of scientific study of educational problems which developed more slowly than did standard tests but has proved to be highly productive; it originally borrowed its methods from experimental psychology. Laboratory investigations of educational problems are either general, dealing with such matters as the laws of learning, or specific, dealing with the habits cultivated in the acquisition of handwriting or reading or some other school subject. One of the earliest investigations of the general type was that of Bryan and Harter. In 1897 these investigators measured the progress from week to week of several persons who were learning to send and receive telegraphic messages. They found that the rates of progress in learning to send messages were not the same as the rates of improvement in learning to receive messages. Furthermore, they found that there are periods in learning to receive messages where for a time the learner seems to make little or no progress.

General Principles.—Later investigators have discovered many important facts about the learning process. It has been found that in committing to memory a poem or series of passages it is better to read repeatedly the whole poem or series of passages rather than to commit to memory one line at a time. "Whole learning," as the method of reading the poem through is called, has the advantage of giving the learner from the outset the general idea which the passage is intended to convey and prevents the mere revolving of attention around a single line. Another important discovery is that pauses between periods of learning are advantageous. Long periods of continuous effort in learning evidently set up certain conflicts which defeat the learning process. It has also been found that mere repetition without careful attention to the material which is being repeated is not favourable to learning.

Transference.—In addition to the establishment of such general principles, experimental investigations have measured the extent to which knowledge or habits of action acquired under one set of conditions will transfer and guide the learner under other sets of conditions. A vigorous dispute has been carried on between those who interpret their results in regard to transfer as showing that all learning is specific, that is, that there is no transfer and those who find that the human mind is capable of many forms of generalization. Extreme believers in the necessity of specific training hold, for example, that every possible number combination to be encountered in practical life should be explicitly attended to and taught in the schools. On the other hand, it is believed by those who find evidence of generalization, that when a pupil has learned the meaning of number combination by dealing with a limited number of cases, he will be able to carry over the general principles of combination into number fields in which he has had no specific training.

METHODS AND ERRORS OF PUPILS

The laboratory analysis of methods exhibited in learning constitute the most productive application of experimental methods. A common method to study reading is to photograph the movements of a reader's eyes as he looks along a line of printed matter. The movements of the eye are much better indicators of what is going on in the reader's nervous system when he tries to recognize and interpret printed words than are the movements of articulation which the reader makes in pro-

nouncing words orally. Oral pronunciation is a remote process following the recognition of words after so long an interval that other factors such as the physiological limitations of vocal action obscure the true reading process. Eye movements, on the other hand, are very closely related to the reader's efforts to comprehend passages. Photographic records of the eye movements show among other facts that there is a marked difference between the individual's mental processes when he is reading silently and when he is reading orally. Silent reading makes possible attention to large units. Whole phrases are apprehended at a single glance. In oral reading, on the other hand, attention is relatively fragmentary, controlled by the necessity of separate pronunciation of each sound. The discovery of this fact has had a profound effect on school practice. It was formerly the universal practice of schools to limit instruction in reading to oral reading. The newer reading books and reading courses of the elementary schools are organized with a view to encouraging pupils at an early age to read silently.

Similar methods of investigation have been employed in investigating the habits of pupils in dealing with foreign languages. It has been found that high-school pupils in the United States rarely reach the stage in the study of Latin where they read the sentences. They are evidently preparing, each time they look at a Latin word, to fix it in mind, not as part of a sentence but as a separate item to be carried in the mind long enough to be related to the vocabulary at the back of the book. The investigations of the results of instruction in French show that in this case pupils approach more nearly to the type of reading which they exhibit in dealing with the vernacular.

Experimental analyses of the habits of pupils in handwriting show that when pupils first begin to write, their movements are without rhythm and their co-ordinations are undeveloped. Their muscles are tense and diffusion of nervous impulses throughout the whole body results in contractions of muscles which are in no wise involved in the writing of a mature individual. It has been possible to arrange a series of training exercises which develop in pupils proper habits of fluent movement much more economically than was possible under old systems of training.

Analyses of the learning processes in all branches of mathematics are very difficult because there are very few external manifestations of behaviour accompanying the mental steps involved in solving a mathematical problem. In spite of the difficulties, some progress has Ecen made in this field. Especially has it been possible to deal with the simplest phases of number experience. The rate of counting has been measured under different conditions. It has been found, for example, that counting a series of sounds is more fluent and accurate than is the counting of a series of flashes of light. Counting a series of tactile experiences is very uncertain. These and similar facts show the complete dependence of number experiences on training. The reason why sounds are easier to count than are other forms of sensory experience is that sounds are far more often associated in a child's experience with number names than are the other forms of sensation. The more elaborate processes of arithmetical manipulation have been analyzed by securing from learners descriptions of their methods of solving problems. Adequate laboratory experiments have not been devised for the analysis of the processes of reasoning such as those which appear when a verbal problem is attacked. Passing from arithmetic to the higher branches of mathematics, it is possible to give a fairly complete account of the way in which pupils acquire notions of space and to discover the mental processes which are involved in the study of geometry. Here again the higher processes of reasoning are too complex to be readily investigated.

Classification of Errors.—A prodactive method of study which has been employed in all fields is that of recording and classifying the errors which pupils make. **A** mistake made by a pupil is revealing because it supplies a contrast through which investigators can gain much information about normal processes, and also because it throws light on the effectiveness or ineffectiveness of school methods. A number of contributions to educational literature have concerned themselves with cataloguing the typical mistakes made by pupils in different subjects and with the discovery through trial of so-called remedial measures by means of which errors may be corrected or avoided. **A** wide variety of causes of mistakes have been discovered. Defective vision or hearing may cause mistakes. Emotional disturbances are fruitful causes of distraction. Distractions of many different kinds interfere with the progress of the learning process. When the causes of mistakes can be definitely located, it is possible ta adjust instruction to the needs of pupils much more specifically than when all mistakes are classified as belonging together in a vague, general way and when teachers think of them as purely negative facts.

FIRST RESULTS

New methods of teaching that have been developed through these tests and analyses have been extensively employed since about 1900. Confidence in conventional school practices has been so weakened that the demand has been emphasized for new forms of teaching. These demands for new adjustments of school practices have been powerfully reinforced by the fact that modern civilization has created a series of new intellectual demands. While formerly there were only three learned professions, to-day industry has its engineers and commerce has its professional experts. In short, the modem world is calling for higher types of training in fields which formerly were not thought of as especially affected by school training. It has followed naturally that the system of education has found itself confronted with the necessity of extensive reconstruction of the school curriculum. Since about 1918 the interest of teachers and school administrators has been largely centred on curriculum problems. A number of the leading school systems and practically all the educational associations of the country have organized committees on curriculum revision. Various techniques have been employed in the studies of the curriculum. One of these consists in a tabulation of all of the forms of knowledge used in common life; another, in the analysis of the mature sciences in order to discover the fundamental lines of thought to which one should be introduced if he is to be intelligent about modern issues. Thus, it is asked, what are the economists and sociologists discussing in their mature sciences? Having found the answer to this question, one may, it is held, undertake to rewrite the text-books used in the schools. **A** third technique consists in a so-called "job analysis" of various trades and practical activities of life. The phrase "job analysis" has been extended to cover such general matters as the activities of women who have charge of homes and the professional activities of doctors and lawyers as well as the manual skills of tradesmen and mechanics. **A** job analysis having been made, the second step in curriculum construction is to discover the methods of intellectual adaptation which are necessary to the successful mastery of the demands of the job.

It is significant that curriculum reconstruction is engaging the attention not only of the directors of the lower schools but of the institutions of higher learning and of the professional schools. National commissions are engaged in making elaborate studies of the curriculums of engineering schools and schools of medicine.

The types of scientific work which have been described have at times been combined in what are known as school surveys. **A** survey is an examination, by means of the most exact methods available, of the conditions which obtain in any given school system. In many cases the survey originates in dissatisfaction with existing local conditions. The citizens of a community, for example, are doubtful whether the efficiency of their schools has improved at a pace commensurate with the mounting costs; they accordingly invite an expert or a group of experts to test their system of education. Surveys of schools have been common since about 1912. There is a great volume of published material reporting surveys of State systems of education and of smaller units of school organization down to the single school.

Agencies.—In its beginnings the science of education was hardly more than a series of practical applications of psychology or at most a special branch of that science. A few psychologists devoted themselves to the cultivation of the new science, School administrators and classroom teachers were at first very little concerned with it. 'They were absorbed in the routine duties of con-

ducting school. The first great impetus to the new science was given by Clark university and Teachers' college of Columbia university. The first was organized in 1887 and the second was reconstructed and made effective at a somewhat later period. These two institutions graduated groups of students who have since been leaders in the development of the science of education. Not only so, but they set an example which has been extensively imitated until there are very few institutions of higher learning which do not have at least one representative of this science on the faculty, and in many instances instruction and research in education are organized in a separate school or college.

While the higher institutions are thus providing centres for research and instruction, school systems are beginning to feel the influence of the developing science. Gradually the organization of the leading school systems of the country have been enlarged so as to include what is known as a division of tests and research or a bureau of efficiency. A recent report indicated that (1927) there are 200 or more such scientific agencies within public school systems. In many cases the heads of these scientific divisions of the school system rank as assistant superintendents.

A highly effective agency for the support of scientific work in education is the Bureau of Research of the National Education Association. The example of the National Teachers Association in conducting scientific studies has been imitated by a number of State educational associations. The teaching profession has thus taken an active part in the development of educational science. Another central agency for the collection and interpretation of scientific information is the U.S. bureau of education of the Department of the Interior. This bureau has long been occupied in the colfection of statistics regarding the schools of the country. Congress has enlarged its resources and it is now the leading public agency for the conduct of surveys and one of the most important centres for the collection of information and for the conduct of scientific studies.

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(C. H. J.)

IV. EDUCATIONAL EXPERIMENTS

Educational experiments in England and Wales are usually suggested by the needs of the moment. (For America see "Educational Experiments in the U.S.") Those who conduct them do so to overcome a recognized difficulty or to achieve a better way of teaching. In one department, that of intelligence testing (see EXAMINATIONS), research experiments are tried and it is here that, in the strict sense of the term, experiment takes place. The importance of this subject led to its being referred to the consultative committee of the Board of Education which issued a report on it in 1924. Their findings were not conclusive, but they recognized the importance of these tests.

Central Schools.—Of experiment in a wider sense there is a great deal. The Board of Education itself has encouraged an experiment on a very large scale in urging local education authorities and school managers to set up central schools, to which boys and girls in elementary schools are transferred at or about the age of 11 for a course of study specially designed to cover the years up to 15 and even 16, selection being either by age alone, or through examination. The establishment of central schools has been proceeding for some years but wili henceforward be part of the reorganization of schools recommended by the Consultative Committee of the Board of Education in their report on the Education of the Adolescent (1926). The main position taken in the report is that the primary age ends or should end at 11, with a fair equipment in the tools of learning; and that all teaching beyond that age should be post-primary in character.

Where the central or modern schools are of the selective type, provision must be made for the scholars over the age of 11 who are not transferred to them or to a secondary school. The schools (the report calls them senior schools) that are being established for this purpose offer an interesting and important field for experiment which has hitherto hardly been touched.

Experiments in *Infant* Schools.—Apart from organization, one of the mcst striking waves of experiment has taken place in infants' schools and classes. Where formerly the three R's in a dull form were the staple of instruction, modified by some artificial exercises denominated "Kindergarten," the school now tries to cultivate speech besides reading and leading "up to reading," activity instead of immobility, self-help instead of formal instruction. This new orientation in fact preceded the spread of Montessori doctrines, but it was strongly reinforced by them (see MONTESSORI SYSTEM), even where they were not accepted in full. The infants' school and class become now more of a social agency and a centre of education than a centre merely of instruction. (See also NURSERY SCHOOLS.)

School Experiments.— Another movement has grown quietly without the support of a great name, but spreading by its own reasonableness. This is the "ruralizing" of many schools, not only in the country but also in many towns. When this goes no further than nature study, it is a recognition that school lessons should be related to the child's surroundings. But gardening is very popular and a school often includes bee-keeping and even poultry-keeping. The Welsh Department of the Board of Education have stimulated the extension of the idea that rural lore, including history, antiquities, architecture, folk-song and speech, should be cultivated in country schools. Connected with this trend is the tendency to localize the geography teaching on the one hand, by studying closely the geography of the town, village or region, and on the other to supplement the local study by school journeys. School journeys are not for all, since their management requires very special organizing and personal care. In small numbers they preceded the Boy Scout movement (see BOY SCOUTS), but the proved practicability of school journeys reinforced the camping idea of the Scouts, and camps grew in popularity. One annual camp under the patronage and the personal attention of the Duke of York, combining boys from the public schools and boys brought up in elementary schools, is a noteworthy example of an attempt to create a sympathy between classes brought up very differently. Both secondary and primary schools have organized school journeys and school camps in other countries. The great extension of self-government (*see* above) in elementary schools and the movement for providing playing fields for elementary pupils has had a most profound effect on the character and physique of the younger generation. Within the school itself the holding of school exhibitions and open days for parents are forging a valuable link between home and school.

Handicraft Work.—The progress of instruction in handicrafts is on the whole slow, for this form of instruction is apt to be expensive. But the idea that handicraft for girls, as well as for boys, is an essential element in education has undoubtedly grown. Handicraft for boys means usually work in wood and metal; and for girls besides needle work and cookery, laundry work, housecraft and the simpler beginnings of crafts like weaving, basketry, embroidery, lace making and pottery.

Cinema, Gramophone and Radio.—These are past the stage of experiment. Schools are considering and trying experiments in new fields with results which are not yet firmly established, experiments with the gramophone, the radio and the cinema. The gramophone has practically won its way to a position of limited but decided usefulness. It becomes more and more used for music, and the introduction by its means of a wide variety of good music into the schools means an increase of music and the appreciation of it as a liberal factor in education. It is also used in the teaching of languages. Radio reception is on its trial (see BROADCASTING); every day at fixed hours in the afternoon lectures and talks are broadcast from the various studios and schools, and the teachers are asked to co-operate by giving the children who listen appropriate revision and appropriate exercises, talks on literature, history, simple science, especially natural history which in this way may gain a larger place in children's education, and,

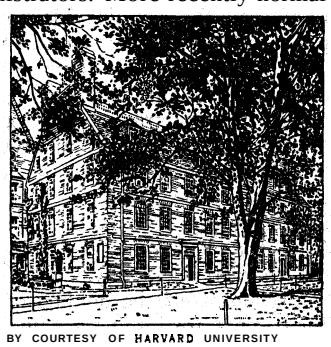
of course, music. The value of the cinema is still the subject of educational thought. It appears as yet—with some notable exceptions—to be of use (where it can be used) specially as a recreative aid or as giving a pictorial impression of matter, the mass of which has been communicated by word of mouth or reading.

The Dalton System.—Mention must be made of experiments in teaching such as the Dalton plan with its system of independent work and assignment. In a few schools this is followed very thoroughly: in more, adaptations of it are made to meet special conditions, in part of a school, or in some subjects only. The experiments so far have hardly been crucial enough for a final verdict to be passed. The plan was started originally in secondary schools, but it has also been adopted experimentally in a few elementary schools. In the Howard plan the Dalton system of individual work and assignment is combined with the temporary dropping, generally for a term, of some subject or subjects in order to allow of an intensive study of others. The direct method of teaching foreign languages is another example of a movement which has passed the stage of experimentation in one sense. Its principle is fairly well accepted; but it is carried out not always in its purist form but modified to suit the circumstances of pupils. At the Perse School, Cambridge, it is used for Latin and Greek but it has not found much favour among classical teachers.

(H. WA.; T. P. N.)

UNITED STATES

In America experimentation has become a normal function not only of individual schools and colleges but of whole systems of education. The experimental movement has coincided with the rapid quantitative expansion of educational facilities which has marked the first part of the 20th century. The movement owes its impetus primarily to the university schools devoted to the scientific study of education which prepare for professional service an ever-increasing number of school administrators. More recently normal schools and teachers' colleges, philanthropic foundations and special research bureaux maintained in connection with State and city systems have likewise made important contributions to the movement. Not only have these latter agencies extended the range and variety of experiments, but they have also done much to inoculate the whole teaching profession with the experimental point of view.



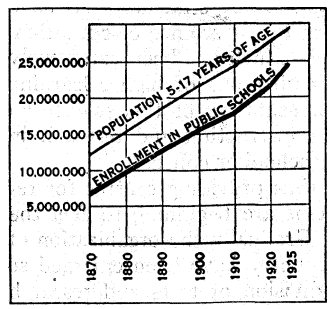
BY COURTESY OF HARVARD UNIVERSITY

MASSACHUSETTS HALL. BUILT 1718. OLDEST BUILDING IN HARVARD YARD Erected as a dormitory 82 years after the founding of the college, this building accommodates 39 men. During the Revolution it was used as a barracks

The most significant educational experiments may be classified for convenience as (1) experiments based on psychological investigations, (2) experiments dealing with the reconstruction of the curriculum and (3) experiments bearing on the reorganization of the educational system.

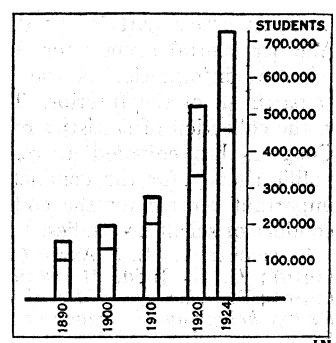
Experiments Based on Psychological Investigations, Educational psychologists have been concerned with developing two kinds of measures: measures of native capacity and measures of intellectual achievement. Since the World War the measures of native capacity, the so-called intelligence tests (*q.v., see* also EXAMINATIONS), have come into general use in schools of all grades. They have been steadily refined and improved, but are still regarded as in the experimental stage. In the classification of pupils and their selection for special treatment, in comparing the progress of different groups of children, and in a wide variety of studies of the educational process, the tests find constant application. They have been adopted by many colleges as part of the matriculation machinery.

The effort to invent objective measures of achievement in school subjects has produced a series of new devices called scales or standard tests. These are designed to estimate the results of the work done in the schools more reliably than is possible by means of the conventional examination. By the correlation of the scales and standard tests with the age of the pupils, tentative norms of achievement at different stages of school life are being established. Scales or standard tests and intelligencetests are now being used in conjunction, with a view to determining the respective rates of progress of children of different mental endowments. Scales and tests of proved reliability are already available in most of the school subjects.



GRAPH SHOWING PUPILS ENROLLED IN ELEMENTARY AND SECONDARY PUBLIC SCHOOLS OF THE UNITED STATES

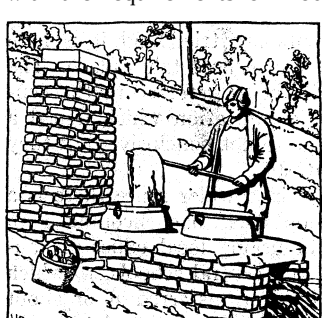
The whole testing movement has led teachers and administrators to appreciate more fully the essential importance of adapting school procedures to individual differences. Thus in spite of the great growth in the school population, devices for individualizing instruction are becoming more numerous and more effective. The defective or subnormal child (*see* MENTAL DEFICIENCY) was the first to receive special attention. More recently, however, the realization has grown that the gifted child suffers quite as much from subjection to an inflexible régime designed for the mediocre and that society suffers still more from a training process that hampers the full development of the superior individual. Hence a variety of experiments are in progress throughout the United States which have as their object the identification and the appropriate education of the gifted pupil. In these experiments colleges and universities are beginning to participate through the establishment of so-calledhonours courses and through devices for segregating and stimulating the superior student.



GRAPH SHOWING ENROLLMENT IN UNIVERSITIES. COLLEGES, AND PROFESSIONAL SCHOOLS OF THE UNITED STATES 1890–1924

The lower division of each column represents the number of men students: the upper, the number of women

Experiments in the Reconstruction of the Curriculum.—For some years the conviction has been gathering momentum that the curricula of schools at all levels are not only out of harmony with the requirements of modern life, but that they are also at variance with the laws of mental growth and of learning which the psychologists have been discovering. Modern living conditions have transferred to the schools a multiplicity of tasks previously performed by other agencies. The social aims of education have also become more prominent at the same time that the necessity of recognizing the idiosyncrasies of the individual has been revealed. The problem of reconstructing the curriculum is now the central problem of American education. It is being attacked in hundreds of schools. Certain experiments have seemed promising enough to be widely imitated, with some local modification. One of these is the Dalton plan and another is the platoon or work-study-play plan. Under the latter plan, half the children are in classrooms while the other half are at work or at play in school shops, laboratories, studios, on the playground or in the auditorium. Decreased classroom space and greatly increased facili-

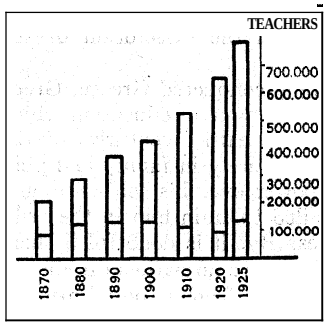


BY COURTESY OF TALLULAH FALLS INDUSTRIAL SCHOOL

DYEING WITH COLOURS PRODUCED FROM TREE-LICHENS. HICKORY LEAVES OR RUSTY WIRE. AT AN INDUSTRIAL SCHOOL IN GEORGIA

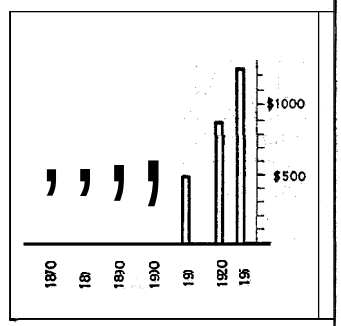
ties for work and play are features of the physical plants of schools that operate on this plan. The school day is lengthened and the school becomes responsible for the child during the major part of his waking hours.

Cutting across schemes like those just mentioned, which involve complete reorganization of the school is the project method. This method focuses instruction around typical problems actually encountered in life outside the school. In the course of solving these problems, or working out the projects, principles are discovered and learned. The topical organization of instruction largely disappears. The pupils actively seek the solution of the problem wherever the search may lead, even outside the confines of the school. Experiments with the project method are numerous. Some schools have applied it in a few subjects, some in practically all subjects. Instruction in vocational subjects is now largely dominated by some form of the project method. The system of co-operative part-time instruction, first developed in the engineering school of the University of Cincinnati and now followed in many other engineering schools and industrial schools, is founded on the same underlying concept.



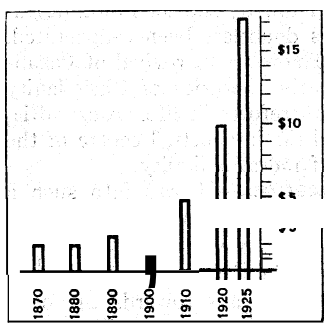
GRAPH SHOWING NUMBER OF TEACHERS IN ELEMENTARY AND SECONDARY PUBLIC SCHOOLS OF THE UNITED STATES
The lower division of each column represents the number of men; the upper, the number of women

Experiments in the reconstruction of the curriculum are not confined to schools or school systems that are committed to some new departure in method or in organization. In many institutions where the older type of school regimen has not been radically changed, the curriculum is being experimentally revised by the introduction of new material, the elimination of old material and the alteration of the order of presentation.



GRAPH SHOWING AVERAGE SALARY OF TEACHERS IN ELEMENTARY AND SECONDARY PUBLIC SCHOOLS OF THE UNITED STATES

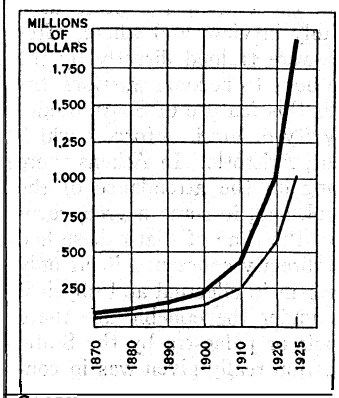
Numerous private schools have sprung up which are frankly experimental. These have come to be known as progressive schools. For the greater part they have been inspired by the educational philosophy of John Dewey. They have been quick to take up and test under the most favourable conditions any methods, materials or plans of organization that muster substantial scientific support. Devices that have proved successful in the progressive schools constantly find their way into the more conservative public institutions.



GRAPH SHOWING EXPENDITURE PER CAPUT FOR PUBLIC EDUCATION IN THE UNITED STATES 1870–1925

Experiments in Reorganizing the Educational System. —The typical organization of the American system consisting of an eight-year elementary school, a four-year high school and a four-year college, with entrance upon professional study coming either at the end or in the middle of the college course, has long been criticized. The several institutional units are the product of diverse influences, mostly foreign. The welding of them into a system was largely accidental. It is generally believed that the period devoted to secondary education is too short, that it should begin earlier and that secondary education should embrace much of the present content of the college curriculum. Educators commonly hold that with a rational organization of the system and with an altered and condensed curriculum, time can be saved and educational results improved.

Two experimental movements looking toward the accomplishment of these reforms are now well under way. One of these involves the reorganization of the elementary and secondary schools and has come to be known as the junior high school movement (*see* SECONDARY EDUCATION). At the other end of the conventional secondary school period another new institution is evolving, the junior college. The typical junior college offers the first two years of the usual college course, with certain modifications dictated by its local environment. There are (1928) more than 300 independent junior colleges in the United States; the majority are private institutions but a large minority are attached to city school systems. Whether the junior college as a separate institution is a transitory phenomenon it is too early to say. Its appearance has had one noteworthy effect upon universities, however. It has led a considerable number of them to divide their colleges of liberal arts into junior and senior colleges and to organize the programme of instruction so that the end of the junior college period marks the completion of general education of a secondary character and the beginning of university specialization. This tendency, together with the multiplication of junior colleges as upward extensions of public school systems, seems to point to the ultimate assimilation of the work of the first two years of the American college of liberal arts into the scheme of secondary education.



GRAPH SHOWING TOTAL EXPENDITURE FOR PUBLIC EDUCATION IN THE UNITED STATES 1870–1925
The shortest line shows the amount spent for salaries of teachers, supervisors and principals

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HISTORY

Ancient Greece.—In ancient Greece the supremacy of the State was generally unquestioned, and, especially in the earlier times, the good man was identified with the good citizen. The highest life was one of cultured leisure in which the energies were mainly concentrated on the pursuit of knowledge for its own sake. But this life was only for the select few; for the undistinguished many the fulfilment by each of the duties of his station remained the measure of worthy life. For those, therefore, who devoted their lives to the highest culture, the essential preliminary condition was the existence of such a State as would form the most favourable environment for their leisured life. Thus Greek thought was saturated with the conception of life as essentially a set of relations between the individual and the city State of which he formed an integral part. The first aim of education was, therefore, to train the young citizens. (For the evolution of the school from early times, see SCHOOLS.)

Each State, however, had its special character, and to this character the education given in it must conform if it were to be an effective instrument for training the citizens. From these fundamental conceptions flowed the demands of Plato and Aristotle that education should be regulated in all its details by the State authority, should be compulsory on all free citizens, and should be uniform—at any rate in its earlier stages—for all. In the Republic and the *Laws*, Plato shows to what extreme lengths theory may go when it neglects to take account of some of the

most pertinent facts of life. For the guardian-citizens of the ideal State, family life and family ties are abolished. Aristotle, indeed, did not go to these extreme lengths; he allowed the family to remain, but he seems to have regarded it as likely to affect children more for evil than for good. Neither philosopher, however, was at variance with the accepted Greek theory on the subject, although the actual practice of Greek States departed, and often widely, from this ideal, for, especially in later centuries, the Greek always tended to live his own Life. The nearest approach to the theory was found in Sparta, where the end of the State as a military organization was kept steadily in view, and where, after early childhood, the young citizens were trained directly by the State in a kind of barrack life — the boys to become warriors, the girls the mothers of warriors. It was this feature of Spartan education, together with the rude simplicity of life it enforced, which attracted Plato, and, to a less extent, Aristotle. In Athens there had of old been State laws insisting on the attendance of the children of the free citizens at school, and, in some degree, regulating the schools themselves. But at the time of Plato these had fallen into desuetude, and the State directly concerned itself only with the training of the ephebi (*q.v.*) in intellectual and physical pursuits. For children and youths under the ephebic age there was no practical regulation of schools or palaestra by the State. Yet there is no doubt that the education really given was in conformity with Athenian ideals of culture and life, and that it was generally received by the children of free citizens, though of course the sons of the wealthy, then as now, could and did continue their attendance at school to a later age than their poorer brethren. The education of girls was essentially a domestic training. What Plato and Aristotle, with the theorist's love of official systematic regulation, regarded as the greatest defect of Athenian education was in reality its strongest point. In practice, the harmony between individual liberty and social claims was much more nearly attained under a system of free working out of common thoughts and ideals than would have been the case under one of the irresistible imposition from without of a rigid mould.

The instruments of education everywhere found to be in harmony with the Greek conception of life and culture were essentially twofold — "music" (μουσική), or literary and artistic culture, for the mind, and systematic gymnastic (γυμναστική) for the body. Plato, in the Republic, shows that the latter, as well as the former, affects the character, and doubtless, though not formulated, this was generally more or less vaguely felt. But Greek gymnastic was really an individual training, and therefore made only indirectly for the aim of cultivating the social bonds of citizenship. The "musical" training was essentially in the national literature and music of Greece, and this could obviously be carried to very different lengths. The essential purpose throughout was the development of the character of a loyal citizen of Athens. As Athenian culture advanced, increasing attention was paid to intellectual studies, especially in the ephebic age, with a corresponding decrease of attention to merely physical pursuits; hence the complaints of such satirists as Aristophanes of a growing luxury, effeminacy and corruption of youths; complaints apparently based on a comparison of the worst features of the actual present with an idealized and imaginative picture of the virtues of the past. But a disintegrating force was already at wark in the educational system of Greece which Plato and Aristotle vainly opposed; this was the rhetorical training of the Sophists. In a democratic city State the orator easily became a demagogue, and oratory was the readiest path to influence and power. Thus oratory opened the way to personal ambition, and young men who were moved by that passion eagerly attended the Sophist schools where their dominant motive was strengthened.

Further, the closer relations between the Greek States, both in nearer and farther Hellas, led naturally to the diminution of differences between civic ideals, and, as a consequence, to a more cosmopolitan conception of higher education, This process was completed by the loss of political independence of the city States under the Macedonian domination. Henceforth, higher education became purely intellectual, and its relation to political and social life increasingly remote. The University of Athens was the outcome of a fusion of the private philosophical schools with the State organization for the training of the ephebi, and there were other such centres of higher culture, especially in after years at Alexandria, where the contact of Greek thought with the religions and philosophies of Egypt and the East gave birth in time to the more or less mystical philosophies which culminated in Neo-platonism. But at Athens itself education became more and more a mere training in unreal rhetoric, till the dissolution of the university by Justinian (A.D. 529).

Ancient Rome. — Thus when Rome conquered 'Greece, Greek education with which it came in contact was an education which had largely lost its life-springs. In the earlier centuries of the republic, Roman education was given entirely in family and public life. The father had unlimited power over his son's life, and was open to public censure if he failed to train him in the ordinary moral, civic and religious duties. But it is doubtful if there were any schools, and it is certain there was no national literature to furnish an instrument of culture. A Roman boy learnt to reverence the gods, to read, to bear himself well in manly exercises, and to know enough of the laws of his country to regulate his conduct. This last he acquired directly by hearing his father decide the cases of his clients every morning in his hall. The rules of courtesy he learnt similarly by accompanying his father to the social gatherings to which he was invited. Thus early Roman education was essentially practical, civic and moral, but its intellectual outlook was extremely narrow.

When a wider culture was imported from Greece, the instrument of education first introduced was Greek literature, much of which was soon translated into Latin. In time the schools of the *grammatici,* teaching grammar and literature, were supplemented by schools of rhetoric and philosophy, though the philosophy taught in them was itself little more than rhetorical declamation. These furnished the means of higher culture for those youths who did not study at Alexandria or Athens, and were also preparatory to studies at those universities. Under the empire the rhetorical schools were gradually organized into a State system. This widening of culture affected both boys and girls, the domestic education of the latter being supplemented by a study of literature. But it is the higher training in rhetoric which is especially characteristic of Hellenized Roman education.

The conception of a rhetorical culture is seen at its best in Quintilian's *Institutio oratoria,* the most systematic treatise on education produced by the ancient world. With Quintilian the ideal of an orator was a widely cultured, wise and honourable man. And at first the teaching of rhetoric undoubtedly made for higher and true culture. But with the autocracy, soon passing into tyranny, of the empire, rhetoric ceased to be a preparation for real life. Nor was there anything in the general conditions of society to counterbalance the ill effects of such an unreal education. Quintilian lamented that, even in his time, the old Roman family education by example was corrupted; and the moral degradation of later times, though it has doubtless been exaggerated, was certainly real and widespread. The religious revival of Pagan ism which synchronized with the early centuries of Christianity does not appear to have effected any reform in life. Alexandria, the birthplace of Neo-platonism and the intellectual centre of the later empire, was also a very sink of moral obliquity.

Christianity and Pagan Education. — It was into such a decaying civilization that Christianity brought new life. Of course, careful instruction in the Faith was given in catechetical schools, of which that at Alexandria was the most famous. But the question as to the attitude of Christians towards the ordinary classical culture became of growing importance. The Greek Fathers,' especially Clement of Alexandria (150–217) and Origen (185–253), regarded Christianity as essentially the culmination of philosophy, to which the way must be found through liberal culture. Without a liberal education the Christian could live a life of faith and obedience but could not attain an intellectual understanding of the mysteries of the Faith. On the other hand, Tertullian (160–240) was very suspicious of Pagan culture; though he granted the necessity of employing it as a means of education, yet he did so with regret. Many of the cultivated

Christians of the 3rd and 4th centuries were little more than nominal adherents to the Faith, and the intercourse between Christian and Pagan was often close and friendly. The general attitude of Christians towards the traditional education is evidenced by the protest raised against the edict of Julian, which forbade them to teach in the public schools, The ultimate outcome seems to be fairly expressed in the writings of St. Augustine (354–430) and St. Jerome (346–420), who held that literary and rhetorical culture is good so long as it is kept subservient to the Christian life.

In another way Greek philosophy exercised a formative influence over the culture of future ages, in the case of the Eastern Church through Neoplatonism, the last effort of Paganism to attain a conception of life and of God. In the West, this formulation had to be translated into Latin, for Greek was no longer generally understood in Italy, and thus the juristic trend of Roman thought also became a factor in the exposition of Christian doctrine. This formulation of the Faith was one of the chief legacies the transition centuries passed on to the middle ages. Had classical culture been less formal than it was during the early centuries of Christianity, the innate antagonism of the Pagan and Christian views of life and character must have been so apparent that the education which prepared for the one could not have been accepted by the other. Thus the Pagan ideal of life, especially as it had been developed in the individualistic ethics which had prevailed for more than six centuries was antithetical in essence to that of the Christian Church. The former was essentially an ethics of self-reliance and self-control showing itself in moderation and proportion in all expressions of life. An essential feature in such a character was high-mindedness and a self-respect which was of the nature of pride. On the contrary, Christian teaching exalted humility as one of the highest virtues, and regarded pride and self-confidence as the deadliest of sins. The highest state attainable by man was absorption in loving ecstasy in the mystic contemplation of God. The practical attempt to realize this gave rise to monasticism, with its minutely reguiated life expressing unlimited obedience and the renunciation of private will at every moment. The monastic life was regarded as the nearest approach to the ideal which a Christian could make on earth. Naturally, as this conception gathered strength in generations nurtured in it, the value of classical culture became less and less apparent, and by the time of St. Gregory the Great (d. 604) the use of classical literature as a means of education was discouraged.

Of course, during these centuries, the gradual subjugation of the western empire by the barbarians had been powerfully operative in the obscuring of culture. Most of the public schools disappeared, and such light of learning as was kept burning in the monasteries was mainly confined to monks and novices. Though the barbarians absorbed the old culture in various degrees of imperfection, yet the four centuries following the death of St. Augustine were plunged in intellectual darkness, relieved by transitory gleams of light in Britain and by a mote enduring flame in Ireland. The utmost that could be done was to preserve to some extent the heritage of the past. This, indeed, was essentially the work of men like Boethius, Cassiodorus, Isidore and Bede.

Modification of Latin — During these same centuries another process had been advancing with accelerating steps. This was the modification of the Latin language. Thus, with Christian writers, slavish imitation of the past gradually gave way to the evolution of a new and living Latin, which showed itself more and more regardless of classical models. This Christian Latin was a real living instrument of expression, which conformed closely in its structure to the mode of thought and expression of actual life. It is the Latin in which St. Jerome wrote the Vulgate. But with the obscuring of culture during the barbarian invasions this current Latin became more and more oblivious of even such elements of form as grammatical inflexions and concords.

It was to the reformation of this corrupt Latin by a return to classical models, and to the more general spread of culture, especially among clergy and nobles, that the Carolingian revival addressed itself. The movement, essentially practical and conservative, was directed by Alcuin (735–804), who was Charlemagne's educational adviser and chief executive officer in scholastic matters. Its most valuable outcome was the establishment of the palace school, and of bishops' schools and monastic schools throughout the empire. Thus, the educational system north of the Alps was pre-eminently ecclesiastical in its organization and profoundly religious in its aims. For two centuries the new intellectual life was obscured by the troubled times which followed the death of Charlemagne, but the learning which the Carolingian revival had restored was preserved here and there in cathedral and monastic schools, and the sequence of well-educated ecclesiastics was never altogether interrupted.

Mediaeval Curriculum.—The scope of that learning was cbmprised within the seven liberal arts and philosophy, on the secular side, together with some dogmatic instruction in the doctrines of the Church, the early Fathers, and the Scriptures. Theology was as yet not organized into a philosophical system: that was the great work the middle ages had to perform. The seven liberal arts (divided into the *Trivium*—grammar, dialectic, rhetoric; and the more advanced Qzcadrivium—geometry, arithmetic, music, astronomy) were a legacy from old Roman education through the transition centuries. They appear in the *Disciplinarum libri IX.* of Varro in the 2nd century B.C. But they reached the middle ages chiefly through the summaries of writers in the transition centuries, of which the best known were the De *nuptiis Philologiae* et *Mercurii* of the Neoplatonist Martianus Capella, who wrote probably early in the 5th century; The *De artibus* ac *disciplinis liberalium litterarum* of the Christian Cassiodorus (*c.* 490–*c.* 585); and the *Etymologiarum libri XX* of St. Isidore of Seville (570–636).

The scope of the arts was wider than their names would suggest in modern times. Under grammar was included the study of the content and form of literature; and in practice the teaching varied from a liberal literary culture to a dry and perfunctory study of just enough grammar to give some facility in the use of Latin. Dialectic was mainly formal logic. Rhetoric covered the study of law, as well as composition in prose and verse. Geometry was rather what is now understood by geography and natural history, together With the medicinal properties of plants. Arithmetic, with the cumbrous Roman notation, included little more than the simplest practical calculations required in ordinary life and the computation of the calendar. Music embraced the rules of' the plain-song of the Church, some theory of sound and the connection of harmony and numbers. Astronomy dealt with the courses of the heavenly bodies, and was seldom kept free from astrology. In philosophy the current text-books were the *De* consolatione *philosophiae* of Boethius (470–524), an eclectic summary of pagan ethics, and the same writer's adapted translations of the Categories and *De interpretatione* of Aristotle and of Porphyry's *Introduction* to *the* Categories.

Scholastic Revival.—In the 11th century Europe had settled down, after centuries of war and invasion, into a condition of comparative political stability, ecclesiastical discipline and social tranquillity: the barbarians had been converted, and civic life had developed in the fortified towns of Italy, raised as defences against the pressure of Saracen and Hungarian invasions. Soon. communication with the East by trade and in the crusades, and with the highly cultivated Moors in Spain, further stimulated the new burst of intellectual life. Arabic renderings of some of the works of Aristotle and commentaries on them were translated into Latin and exercised a profound influence on the trend of culture. A new translation of Aristotle's Metaphysics appeared in 1167, and by the beginning of the 13th century all his physical, metaphysical and ethical treatises were available, and during the next half century the translations from Arabic and other Semitic versions were superseded by renderings direct from the original Greek. It was only when the real Aristotle was known that it was found possible to bring the Peripatetic philosophy into the service of theology. There were thus two broad stages in the educational revival commonly known as scholasticism. In the first the controversies were essentially metaphysicsl, and centred

round the question of the nature of universals; the orthodox theological party generally supporting realism, or the doctrine that the universal is the true reality, of which particulars and individuals are only appearances; while the opposite doctrine of nominalism—that universals are "mere sounds" and particulars the only true existences—showed a continual disposition to lapse into heresies on the most fundamental doctrines of the Church. The second stage was essentially constructive; the opposition of philosophy to theology was negated, and philosophy gave a systematic form to theology itself. The most characteristic figure of the former period was Abelard (1079–1142), of the latter St. Thomas Aquinas (1225–74). The former knew little of Aristotle beyond the translations and adaptations of Boethius, but he was essentially a dialectician who applied his logic to investigating the fundamental doctrines of the Church and bringing everything to the bar of reason. This innate rationalism appeared to bring theology under the sway of philosophy, and led to frequent condemnations of his doctrines as heretical. With St. Thomas, on the other hand, the essential dogmas of Christianity must be unquestioned. In his *Summa theologiae* he presents all the doctrines of the Church systematized in a mould derived from the Aristotelian philosophy.

It is evident, then, that during the period of the scholastic revival, men's interests were specially occupied with questions concerning the spiritual and the unseen, and that the great instrument of thought was syllogistic logic, by which consequences were deduced from premises received as unquestionably true. There was a general acceptance of the authority of the Church in matters of belief and conduct, and of that of Aristotle, as approved by the Church, in all that related to knowledge of this world.

Before the rediscovery of Aristotle exerted such a general influence on the form of education, there was a real revival of classical literary culture at Chartres and a few other schools, and John of Salisbury (d. 1182) in his *Metalogicus* advocated literature as an instrument of education and lamented the barrenness of a training confined to the subtleties of formal logic. But the recrudescence of Aristotle accelerated the movement in favour of dialectic, though at the same time it furnished topics on which logic could be exercised which only a bare materialism can esteem unimportant. The weaknesses of the general educational system which grew up within scholasticism were that haste to begin dialectic led to an undue curtailment of previous liberal culture, and that exclusive attention to philosophical and theological questions caused a neglect of the study of the physical world and a disregard of the critical functions of the intellect. Doubtless there were exceptions, of which perhaps the most striking is the work in physical science done at Oxford by Roger Bacon (1214–94). But Albertus Magnus (1193–1280), the master of St. Thomas, was also a student of nature and an authority for his day on both the natural and the physical sciences. And the work of Grosseteste (d. 1253), as chancellor of the University of Oxford, shows that care for a liberal literary culture was by no means unknown. Probably the most striking instance of the stunting effect of this premature specialization may be found in the fact that the encyclopaedias of general information which were in general use during the middle ages show little or no advance in positive knowledge upon the treatment of similar subjects in Isidore of Seville.

Foundation of Universities.—The services of scholasticism to the cause of education, however, cannot well be overestimated, and the content of scholastic studies was in fundamental harmony with the intellectual interests of the time. Above all other benefits owed by future ages to scholasticism is the foundation of the universities of western Europe. (See SCHOOLS and UNIVERSITIES.)

The concentration of higher instruction in universities was not antagonistic to the mediaeval conception of the Church as the teacher of mankind. University life was modelled on that of the cloister, though the monastic ideal could not be fully realized, and the scholars not infrequently exhibited considerable licence in life. This was inevitable with the very large numbers of the scholars and the great variations of age among them. Moreover, students. and to a less extent teachers, passed from university to university, so that the universities of mediaeval Europe formed a free confederacy of learning in close relation to the Church but untrammelled by State control. Nevertheless, the introduction of studies derived from the Greeks through the Arabians led to an increased freedom of thought, at first within authorized limits, but prepared, when occasion served, to transcend those limits. The scheme of instruction was arranged on the assumption that special studies should be based on a wide general culture. Thus of the four faculties into which university teaching was organized, that of arts, with its degrees of Baccalaureus and *Magister,* was regarded as preliminary to those of theology, law and medicine. It often included, indeed, quite young boys, for the distinction between grammar school and university was not clearly drawn. Little or no attempt was made to extend the bounds of knowledge: the aim was to pass on a body of acquired knowledge regarded as embracing all that was possible of attainment, and the authority of Aristotle in physics as well as in philosophy, and of Galen and Hippocrates in medicine was absolute. The methods of instruction—by lecture, or commentary on received texts; and by disputation, in which the scholars acquired dexterity in the use of the knowledge they had absorbed—were in harmony with this conception, and were undoubtedly thoroughly well suited to the requirements of an age in which the ideal of human thought was not discovery but order, and in which knowledge was regarded as a set of established propositions, the work of reason being to harmonize these propositions in subordination to the authoritative doctrines of the Church.

Such an extension of the means of higher education as was given by the universities was naturally accompanied by a corresponding increase in schools of lower rank. Not only were there grammar schools at cathedral and collegiate churches, but many others were founded in connection with chantries, and by some of the many gilds into which mediaeval middle-class life organized itself. In addition to the grammar schools were writing and song schools of an elementary type, in which instruction was usually in the vernacular. Girls were taught in women's monasteries and in the home, and those of the upper classes, at least, very generally learned to read, write and keep accounts, as well as fine needlework, household duties and management, and such elementary surgery and medicine as served in cases of slight daily accidents and illnesses. Even those boys and girls who did not receive formal scholastic instruction were instructed orally by the parish priests in the doctrines and duties of the Faith; while the pictures and statues with which the churches were adorned aided the direct teaching of sermons and catechizing in giving a general knowledge of Bible history and of the legends of the saints.

No doubt, in times of spiritual and intellectual lethargy, the practice fell short of the theory; but on the whole it may be concluded that in mediaeval times the provision for higher instruction was adequate to the demand, and that, relatively to the culture of the time, the mass of the people were by no means sunk in brutish ignorance. Indeed, especially when the paucity of books before the invention of printing is borne in mind, the number of people who could read the vernacular, as evidenced by the demand for books in the vulgar tongue as soon as printing made them available, is clear proof that the latter part of the middle ages was by no means a time of general illiteracy.

Feudalism, the other characteristic aspect of mediaeval society, had also its system of education, expressing its own view of life, and preparing for the adequate performance of its duties. This was the training in chivalry given to pages and squires in the halls and castles of the great. This training was not in opposition to the spirit of religion which animated the scholastic education which went on side by side with it. Throughout chivalry was sanctified by the offices of the Church. The education of chivalry aimed at fitting the noble youth to be a worthy knight, a just and wise master, and a prudent manager of an estate. Much was acquired by daily experience of a knightly household, but in addition the page received direct instruction in reading and writing; courtly amusements, such as chess and playing the lute, singing and making verses; the rules and usages of courtesy; and the knightly conception of duty. As a squire he practised more assiduously the knightly exercises of war and peace, and in the man-

agement of large or small bodies of men he attained the capacity of command.

With the unification of existing knowledge and the systematization of theology the constructive work of scholasticism was done. At the same time the growth of national feeling was slowly but surely undermining feudalism. Moreover, deep resentment was accumulating throughout western Europe against the practical abuses which had become prevalent in the Church, and especially in the court of Rome and in the prince-bishoprics of Germany. In such conditions, the customary and traditional education of school and university tended to lose touch more and more completely with the new aspirations and views of life. Had a new cultural movement not begun, the education of Europe threatened to become as arid as the rhetorical education of the last centuries of the Roman empire had been. From this it was saved by the renaissance of classical studies which began in the 14th century.

The Renaissance. — Ever since the 11th century the cities of northern Italy had been in advance of Europe beyond the Alps both in culture and in material progress. The old classical spirit and the feeling of Roman citizenship had never quite died out, and the *Divina Commedia* of Dante (1265–1321) furnishes evidence that the poet of the scholastic philosophical theology was also a keen student and lover of the old Latin poets. But the greatest impulse to the revived study of the classics was given by Petrarch (1304–74) and Boccaccio (1313–75). Generally throughout western Europe the 14th century, though full of war and political unrest, was a time of considerable intellectual activity, shown in the increase of schools and universities. as well as in the literary and artistic revival in Italy, in the social and theological movement in England and Bohemia associated with the names of Wycliffe and Huss, and in the more or less complete substitution of Roman law everywhere except in England for the law of custom which had hitherto prevailed.

But it was the literary movement which most affected education, and, indeed, the whole life of Europe. A decisive step was taken when Manuel Chrysoloras was invited to teach Greek in the University of Florence in 1397. The enthusiasm for classical culture, to which Petrarch had given so great an impetus, gathered force and extended over the whole of Italy, though, of course, felt only by a select few and leaving the mass of the people little, if at all, affected. From Italy it spread gradually to countries north of the Alps. In the old writers men found full expression of that new spirit of self-conscious freedom which was vaguely striving for expression throughout the whole of Christendam. In the free political atmosphere of the Italian communes, with their wealthy and leisured merchant class, that spirit could flourish much more readily than in the feudalized Europe across the Alps. Moreover, the antique spirit was in direct line of ancestry with that of mediaeval Italy. Thus, for a couple of centuries, Italy stood in the van of European culture.

It is the spirit of the new movement which is of interest to the student of education. And that spirit was essentially one of opposition to authority and of assertion of individual liberty, which worked itself out in various forms among peoples of different temperaments. In Italy the form was literary and artistic, and the full development of the Renaissance spirit was seen in a practical Paganism which substituted the attractions of art for the claims of religion and morality, and eventuated in deep and widespread immorality and a contemptuous tolerance of the outward observances of religion without faith in the doctrines they symbolized. The most valuable service of the Italian humanists to Europe was the restoration to man of the heritage of knowledge which he had allowed to slip from his grasp, and the leading the way to a freer intellectual atmosphere. In Germany the spirit manifested itself in a rebellion against the doctrinal system of the Church as the only effectual means of attaining reform of ecclesiastical abuses. The Protestant Reformation of Luther was the real German outcome of the Renaissance. In no other country of Europe did the movement take so distinctive a form.

The revival of interest in classical studies was, therefore, only a first step. These newly discovered literatures responded to the intellectual and moral cravings which had been blindly gathering force for generations, as they encountered in them the pagan view of life with its assumption of the essential worth and self-reliance of the individual and its frank delight in all the pleasures of existence. It was in just this Pagan view of individual worth and the supremacy of the human intellect, that the Church gradually realized the supreme danger to herself.

At first the revival of interest in the classical literatures did not show any antagonism to Catholic faith and practice, and its warmest supporters were faithful sons of the Church. The view of the relation of classical literature to Christianity adopted by the great humanist schoolmaster, Vittorino da Feltre (1378–1446), was broadly that of the early Fathers, and in his school at Mantua he showed that culture was not inconsistent with loyalty to the Church or with purity of life. With him classical literature was not the end and sum of education, but was a means of implanting ideas, of developing taste and of acquiring knowledge, all as helps and ornaments of a Christian life. The school at Mantua may, indeed, be said to have exhibited in practice a Christianized application of the doctrines of Quintilian and Plutarch.

So was it in the other countries of Christendom. In the Netherlands the Brethren of the Common Life introduced humanistic studies into their schools side by side with definite religious teaching and observances and their work was always dominated by the Christian spirit. The earlier German humanists, such as Nicholas de Cusa, Hegius, Agricola and Wimpheling, adopted the same attitude, and Erasmus himself, bitterly as he attacked the practical abuses of the Church, remained in communion with it, and aimed at harmonizing classical culture with the Christian life. In England the same love of culture combined with devotion to the Church was seen in Selling, prior of Christ Church, Canterbury, the first real English humanist; in Grocyn, Linacre, More, Fisher, Colet and many others whose enthusiasm for culture was as undoubted as was their loyalty to Catholicism. It seemed, then, at first as if the greatest educational effect of the classical revival would be the deepening of literary culture, and the substitution of real enquiry for dialectic subtleties in the courses of schools and universities, without any break with established religious teaching. It is true that the majority of schools were but little affected, and many of the universities had given but a half-hearted welcome to humanistic studies when the religious revolt in Germany under the leadership of Luther threw the whole of Europe into two hostile camps. But even the conservative University of Paris — the headquarters of scholastic philosophical theology — had permitted the teaching of Greek as early as 1458, and both Oxford and Cambridge had welcomed the new studies.

The Reformation. — The immediate effect of the religious controversies of the 16th century on education was disastrous. The secularization of ecclesiastical property too often absorbed the endowments of the schools, so that, both in Germany and in England, the majority of grammar schools either disappeared or continued a starved existence with diminished funds; the doctrine of salvation by faith alone and the futility of good works dried up the source from which such endowments had flowed; the violent fulminations of the German reformers against the universities as the homes of the hated scholastic theology and philosophy led to wholesale abstention from those seats of learning; while the theological speculations and quarrels led those few who did resort to the universities to devote their energies to interminable wrangling over controversial points. This decadence in culture was attended by an outbreak of licence and immorality, especially among the young, which called forth violent denunciations from Luther and many of his followers in Germany, and from Latimer and other reformers in England. Humanism and Protestantism, which had so far diverged that Erasmus (1467–1536) had declared that where Lutheranism flourished learning decayed, were brought together again by Melanchthon (1497–1560), under whose influence universities were founded or reorganized and schools re-established in Protestant German States; and in England the reign of Elizabeth saw the creation of a certain number of new

foundations, But this restoration of the means of education was only partial, and the doctrine of the worthlessness of "carnal knowledge," which led the Barebones Parliament to propose the suppression of the English universities, was held by many fervent Protestants both in England and in Germany all through the 17th century.

Moreover, the schools continued to ignore the new directions of men's thoughts and the new view of knowledge as something to be enlarged, and not merely a deposit to be handed down from generation to generation. The later humanist theories of education, which the schools continued to follow generally for over two centuries, and in many cases for another hundred years after that, were drawn mainly from Erasmus and Melanchthon, who found in the classical languages and literatures, and especially in Latin, the only essential instruments of education. General knowledge of natural facts might be desirable to the cultured man as ornaments to his rhetoric, but it was to be sought in the writings of antiquity. Even so revolutionary a thinker on education as Rabelais (1495–1553) with all his demand for an encyclopaedic curriculum, held the writings of the ancients as authoritative on natural phenomena. Nelanchthon exercised enormous influence, both directly and through such disciples as Trotzendorf and Neander, but especially through his friend Sturm (1507–89), whose Latin gymnasium at Strasbourg became the model which the grammar schools of Protestant Europe strove to imitate. In this school nearly the whole of the energies of the boys was given to acquiring a mastery of the Latin language after the model of Cicero.

In Catholic countries the Church retained control of education. The practical reformation of abuses by the Council of Trent, and the energy and skill of the Society of Jesus, founded by St. Ignatius Loyola, in 1534, brought back most of south Germany into the fold of the Church. Everywhere Catholic universities were mainly taught by Jesuit fathers; and under their influence, scholasticism, purged from the excretions which had degraded it, was restored. Everywhere the society established schools, which, by their success in teaching and the mildness of their discipline, attracted thousands of pupils who came even from Protestant homes. Their curriculum was purely classical, but it was elaborated with much skill, and the methods of instruction and discipline were made the subject of much thought and of long-continued experiment. All Jesuit fathers being trained, the teachers in Jesuit schools attained a degree of skill in their art which was too generally wanting elsewhere.

Decadence of **Schools** and ***Universities.***—Mulcaster (1530–1611) pointed out that Latin was not of value to the majority of boys. For them he urged an elementary education in the vernacular; but neither in this nor in his advocacy of the training of teachers was his advice followed. In the 17th century the dislocation between the Latin schools and the needs of life began to be accentuated as Latin gradually ceased to be the language of learning; and, as a consequence, the numbers attending the schools decreased, and the mass of the people sunk continually lower in ignorance. In vain Hoole urged the establishment of a universal system of elementary schools giving instruction in the vernacular, Petty put forth his plan for elementary trade schools, and Cowley proposed the establishment of a college devoted to research. Ideas of reform were in the air, but the main current of scholastic practice flowed on unaffected by them. Some attention was, indeed, paid to the conservative reforms advocated by the Port Royalists, of which the most important was the inclusion of the vernacular as a branch of instruction, but the cry for more fundamental changes based on the philosophy of Bacon was unheeded. Of these, none was a more active propagandist than Comenius (1592–1670). Unfortunately his Great Didactic, in which he set forth his general principles, attracted little attention and won less adherence, though his school books, in which he attempted with very little success to apply his principles, were widely used in schools. But these were little more than bald summaries of real and supposed facts, stated in Latin and the vernacular in parallel columns. In content they differed from such mediaeval summaries of knowledge as the well-known work of Bartholomew Anglicus, which had been widely used since the 13th century, chiefly by their greater baldness and aridity of statement.

In the universities, too, the 16th and 17th centuries saw a continuous decadence. The 16th century was not ripe for real intellectual freedom; and Protestantism, having based its revolt on the right of private judgment, soon produced a number of conflicting theological systems, vying with each other in rigidity and narrowness, which, as Paulsen says, "nearly stifled the intellectual life of the German people." Further, the idea of national autonomy, which exercised so great an effect on the politics of the time, included the universal adherence of the citizens to the religion of the State. Hence, till the end of the 17th century the universities of Protestant Europe were regarded mainly as instruments for securing adhesion to the national theological system on the part of future clergy and officials, and the State interfered more and more with their organization and work. In Paris, on the other hand, the faculty of theology had decayed through the withdrawal of those preparing for the priesthood into episcopal seminaries, and the higher studies pursued were mainly law and medicine. Thus, generally, the universities were less and less fulfilling the function of providing a general liberal education. Another change, due to the same causes and making for the same results, was the isolation of universities, often directly fostered by the State governments, which for the universal interchange of mediaeval thought substituted a narrow provincial culture and outlook.

Indeed, from the middle of the 17th century, the main current of intellectual life had drifted away from the orthodox centres of learning. The formation of the Berlin Academy in Germany and of the Royal Society in England, and the refusal of Leibnitz to accept a chair in any German university, were signs of the times. In France, and later in Germany, the education of the noble youth was increasingly carried on apart from the schools, and was really an outgrowth from the education of chivalry. In the 16th century Castiglione and Montaigne had advocated a training directly adapted to prepare for active public life, and Elyot wrote on similar lines. But the most important movement in this direction was the formation of the courtly academies which flourished in France in the 17th century, and were soon imitated in the *Ritterakademien* of Germany. In these schools of the nobility French was more honoured than classics, and the other subjects were chosen as directly adapted to prepare for the life of a noble at the court or in camp. Milton in his *Tractate* advocated the foundation of such academies in England. More and more, too, foreign travel had, from the middle of the 16th century, been looked upon as a better mode of finishing the education of a gentleman than a course at a university.

Revival of University Life.—The later years of the 17th century saw a revival of university life in Cambridge, through the work of Newton and the increasing attention paid to mathematics and the physical sciences, though the number of students continued very small. In Germany, also, a new era opened with the foundation of the Universities of Halle (*q.v.*) in 1694 and Gottingen in 1737, which from the first discarded the old conception that the function of a university is tb pass on knowledge already complete, and so opened the door of the German universities to the new culture and philosophy. It was soon seen that students Could thus be attracted, and the influence spread to the other German universities, which by the end of the 18th century had regained their position as homes of the highest German thought.

At Halle, too, was set the example by Francke of providing for the education of the children of the poor, and to his disciple. Hecker, Germany owes the first *Realschule.* Simultaneous movements for the education of the poor were made by St. Jean-Baptiste de la Salle and the Brothers of the Christian Schools in France, and by the Society for the Promotion of Christian Knowledge in England. Mention should also be made of the Sunday School movement started by Robert Raikes in 1780. But the total results were not great; the mass of the people in every European country remained without schooling throughout the 18th century.

Education in the **18th** Century. — The intellectual movements of that century were, indeed, essentially aristocratic. Voltaire and the Encyclopaedists aimed at the enlightenment of the select few, and Rousseau declared baldly that the poor need no education. That these movements influenced education profoundly is undoubted. The individualistic and abstract rationalism of Voltaire, derived from the sensationist philosophy of Locke through the more thoroughgoing Condillac, and finding its logical outcome in the materialistic atheism of La Mettrie and the refined selfishness of Rochefoucault, infected the more cultured classes. In Lord Chesterfield's *Letters* to *his* Son is shown its educational outcome — a veneer of superficial culture and artificial politeness covering, but not hiding, the most cold-blooded selfishness. Against this fashionable artificiality, as well as against the obvious social and political abuses of the time, Rousseau's call for a return to nature was a needed protest.

Rousseauism, however, was not merely a transitory revolt against a conventionality of life that had become unbearable; it was emphatically the voicing of a view of life and of education which has profoundly influenced Europe ever since. In that Rousseau (1712–78) attempted to look at life as a whole, he was on truer ground than were the intellectualists of the "Enlightenment," especially in his advocacy of the hitherto ignored claims In education of feeling and emotion. His *Émile* may be, in spite of certain crudities, not unfairly described as the charter of childhood. It is, in fact, a declarztion of childhood's rights. On the other hand, his overinsistence on the efficacy of nature, as shown by his theory that man is born good, and if left to his own instincts cannot fail to achieve happiness, is obviously one-sided.

Against this position the educational teaching of Kant (1724–1804), influenced though he was by the *Émile*, is essentially a protest. The most necessary element in education, according to Kant, is constraint, which by the formation of habit prepares the young to receive as principles of conduct the laws at first imposed upon them from without. And the supreme guide of life is the law of duty which is always more or less opposed to the promptings of inclination. The French Revolution — the natural outcome of the teachings of Voltaire and of Rousseau — was the second stage in the movement of which the Reformation was the first. It was essentially the assertion of the natural rights of man, and, as a logical sequence, of the right of every child to be properly trained for life. The gradual recognition of this truth, with the necessary corollary of the establishment of a national system of education, is emphatically the characteristic mark of the educational history of all countries in the 19th century.

The 19th Century. — Preached and practised by Pestalozzi (1746–1827) in Switzerland, the general education of the poor was first made a reality by Prussia after the crushing defeat of Jena. In France and England it remained for nearly three-quarters of the century the work of the Church and other voluntary agencies, though aided by the State. Finally a State system of schools was more or less fully set up in every State of western Europe and in America, and subjected to more or less State regulation and control. Equally marked was the growing care for the education of girls as well as boys, though only in America were the two regarded as practically identical in form and content.

Thus the 19th century saw the final working out of the idea that the State should be substituted for the Church as the official agent of education. Among the principal causes of such a change, was the growing conviction that with the ever-widening distribution of political power, the State has a right to demand a minimum of knowledge from every citizen, while, on the other hand, it is alike to the benefit of the individual and the State that the door of educational opportunity should be thrown as wide open as possible. Equally potent was the idea which had its roots in the Renaissance conception of the right of man to direct his life apart from theological determinations. The more direct outcome of the same idea was apparent in the absolute liberty with which the presuppositions of knowledge were questioned, and the maxim of Descartes — to prove everything by the reason and to accept nothing which fails to stand the test — was acted upon. No greater contrast is possible than that between the mediaeval student and the modern searcher after truth.

The influence of the same spirit has wrought an equally momentous change in the methods of instruction. The impetus given by the doctrine of Rousseau to the view that the nature of the child should determine the means of education, led to more thoroughgoing attempts than had hitherto been made to base educational method on a knowledge of child psychology. Pestalozzi and Froebel (1782–1852), by their insistence on the need of educating a child through his own activity, and by their widespread influence, made the new view of method an actuality. The influence of Rousseau has, thus, passed into modern educational practice in a form that, in its essence, is true, though in practice it has shown itself apt to run into the same excess of emphasis on impulse and feeling which characterizes his teaching. The influence of Herbart (1776–1841) tended to counteract this. The essence of Herbartianism was that mental life consists of presentations, or reactions of the mind on the environment, and that will springs from the circle of thought thus developed. The emphasis was therefore placed on intellect and instruction, while in Froebelianism it was placed on spontaneous activity and on the arrangement of the environment. Each exaggerated the function of the one factor in concrete experience which it made the centre of interest, and each was tinged with the individualistic conception of life which characterized the 18th and early 19th century. (See also ACADEMIES; CLASSICS; CO-EDUCATION; EXAMINATIONS; POLYTECHNIC; SCHOOLS; TECHNICAL EDUCATION; UNIVERSITIES, etc.)

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(X.; C. BR.)

NATIONAL SYSTEMS

ENGLAND

Elementary Education. — It was the development of industry and the social unrest at the end of the 18th century, following on the French Revolution, which combined to bring home to the public mind the need of a national system of day schools. Unfortunately, just at this moment the revival of Nonconformity as the result of the religious vitality of the Evangelical movement shattered the religious peace of the early Hanoverian period and divided the nation once more into hostile camps, to which class distinctions lent additional bitterness. The famous controversy between Andrew Bell and Joseph Lancaster and their respective followers in the opening years of the 19th century served to define the religious difficulty substantially in the form in which it existed for over 100 years. Both these remarkable men conceived independently the idea of a national system of popular education upon a voluntary basis. The controversy between them, begun upon personal grounds, resolved itself into a national contest of rival principles of religious teaching. Lancaster as a young Quaker schoolmaster, confronted with pupils drawn from various religious bodies, planned his religious instruction upon the lines of doctrine common to all the orthodox Christian denominations. Thus he is the father of the undenominational religious teaching which later formed the basis of the Cowper-Temple compromise. But whereas the Cowper-Temple clause is purely negative in form and so seems to point to an undogmatic religion, the Lancastrian teaching was essentially positive and dogmatic within its limits. The Church as a whole refused to co-operate in religious teaching upon the basis of a common Christianity, and joined issue with Lancaster and his Whig and Nonconformist following not merely upon the question of the exclusion of dogmatic formularies, but also upon the question of the control of whatever religious teaching should be given. In fact the vital question at this period was whether the clergy of the Established Church were to control the national education. The religious issue was prominent in connection with the remarkable attempt at legislation made by the Whig statesman Whitbread in his Parochial Schools bill of 1807. It was rejected by the Lords, mainly on

the ground that it did not place education on a religious basis or sufficiently secure control to the minister of the parish.

Early Voluntary Schools.—The failure of the liberal proposals of Whitbread, and the strength of the Dissenting opposition to any settlement on purely Church lines (such as that advocated by Bell in 1808 for establishing schools under the control of the parochial clergy), rendered recourse to voluntary effort inevitable. In 1808 the Royal Lancasterian Society was formed to carry on the work of Lancaster, the name being afterwards changed to the British and Foreign School Society. In the following year the National Society for promoting the education of the poor in the principles of the Established Church throughout England and Wales was formed, with Bell as its superintendent. In voluntary effort on a grand scale the Church easily outdistanced her opponents, and in 1831 the National Society was able to show that there were in all over 13,000 schools in connection with the Church, of which 6,470 were both day and Sunday schools, having a total attendance of 409,000.

The rapid development of the voluntary school system was no doubt greatly facilitated by the monitorial plan of teaching, upon which Bell and Lancaster equally relied. This plan never rested upon any educational theory; it was simply a rough-and-ready expedient for overcoming the practical difficulty caused by the dearth of competent teachers. Historically it is important as the precursor of the pupil-teacher system which so long formed the exclusive basis of the English elementary system.

Meantime, Brougham, in 1816, procured the appointment of a general commission of enquiry into endowed charities. The labours of this great inquisition lasted for 20 years and led to the reformation of many cases of abuse or waste of wealthy endowments, and eventually to the establishment of the Charity Commission in 1853. In 1820 Brougham introduced a bill which proposed to require teachers to be members of the Church of England and to be appointed upon a certificate from the parochial clergyman, and on the other hand to prohibit religious formularies and to confine religious instruction to Bible reading without comment. The bill naturally failed through the opposition of the dissenters, and served only to accentuate the religious impasse.

Establishment of State Aid.—In 1832 the Whig Government placed on the estimates a sum of £20,000 for public education, thus initiating the system of the annual grant voted by parliament. The funds thus granted were to be confined to the erection of school buildings, and to be administered only through the National and the British and Foreign School societies. In 1839 Lord Melbourne's Government, by means of an order in council, established a Committee of Council on education, and the sum voted by parliament was increased to £39,000. The original intention of the Government was to establish a State normal school or training college as the foundation of a national system of education. Unfortunately this design had to be abandoned in view of the religious difficulty, with the result that the training of elementary teachers was left in private hands. In view of the limited resources placed at their disposal by parliament, the Committee of Council were at first compelled to confine their assistance to capital grants in aid of the provision of school buildings, but in the distribution of the money three important conditions were at once imposed. In the first place, the continuing right of inspection was required in all cases; secondly, promoters were obliged to conform to a fixed standard of structural efficiency; thirdly, the building must be settled upon trusts permanently securing it to the education of poor children.

By the minute of Aug. 10, 1840, the Committee of Council concluded what came to be known as the concordat with the Church. Under this minute no appointment was to be made of any persons to inspect schools in connection with the Church of England without the concurrence of the archbishop of the province, and. what seems still more extraordinary to modern ideas, any such appointment was to be revoked should the archbishop at any time withdraw his concurrence. The altered financial relations, however, between the State and the voluntary managers brought about by the institution of maintenance grants soon rendered this concordat obsolete,

Among the first acts of the Committee of Council was the promulgation of a set of model trust deeds. The necessary conditions were the permanent appropriation of the site to purposes of education, and the permanent right of Government inspection; a conscience clause was not obligatory, and indeed was only offered in the limited form of exemption from instruction in formularies and attendance at Sunday school or public worship. Special facilities for the conveyance of land for school purposes were afforded to limited owners by the School Sites Acts of 1841 and subsequent years. The landed gentry responded with great public spirit to the call thus made upon their generosity by the State, with the result that the vast majority of rural, and many urban, parishes were freely endowed with sites for elementary schools.

The Grammar Schools Act of 1840, which was passed to deal with the case of the decayed "grammar" (*i.e.*, classical) schools which abounded throughout the country, belongs to the history of elementary rather than secondary education. As a result of this act a considerable number of ancient endowments were reorganized so as to afford an improved elementary instead of an inefficient classical education, and the schemes made under the act constituted an early, but not very successful, experiment in the direction of higher elementary schools.

In 1843 the Committee of Council decided to make grants in aid of the erection of normal schools or training colleges in connection with the National Society and the British and Foreign School societies, thus marking the definite abandonment of the system of relying on voluntary effort for the provision of training colleges.

In 1846 an important step forwards was taken in the foundation of the pupil-teacher system. The regulations of this year inaugurated annual maintenance grants in the form of stipends for apprenticed pupil-teachers'receiving a prescribed course of instruction under the head teacher, and a lower grade of stipendiary monitors in schools where such instruction could not be provided. These regulations inaugurated the system of Queen's scholarships to assist pupil-teachers to proceed to a training college; they also established capitation grants for the support of such colleges, and annual grants to elementary schools under Government inspection of from £1 j to £30 in aid of the salary of every trained teacher employed. Provision was at the same time made for retiring pensions to elementary teachers.

To facilitate the recognition of denominational schools other than Church of England, the Committee of Council in 1847 issued a minute dispensing schools not connected with the Established Church from enquiries concerning their religious condition, and in the same year State aid was extended to Wesleyan and Roman Catholic schools. Jewish schools received recognition in 1851 upon condition that the Scriptures of the Old Testament should be daily read in them.

During the middle years of the century various unsuccessful legislative attempts were made to establish a national system of elementary schools upon the basis of rate-aid. The only one of these attempts which calls for notice here is the bill introduced by Lord John Russell (called the Borough bill, on account of its being restricted to municipal boroughs) in 18 j3, and forming part of a comprehensive scheme of legislative and administrative reform of which a portion was actually carried into effect. The bill as a measure for elementary education was supplemented by an administrative system of capitation grants for rural areas. The Government scheme also comprised a measure dealing with the administration of charitable trusts (which took shape as the Charitable Trusts Act 1853), the constitution of the Department of Science and Art, and university reform upon the lines recommended by the Oxford and Cambridge commissions.

The failure of the Borough bill did not affect the new system of capitation grants which was introduced by minute of the Committee of Council dated April 2, 1853. These grants were fixed at a scale varying from 3s. to 6s. per head, payable upon certain conditions, of which the most important were that the school must be under a certificated teacher, and that three-fourths of the children must pass a prescribed examination. The capitation grant was, by minute of Jan. *26,* 1856, extended to urban areas. As in

the case of all the early grants, the regulations governing the distribution of the capitation grants were framed upon the principle that subventions of public money must be met by local funds derived from voluntary contributions, endowments and school fees; thus the basis of the denominational system as fostered by the State at this stage was one of financial partnership.

In 1856 a purely administrative bill was passed, establishing the office of vice-president of the Committee of Council on education as a minister responsible to parliament. At the same time, the Science and Art department was transferred from the Board of Trade to the Committee of Council.

The Newcastle *Commission.*—The progress of State-aided education during this period may be measured by the increase of the annual parliamentary grant, which rose from £30,000 in 1839 to £100.000 in 1846, £150,000 in 1851, £396,000 in 1855, and £663,-400 in 1858. This expansion was viewed with misgiving by the friends of the denominational system, and by the strong individualist school of that day, who upon wider grounds clung to the old ideal of voluntary initiative. These sections combined with the advocates of further State intervention to press for a commission of enquiry, and a royal commission was appointed in 1858, under the chairmanship of the duke of Newcastle, to inquire into the state of popular education in England, and to consider and report what measures, if any, were required for the extension of sound and cheap elementary instruction to all classes of the people. The Report of the Newcastle commission, issued in 1861, contains an exhaustive account of the existing condition of elementary education, and, with due allowance for the grave defects revealed, and in particular the glaring inefficiency of the numerous little private-venture schools kept by "dames" and others, the graphic picture drawn by the commissioners constitutes a striking tribute to the sterling qualities of self-help and religious earnestness which were so characteristic of the early Victorian period. It was found that in round numbers about 2,500,000 children were attending day schools, the proportion to population being one in seven, as compared with one in nine in France, one in eight in Holland and one in six in Prussia, where education was compulsory. On the other hand, of this number only 1,675,000 were in public schools of all kinds, only 1,100,000 in schools liable to inspection, and 917,000 in schools receiving annual grant. The result was that only one child in every 20 was attending a school whose efficiency could be in any way guaranteed by the State. The commissioners as a body rejected free and compulsory education in view of the religious difficulty and upon general grounds of individualistic principle. In view of the solution adopted in 1902 it is of interest to note that the Newcastle commissioners deliberately rejected the parish as unfit to be taken as the unit of elementary education upon the ground that management by parochial ratepayers must tend to be illiberal and niggardly, and recommended the constitution of county boards with power to levy a rate for the aid of existing voluntary schools.

The one definite achievement of the Newcastle commission was the famous system of payment by results. Impressed by the defects of the existing teaching, the commissioners reported that there was only one way of securing efficiency, and that was to institute a searching examination by competent authority of every child in every school to which grants were to be paid, with the view of ascertaining whether the indispensable elements of knowledge were thoroughy acquired, and to make the prospects and position of the teacher dependent to a considerable extent upon the results of this examination. They recognized that to raise the character of the children, both morally and intellectually, was and must always be the highest aim of education; but they thought that the training in the rudiments of education, which must be the foundation of all teaching, had been lost sight of, and that there was justice in the common complaint that while a fourth of the scholars were really taught, three-fourths after leaving school forgot everything they had learnt there.

Lowe (Lord Sherbrooke), as vice-president of the Committee of Council (1859–64), adopted the system of payment by results in what became famous in history as the Revised Code, issued in 1862. The Revised Code provided for the payment of a grant of 4s. upon the old principle and a further grant of not more than 8s. upon the result of examination. Lowe declared of the system in the House of Commons that "if it was costly it should at least be efficient; and if it was inefficient it should at least be cheap." In fact, it proved to be cheap; the grant fell from £813,-400 in 1861 to £636,800 in 1865. Later, to meet objections, some modifications were introduced in the code under the Conservative Government in 1867. The system of paying grant upon the result of individual examination of the scholars was not finally abolished till 1904.

The Act of 1870 *and Its Effects.*—In 1868 the Conservative Government brought in, but did not proceed with, an education bill deliberately discarding the principle of rate-aid on the ground that it would destroy voluntary contributions and gradually starve out the denominational schools. In 1867 and again in 1868, Bruce (afterwards Lord Aberdare), W. E. Forster and Algernon Egerton introduced a bill which formed the basis of the measure of 1870. As redrafted in 1868 the bill of Bruce and his coadjutors proposed a universal system of municipal and parochial rating with liberty for voluntary schools to unite themselves to the rate-aided system under their existing management, subject to the acceptance of a conscience clause. The bill also proposed to empower town councils to co-opt outsiders upon their education committees. Thus both in the principle of co-optation and in the extension of rate-aid to schools not under public control the bill of these Liberal statesmen in 1868 anticipated certain features of Balfour's Education Act of 1902. In the meantime, in the country the Education League, originated at Birmingham, was carrying on a propaganda in favour of free secular schools, whilst the Education Union, formed to counteract the influence of the league, urged a settlement upon the old lines. As a concession to the popular feeling against secularism, the league proposed to allow Bible reading without doctrinal exposition. Thus opinion was sufficiently focussed to enable Gladstone's administration in 1870 to undertake a comprehensive measure of educational reform.

The Elementary Education Act of 1870 bore in every respect the marks of compromise. As Forster explained in introducing the bill, the object of the Government was "to complete the voluntary system and to fill up gaps," not to supplant it. To this end the Education Department was charged with the duty of ascertaining whether or not there was in every parish a deficiency of public school accommodation, and of making provision for the formation of school boards in every school district (*i.e.*, parish or municipal borough) requiring further public school accommodation. The definition of public elementary school contained in section 7 of the act is still in force (1928). Shortly, a public elementary school is a school subject to a conscience clause entitling scholars to complete exemption from all religious instruction and observance whatsoever. Any religious instruction or observance in the school must be either at the beginning or the end of the school meeting. The school must also be open at all times to the Government inspectors, and must be conducted in accordance with the prescribed conditions in order to obtain an annual parliamentary grant. In the same connection an important change was made in the conditions of inspection by declaring that it should be no part of the duties of the inspector to inquire into religious instruction, whilst a later section of the act provided that no parliamentary grant should be made in respect of any religious instruction.

Three important changes were made in the measure during its passage through parliament: (1) In lieu of the rate-aid as first suggested, the Government proposed an increased grant from the Treasury, that is to say, the voluntary schools were left standing as State-aided schools under private management, side by side with the new rate-supported schools. (2) The character of the religious instruction in the board schools was determined upon an undenominational basis by a provision which has become known to history after the name of its author, as the Cowper-Temple clause (section 14 of the act), directing that "no religious catechism or religious formulary which is distinctive of any particular denomination shall be taught in the school." The clause was not intended to exclude doctrinal exposition, and was in fact a com-

promise not merely between absolute secularism and denominationalism, but between denominationalism and the view of those who would have the Bible read without note or comment. The Apostles' Creed as a symbol common to all denominations of Christians was held by Forster (at Gladstone's suggestion) not to be excluded under the Cowper-Temple clause. The result was the establishment in the schools, upon the lines laid down by Joseph Lancaster at the beginning of the 19th century, of what may be termed the common Protestantism of the English nation. The Cowper-Temple compromise, notwithstanding its inherent want of logic, stood the test of experience for more than a generation against the consistent denominationalists on the one hand and the party of secular education on the other. (3) The third change in the bill was the substitution of the ad *hoc* school board for the municipally appointed board originally proposed. These boards were elected by the system of cumulative voting under which each elector had as many votes as there were candidates to be elected, with liberty to give all his votes to one candidate or to distribute them amongst the candidates as he thought fit. This system was much criticized as being unduly favourable to minorities, whose representation it was devised to secure; it continued, however, until the act of 1902.

School boards were empowered not only to acquire sites for schools under powers of compulsory purchase, but also to take transfers of existing voluntary schools from their managers. The act of 1870 did not introduce either direct compulsory attendance or free education, but it took a distinct step forward in each direction by enabling school boards to frame by-laws rendering attendance compulsory, and also to pay the school fees in the case of poverty of the parent. Building grants were continued temporarily for the benefit of those who applied (as voluntary managers alone could apply) before Dec. 31, 1870. On the other hand, the Education Department was authorized to refuse parliamentary grants to schools established in school board districts after the passing of the act if they thought such schools were unnecessary.

The following figures are of interest as showing the progress made under the act of 1870. In the year 1870 there was accommodation in inspected day schools for about 2,000,000 ehildren; the average attendance was 1,168,000, and the number on the books about 1,500,000. It was computed, however, that there were, exclusive of the well-to-do classes, at least 1,500,000 children who attended no school at all or schools not under inspection In 1876 accommodation had been provided for nearly 3,500,000, and of the 1,500,000 new places nearly two-thirds were provided by voluntary agencies. "These voluntary agencies," says Sir H. Craik, "had received grants in aid for about one-third of the schools they had built, the grants defraying about one-fifth of the cost of the aided schools." On the other hand, the growth of school boards was rapid and continuous, notwithstanding the permissive character of the act and the strenuous efforts of the voluntaryists to keep pace with the new demands. In 1872, 9,700,000 of the population were under school boards, and of these 8,142,000 were under by-laws; in 1876 the numbers were respectively 12,500,000 and 10,400,000. In the same period the annual grants increased from £894,000 in 1870 to £1,600,000 in 1876. The development evidenced by the above figures, and in particular the fact that 52% of the population were subject to by-laws, enabled Disraeli's Government in 1876 to pass a law introducing universal compulsory attendance, with certain exceptions. In order to complete the machinery for compulsion, the act directed that, in every district where there was no school board, a school attendance committee should be appointed by the local authority.

In 1880 Mundella, as vice-president of the Council in Gladstone's administration, passed a short act which made the framing of by-laws compulsory upon school boards and school attendance committees, thus completing the system of universal direct compulsion. Under the acts of 1876 and 1880 the average attendance increased from 2,000,000 in 1876 to 3,500,000 in 1878 and 4,000,000 in 1881; in terms of percentage to population, 8.06 in 1876, 9.60 in 1878, and 10.69 in 1881. In the last-mentioned year the annual grant rose to £2,200,000, having more than doubled in the decade.

In 1887 a royal commission under the presidency of Viscount Cross was appointed to enquire into the working of the education acts. The labours of this commission produced a thorough discussion of the educational problem in all its aspects. political, administrative, scholastic and religious. For any clear recommendations with regard to the reorganization of education generally the moment was not opportune, inasmuch as the commission just preceded the establishment of the new county authorities and the powers with respect to instruction other than elementary which parliament was shortly to confide to them under the Technical Instruction Acts. Nevertheless the report of the majority of the commissioners pointed unmistakably towards the solutions adopted in the act of 1902, and their definite recommendation that voluntary schools should be accorded rate-aid without the imposition of the Cowper-Temple clause, served as the basis of that legislation.

Of the developments which followed the Cross report, it is convenient to mention in the first place, out of chronological sequence, the practical establishment of free education by the act of 1891, not by the absolute prohibition of school fees but by the device of a special grant payable by parliament in lieu of fees, called the fee grant. The result of this legislation and of subsequent administrative action was to place free education within the reach of every child, fees being retained (with few exceptions) only where some instruction of a higher elementary type was given.

Secondary and Technical Education. — The establishment of county councils by the Local Government Act, 1888, introduced a new factor, destined to exert a determining influence upon subsequent developments of public education. In the first place, it at once rendered possible the partial and experimental provision for higher education attempted by the Technical Instruction Acts, which affected secondary education as well as technical education in the proper sense of the term. In order to understand the state of secondary education at this period, it is necessary to refer to the first attempts made at State intervention (for earlier history, see SCHOOLS).

In 1861 the first step was taken by the appointment of a royal commission, presided over by Lord Clarendon, to enquire into the condition of nine of the chief endowed schools in the country, viz., Eton, Winchester, Westminster, Charterhouse, St. Paul's, Merchant Taylors, Harrow, Rugby and Shrewsbury. The report of this commission led to a statute, the Public Schools Act of 1864, which introduced certain reforms in the administration of seven of these schools, leaving the two great London day schools, St. Paul's and Merchant Taylors, outside its operation.

The Schools Enquiry Commission. — In 1864 the Schools Enquiry Commission was appointed under the presidency of Lord Taunton to enquire into all the schools which had not been included either in the commission of 1861 or the Popular Education Commission of 1858. It thoroughly explored the field of secondary education, discussing all the problems, administrative and pedagogic, which the subject presents, and "its luminous and exhaustive report" (to quote the words of Bryce's commission of 1894) remains the best introduction to the problem of public secondary education in England. The existence of numerous and frequently very wealthy endowments arising from private benefactions and bequests has at all times been a feature in education as in other departments of English social life. At the date of the Schools Enquiry Commission the state of the ancient endowments was largely one of abuse. Very many endowments intended for advanced education were applied for instruction of a purely elementary character, and that of an inferior kind; indeed the possession of an endowment in a rural locality not infrequently operated to prevent the establishment of an efficient State-aided school. The evidence showed that the proportion of scholars in the country grammar-schools who were receiving some tincture of the classical education intended by the founders was steadily decreasing, and nothing had been done to bring the curriculum into harmony with the actual needs of the time. In addition to

the general inelasticity of the curriculum, the special evils from which the grammar-schools suffered were the want of effective governing bodies and the freehold tenure of the headmasterships.

The report of the commission was immediately followed in 1869 by the Endowed Schools Act, which conferred upon a special commission (united in 1874 with the Charity Commission) very wide and drastic powers of reorganizing ancient endowments. A direction for extending the benefits of endowments to girls did much to assist the movement for the secondary education for girls. Thanks to their powers in framing schemes for the reorganization of ancient endowed schools the commissioners found themselves able to treat the majority of cases as undenominational. In such cases the general practice was to direct that instruction should, subject to a strict conscience clause, be given in the principles of the Christian faith; this provision, however, did not exclude special doctrinal instruction.

The Schools Enquiry Commission also submitted proposals for the general organization of a system of secondary education. They recommended the establishment of three authorities — (I) a central authority; (2) a local or provincial authority, representing the county or a group of counties, and (3) a central council of education charged with examination duties. Further, it was proposed to raise the level of proprietary and private schools by offering them inspection and examination and by establishing a system of school registration. Lastly, it was proposed to confer upon towns and parishes powers of rating for the establishment of new schools. For these proposals as a whole the time was not ripe. The bill of 1869 attempted to give effect to the suggested creation of a central council, but exigencies of parliamentary time made it necessary to drop this part of the measure; the result was that the plan of the commissioners was only half carried out. Nevertheless the work accomplished was sufficient to exert a considerable influence upon the secondary education of the country. Thus in 189j Bryce's commission was able to report that schemes under the Endowed Schools Acts had been made for 902 endowments in England, excluding Wales and Monmouth, leaving untouched only 546 endowments out of the total of 1,448 endowments in England known to be subject to the Endowed Schools Acts. The total income of the endowments known to be subject to the Endowed Schools Acts, and therefore available for purposes of secondary education, according to the estimate of the Secondary Education Commission, was in 1895 about £735,000 gross.

The creation by the Local Government Act in 1888 of the representative and popular county authorities rendered the municipalization of secondary instruction at last possible. In 1889 the Technical Instruction Act (extended in some particulars by an act of 1891) empowered the councils of counties, boroughs and urban districts to levy a rate (not exceeding a penny in the pound) for the support or aid of technical or manual instruction. Comparatively few councils were prepared to resort to their rating powers. but progress under these acts mas greatly facilitated by the Local Taxation (Customs and Excise) Act of 1890, which mentioned technical instruction as one of the purposes to which the imperial contribution paid to local authorities in respect of the beer and spirit duties might be applied. (See TECHNICAL EDUCATION.) By virtue of the very liberal interpretation given to technical instruction by these acts the financial assistance afforded under them was extended to cover the whole field of mathematical and physical science, as well as modern languages.

At the same time the Department of Science and Art (founded in 1853) gradually utilized its grants to encourage literary studies in secondary schools as well as the scientific and mathematical subjects to the promotion of which it was primarily directed. Thus the combined effect of the local resources available under the Technical Instruction Act and the imperial grant administered by the department was gradually to develop a national system of secondary education with a marked bias on the side of physical science. But the schools giving higher education still practically consisted, apart from the big public schools, of endowed grammar schools, or proprietary schools established by religious bodies or joint-stock companies. No public body had, as yet, the right to build a secondary school.

An undoubted stimulus was given to secondary education in the great centres of industry during the last quarter of the 19th century by the rise of the new university colleges, among which must be reckoned those established expressly for women. At the same time (1889) a beginning was made of State aid to these colleges, through a committee appointed by the Treasury in a minute of July 1 (see UNIVERSITIES). Meanwhile, with the development of elementary education, the great schdol boards found themselves obliged to provide for the further education of their best pupils in what were known as higher-grade elementary schools. These were really secondary schools of the third grade, and, as the commission on secondary education observed, the school boards simply stepped in to fill the educational void which the Schools Enquiry Commissioners had proposed to fill by schools of that name. Their creation was greatly fostered by the upper departments in such schools being recognized for grants by the Science and Art Department. In fact they continued to multiply and prosper till 1901, when the famous judgment in the test case of Rex v. Cockerton pronounced them to be illegal. It was at once recognized that the legislature must, without delay, step in to secure the educational work which the undoubtedly correct principles of judicial interpretation had placed in jeopardy.

Secondary Education Commission. — Aleanwhile, as far back as 1894, a royal commission had been appointed under the presidency of Bryce to enquire into secondary education. The principal recommendations of the commission were: (1) the unification of the existing central authorities, viz., the Department of Science and Art, the Charity Commission (so far as it dealt with educational endowments), and the Education Department, in one central office, and the establishment of an educational council to advise the minister of education in certain professional matters; (2) the establishment of local authorities, to consist of committees of the county councils with co-opted elements; (3) the formation of a register of teachers with a view to the encouragement of professional training, and a system of school registration upon the basis of inspection and examination. The first of these recommendations was carried out by the Board of Education Act 1899, and under the same act an attempt was made to give some effect to the third-named object, which unfortunately fell short of success. The realization of the second, and the most important, of the recommendations was deferred till 1902, when it was brought about as a part of a wider reorganization of the educational system.

In 1896 an endeavour was made to meet the demands of the voluntary managers of elementary schools by means of a bill introduced by Sir John Gorst. This bill with its provision for a special aid grant to be administered by county education authorities, which were to exist side by side with the school boards, represented a kind of compromise between the systems of 1870 and 1902. It encountered opposition in all quarters and was withdrawn. In 1897, however, the position of the denominational schools was strengthened by the Voluntary Schools Act, which provided for a special aid grant of 5s. per head of the scholars in average attendance in these schools.

Partial effect was given to the recommendations of the Secondary Education Commission by the Board of Education Act of 1899, which united the Department of Science and Art with the Education Department in one central office under the title of the Roard of Education, with a president and parliamentary secretary; and provided for the transfer to this board of the powers of the Charity Commissioners in relation to educational endowments; also for a consultative committee, consisting, as to not less than two-thirds, of persons qualified to represent the views of university and other bodies interested in education, for the purpose (1) of framing a register of qualified teachers, and (2) of advising the Board of Education upon any matters referred to the committee by the board. In 1902, a tripartite division was adopted to correspond with the three branches of education with which the Board of Education is concerned, viz., elementary,

secondary and technological. Mention may also be made here of another uncontroversial measure, the Elementary Education Act of 1899, which dealt for the first time, from the point of view of the State, with mental deficiency (*q.v.*).

Education Act, 1902.—NO law, during the last 50 years, with the exception of the Home Rule controversies, excited a more acute or prolonged controversy than the Education Act of 1902. Yet at this distance of time, when the political and religious passions it provoked have practically disappeared, it appears in its true light as the veritable charter of incorporation of English education, hitherto consisting of disconnected and often discordant elements. In the sphere of elementary education it boldly abolished the school boards and made the one authority for every form of education (below the university), the county or county borough, already the recognized authority for technical and, to a limited extent, for secondary education. By putting voluntary and ordinary elementary schools on the same footing, it practically made the standard of the work in the two identical, and eventually built up an almost complete network of well equipped secondary schools, as well as a vigorous system of technical education. Under the impartial administration of the counties, the religious question practically ceased to exist. The act was extended to London in 1903. For framing and carrying it through, special credit is due to Mr. (afterwards Lord) Balfour a113 Sir R. Morant.

Principal *Provisions* of *the* 1902 Act.—Part I. Local Education Authority. The council of every county and of every county borough is the local education authority for higher and elementary education; for the purpose of elementary education autonomous powers are conferred upon boroughs with a population of over 10,000, and urban districts with a population of over 20,000.

Part II. Higher Education. "The L.E A. (local education authority) shall consider the educational needs of their area and take such steps as seem to them desirable, after consultation with the Board of Education, to supply or aid the supply of education other than elementary, and to promote the general co-ordination of all forms of education." The usual conscience clause in schools, colleges or hostels provided by the council is modified by a provision for facilities for any particular religious instruction to be given at the request of parents of scholars.

Part III. Elementary Education. (1) Powers and duties. The L.E.A. are responsible for and have the control of all secular instruction in public elementary schools not provided by them.

(2) Management of schools. (a) For public elementary schools, such number as they may determine. For schools not provided by the L.E.A. (voluntary schools) the act directs that there shall be a body of six managers, of whom four are to be "foundation managers" and two are to be appointed in counties, one by the L.E.A., and one by the minor local authority, and in autonomous boroughs or urban districts both by the borough or urban district council.

(3) Maintenance of schools. (a) Powers. The L.E.A. are required ta maintain and keep efficient all necessary public elementary schools. The managers must carry out the directions of the L.E A. as to the secular instruction to be given in the school, including any directions with respect to the number and educational qualifications of the teachers, and for the dismissal of any teacher on educational grounds. The consent of the L.E.A. is required to the appointment of teachers, but that consent may not be withheld except on educational grounds; and the consent of the authority is also required to the dismissal of a teacher unless the dismissal is on grounds connected with the giving of religious instruction. (b) Liabilities. The managers are required to provide the school premises to the L.E A. for use as a public elementary school free of charge, and, out of funds provided by them, to keep the school premises in good repair and to make such alterations and improvements in the buildings as might reasonably be required by the L.E.A. The L.E.A. are required to make good such damage as they consider to be due to fair wear and tear of rooms used by them. Assistant teachers and pupil teachers may be appointed in voluntary schools "if it is thought fit" without reference to religious creed and denomination; where there are several candidates for the post of pupil teacher, the appointment is to be made by the L.E.A.

Provision of new schools.—New schools may be provided either by the L E.A. or any other persons, subject to the issue of three months' public notice, and to a right of appeal on the part of the managers of any existing school, the L.E.A. (in the case of proposed voluntary schools) or any ten ratepayers of the district, to the Board of Education on the ground that the proposed school is not required. Any enlargement of a public elementary school which in the opinion of the Board of Education is such as to amount to the provision of a new school, and any transfer of a school to or from the L E.A. must be treated as the provision of a new school. In deciding appeals, the board are to have regard to the interest of secular instruction, the wishes of parents as to the education of children, and the economy of the rates, but existing schools are not to be considered unnecessary if the average attendance is not less than 30.

Aid Grant.—Section 10 provides a new aid grant payable to the L.E.A. in respect of the number of scholars in average attendance in schools maintained by them.

Education Committees.—A11 councils having powers under the act, except those having concurrent powers as to higher education only, must establish education committees in accordance with schemes approved by the Board of Education. All matters relating to the exercise by a council of their powers under the act, except the power of raising a rate or borrowing money, stand referred to the education committee. Every scheme must provide (a) for the appointment of a majority of the committee by the council, the persons so appointed to be already members of the council unless the council otherwise determine; (b) for the appointment by the council of persons of experience in education, and of persons acquainted with the needs of the various kinds of schools in the area of the council; (c) for the inclusion of women.

Expenses.—All parliamentary grants were made payable to the L.E.A. instead of, as previously, to the managers. The county council must charge a proportion of all capital expenditure and liabilities, including rent, on account of the provision or improvement of any public elementary school, on the parish or parishes which are served by the school, such proportion to be not less than one-half or more than three-fourths as the council think fit. The county council may also charge on the parishes benefited any expenses incurred with respect to education other than elementary.

Endowments.—The act introduced a new principle into the administration of endowments by directing that their income, so far as necessarily applicable for those purposes of a public elementary school for which the local authority are liable, must be paid to that authority for the relief of the parochial rate.

A number of Nonconformist ratepayers refused to pay the education rate on the ground that their consciences forbade their supporting the religious teaching in denominational schools; and their willingness to become subject to distraint and consequent inconveniences rather than pay the rates became the foundation of a widespread political campaign known as "Passive Resistance." In Wales, where in the rural districts the schools were commonly Anglican whilst the population was Nonconformist, particular difficulties arose in administering the act in consequence of the hostile attitude of the county authorities. Accordingly the Government passed the Local Education (Local Authority Default) Act, 1904, empowering the Board of Education, in the case of default by the local authority to make payments direct to the managers of the school and to deduct the amount from the sums payable to the defaulting authority.

Supplementary Bills.—When the Liberal Party came into power again in 1906, Birrell, as president of the Board of Education in Sir Henry Campbell-Bannerman's administration, introduced a bill to amend the Education Acts, 1902–03, with the object of securing full public control of all rate-aided schools and the appointment of teachers without reference to religious belief. The bill encountered strong opposition from Anglicans and Catholics; it passed the House of Commons by a large majority, but after

unavailing attempts at compromise upon the amendments introduced in the House of Lords, the two houses failed to agree and the measure was lost.

Early in the session of 1908, McKenna introduced a bill containing a scheme for a new system of allocating the parliamentary grant, and proposing to make Cowper-Temple teaching compulsory in all aided schools. The bill was remodelled by his successor, Runciman, but in spite of negotiations with the Church Party, no compromise was reached, and the bill was ultimately withdrawn by the Government when in committee of the House of Commons.

The Education (Provision of Meals) Act, 1906, enabled local education authorities to aid voluntary agencies in the provision of meals for children attending public elementary schools, and in certain cases with the consent of the Board of Education to defray the cost of the food themselves.

In 1907 an uncontroversial act entitled the Education (Administrative Provisions) Act, besides dealing with various matters of technical and administrative detail, laid upon local education authorities the new duty of providing for the medical inspection of all children attending public elementary schools. In connection with this act the Board of Education established a medical department to advise and assist them in supervising local education authorities in carrying out their statutory duties in this regard. The whole departure was significant of the new sense of the importance of hygiene and physical training, which has been one of the remarkable features in recent educational developments.

Other noteworthy developments were the extension in the provision for mentally and physically defective children *(see* MENTAL DEFICIENCY; BLIND, TRAINING OF THE; DEAF AND DUMB, etc.), and a more definite organization of "after care" work, including the finding of employment for pupils on leaving school. The act of 1902, by placing secular education in public elementary schools under the control of strongly organized local education authorities, enabled the Board of Education in the code of 1904 to abolish the last traces of the system of payment by results, by setting forth "a properly co-ordinated curriculum suitable to the needs of the children, with an indication of the relation which the various subjects of instruction should bear to each other, in place of the relatively haphazard list of possible branches of knowledge which were formerly presented to the choice of individual schools or authorities." In the new code also the board for the first time endeavoured to state for the guidance of teachers and parents the proper aim of the public elementary school, laying stress upon that element of the training of character which the system of payment by results had obscured. The new spirit was strikingly manifested in the volume of *Suggestions for the Consideration of Teachers,* issued by the Board of Education in 1905. Apprehension of the true aims of elementary education led to a corresponding development of instruction of a practical character, observation lessons and nature study being treated as a necessary element in the curriculum, while handicraft and gardening, and domestic subjects (for girls), were encouraged by special grants. Increased attention was bestowed both by the central and local authorities upon the problem of rural instruction, though much still remains to be done in this matter *(see* RURAL EDUCATION).

According to the official returns for 1907–08, the total number of scholars on the registers was as follows: council schools, 2,991,741; voluntary schools, 2,566,030; total, 5,557,771; and the total attendance upon which grant was paid was 4,928,659. The percentage of actual average attendance to average number on the registers was 88·50%. The parliamentary grant (England and Wales) for elementary schools, other than higher elementary, amounted to £11,023,433.

A large number of the old higher grade board-schools (declared illegal under the Elementary Education Acts by the judgment in the case of *Rex* v. *Cockerton* in 1901, and legalized temporarily by an act passed for the purpose in the same year) were converted into municipal secondary schools under the act of 1902. In the succeeding years provision was made in the code for higher elementary schools of a specialized and technical type intended only for industrial districts. In 1906, as the result of the recommendations of the consultative committee, a new type of higher elementary school was admitted for children over 12, corresponding generally to the French *école primaire supérieure,* and having "for its object the development of the education given in the ordinary public elementary school, and the provision of special instruction bearing on the future occupations of the scholars, whether boys or girls." (For subsequent history, *see* CENTRAL SCHOOLS.)

The total expenditure (exclusive of capital outlay) of the local authorities (1906-07) in England only, upon elementary education, including "industrial" and "special" schools, was £19,776,733, of which (a) £10,408,242 was met by the ordinary parliamentary grant, and (b) £8,930,468 was the balance required to be met by rates, the difference being represented by receipts from various sources. The average cost per child of elementary schools in England and Wales (including London) was £3 4s.10d., and the average central grant (excluding grants for special purposes) at 41s., leaving 19s. to be raised locally.

Training of *Teachers.—The* training of teachers for the two great branches of public education, elementary and secondary respectively, is an important part of the general administrative problem. Sir Joshua Fitch pointed out that the full appreciation of the importance of training began at the lower end of the social scale. Shuttleworth and Tufnell in 1846 urged the necessity of special training for the primary teacher, and hoped to establish State training colleges to supply this want; but the one college at Battersea which was founded as an experiment was soon transferred to the National Society (the "National Society for educating the poor in the principles of the Established Church": founded in 1811). Before this, Bell and Lancaster had made arrangements in their model schools for the reception of a few young people to learn the system by practice. The religious bodies in England, notably the Established Church, proceeded to avail themselves of the failure of the central Government, and a number of diocesan colleges for men, and separate colleges for women, were gradually established. In 1854 the British and Foreign School Society (founded 1808) placed their institutes at the Borough road and Stockwell, London, on a collegiate footing, and subsequently founded other colleges at Swansea, Bangor, Darlington and Saffron Walden; the Roman Catholic Church provided two for women and one for men; and the Wesleyans two, one for each sex. The new provincial colleges of university rank were invited by the Educational Department to attach normal classes to their ordinary course and to make provision for special training and suitable practice in schools for those students who desired to become teachers. Thus the residential colleges of the old type and the day colleges attached to institutions of university rank, were both subsidized by grants from the Treasury, and regularly inspected. As the need of special training for teachers became further recognized by the consideration of the same question as regards teachers in higher and intermediate schools (Cambridge instituting in 1879 examinations for a teacher's diploma, and other universities providing courses for secondary as well as primary teachers, and establishing professorships of education), the attitude of the Board of Education towards the problem gradually became more and more a subject of controversy and of public interest, as indicated by the clause in the act of 1899 providing for a public registration of qualified teachers and for the gradual elimination from the profession of those who were unqualified. And meanwhile the increased solidarity of the National Union of Teachers (founded in 1870), the trade union of the teachers, brought an important body of professional opinion to bear on the discussion of their own interests.

The question of preliminary education of elementary teachers reached a critical stage in 1909. The history of pupil-teachership as a method of concurrent instruction and employment shows that it was, in its inception, something in the nature of a makeshift, the ideal placed before local education authorities in the regulations of the Board was the alternative system whereby with the aid of national bursaries (instituted in 1907) "the general education of future teachers may be continued in secondary schools

until the age of 17 or 18, and all attempts to obtain a practical experience of elementary school work may be deferred until the training college is entered, or at least until an examination making a natural break in that general education and qualifying for an admission to a training college has been passed." Under the revised pupil-teacher system established by the regulations of 1903, provision was made for the instruction of pupil-teachers in centres which as far as possible are attached to secondary schools receiving grants from the Board of Education under the regulations for secondary schools. Accordingly, the result has been to modify the old system in two ways; first by providing the alternative of a full course of secondary education, secondly by associating pupil-teachership itself as far as possible with part-time attendance at a secondary school. The success of the scheme has been great and, in fact, no better plan could have been devised for breaking down the party-wall between elementary and secondary education. More recently the abolition of the pupil-teacher system has been strongly advocated (see TEACHERS, TRAINING OF).

One of the principal difficulties which confronted the State and the local authorities in their task of organizing an improved system of public education under the act of 1902 lay in the deficiency of training colleges in view of the increased number of teachers. Moreover there was a widespread feeling that the provision of training colleges should be undertaken by the State as a matter of national concern. Accordingly a new system of building grants in aid of the establishment of training colleges was instituted in 1905. In 1906 these grants were raised from 25 to 75% of the capital expenditure, but were limited to colleges provided by local authorities. A further difficulty in view of the municipalization of education arose from the fact that the majority of the residential colleges were in the hands of denominational trusts which did not admit a conscience clause. Under the presidency of McKenna (1907), the Board of Education, in regulations which excited much controversy, "with a view to throwing open as far as possible the advantages of a course of training in colleges supported mainly by public funds to all students who are qualified to profit by it, irrespective of religious creed or social status," laid down that the application of a candidate might in no circumstances be rejected on any religious ground, nor on the ground of social antecedents or the like. The same regulations provided that no new training colleges would be recognized except on terms of compliance with certain conditions as to freedom from denominational restrictions or requirements. The obligation as to religious exemptions has since been limited to 50% of the admissions.

Training facilities for secondary teachers existed at Cambridge as far back as 1890, and the other universities have since followed suit. None the less progress has been far slower than in the elementary sphere, especially as regards the men. Many headmasters, especially in the public schools, still believe that the best way is for the young master to play himself in. With the headmistresses, on the other hand, training is more and more regarded as a sine *quā* non. It is only fair to add, however, that even with the men the pace has accelerated.

The fear that a considerable part of the national expenditure upon elementary education was wasted, for want of an effective system of continuative instruction to be given out of working hours to adolescents engaged in industrial employment, led to an enquiry by the consultative committee of the Board of Education. whose report (1909) recommended a reduction in the size of classes in elementary schools by the new staffing regulations of that year; an increase in hand-work with a view to rendering the curriculum less bookish and more efficient as a training for industrial and agricultural life; and legislation to reform the system of half-time attendance and raise the age of compulsory attendance to 13 and ultimately 14. They further recommended a superstructure of continuative schools or classes, attendance at which up to 17 would be compulsory under by-laws adoptive locally at the option of the local education authorities. In 1906–07 about 21 per thousand of the population of England and Wales attended evening schools and classes inspected by the Board of Education, and grants amounting to £361,596 were paid in respect of 440,718 regular attendants. (See CONTINUATION SCHOOLS.)

The general progress in elementary education, great as it was in the years following the act of 1902, had been outstripped by that made in secondary education. During that period there had been built up a liberal system of local scholarships and free places, amounting since 1907 to 25% or more of the pupils actually in the schools, providing a ladder from the elementary school to the secondary and thence to the university, including, as we have seen, the majority of future elementary teachers. In addition scales of salaries had been introduced by many local authorities, the curriculum rendered far more flexible by the abolition of regulations, the school life lengthened, and an imposing, though still incomplete, network of schools developed throughout the country. By 1910 there were on the Board of Education's grant list, 841 secondary schools with 141,149 pupils, while in addition 87 schools were recognized as efficient, but received no grant. (For the full history of university education up to 1910, see UNIVERSITIES.)

1910–14.—The period of 1910–14 was one of steady progress in education even if somewhat uneventful from the parliamentary point of view. One noticeable matter in that sphere was the Elementary Education Act of 1914 which renewed the act of 1899 (Defective and Epileptic Children) in a more drastic form. Another landmark was the Board's circular on physical exercises in secondary schools, in which Swedish exercises were definitely laid down as the official form of physical training (*q.v.*), similar recognition having already taken place in elementary schools and training colleges. But, in view of subsequent history, the most important event was in the realm of university education when in 1913 the report of the royal commission on London university (*q.v.*), presided over by Lord Haldane, was issued, the commission having been appointed in 1907. One part of the report seriously threatened the existence of the external degree, a danger since averted, but a still more important part of it dealt with the revision of the organization and government of the university, which formed the groundwork of a subsequent commission and parliamentary action.

The World War.—During the period of the World War all grades of work suffered. The elementary schools lost many of their teachers, who were called on for military service. The men's training colleges were seriously depleted, and several were closed or amalgamated, while in the later stages of the war, the boys' secondary schools lost practically all their pupils at the age of 18. A large amount of the teaching was done by women who occupied positions usually held by men teachers. Nevertheless, there is progress to chronicle. In 1917 the Board, which in 1914 had abolished all examinations for lower and middle forms in secondary schools (*q.v.*), established the Secondary Schools Council for coordinating the standards of the remaining examinations in these schools, multiplicity of examinations, with considerable variety in standard, having been in the past a serious flaw in English education. (See EXAMINATIONS.)

Education Acts *1918* and 1921.—The men who returned from the front on the conclusion of the war had realized the need of education as a sine *qua* non to promotion from the ranks. At the same time there had been forming at home a strong body of opinion in favour of insuring, as far as possible, against the inevitable aftermath of post-war unemployment. This opinion may be said to have focused round the report of the departmental committee on juvenile education in relation to unemployment, which, appointed in 1916, reported in 1917, many of its suggestions being embodied in the bill of 1918.

The Education Act of 1918, which was carried through by H. A. L. Fisher, and which was re-enacted, with most of the earlier acts, in consolidated form by the Education Act of 1921, made a determined attempt to improve the state of things in England and Wales. It aimed at the establishment of "a national system of public education available for all persons capable of profiting thereby," and the local authorities were called on to prepare schemes setting out the provision which they had made and proposed to make to this end. The act effected important changes in respect of elementary education (see ELEMENTARY EDUCATION) including the power to establish Nursery schools (*q.v.*) for children between two and five years of age It raised

the compulsory school age from 12 to 14 with power to the local authority to extend that age to 15. It abolished part-time attendance, made provision for central schools for the older and more intelligent children in the elementary schools, and laid emphasis on physical training, enlarged facilities for recreation of all kinds, and the social side of education. The local authorities were to co-operate in providing for the preparation of children for further education in schools other than elementary, and for their transference at suitable ages to such schools. The act also dealt with the supply and training of teachers, and extended the duties and powers of the local authorities with reference to medical inspection and mental deficiency and treatment, to secondary and continuation schools. It removed the limit imposed on rating powers for education other than elementary.

But perhaps the most novel feature of the statute was that which instituted a compulsory system of part-time education after the close of the elementary school period. "Young persons," between the ages of **14** and 18, were required to attend a continuation school for **320** hours in the year, unless able to claim exemption under the act. *(See* CONTINUATION SCHOOLS.) Other movements that have grown out of this legislation, or have received an added momentum from its presence on the statute book, are the Workers' Education Association and the movement for adult education (*q.v.*).

In **1920**, for the first time in the history of English education, a national scheme of salaries for elementary and secondary teachers *(see* SECONDARY EDUCATION) was established under the chairmanship of Lord Burnham, known henceforth as the Burnham scale. Slight modifications were subsequently made in both pension and salary schemes, but the general result of these reforms was to place the position of the teacher on a distinctly satisfactory footing, one direct outcome being the rapid growth of members on the teachers' register that followed, largely due to the efforts of the National Union of Teachers. In 1920, also, the Board started State scholarships to enable the talented children of parents with limited means to proceed to the university. Dropped during 1922–23, they were revived in 1924, and the maximum number offered in 1927 was **200**. Moreover, during the same period (1918–22), the Board published four reports of committees on modern languages, science, classics and English. In **1922** the Board issued a valuable circular on the possibility of co-ordinating the recommendations made in these reports with the claims of other subjects.

Universities After 1918.—If the universities were depleted during the war, they were speedily overcrowded after the declaration of peace. Most of the men who had interrupted their studies to go to the front returned, and a vast number of ex-officers availed themselves of Government grants which were estimated in 1920 for the five years they were to be in force, to amount to £8,500,000, though the total sum was not entirely expended. No less than 23,000 ex-officers availed themselves of this unique opportunity. Those of them who did not go to the universities went to commercial, art and technical schools, or studied for the various professions. The technical institutes of all sorts, therefore, shared to some extent in the general prosperity. The universities also received substantial grants (£500,000 in 1919–20) to set them on their feet. All these grants were made through a standing committee known as the University Grants committee, and not through the Board of Education direct. The creation of this intermediary body has, like the creation of a buffer state, preserved the complete autonomy of the university which has always been such a marked feature in English education. In this connection it is worth noting that Oxford and Cambridge only accepted State aid in 1919, and at first with no conditions attached. All the universities, quite apart from financial help, gained by the work of this committee which, in practice, was largely a co-ordinating and levelling-up committee.

Developments Since 1922.—After 1922 education went through a period of slowing down and consolidation, while at the same time, a large amount of official investigation and research took place. The financial uneasiness may be said to have started with the seventh report of the Select Committee on national expenditure in **1920**, which specially dealt with national education. But the actual financial stress did not make itself felt till **1922** when, with almost dramatic suddenness, unemployment, hitherto at an insignificant figure, bounded up in less than six months to an abnormal height. Among educational developments the scheme for universal day "continuation schools" (*q.v.*) was the first to suffer. Unfortunately, conceived as the prolongation of a general education, they became speedily unpopular with the pupils, parents and the general public. Practically the only schools that survived were the London ones. A certain number of these were saved by being placed on a voluntary basis with a vocational bias, and as such became increasingly popular.

In spite of the financial crisis, elementary schools, secondary schools, universities and technical institutes of all kinds held their ground, and even progressed, though in elementary education, owing to the falling off in the juvenile population from war causes, the number of pupils showed a considerable decrease. In secondary schools the numbers did not decline and there was a substantial increase in the number of pupils over **16** and in those doing advanced work. The Burnham scale was extended to technical institutes. In the universities the organizations for finding employment for graduates continued to extend, many new chairs were created, and the volume of research increased. The university grants were increased also and one of the outstanding features of post-war years was the commissions on Oxford, Cambridge and London universities, appointed by parliament.

Publications by the Board of Education.—Since **1922** the Board has published some exceedingly valuable reports, memoranda and suggestions. Thus in **1922** suggestions were issued on the teaching of gardening and handcraft. In 1923 the consultation committee of the Board published a long report on the differences in curricula between the sexes in secondary schools, recommending *inter alia* greater freedom of curricula and more flexibility in the matriculation, more free periods for pupils in school, a more generous time allowance for music and art, both the latter to be recognized as suitable subjects for the first school examination, with further investigations into the subject of mental and physical fatigue. Two pamphlets which, though published by the Industrial Fatigue Board, have a considerable bearing on education are worth mention—one on performance tests of intelligence (1925) and the other a study in vocational guidance **(1926)**.

The Board also issued reports, circulars or suggestions on the teaching of English and drawing in secondary schools (1924), the teaching of arithmetic in elementary schools and the teaching of science in secondary schools (1925), the position of French in grant-aided secondary schools (1926), short courses for teachers (giving a list of courses available) and a revised edition of the *Handbook of Suggestions* (1927); a *Survey of Technical and Further Education* (1926); *Recent Developments of Secondary Schools*, a history of the subject since 1902 and even earlier; *First Report of the Committee on Education and Industry* (1926), a committee partly appointed by the Ministry of Labour; *Report of an Inquiry into the relationship of Technical Education to other forms of Education and to Industry and Commerce* (1927); *Report of the Departmental Committee on the Training of Teachers* mainly remarkable for the wide divergence of opinion it contained, and the *Report of the Departmental Committee on the Preparation of the Rural Teacher* (appointed 1927). Perhaps the most important report was that on the education of the adolescent —dealing with further education of pupils over 11 *(see* ELEMENTARY EDUCATION).

Since the beginning of the present century there has been great development in elementary education, and consolidation of the whole system. Teachers' salaries have been placed on a satisfactory basis and pensions put on a proper footing; the whole curriculum has been modernized and rendered more elastic, though education in the years after 11 still needs modification in the direction of a more distinct preparation for livelihood. One of the most striking features of the new learning is the way in which the reading habit is being developed, not merely inside and outside the elementary school, but for all grades of education, including secondary and evening students, whether in adult educa-

tion classes, or honours and research students in the universities. (See LIBRARIES.) The whole bias of education is slowly shifting to making the pupil an active co-operator in his own development. (See above *Educational* Experiments.)

A vast deal of quiet experiment is going on; physical exercises, and especially games, have undergone a wide extension; the perfect system has been developed with the happiest results in boys', and to a certain extent in girls', schools; after-care committees, medical inspection, meals for necessitous children, special treatment for mental and physical defectives have become an integral part of national education in the broader sense. Classes have been cut down (in a few years the number of classes with over 60 pupils fell from nearly 7,000 to under 280). Buildings have been modernized to a great extent. The religious question, so rampant at the beginning of the century, is quiescent, thanks to the broad-minded and impartial administration of the local authorities, but the Church people still feel the "intolerable strain" of maintaining their school buildings, and from time to time feelers are thrown out to try to discover some way of handing over the schools while safeguarding the religious teaching. Moreover, the crisis in the Anglican Church (1927–28) only tended to accentuate the difficulty of the whole question. The Central schools (*q.v.*) have more than made good, and their pupils can now stay on till the age of 16. In 1926–27 there were 9,170 Council schools, 11,553 voluntary, and over 15,000 departments in each category, with an average attendance of 3,231,494 in the former and 1,742,162 in the latter, the percentage of attendance being 88·3. The teachers numbered 169,702, including nearly 120,000 certificated teachers, three-quarters of whom were college trained. The uncertificated numbered 33,852, and the supplementary teachers, 8.734. Training colleges have been multiplied. The study of educational science has increased by leaps and bounds. The connection with the university has been greatly extended; many two-year students frequently spend a third year abroad, or at some English institution.

In the sphere of secondary education where there was most leeway to make up, the progress has been immense. In place of a totally inadequate and often poorly staffed number of schools before 1902, the country is practically covered with a network of secondary schools, in many of which advanced courses have been established, and in the majority of which the pupils leave at 16 or even later. The claims of art and music have been increasingly recognized, considerably less, however, in boys' than in girls' schools. The examination figures are eloquent: though more elasticity in the choice of subjects is necessary (see EXAMINATIONS). In 1917–18, 14,232 took the first examination and 550 the second; in 1926–27, 43,752 took the first, 6,691 the second, over 68% passing in each case (see SECONDARY EDUCATION). Games and self-government are everywhere to-day flourishing, in boys' and girls' schools alike. The number going to the universities has increased beyond all comparison—over 3,300 went in 1926. One effect of these increasing numbers is to raise the standard of study in the universities.

Salaries have increased and teachers' qualifications have steadily risen. In 1908 there were only 4,841 men teachers and 4,484 women, of whom 62% of the men and 41·7% of the women were graduates; in 1926–27 the men teachers (full time) had risen to 9,572, the women (full time) to 9,682, and about 80% of the men and 61% of the women were graduates. In the same period there were 1,319 schools on the grant list, with 371,493 pupils (196,289 boys and 175,204 girls), and 59,141 pupils (29,839 boys and 29,302 girls) in other schools merely recognized as efficient. Within a quarter of a century, a comprehensive system has been built up which can challenge comparison with those of older countries, and which recognizes that the most valuable training the school can give is the development of a healthy and public-spirited citizen.

The 20th century has seen a vast extension in the growth of the provincial universities (previously component parts of a joint university). The movement began with Liverpool and Manchester in 1903 and was followed by Birmingham, Leeds, Sheffield and Bristol, while Durham expanded and took in Newcastle, and finally Reading was founded. Meanwhile, London is being again reorganized, having immensely grown in the interval, and Oxford and Cambridge have also greatly expanded, not only in numbers but also in the ever increasing branches of knowledge they teach and in their outside activities (see UNIVERSITY EXTENSION, etc.), their ties and connections with national life being far more close and numerous than in the preceding century. The number of students in the universities in 1927 was 41.606.

Technical educntion (*see* above), whether within or without the university, has also extended its ramifications on specific subjects, while concentrating with advantage the work of many of its institutes. Its lower grades have shown a considerable increase, whether in junior technical schools, art schools or evening classes of all kinds. The total number of students, whether in day or evening institutes or classes in 1926–27 was 843,637. There is probably, however, in spite of these figures, still abundant room for expansion in all grades of this work, which is peculiarly in keeping with the English temper and genius.

A few figures on educational expenditure since 1913–14 may help to provide a rough index of the volume of growth and development, though on the other side a considerable allowance must be made for the increased cost of living. In 1913–14 higher education (secondary and technical) received from the local and central authorities nearly four and a half millions, and elementary education over 25½ millions, or a total of about 30 millions, of which the State found 45.6%; other items must be included in the general expenditure on education, but none the less the comparison with 1925–26 is striking. In that year higher education received 14 millions, elementary nearly 58½ millions, a total of nearly 72½ millions, the percentage of the State contribution having risen to 53·8. This, with other items, brought the total expenditure to £76,549,460.

English education has always been noted for its variety and elasticity. The 20th century has seen the development of a substantially complete system of national education in all grades, in which the new has been skilfully interwoven with the old, without injuring its two predominant qualities. It has been an immense and unparalleled achievement, in which the work of a few men stands out, chief among whom are Lord Balfour who, by the act of 1902, laid the foundations of the present composite structure with the ultimate aim of forming one single edifice; Sir Robert Morant, his chief henchman and architect, and Sir Michael Sadler who, more than anyone living, has heartened and inspired the enormous army of lay and professional workers in the laborious task of consolidating and enlarging the new temple of knowledge. Other notable master builders have been H. A. L. Fisher and Lord Burnham, each responsible for certain valuable additions to the fabric. The building has, indeed, been, like the building of a great mediaeval cathedral, the work of the anonymous co-operation of thousands of men of goodwill. (C. BR.)

WALES

Wales continued to be treated as one with England for purposes of educational administration until, towards the end of the 19th century, the striking revival of Welsh nationality led to a demand among the Welsh people for a national system of higher education. The Welsh Intermediate Education Act (1889) provided for the creation of education committees in every county in Wales (including Monmouthshire). To these committees were entrusted the establishment of intermediate and technical schools and the application of endowments, and the administration of a ½d. county rate, which was supplemented by a Treasury grant, not exceeding the amount raised by the rate. The duties of inspection and examination were entrusted to a Central Education board. The Education committees were superseded (except for the purpose of framing schemes for endowments) by the local education authorities under the act of 1902. The public assistance afforded to secondary education in Wales under the Intermediate Act is supplemented by the grants of the Board of Education, and the board's revised secondary school regulations were applied to Wales in 1908. In 1907 a Welsh department of the Board of Education was established.

There has thus grown up a dual organization of secondary education in Wales: the intermediate (endowed) schools under the central board, and the municipal secondary schools and others under the local education authorities. The intermediate schools, however, accepted the Board of Education grant and inspection under the act of 1902. In 1920 a departmental committee recommended that the Welsh Intermediate Education Act be repealed, and that all types of schools in a district be placed under the same authority. It recommended the formation of a National Council of Education for Wales, with majority representation of the local authorities and further representatives of the university, the teachers, and other educational bodies. Its functions should be mainly advisory, but it should maintain training colleges (for which the county unit is too small) and conduct examinations. Further recommendations were the creation of teachers' councils, an increase in the number of secondary schools so that admission might be on a qualifying rather than a competitive basis, allowances according to the parents' means, and more university scholarships.

These recommendations have not been put into effect, but a system of close co-operation between the inspectorates of the central board and the Board of Education has been adopted. The National Council of Education has not been formed; the Central Board continues its work and enjoys an increased Government grant.

In 1921 Swansea Technical college became a university college of the National university, created in 1893. (See also UNIVERSITIES.)

SCOTLAND

Historical Development. — In Scotland the practical unanimity of the people in religious faith, the wider diffusion of the sense of the value of education, the greater simplicity of life which has rendered all classes largely content to avail themselves of the preparatory education of the common school and favoured the development in the secondary sphere of day rather than boarding schools, have contributed to the early building up of a national system which in some respects resembles the Continental rather than the English type.

Before the Reformation a statute of James IV. (1494) required all freeholders of substance to send their heirs to school and to keep them there until they had perfect Latin. The Reformation put fresh life into the educational aspirations of the people. As early as 1560 the Church Assembly, largely under the influence of John Knox, issued the Book of *Discipline*, providing that "every several kirk" in a town "of any reputation" was to have its Latin school, that the "upaland" or country parts were to have a teacher of the "first rudiments" in every parish, and that each "notable" town was to have "a college for logic, rhetoric and the tongues." Practical effect was later given to this scheme by an act of the Scottish parliament in 1696, under which parish schools were set up in connection with the Established Church of Scotland. This system was extended by an act of 1803, which made better provision for teachers' salaries and also confirmed the position of the parish school as an adjunct of the parish church. The system of inspection and State aid, introduced in England in 1839, was made applicable to Scotland. In 1861 a new act was passed which relaxed, though it did not sever, the ties which bound the parish school to the church.

The Education (Scotland) Act of 1872 set up elective school boards and vested in them the existing parish and burgh schools. A conscience clause, allowing exemption from religious instruction, did little more than confirm existing usage. The school boards were left full liberty as to the religious instruction to be given in their schools, and in practice school boards universally adopted the Shorter Catechism, which was acceptable to all denominations of Presbyterians. The act made the school boards responsible for the supply of school accommodation, and introduced compulsory attendance. By the act of 1901 the age of compulsory attendance was raised to 14, with provision for exemption after 12.

A notable feature, historically, in Scottish education is the extent to which the parish schools supplied their best pupils with higher education. Administrative changes under the code of 1903 and later codes led to a remarkable development of higher-grade schools and departments, organized upon the lines of the higher primary schools of France "to continue a stage further," says the report of the Scottish Education Department, "the general education of that considerable body of pupils who, under new conditions, may be expected to remain at school till 15 or 16."

There has been a gradual abandonment of individual examination as the basis for the payment of grants. Elementary education was generally rendered free by the fee grants under the parliamentary vote, and by the sums accruing under the Local Taxation (Customs and Excise) Act of 1890 and the Education and Local Taxation (Scotland) Act of 1892.

The Act of 1908. — Certain additional powers were conferred upon school boards by the Education (Scotland) Act of 1908, including powers to provide school meals; in outlying parts to provide means of conveyance, or pay travelling expenses of pupils or teachers, or defray the cost of lodging pupils in convenient proximity to a school; to provide for medical inspection; and in the case of children neglected by reason of ill-health or poverty of the parent, to supply food, clothing and personal attention. Perhaps the most noteworthy provision of the act of 1908 is that which enabled (not obliged) school boards to make by-laws requiring attendance at continuation classes up to the age of 17. It laid upon the school boards the duty of making suitable provision of continuation classes in the crafts and industries practised in the district.

The Scottish Education Act of 1872 distinguished certain burgh and parish schools as "higher class public" or secondary schools. The act of 1908 dealt in some detail with secondary education. Secondary schools were distinguished from intermediate, the former being defined as providing at least a five-years' course, the latter as providing at least a three-years' course for pupils who had reached a certain standard of attainment in elementary subjects. Intermediate schools have now been abandoned and a three-years' advanced course from the ages of 12 to 15 is provided at primary schools, leading to the higher day school certificate. A two-years' advanced course leads to the lower day school certificate. The teaching in these advanced courses is partly practical, but includes also morals and citizenship, music, drawing, English, science, mathematics, and physical exercises. It is the aim of the authorities to staff the advanced divisions with teachers as highly qualified as those in secondary schools. A qualifying test at the age of 11 or 12 decides whether a child is to enter an advanced course or proceed to the secondary school. But there are facilities for changing over at a later stage.

The Act of 1918. — By the Education (Scotland) Act of 1918 the machinery of the system of education was reorganized, with a large increase of expenditure, both national and local, partly due to the transfer of voluntary schools to the public authorities. A scale of minimum salaries for teachers was drawn up in 1919. In 1920 the Education Department urged rigid economy, and there followed a reduction in salaries and staffs and an increase in the size of classes. In 1924 the restrictions were relaxed and there was a noticeable increase in educational activity, but in 1925 the urge for economy was again dominant.

The 1918 act swept away the system of parochial school boards. Five large burghs, Edinburgh, Glasgow, Aberdeen, Dundee and Leith, remained separate educational areas (the number was reduced to four by the amalgamation of Leith with Edinburgh in 1920); elsewhere the area is the county, including the burghs within its bounds. Electors to the education authorities are registered local government electors, and voting is conducted on the principle of proportional representation. School management committees, composed of representatives of the education authorities, parents, teachers, and others nominated by local bodies, have limited powers under the education authorities.

Education authorities are required to provide free primary, intermediary and secondary education in all districts, but they may maintain a limited number of fee-paying schools and make grants to others. No pupil, however, must be debarred from con-

tinued education by inability to pay fees, and each education authority has a bursary scheme. They are also empowered to spend money on the provision of food and books for the children, and to give assistance to qualified persons attending the university or training college.

Nearly all the voluntary or denominational schools have been transferred to the education authorities in accordance with the act; the teachers in such schools are appointed by the education authority after being approved, as regards character and religious belief, by the denomination concerned. No child whose parents object to his receiving religious instruction is thereby to lose any other advantage of the school. Voluntary schools which are not transferred to the education authority cease to be eligible for grant from the education fund. A national committee for the training of teachers, established in 1920 and elected by the education authorities, now controls the former denominational training colleges.

The act contemplated an extension of the school age to 15 and the provision of continuation schools giving vocational instruction, besides general education and physical culture. But these provisions have only been partially carried out, and school attendance is compulsory from five to 14, with powers to exempt or allow part-time attendance in special circumstances at 12. The Treasury grant to the universities was largely increased, and since the end of the World War private benefactions have greatly improved the teaching equipment of all four universities, and especially Glasgow and Edinburgh.

The departmental committee on Endowments for Scottish Education, presided over by Lord Mackenzie, reported in Oct. 1927 on endowments whose original purpose had become obsolete. It advised the appointment of an executive commission of seven members to reconsider their use, and suggested the following objects: universities, residential halls for students, central institutions (*i.e.*, advanced technical colleges), hostels for school children, adult education, playing fields, social organization, and nursing.

IRELAND

Historical Development. — In Ireland education has suffered in the past from the general absence of local interest almost as seriously as from the mistakes of the English Government. State intervention is actually of earlier date in Ireland than in Englacd From the reign of Elizabeth onwards English Protestant schools were founded by the Government in an intermittent fashion in pursuance of its anglicizing policy. The Kildare Place Society (founded in 1811) comprised both Roman Catholic and Protestant schools upon a common religious basis of Bible reading without note or comment, and received Government grants until 1833. The religious compromise broke down in consequence of Catholic dissatisfaction. In 1833, as the result of a commission of enquiry (1824) and a select committee of the House of Commons (1828), Stanley inaugurated the national system of grant-aided elementary schools under a board of commissioners nominated from the different denominations. In these schools teachers were paid by the State, but were appointed by the school managers, subject to the commissioners' approval. The Government appears to have aimed at combined secular and separate religious instruction for Roman Catholics and Protestants; at the same time an attempt was made to provide an ethical basis for secular instruction by means of Bible extracts. This solution through common schools with separate religious teaching was advocated by the great Irish educationalist, Sir Thomas Wyse, himself a Roman Catholic. In 1830 he had urged on the Government a kind of local option in education: each parish was to decide for itself whether to establish a school; if it did so, it was to receive Government support. Catholics and Protestants were to be educated together, but each to receive religious instruction from their own pastors. The growing Catholic objection to the Government's policy, however, found expression in a decree of the Roman Congregation De Propaganda Fide of Jan. 11, 1846, declaring that non-sectarian religious instruction was dangerous to youth.

The religious difficulty in Irish elementary education may be said to have been solved in process of time by the conversion of the national system in practice, though not in theory, into a system strongly denominational, separate schools taking the place for the most part of the combined schools of the two creeds. In addition to national schools there were a considerable number of convent or monastery schools, which received capitation grants, but not direct salaries.

In 1845 a bill was passed "to enable Her Majesty to endow new colleges for the advancement of learning in Ireland," based on Wyse's plan of joint secondary schools for Catholics and Protestants with separate religious teaching. But here again there was Catholic opposition, and the schools were declared, in rescripts of the council of cardinals, to be "dangerous to faith and morals." The Irish Education Act of 1892 provided for compulsory attendance in towns and for the adoption of compulsion in other districts. In virtue of the financial sections of the act, which provided an increased grant for salaries, most of the national schools became free.

Agriculture is Ireland's key industry, and towards the end of the last century there was a vigorous movement, led by Sir Horace Plunkett, for improved methods, better technical education and farmers' co-operation. In the parliamentary recess of 1895–96 Sir Horace Plunkett assembled the Recess committee to report on the subject. Its report resulted in the act of 1899, which created a department of agriculture and technical instruction. This department helped to establish continuation schools, technical schools and winter agricultural schools. It also sent out itinerant agricultural instructors.

Irish Free State. — Before the Government of Ireland Act of 1920 there were two central authorities dealing with secondary education, the Intermediate Education Board and the Department of Agriculture and Technical Instruction. The Intermediate Board administered sums available under the Intermediate Education Act of 1878 from the Irish Church surplus, and also the sum allocated under the Local Taxation Act of 1890. The first step of the Free State Government was to unify control, under a Minister of Education, of primary, secondary and endowed schools.

The so-called First Conference of Educationalists met in 1920 and drafted a programme for primary education, which aimed at stirring in the children a consciousness of their national heritage. Irish was to be the medium of instruction. This programme was adopted by the Government in 1922. Difficulties arose in putting it into effect, partly because the Irish language was not familiar to all teachers and pupils. A further conference, representing school managers, teachers in national schools, the General Council of County Schools, and the Gaelic League, and including nominated members, reported in 1926. It praised the new programme as "giving the language, history, music and tradition of Ireland their natural place in the life of the Irish schools." But it recognized the difficulties and recommended that transition to the use of the Irish language should be gradual and that the best Irish teacher in a school should be allocated to the infants, and instruction in other standards given in English where it could not properly be given in Irish. It was proposed to establish six preparatory colleges for candidates for training colleges, five to be situated in districts where Gaelic is still a living language and staffed with teachers capable of teaching the secondary school programme entirely through the medium of Irish.

The old managerial system, under which the power of appointment and dismissal lay, under certain limitations, with the manager of the school (usually a clergyman) was retained. This system means that each religious denomination controls the appointment of teachers in schools attended by children of that denomination. Opportunities must be afforded to the pupils of all schools for receiving such religious instructipn as their parents approve. It is given at a time not counted when computing attendance, and does not come under the supervision of the depart. ment.

As regards secondary education, a wide problem confronted the Government. The Intermediate Education Act of 1878 prescribed

that grants were to be paid on the results of a general public examination. Under the Free State Government this was replaced by a capitation grant, dependent on the reports of inspectors who take into account every feature of the school. The Intermediate Education Act of 1924, embodying recommendations of a commission which reported in 1922, introduced both financial and educational changes. A salary scheme for secondary teachers was adopted. Technical instruction was placed under the control of the Minister of Education, but the organization under local committees was retained.

In the Free State only primary education is gratuitous, but county and county borough councils may levy a rate to provide scholarships in secondary schools. Until the passing of the School Attendance Act of 1926 education was not universally compulsory. That act required attendance for secular instruction from six to 14; and the minister has power to extend the age limit to 16. Parents have the right to object lo any school on religious grounds. Schools are inspected and certified by the minister as suitable for giving elementary instruction.

Northern Ireland. — In 1922 educational services were transferred to the Government of Northern Ireland. The Education Act of 1923 largely gave effect to the recommendations of the Lynn departmental committee of enquiry, which published an interim report in 1922 and a final report in 1923. According to the ministry's report for 1923 the predominant feature of the act is that "it abolishes a highly centralized system of control, and sets up in its place a decentralized system of local control." Later reports describe the policy of amalgamating small primary schools for the sake of greater efficiency; in some cases there were several denominational schools in a single area, rendering less efficient service than one public school could give. The ministry put an end to the system of paying grants to schools conducted for private profit, and successfully encouraged private secondary schools to place themselves under governing bodies of a representative character, and so qualify for grants. Grants to secondary schools are now made by capitation payments, depending on the inspectors' reports, and no longer on the results of examination. The pupil teacher system was so amended that candidates for admission to training colleges complete their secondary school course.

The act of 1923 defines elementary education as education below the age of 14 "both literary and moral, based upon instruction in reading and writing of the English language and in arithmetic." Fees may be charged "if there exists otherwise a sufficient supply of free places." School books may be provided free. Attendance is compulsory from the age of six to 14, and by-laws are allowed lowering the age to five. The education authority may exempt individuals partially for reasons of employment after the age of 12.

Schools may be provided by the public authority, or transferred from voluntary agencies to the education authority. Further, there are voluntary schools recognized as public elementary schools, which receive a 50% grant on maintenance and repairs. In all schools religious instruction must be so arranged as not to put children of any denomination at a disadvantage in the matter of secular education. The education authority does not itself provide or inspect religious instruction, but the clergy of all denominations have access to provided and transferred schools according to the parents' wishes. The education authority appoints the teachers, and there are no religious tests.

Higher education includes preparatory schools, intermediate schools (a three-years' course beyond the primary school), and secondary schools (a five-years' course beyond the primary school). The education authority is empowered to pay for the higher education of all children capable of profiting by it, as also for their continued education at the university or training college.

(M. M. G.)

UNITED STATES

Religious Origin **of** Schools.——Schools of America, as with the older European countries from which the early American settlers came, arose as children of the Church. From instruments of religion they have gradually been changed into instruments of the State. The first schools in America were clearly the fruits of the Protestant revolts in Europe, and were set up by dissenters who had come to America to obtain a freedom in religion which they could not enjoy in their own lands. The reformers had insisted upon the necessity of a knowledge of the Gospels as a means to personal salvation, and the ultimate outcome was the creation of schools to teach children to read. These ideas the early settlers in New England brought with them, and one of their first interests, after they had built their homes and churches and settled the civil Government, was the creation of schools and a college to advance learning in the new land and to provide a supply of literate ministers. With practically all the early religious groups that settled in the central and northern colonies the education of the young for membership in the Church, and the perpetuation of a learned ministry for the congregations, elicited serious attention. Only in the Anglican colonies of Virginia and southward was this early interest in education largely lacking.

Three Type Attitudes. — From the European background of the early colonists three type attitudes toward education were established in the American Colonies. These are of importance because they materially affected the development of education in the States during the early national period. The first was the compulsory-maintenance attitude of the Puritans of the New England colonies, who set up a combined religious and civil form of town government, and by colony legislation in 1642 and 1647 established schools and ordered children to be taught to read and to be given instruction in religion. Still earlier (1635) the beginnings of an English type of Latin grammar school had been made at Boston, and the year following (1636) an English type college (Harvard) had been established by the same people at Cambridge, Mass. The laws of 1642 and 1647 are important, in part because for the first time in the English-speaking world a legislative body representing the State made education compulsory, and also because what the Calvinistic Puritans of Massachusetts established in practice has since been generally adopted by the different American States. This distinctively Calvinistic contribution to the New-World life was one of large future importance.

The second type attitude was what has become known as the parochial-school attitude, and was best represented in Pennsylvania. Unlike New England, no sect was in the majority in Pennsylvania, and Church control by each denomination rather than general colonial action resulted. There was no appeal to the State. Instead, parochial schools were established in connection with the churches and private pay schools were opened in the larger towns. Under the primitive conditions of the time the interest even in religious instruction often declined almost to the vanishing point, and Pennsylvania and the other middle colonies finally settled down to the policy of leaving education to such private and parochial schools as cared to undertake it, a policy that was overcome later only after long and stubborn resistance.

The third type attitude was what was known as the pauper-school non-State-interference attitude, and was best exemplified by Virginia and the southern colonies. Unlike New England, these had been settled by English who had come to America for gain rather than for religious freedom, and the lack of any strong religious motive for education naturally led to the continuation of English practices rather than development on distinctively colonial lines. The tutor in the home, education in small private and select pay schools, or education in the mother country for the sons of the well-to-do planters, with apprenticeship training and a few pauper schools for the children of the poorer classes consequently came to be the prevailing system and, as in the mother country, education was not considered the business of the State, nor did the Church give any special attention to it. As a result in Virginia, and the colonies which followed her example, the English charity-school idea came to dominate such general education as was provided, with the apprenticing of orphans as a prominent feature.

The 17th century was a period of the transplanting of European ideas as to Government and religion and education to the new

American Colonies, and by the 18th century the three type attitudes toward educational responsibility had been clearly established on American soil, deeply influencing subsequent American educational development. In time the first or New England Calvinistic attitude came to be the accepted American conception, and the other two types were subordinated or eliminated. Almost all the early 19th century struggles to establish education in the States were battles between the upholders of these different type attitudes.

Change in Character. — During the 17th century little or no attempt at adaptation or change in English ideas transplanted to the colonies was made. With the coming of the 18th century there was a waning of the old religious interest, a tendency to create native institutions instead of copying those of the mother country, the rise of a civil as opposed to a religious form of government, new interests in trade and shipping, a breakdown in the old aristocratic traditions and customs, and a dawning individualism — all of which tended to weaken the hold of the old religious influences and in turn the interest in the old type of schools and learning. By 1750 the change in religious thinking had become quite marked, the New England religious town had begun to disintegrate, and a native type of district school and academy had arisen to threaten the very existence of the town grammar school. By 1750, too, it was clearly evident that European traditions and ways and manners and social customs and types of schools no longer satisfied. To the North this expressed itself in a tendency to modify all established educational institutions to make them conform more closely to American thinking; to the South in a tendency to discard schools altogether. There were many evidences, in education as in Government, that the end of the colonial period was near at hand, and the Revolutionary War came as the culmination of a process of evolution which had been taking place for some time.

Effect of the War of Independence. — With the outbreak of the war education everywhere suffered seriously. Most of the rural and parochial schools closed, or continued a more or less intermittent existence. In some of the cities and towns, the private and charity schools continued to operate, but in others they were closed entirely, for the war engrossed the energies and resources of the peoples of the different Colonies. In New York city, then the second largest city in the country, practically all schools closed with British occupancy and remained closed until after the end of the war. The Latin grammar schools and academies often closed from lack of pupils, while the colleges were almost deserted; Harvard and Kings, in particular, suffered grievously, and sacrificed much for the cause of liberty. The period from the revolution to the beginning of the national Government (1775–89) was a time of rapid decline in educational advantages and increasing illiteracy among the people. Meagre as had been the opportunities for schooling before 1775, by 1790, except in a few cities and in the New England districts, they had shrunk almost to the vanishing point.

A Half-century of Transition. — The first half-century of America's national life may be regarded as a period of transition from the Church-control idea of education to the idea of education under the control and support of the State. It required time to make this change. Up to the period of the beginnings of national development education had almost everywhere been regarded as an affair of the Church, somewhat akin to baptism, marriage, the administration of the sacraments and the burial of the dead. Even in New England, which formed an exception, the evolution of the civic school from the Church school was not yet complete. A number of nevi forces — philanthropic, political, social, economic — now combined to produce conditions which made State rather than Church control and support of education seem both desirable and feasible. The rise of a new national Government based on the two new principles of political equality and religious freedom, together with the rise of new economic conditions which made some education for all seem necessary for economic as well as for political ends, changed this age-old situation.

For long the Churches made an effort to keep up, as they were loath to relinquish their former hold on the training of the young. The Churches, however, were not interested in the problem except in the old way, and this was not what the new democracy wanted. The result was that, with the coming of nationality and the slow but gradual growth of a national consciousness, national pride, national needs, and the gradual development of national resources in the shape of taxable property, — all alike combined to make secular instead of religious schools seem both desirable and possible to a constantly increasing number of citizens. This change in attitude was facilitated by the work of a number of semi-private philanthropic agencies, the most important of which were: (1) the Sunday school movement; (2) the growth of city school societies; (3) the Lancasterian movement; and (4) the coming of the infant-school societies.

Of these the Lancasterian movement was by far the most important because it, for the first time, made general education for all seem financially possible. All at once, comparatively, a new system of teaching had been evolved which not only improved but at the same time tremendously cheapened education. The new Lancasterian schools materially hastened the coming of the free school system in all the Northern States by awakening thought, provoking discussion and accustoming the people to bearing the necessary costs which public education entail. The city school societies, privately organized associations to provide educational facilities in the cities, formed a connecting link between the Lancasterian schools and the publicly organized schools which followed.

Creation of the American State School. — By the close of the first quarter of the 19th century a great struggle for the creation of a series of tax-supported, publicly controlled and directed, and non-sectarian common schools was in progress, and the second quarter of the century may be said to have witnessed the successful conclurion of the battle. In 1825, always excepting certain portions of New England where the free school system had become thoroughly established, such schools were the distant hope of statesmen and reformers; in 1850 they were becoming an actuality in every Northern State. The 25 years intervening marked a period of public agitation and educational propaganda; of many hard legislative fights; of a struggle to secure desired legislation, and then to hold what had been secured; of many bitter contests with Church and private-school interests, which felt that their "vested rights" were being taken from them; and of occasional referendums in which the people were asked, by vote at the polls, to advise the legislature as to what to do. Excepting the battle for the abolition of slavery, perhaps no question has ever been before the American people for settlement which has caused so much feeling or aroused such bitter antagonisms.

To meet the arguments of the objectors, and to change the opinions of a thinking few into the common opinion of the many, to overcome prejudice, and to awaken the public conscience to the public need for free and common schools was the work of a generation. It was likewise the work of a generation to convince the masses that the scheme of State schools was not only practicable but also the best and the most economical means of giving their children the benefits of an education; to persuade propertied citizens that taxation for education was in the interest of both public and private welfare; to show legislators that it was safe to vote for school bills; and to overcome the general opposition due to apathy, sectarian jealousy and private interests. In time, however, the desirability of common, free, tax-supported, non-sectarian, State-controlled schools came to be evident to a majority of the citizens of the different American States, and as it did so, the American State school, free and equally open to all, was finally evolved and took its place as the most important influence in the national life working for the perpetuation of American democracy and the advancement of the public welfare.

The Struggle for Public Schools. — The problem confronting those interested in establishing State-controlled schools was not the same in any two States, though the struggle in many States possessed common elements, and hence was somewhat similar in character. There were six strategic points in the struggle, which may be described briefly, as follows:

1. *The Battle for Tax* Support. — Land endowments, lotteries, licence taxes, and rate bills were the favourite early means for

raising money for school support. The land endowments made by the early States and by the Federal Government to the hew western States were looked upon as having large potential values. The early idea was that the income from such sources would in time entirely support the necessary schools. Later this idea had to be abandoned when it was seen how little yearly income these sources produced, and how rapidly the population of the country was increasing. By 1825 it was evident to the leaders that the only safe reliance of a system of State schools lay in the general and direct taxation of all property. The cry that "the wealth of the State must educate the children of the State" now became a watchword, and by 1825 to 1830 the battle for direct taxation for education was joined in all the Northern States except the four in New England where the principle had long been established. The struggle was a prolonged and bitter one. "Campaigns of education" had to be prepared for and carried through. Often those in favour of taxation were fiercely assailed and even at times threatened with personal violence. Indiana and New York were the critical battle-grounds, and referendums were taken. In Kentucky a long fight was waged to prevent misappropriation of the school fund and to secure a two-mill (one-fifth of a cent in American currency) tax. The right of the State to tax for education and to compel the duplication of State aid by local taxation was seen to be the key to the whole problem of the creation of a State school system of public instruction. When this key position had been won, as it had been generally in the North by 1850, the process of evolving an adequate State school system became merely that of the further education of public opinion to cover the new educational needs. The development since has followed different lines in different States, and probably no two States stand at the same point in the evolution of a system of school support. Everywhere, though, the New England idea of State support has been accepted, and the New England co-operative-maintenance attitude has been established as the common practice of the different American States. New England Puritanism here makes what is probably its greatest contribution to American life.

2. *The* Battle to Eliminate the *Pauper-School* Idea.—The home of the pauper-school idea was in the old Central and Southern States; it made no headway in the North and the new democratic West would not tolerate it. Its friends were found among the old aristocratic or conservative classes, the heavy taxpayers, the supporters of Church schools, and the proprietors of private schools. Large numbers of those for whom the pauper schools were intended would not brand themselves as paupers by sending their children to them, and those who accepted the advantages offered, for the sake of their children, despised the system. Finally the battle to eliminate the pauper-school idea began in Pennsylvania in 1834 and in New Jersey in 1838, and in each State a victory was won and a State system of schools created only after a most bitter fight in the legislature and at the polls. The idea continued some time longer in Maryland, Virginia and Georgia and at places in other Southern States, but finally disappeared in the South with the establishment of State taxation and with the educational reorganizations following the American Civil War. The rate bill, a per-pupil charge levied on parents to supplement the public funds, lingered a little longer; the cities did away with it first, and by 1871 it had disappeared from every Northern State and the schools of the nation were tax-supported and entirely freed from the pauper taint.

3. The *Establishment* of *Supervision.*—The battle for taxation for education was also indirectly a battle to establish some form of State oversight for the hundreds of systems which had grown up in each of the States. The acceptance of State aid inevitably meant a small but gradually increasing State control. To exercise this control me next find the States creating a series of school officers to represent the State, the enactment of laws extending State control, and a struggle to integrate, subordinate and reduce to some semblance of a State school system the great numbers of small community school systems. The pivotal States in this struggle were Massachusetts, Connecticut, New York, Ohio and Michigan, and the pivotal point in the struggle was the attempt to control the local systems of school organization which had developed and spread with time. In most States the district system had run rampant, and an exaggerated idea as to district rights, district importance and district perfection had become common. In Massachusetts, New York and Indiana, in particular, such systems had almost destroyed the schools. The Massachusetts law of 1826, requiring each town to appoint a town school committee to control the schools; the establishment, in 1834, of the State school fund; and the creation, in 1837, of the celebrated Massachusetts State Board of Education with an appointed secretary—a position held by Horace Mann for 12 years—mark the culmination of the struggle in that State. Connecticut provided for a somewhat similar board in 1839, and Henry Barnard became the first secretary. Michigan and Ohio provided for a State superintendent of public instruction in 1837, and the other States soon followed these examples. From then on State supervision came to be regarded as an established principle, the work of the future being largely an elaboration of the work of Mann in Massachusetts and Barnard in Connecticut,—two men who may be said to have created State supervision in the United States.

4. The *Elimination* of Sectarianism.—So long as there was little intercourse and migration, and the people of a community remained fairly homogeneous, it was perfectly natural that the common religious faith of the people should enter into the instruction of the school. With the coming of foreign immigration, which began to be marked after about 1825, and the intermingling of peoples in the cities, religious uniformity ceased to exist. As necessity compelled the State to provide education for the children, sectarian differences made it increasingly evident that the education provided must be non-sectarian in character. The secularization of education in America thus came about as an unavoidable incident in the development of government among a people, and not as either a deliberate or wanton violation of the rights of the Church. The change to non-sectarian schools came gradually. Beginning early in American national history and in a way a sequel to a waning interest in religion, it was not until the 1840s that the question became at all acute. Then the fight was precipitated in both New York and Massachusetts at about the same time, and with about the same results. Finally, to settle the question, State after State amended its constitution to forbid any division or diversion of the public school fund, and each new State when admitted made similar provision. The matter may now be regarded as settled in the different American States.

5. The Establishment of the High *School.*—The schools established by the early States were almost entirely elementary, or the so-called "common schools." The next struggle came in an attempt to extend the public school system upward so as to provide a more complete education than the common schools afforded. The academy development, beginning about the middle of the 18th century (see SECONDARY EDUCATION), had created a new type of secondary school that was semi-public in control and more democratic in character than the town Latin grammar schools had been, and the development of the academy was marked during the first half of the 19th century. In particular, this institution offered a much broader course of study than did the Latin grammar schools, often was open to girls as well as boys, and aimed to prepare for practical life and for teaching instead of merely for college. One result of this development was a demand that the cities should establish free higher schools of a somewhat similar nature. In 1821 Boston created what is regarded as the first American high school, and in 1827 Massachusetts enacted a law requiring a high school in every town of 500 families or over, in which certain specified modern studies should be taught. In 1835 smaller towns also were permitted to establish such a school. This law marks the real beginning of the American high school as a distinct institution, formed the basis of all subsequent legislation in Massachusetts, and deeply influenced development in other States.

Up to 1840 about a dozen high schools had been established in Massachusetts, and a similar number in other States. The democratic West soon adopted the idea and established high schools as cities developed and the needs of the population warranted their

creation. The struggle to establish and maintain these schools which New York and Massachusetts had undergone was repeated in every new State east of the Mississippi river and north of the Ohio. One of the most important of these conflicts came in the City of Kalamazoo, Mich. This case finally reached the State supreme court of Michigan which, in 1874, handed down a decision which deeply influenced all subsequent development. It confirmed the high school as an integral part of the common school system, and affirmed that the voters might provide for the support of any kind of public instruction authorized by the laws of the State. This decision ranks with the Massachusetts law of 1827 as one of the important milestones in the creation of the American public high school.

6. The State University. — *During* the colonial period of American history nine colleges had been established: Harvard in 1636, William and Mary in 1693, Yale in 1701, Princeton in 1746, Pennsylvania academy and college in 1753–55, Kings (Columbia) in 1754, Brown in 1764, Rutgers in 1766 and Dartmouth in 1769. The religious purpose had been dominant in the founding of each institution, though there was a gradual shading off in denominational control and insistence upon religious conformity after about 1750. Fifteen additional colleges were founded before 1810, though the two dozen colleges then existing did not have all told over 100 professors and instructors, and not over $1,000,000 worth of property. All were small. No one of the 24 admitted women in any way to its privileges. Fourteen more colleges were added before 1820, after which a great period of denominational effort in the founding of new colleges began, and during the next 40 years 196 new colleges were founded in the United States. Though the Federal Government, beginning with Ohio in 1803, had given land to each of the new States to help endow a seminary of higher learning within the State, of the 246 colleges in existence by 1860 but 17 were State institutions.

In 1816 the legislature of New Hampshire attempted to take over Dartmouth college and make of it a State university, but was stopped from so doing, in 1819, by a decision of the U.S. Supreme Court which held that the charter of a college was a contract the obligations of which a legislature could not impair. The effect of this decision was to give a new impetus to the States to extend their public school system upward and to crown it with a State university. It was some time, however, before such institutions became either numerous or important. For long they remained much like the denominational colleges about them—small, poorly supported, and afflicted with denominational and political controversies. Michigan was the first of the State universities to throw off the incubus of political and denominational control. Opened in 1841 at Ann Arbor, Mich., in 1852 it had a faculty of only six, 72 students and a single course of study, but by 1860 it had enrolled 519 students and its remarkable development as a State university had begun. During the next two or three decades most other State institutions followed its example. Large and important State universities are to be found in every State west of Pennsylvania and south of the Potomac, and a few elsewhere. In every State, too, some form of a State college or university now exists.

The Land-grant Colleges (*q.v.*).—In 1862 Congress provided (Morrill Act) for a grant of public land to each State to found a college of agriculture and mechanic arts. The grant was accepted and such an institution was created in every State. 18 States added the land-grant to their existing State universities and combined the two institutions; three of the older States (originally five) gave the grant to private institutions already established within the State; and the remainder established separate agricultural and mechanical colleges.

The financial returns from the land-grants were disappointing, but the educational returns have been very large. Probably no aid given by the national Government to the States has proved so fruitful as have these grants of land, and subsequently of money, for instruction in agriculture and the mechanic arts. New and vigorous colleges have been created (Cornell, Purdue, and the State universities of Ohio and Illinois are examples); small and feeble State universities have been awakened into new life (Vermont and Wisconsin are examples); agriculture and engineering have been developed as new learned professions; and the States have been stimulated to make larger and rapidly increasing appropriations for their universities, until the State universities largely overshadow all but the best endowed of the old denominational colleges. The far-reaching educational importance of the Morrill Act is not likely to be overestimated.

The Free Public School System. — By the close of the second quarter of the 19th century, certainly by 1860, we find the American public school system fully established, in principle at least, in all the Northern States. Much yet remained to be done to carry it into full effect but everywhere democracy had won its fight, and the American public school, supported by general taxation, freed from the pauper-school taint, free and equally open to all, under the direction of representatives of the people, free from all sectarian control, and complete from the primary school through the high school, and in the Western States through the university as well, may be considered as a permanency in American public policy and, with the State university, represents the crowning achievements of those who worked for a State-supported educational system fitted to the needs of great democratic States. Probably no other influences have done more to unify the American people, reconcile diverse points of view, eliminate State jealousies, set ideals for the people, and train leaders for the service of the States and the nation than have the academies, high schools and colleges scattered over the land. They have educated but a small percentage of the population, to be sure, but they have trained most of the leaders who have guided the American democracy since its birth.

New Influences. — Up to the close of the first third of the 19th century American educational development was largely native, modified from time to time during the colonial period by new ideas brought over from England and new plans as to organization from France. The revolution put an end to English influences, and the schools evolving afterward were those adapted to the needs of a new nation on a new continent. They were distinctly of a homespun variety. It was not until the decade of the '20s that educational journalism in America had its beginnings, and not until a decade later that it may be said to have got under way. The first real contact with what Europe had been doing came in 1819 through the publication in America of John Griscom's *A Year in Europe*, in which he described the schools of a number of European countries, and especially the schools and work of Pestalozzi. A few other travellers published their descriptions, and in 1835 a translation of Victor Cousin's *Report* on public instruction in Prussia was printed in New York. The influence of this volume on the new constitution of Michigan, then being formulated, was of great importance. Both Stowe's *Report on Elemerztary Education in Europe*, made to the legislature of Ohio in 1837, and Bache's *Report on Education in Europe* (1839), awakened wide interest. In 1843 Horace Mann spent some months in visiting European schools, and on his return reported at length on what he had seen.

The general results of these various observations by travellers and official *Reports*, extending over nearly a quarter of a century, and the work of the newer educational journals, particularly the work of Henry Barnard, were to give to American educators some knowledge of school organizations elsewhere. They especially gave strong support to the movement, already in progress, to organize the many local school systems into State school systems, subjecting them to State oversight and control; they further stimulated the movement, already well begun, to grade and classify the schools in a more satisfactory manner; they helped to inaugurate a movement for the introduction of Pestalozzian methods to replace the wasteful individual and the mechanical Lancasterian plans which had for so long been in use; and they gave material assistance to the few leaders in Massachusetts and New York who were urging the establishment by the State of professional training for teachers for the educational service.

The training of teachers had been begun in the Lancasterian model schools, about 1810, but the first regular teacher-training school in America was established privately in 1823, at Concord,

Vt., by the Rev. Samuel R. Hall, as an adjunct to his work as a minister. In 1827 New York State, at the instance of Gov. Clinton, provided for teacher training in connection with a few of the academies of the State. The training offered in all these institutions was entirely academic, as there was in America at that time no body of professional knowledge to teach. Practice in the work was obtained by teaching during the winter in the rural schools. Hall, however, tried to tell his pupils how to organize and manage a school, and finally wrote out his ideas in a series of *Lectures on Schoolkeeping* (1829), a little volume that constituted the first professional book on teaching to appear in America in the English language. In 1835, a Dr. Julius, of Hamburg, visited America and described to the Massachusetts legislature the Prussian system of elementary education and teacher training. A State-wide agitation for State training of teachers followed, culminating in the opening of the first American State normal school at Lexington, Mass., in 1839, followed by another at Barre the same year, and a third at Bridgewater in 1840. New York State followed with a similar school in 1844, and Connecticut and Michigan in 1849. By 1860 12 normal schools in nine States, and six private normal schools, had been organized for the training of teachers *(see* NORMAL SCHOOLS).

About 1860, largely through Edward A. Sheldon, of Oswego, N.Y., the introduction of the new Pestalozzian procedures began. Within a few years visitors from near and far came to Oswego to see the work of Sheldon and his teachers. The "Oswego movement," which he inaugurated, during the two decades following almost completely reshaped elementary instruction in the better schools of America. The normal school came into its own, and teacher training by Oswego methods was generally adopted by educationists. Between 1850 and 1880 new subjects of study were introduced in elementary education, the teaching of the older ones was revolutionized, and a new technique—a methodology—for instruction in each subject was worked out. Where before the ability to organize and discipline a school had constituted the chief art of instruction, now the ability to teach scientifically took its place as the prime professional requisite. A new conception of the child as a slowly developing personality, demanding subject matter and method suited to his stage of progress, also replaced the earlier conception of the school. With the addition of new ideas as to the teaching of history and literature, which came in with the Herbartian theories in the '80s, and manual training and home economics instruction, which began about the same time, the most important foreign contributions to the elementary school were made. The kindergarten (*q.v.*), which reached America in the '70s and became well established by the '90s, also should be mentioned among the material contributions from foreign sources.

By 1900 the centre of gravity had been shifted from the subject matter of instruction to the child to be taught. The school, in consequence, had begun to change from a place where children prepare for life by learning certain traditional things to a place where children live life and are daily brought into contact with such industrial, social, community and real life experiences as will best prepare them for the harder problems of living which lie just ahead. These changes in character and purpose, largely due to the teachings of John Dewey, have become dominant purposes of the American elementary school of the 20th century.

Expansion of the High School.—Though dating from 1821, the public high school up to about 1860 had made little headway except in regions where New England people had gone. The Civil War checked development for two decades, but after about 1880 a very rapid growth took place. From about 500 high schools in 1870, and about 2,500 in 1890, some 16,000 had been established by 1925. The old academies were replaced, and the high school has become the accepted American secondary school. Along with this rapid development—in number of schools, teachers and students—a marked change in the high school itself has taken place. The course of study, up to about 1860 essentially a uniform book-study course of three years, after about 1880 was expanded so rapidly by the introduction of new subjects that it was soon lengthened to four years and subdivided into numerous parallel courses. Entirely new types of high schools, too, were created, such as commercial, agricultural and manual arts; and out of this evolution has come the so-called cosmopolitan high school which oifers instruction in many different types of general and special training. With the enactment by Congress of the Smith-Hughes Vocational Education bill (1917), giving aid to the States for agricultural, home economics and industrial education, a vast system of vocational education, secondary and local in character but national in scope and purpose, began to be developed. Hence we find the American high school, as the result of a century of progress and evolution, has developed into a comprehensive system of secondary education which an increasingly large proportion of the youth of the land, of both sexes. attend. Day schools, night schools and continuation schools all form a part of this secondary school system.

University Expansion.—Accompanying the expansion of the high school has come a similar development of college and university training. Since about 1880, when the State universities began to turn their attention to serving and advancing the welfare of the State, both university attendance and university revenues have advanced by leaps and bounds. During the same period a number of new and important endowed university creations have also made their influence felt. Coincident with the rapid increase in students, faculty, schools and courses, has come the greatest number and amount of gifts of money ever made to aid higher education in any land. The States, too, have put millions of dollars into the equipment and maintenance of these higher institutions, believing in them as the creators of advanced public opinion and as training schools for the future leaders of the State.

Educational Reorganization.—Beginning about 1910, a very important reorganization of the upper years of the public school systems in the United States has taken place. Instead of an educational organization consisting of eight years of elementary school and four years of secondary school, there has been evolved a six-year elementary school dealing with the fundamental tools and skills, a three-year junior high school with a greatly enriched course of study designed to meet the special biological and psychological and social needs of young people in their teens, and a three-year senior high school planned for later adolescents. This has substituted a 6–3–3 type of educational organization for the former 8–4 type. Few fundamental changes in educational organization have been accepted more rapidly than this; whereas but two cities had organized junior high schools before 1900, and but ten cities before 1910, 198 cities had organized such schools by 1915, 386 cities by 1920, 704 cities by 1924 and 1,109 cities by 1927. This type of organization promises to become well nigh universal in another decade.

Another administrative reorganization, and one of great importance to the future of public education in America, is the extension upward of the public school system to include the 13th and 14th years of school life—the freshman and sophomore years of the traditional college. A number of American cities have already added these years to their public school system by organizing what has come to be known as a junior college, thus making their public school system a 6–3–3–2 school system. The final result of such a reorganization will be not only a kindergarten—6–3–3–2 school system, or possibly a kindergarten—6–4–4 plan of organization, but also the dropping of the first two years of work from the traditional college and the transformation of the universities of America into what continental European universities have for long been—a group of professional schools beginning with the junior year.

Lateral Expansion of the School.—Along with the vertical expansion of the public school system there has also been a vast lateral expansion of the school. Especially since about 1900 has this been a marked feature of American educational work. Pedagogical and intelligence testing have revealed the need for differentiated instruction, and this has been met by the institution of flexible plans for grading and promotion and the organization of ungraded and special-type classes to meet many varying needs. Classes have been organized for over-age, non-English-speaking, deaf, blind, crippled, tubercular, anaemic, speech-defectives, subnormals and other types of children in need of special attention

and care. The handling of disciplinary cases also has called for the organization of the ungraded room, the opportunity school and the parental school. Industrial classes, trade schools and special vocational and home-making schools have been instituted for other children who cannot profit by the book-work of the ordinary school. Adult instruction has experienced a very marked development. Another aspect of the lateral expansion of the school has been the attention given to problems of health, physical welfare, playground work, nutrition, abnormalities, child care, preventive hygiene and parental guidance and infant welfare. The school physician, the school nurse, the visiting teacher and the compulsory attendance officer have all combined in service to the child who does not make proper progress in the regular school. The school guidance counsellor has also been added to help guide boys and girls into tasks which they can do, and other advisers (deans) to help the youth of both sexes in handling their personal problems. Education in America has thus taken on many new functions of a personal and public welfare character.

Throughout all the reorganizations and expansions of public education one sees a determined effort to readjust the school to meet the changed conditions in national life — social, industrial, political, religious, economic, scientific. While the school systems which have been developed are State school systems, and in their internal organization and administration the States are supreme, many of the difficult social and educational problems America has come to face are national in scope and character and call for general and country-wide solution. To assist in such national solution many nation wide agencies have been set up, and there has been a strong and persistent movement for some national financial aid to the States, and for a secretary of education in the President's cabinet. (E. P. Cu.)

SCHOOLS FOR NON-ENGLISH-SPEAKING ADULTS

In the United States schools are provided for three main lines of educational effort: instruction in English; preparation for naturalization and citizenship; educational service for individual, family and group adjustment. To meet the needs of the foreign-born in adjusting themselves to a new environment and to new culture patterns and forms of behaviour, special materials relating to American history, biography, institutions, traditions, customs, ways of living, geography, industry and other subjects are provided.

These schools range from elementary to higher education. Emphasis is placed upon elementary instruction because of much illiteracy and limited educational attainments among many immigrant groups. Educational facilities include public and institutional evening schools and classes; day classes in schools, libraries, churches, neighbourhood centres and homes; classes in factories, industrial plants, hotels and other places of employment. Special attention is given to home and neighbourhood classes for women and mothers.

Schools for non-English-speaking people are direct results of immigration. Their rapid development is largely due to an Americanization movement during and immediately following the World War. They are regarded as distinct instrumentalities in nation-making. For several years prior to the war, public evening schools, settlements, Y.M.C.A.'s, Y.W.C.A.'s, various social agencies, churches, corporations and other organizations conducted schools and classes for immigrants. Chief attention was devoted to instruction in English. Fear of the foreign-born during and after the war; comparative ignorance about their conditions and needs; the prominence of the foreign-language press and increasing delinquency among the second generation, coloured much of what was promoted as Americanization. Departments, divisions or bureaux of Americanization were created in numerous city and State departments of education. This nationalistic movement has been partially transformed into a definite educational movement for adults of foreign birth and speech with appropriate redirections on emphasis, organization, materials and methods.

Complete and accurate statistics for the country as a whole are difficult to secure. The U.S. Bureau of Education for the year 1925–26 reported 128 public school systems with Americanization classes, employing 262 supervisors and principals and 3.436 teachers. and enrolling 141,064 pupils. To these figures should be added the considerable number of schools and classes conducted by individuals, social organizations, private and semi-public institutions, religious organizations, industries and other agencies. In certain communities, as for instance, New York city, where foreign-born men and women comprise about go% of evening school enrolment, a large proportion of adults enrolled in schools are immigrants.

Community co-operation of various forms — between public and private agencies; between organizations and individuals representing the native and foreign-born — is necessary. Some cities have central co-ordinating organizations. Public responsibility for socialized educational service is increasingly emphasized with larger provisions for schools under competent leadership. In general, local public educational authorities provide funds for supervision and full or part-time teaching according to local demand; local appropriations are commonly supplemented by some form of State aid, in keeping with general educational fiscal policies of the several States.

See Sharlip and Owens, *Adult Immigrant Education* (1925); Cook and Walker, *Adult Elementary Education* (1927); Caroline A. Whipple, *Course of Study for Non-English-speaking Adults* (1927).
(R. T. Hi.)

FRANCE

France (*q.v.*) presents the most complete type of a state system of education organized under a strongly centralized administration in all grades. This centralized administration in education, as in other departments, represents the Napoleonic heritage of the republic. The teaching profession, both in the primary and higher spheres — and the two are sharply marked off from one another — consists of a highly organized body of state functionaries, united by a strong *esprit de corps* and actuated by ideals and aims which are inspired by the State. The importance of this condition of things lies in the fact that the republic is something more than a form of government; it is the social and moral expression of the democratic ideal as conceived by a people profoundly imbued by tradition with the sense of social solidarity, or collectivism; and nowhere has this expression been more characteristic or more complete than in the domain of public education. Yet the educational system of modern France is by no means exclusively the creation of the Third Republic, and the main stages in its development deserve to be traced historically.

Early Stages of Public Education. — No historical sketch of French education can ignore the great catholic religious educator of the 18th century, Jean Baptiste de la Salle, the founder of *Les Frères de la Doctrine chrétienne,* commonly known as the "Christian Brothers." The brothers were not merely pioneers of elementary education, they may also be regarded (as M. Buisson, formerly director of public instruction, has shown) as the originators of higher primary instruction. Under the restoration they upheld the method of simultaneous teaching against the partisans of the mutual (or monitorial) method, successfully demonstrating the superiority of the trained teacher.

The Revolution. — The constitution of 1791 decreed that primary instruction should be compulsory and gratuitous. In this as in much else the revolution was powerless to do more than enunciate general principles which it left for later generations, in the present instance after the lapse of nearly a century, to carry into effect. True to its theories of individualistic liberty, the revolution admitted liberty of teaching. Napoleon, on the other hand, by the law of 1806, centralized all forms of education in one official teaching body under the name of the Imperial University, thus securing a monopoly of teaching to the state.

Under the restoration education fell inevitably under the control of the church, but under the Liberal monarchy Guizot in 1833 passed a law which laid the foundations of modern primary instruction, obliging the communes to maintain schools and pay the teachers. It is also to the credit of Guizot as an educational reformer that he perceived the necessity for the higher primary as distinct from the secondary school. The higher primary schools

which he founded were unfortunately suppressed by the *Loi Falloux;* their restoration constitutes one of the great positive services rendered by the Third Republic to the cause of popular education.

Loi Falloux.—The *Loi Falloux* of 1850, passed by the Second Republic under the influence of the prince president, is chiefly memorable for its restoration of the liberty of teaching, which in a catholic country means in effect free scope for priestly schools. This law also made provision for separate communal schools for girls, for adult classes, and for the technical instruction of apprentices. In 1854 France was divided for purposes of educational administration into 16 academies, each administered by a rector with an academy inspector under him for each department. This organization survives to-day, with the difference that for each academy (except Chambéry) there is now a local teaching university.

The ministry of the well-known educationist, M. Duruy (1865–69), corresponding to the period of the Liberal empire, rendered primary schools for girls obligatory in communes of over 500 inhabitants. Duruy also provided for the introduction of gratuitous instruction at the option of the commune.

Organization by the State. — The task of educational reform imposed itself upon the republic by a twofold necessity. The wars of 1866 and 1870 were victories for the Prussian school-master, and aroused western Europe to the national importance of popular education. For France the reform of popular education was an essential part of the work of national restoration. For the republic, too, menaced by older and hostile traditions, the creation of a national system of education inspired by its own spirit was an essential condition of the permanence and security of its government and the social ideals of which that government was the expression. Hence the energy with which the republican state addressed itself to the organization of primary instruction, "obligatory, gratuitous, secular."

By the law of June 1, 1878, there was imposed upon the communes the obligation of acquiring their school buildings; and as a grant in aid a sum of £2,400,000 was set aside for this purpose by the State. In 1879 a law was passed compelling every department to maintain a training college for male and female teachers respectively. The two higher normal schools of Fontenay and St. Cloud were also founded to supply the training colleges with professors. During the same period, among other *certificats* or professional diplomas, there were established the *certificat d'aptitude ptdagogique,* which qualifies probationer-teachers (stagiaires) for appointment as teachers in full standing (titulaires), and the *certificat d'aptitude* for primary inspectors and heads of normal schools. The law of June 16, 1881, rendered obligatory for all teachers, whether public or private, the *brevet de capacité.* It was found, however, impracticable to carry this law into immediate effect, though conditions have improved.

The laws making primary education gratuitous, compulsory, and secular are indissolubly associated with the name of Jules Ferry. The law of June 16, 1881 abolished fees in all primary schools and training colleges, the law of 1882 established compulsory attendance, and finally the law of Oct. 30, 1886 enacted that none but lay persons should teach in the public shools, and abolished in those schools all distinctively religious teaching. In the boys' schools members of religious communities were to be displaced within five years, but in girls' schools the religieuses might remain till death or resignation.

Moral Instruction. — Religious teaching was replaced in the state schools under the Ferry law by moral instruction according to official curricula. As regards the character of this instruction, it would seem to have shifted from a Kantian mainly to a sociological basis. Roman Catholic opinion is at least not unanimous in regarding the "lay" or neutral school as essentially or necessarily anti-religious, and plainly there is no inherent reason why the neutrality should not be a real neutrality, but with the existing relations between the catholic church and modern thought in France the influence of the normalist teachers is in fact to be anti-religious, and moreover no system of independent moral doctrine, whether based upon *a priori* or inductive reasoning, can be acceptable to the Roman Catholic church. In whatever degree the blame may be rightly apportionable between church and state, the fact is that the two find themselves in acute conflict. It may be that the mischief would have been mitigated had more moderate counsels prevailed at the time of the Ferry law, and had the church been willing to accept (as the republic might have been willing to concede) right of entry for the clergy into the schools. In the meantime the religious difficulty in the schools divided the nation into two hostile camps (*les deux Frances,* as a Swiss Protestant writer put it) in the shape of the state secular schools on the one side and the private religious schools on the other.

Administration. — In 1889 an important change was made in educational finance by transferring the cost of teachers' salaries in primary schools from the communes to the state, a right consequence of the change which made the teacher a state official. Thus the state assumed the greater part of the burden of primary instruction, leaving to the communes merely the cost of fabric, and to the department the maintenance of the fabric of the normal schools.

Central Authorities. — The minister, the head of the entire hierarchy, is assisted by a *conseil supérieur* consisting of 57 members, of whom the majority are elected by the higher teaching profession. Practically the ordinary work of the council is carried on by a sub-committee consisting of the nine nominees of the president and six others designated for this purpose by the minister. The council has administrative, judicial, and disciplinary, as well as advisory, powers which enable it to exert a direct influence upon the internal organization of schools. There is also a pedagogic *comité consultatif* and a legal *comité contentieux,* whose respective functions are purely advisory.

The *inspecteurs généraux* should "act as the eyes and ears of the central authority." Their main duties are to inspect the normal schools and supervise the work of the ordinary inspectorate. For the purpose of general inspection France is divided into seven districts.

Local Authorities. — As already indicated, for the purpose of educational administration, the departments of France, to which must be added Algiers, are grouped in 17 divisions called academies. At the head of each academy is the rector. He is appointed directly by the president and is not only the head of the local teaching university, but is also charged in a general way with the oversight of all three departments of education — superior, secondary, and primary. The direct share of the rector in administration is mainly confined to the normal schools and the higher primary schools. The rector is assisted by an academic council composed almost exclusively of pedagogic elements.

Each department of France has an academy inspector appointed by the minister. The duties of the academy inspector embrace both higher and primary education. In the latter sphere he is the real head of the local administration, and the primary inspectors are his subordinate officers. He appoints the probationer-teachers and nominates the regular teachers for appointment by the *pre'fet.*

The *préfet,* the chief administrative officer of each department, not only appoints the teachers upon the proposition of the academy inspector, he is also, as president of the *conseil départemental,* concerned generally with the externa of school administration, including the supply of schools. As regards its constitution, the *conseil départemental* is in no sense a municipal body, the representatives of the *conseil général* of the department being greatly outnumbered by the pedagogical members.

The inspectors of primary schools, as has already been stated, act under the academy inspector. They are appointed upon the result of examination, and not by direct nomination as in England. The examination is severe, and it is from the body of the professors of the normal schools rather than from the ranks of the primary teachers that the successful candidates are chiefly drawn.

Very limited powers are entrusted to certain communal and cantonal authorities. The *commission scolaire* is a committee organized in each commune for the purpose of improving school attendance, to which end they administer a *caisse des écoles* or school fund for supplying clothing and meals to needy children The *maire* of the commune has the right of visiting the schools,

but neither he nor any of the minor local authorities can interfere with the teaching. Similar duties are assigned to the *délégués cantonaux* who are appointed by the *conseil départemental* for each canton (a wider area than the commune), and can best be described as local visitors or visiting committees rather than managers in our sense of the word.

Nursery Schools.—Probably the most important modern development in France has been the creation on a large scale of public *e'coles maternelles* (nursery schools).

In the single department of the Nord there are no less than 60 of such schools, more than in all England at the present time. In fact, for all France, the number of pupils in these schools in 1923–24 was 280,768.[1]

SECONDARY EDUCATION

In proceeding to sketch the French system of higher primary and secondary schools, it may be observed that European systems of higher education have generally been framed upon the view that secondary education is a training complete in itself from the preparatory stage to the university, with aims and ideals of general culture which differentiateit radically and at the very outset from education of the elementary type. On the other hand, in the United States, the view has prevailed that the secondary school must be complementary to the elementary school, in which even the Clite must receive their preparatory or elementary training. At any rate, down to the reform of 1902, which will presently be explained, the French system could be regarded as a typical and even extreme example of the European theory, little consistent as this might seem to be with the broader principles of democracy. A further breach has been made in the theory by an augmentation in the number of scholarships since the World War, and by an experiment to amalgamate in country districts small secondary day and higher finishing schools

Higher Primary Schools.—The aim of the *e'coles primaires supérieures* is to fill the void which must otherwise exist for those who need a higher education than the primary school can give. Throughout the organization of primary education the French have kept steadily in view the danger of creating an intellectual proletariat. *Nous poursuivons la culture générale du caractère et de l'esprit, mais nous cherchons en même temps à orienter l'enfant vers la vie pratique,* says an official report. The aim of the higher primary school is to continue education in this spirit up to the age of 16 so as to prepare the scholar to take an honourable place in the higher ranks of skilled industry. Within the limits necessarily marked out for them the higher primary schools of France have aimed at imparting what may be termed a general culture as distinct from purely technical or trade teaching, and this development has been greatly furthered by the separate organization given to the latter teaching in the *e'coles professionnelles.* At the same time, prominence is given in the higher primary schools to practical training of an educational character with special reference to the industries and circumstances of the locality, and in the rural districts a special agricultural bias is imparted to the curriculum. It is interesting to note that the institution of the higher primary schools was due in large part to the spontaneous initiative of the municipalities.

A wider extension has been given to higher primary instruction by the establishment of *cours complémentaires* in certain schools, at centres at which it would be impossible to organize separate higher primary schools. A similar solution of the continuation school problem has recently commended itself to the consultative committee of the Board of Education for England.

Admission to the higher primary schools in France is only accorded to those who have obtained the elementary school leaving certificate, *certificat d'études primaires.* A feature of importance for continuation work in rural districts is the provision made for boarding scholars in attendance at these schools. The boarding arrangements are generally, as in the case of the secondary schools, left to the head teacher, but in some instances municipal hostels have been provided. No fees may be charged for higher primary instruction, and scholarships (bourses) are provided to a certain extent in the form either of boarding scholarships or maintenance allowances to compensate the parent for the loss of the child's labour. The number of scholars in the public higher primary schools for the year 1903–04 was 34,084, and in *cours complémentaires* 21,777, making a total of 55,861. In addition, there were 8,801 scholars in receipt of higher primary instruction in private schools. In 1923–24 there were in these schools 39,309 boys and 34,091 girls.

Lycées and Colleges.—Practically every department has two training colleges for students of the two sexes. While the professors in these colleges receive their preparation in the two higher normal schools of St. Cloud and Fontenay-aux-Roses, French secondary education is given in the *lyce'es,* which are first-grade schools maintained and controlled by the state, and the *collèges,* which are schools of the second grade, maintained partly by the state and partly by the municipality. In both grades of schools the teachers are paid by the state and nominated directly or indirectly by the minister of education. They are required to possess certain specified academic qualifications which can only be obtained from the *université,* but failing teachers with the prescribed qualifications the classes are taught by teachers styled *charge's de cours* as distinct from professors. .

With a view to supplying teachers for the upper classes of the secondary schools, the state maintains the *e'cole normale supérieure,* a college in which instruction, board, and lodging are given free to a number of scholars selected by competition from the best secondary school boys, though residence in the institution is no longer compulsory. The *e'cole normale* has now become practically the college of pedagogy of the university of Paris. Its students are entered as students of the university, and study for their qualifying examination as teachers in secondary schools (*agrégation*) under university professors, partly at the Sorbonne, partly at the *e'cole normale,* while their professional preparation is entrusted solely to the latter institution. Before the World War the profession was the best qualified academically in Europe. With, however, the fall of the franc the recruitment was seriously threatened This danger has been removed by the stabilization and the large rise in salaries.

Secondary Education for Girls.—The foundation of secondary schools for girls was in its way one of the most notable achievements of the republic. It was inaugurated by the law of Dec. 22, 1890, called after its author, *la loi Camille Sée.* At first the curricula were different from those of the boys, and the course of study was only five years. There were no ancient languages, and mathematics were not carried to so high a pitch as in the boys' *lyce'es.* To-day there are three types of establishments: the *cours secondaires* (municipal or private) assisted by the state and regarded as colleges in the making, communal colleges, and *lycées.* Moreover, the pupils can prepare for the baccalauréat on equal terms with the boys. The rest of the girls confine themselves to working for the *diplôme de fin d'études secondaires.* The number of girls following the *cours secondaires* in 1923–24 was over 50,000.

Private Secondary **Schools.**—Until the passing of the Waldeck-Rousseau laws prohibiting religious associations, the number of pupils in the state secondary schools and the private secondary schools were approximately equal, the great majority of the latter schools being in the hands of the religious orders. The Waldeck-Rousseau Act was passed on July 1, 1901, and in 1904, under M. Combes, the religious schools were suppressed by law. Some managed none the less to maintain their ground, but their pupils shrank to a little over 20,000, with 35,000 in the free lay schools (some of these being transformed religious schools), while the numbers in the state schools amounted to about 100.000. In 1912 the number in the religious schools had risen again to 56,000; the number in the free lay schools had fallen to 17,000, while the number in the state schools was stationary. Under the heading of the private secondary schools should be mentioned here *honoris causa, l'école des Roches* founded by M. Demolins (author of *À quoi tient la supériorité des Anglo-Saxons*) and *le Collège de Normandie,*

[1] In this and other cases later statistics are not available owing to the economic crisis which has considerably reduced the staff in French government departments.

founded by M. Duhamel, a former French master at Harrow school, England. The Waldeck-Rousseau Act also caused a temporary decrease in the number of pupils in the religious elementary schools. But here again the impossibility of finding funds for building new schools or providing for new teachers speedily made itself felt, and the numbers rose again. They amounted in 1903–04 to 1,298,571, as against 4,935,000 in the public primary schools. To-day the terrible effects of the World War have markedly affected the numbers in both types of schools. In 1922–24 the numbers in the State primary schools were only 3,175,637, and the numbers in the private elementary schools had proportionately declined.

Secondary School Curriculum. — In 1902 reforms were made in the curriculum. Article 1 of the decree of May 31, 1902, coordinated with primary education so as to constitute a continuation of a course of primary studies of a normal duration of four years. The decree went on to provide for a full course of secondary studies of seven years' duration, divided into two cycles of four and three years respectively. In the first cycle the scholar had two options. In section 1 Latin was obligatory and Greek optional from the beginning of the third year (*classe* iv.). In section 2 there mas no Latin. At the end of the first cycle the state granted a *certificat d'études secondaires du premier degré*. In the second cycle one of four courses might be taken: section 1 with Latin and Greek continued the old classical education; section 2 with Latin and modern languages corresponded to the German Realgymnasium; section 3 with Latin and science; and section 4 with modern languages and science to the Oberrealschule. The *baccalauréat,* or secondary school-leaving examination, conducted by the university, was adapted to all the courses on the principle that courses of study of equal length, whether classical or modern, literary or scientific, were entitled to equal advantages.

Final Re-draft of the Curriculum, 1924.—Since 1910 the most important event in the sphere of secondary education has been the changes in the curriculum. In 1923 the minister of public instruction, M. Léon Bérard, decided to abolish the four alternative sections and make Latin compulsory for four years and Greek for two. for all secondary pupils. The course in science was to be the same for all pupils, and it was only in the year before the baccalauréat that the pupil could choose between classics and a modern course. The Bérard reforms considerably lightened the time-table by cutting down, above all, the mathematics and simplified the over-elaborate choice of studies, but the proposal of classics for all roused the most violent opposition. A change of government made it easy for M. Herriot — the new minister of public instruction — to re-establish the modern Latin-less course, but the others were not revived. Henceforth the pupils have a choice between classics and a modern course, but whichever they choose, for two-thirds of the time-table in such subjects as French, history, geography, etc., they are taken together, though the system is meeting with a good deal of criticism.

Physical Education. — A word must be said here on physical education. Since 1923, two hours a week have been prescribed for pupils of both sexes in the elementary schools. Since Jan. 19,1925, it has been laid down by the ministry that similar time shall be devoted to the subject in boys' and girls' secondary schools. The teaching consists in conferences on health and in practical exercises. Attempts are being made to build up a properly equipped *personnel* by establishing a *certificaf d'aptitude à l'enseignement de la gymnastique,* which is now to be replaced by an examination of more general culture entitled *le certificat d'aptitude au professorat de l'éducation physique*. Meanwhile, the number of secondary pupils playing tennis, football, and basket-ball (the latter being played by both sexes!) has largely increased of recent years.

Technical Schools. — A certain number of technical schools, formerly under the ministry of commerce, have been brought under dependence of the ministry of public instruction. They include six national professional schools, six *e'coles nationales d'arts et métiers,* higher schools of commerce and 84 *écoles pratiques de commerce et d'industrie,* as well as commercial and technical courses followed by some 280,000 students in 1923–24. There are also a network of institutions and schools run by the ministry of agriculture, from the national agricultural institute of Paris, and the national schools of agriculture at Montpellier and Rennes, down to the *fermes-écoles* and the *e'coles pratiques d'agriculture* (over 30 in number with generally a two years' course). There are also some 50 fixed winter schools and more than half that number of travelling winter schools. In addition, there are some 700 continuation classes in agriculture and agricultural economy for adults of both sexes. Various other ministries have professional schools attached to them, the most important being those of the ministry of war *(e'cole polytechnique* for military engineers, *école militaire,* St. Cyr, for ordinary officers, and St. Maixent for non-commissioned officers seeking commissions), the ministry of the marine (naval school), and the ministry of the colonies *(e'cole coloniale,* for the colonial civil service — also French schools abroad). Some of the schools in other countries are also under the ministry of foreign affairs.

The question of restoring some of the religious teaching orders was discussed by the Poincaré cabinet in November, 1928.

As regards higher education and the creation of regional universities in 1896, *see* UNIVERSITIES.

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GERMANY

Until the fall of the Empire, education was left to the exclusive control of each of the federated states. The only points of direct contact between the Empire and education lay in the mutual undertaking of the states to enforce the law of compulsory attendance at school and to maintain approximately equal standards in the award of final secondary school certificates. Of far greater moment than these indications was the moral influence exerted on other states by the Prussian hegemony, in virtue of which the Prussian system came to be in all essential characteristics typical and representative of Germany as a whole. Complete and careful though the system was it was not within the power of any government in Prussia to pass a comprehensive education law. The growth was determined by a series of special laws, royal decrees and wise administrative regulations. A detailed historical study would bring out clearly the intimate connection between the development of the educational system and the Prussian state and again between these and the expansion of the national life of the German people.

Latin Schools. — Stress is rightly laid by all educational writers upon Luther's famous letter to the German municipalities in 1524 urging upon them the duty of providing schools and upon parents the duty of sending their children to school. An attempt to carry this into effect was made by the Electoral government of Saxony which issued in 1528 an ordinance, drawn up by Melanchthon, providing for the establishment in every town and village of Latin schools, for the Protestant Reformers were solidly in favour of classical education. It is, therefore, all the more remarkable that the Ordinance issued by the Elector of Wiirttemberg 1559 represented the first systematic attempt to provide both elementary and higher education, directing the establishment of elementary schools throughout the country and of Latin schools (or *Particularschulen*) in every considerable centre of population. These promising beginnings were, however, brought to nought in the troublous times of the Thirty Years' War, and by the desolation and national decadence which that calamity brought in its train. The permanent and positive value of Luther's pronouncement of 1524 lies not so much in its direct effects as in the hallowed associations which it established for Protestant Germany between the national religion and the educational duties of the individual and the state. Thus, doubtless, was created that healthy public opinion which rendered the principle of compulsory school attendance easy of acceptance in Prussia at a much earlier date

than in England. State interference in education was almost coincident with the rise of the Prussian state. In 1717 Frederick William I. ordered all children to attend school where schools existed. This was followed in 1736 by edicts for the establishment of schools in certain provinces and by a royal grant of 50,000 thalers for that purpose in the following year. In 1763 the Landschulreglement of Frederick the Great laid down the broad lines upon which the Prussian state has since proceeded, asserting the principle of compulsory school attendance.

Karl Wilhelm von **Humboldt.**—It was not till after the disaster of Jena (1806) that any effective reorganization of the educational system was carried out. One of the first acts of the great patriotic minister vom Stein in 1807 was to abolish the semi-ecclesiastical *Oberschulkollegium,* and to place education under the ministry of the interior with Karl Wilhelm von Humboldt (*q.v.*) at the head of a special section. Humboldt's greatest positive achievement—the foundation of the university of Berlin—lies beyond the scope of this article. But it may be noted that his policy in secondary education is a compromise between the narrow philological pedantry of the old Latin schools and the large demands of the new humanism of the period. The measure introduced by Humboldt in 1810 for the State examination and certification of teachers checked the then common practice of permitting unqualified theological students to teach in the schools, and at once raised the teaching profession to a high level of dignity and efficiency which of itself sufficed to place Prussia in the forefront of educational progress. It was due also to the initiative of Humboldt that the methods of Pestalozzi were introduced into the teachers' seminaries, through them to vitalize the elementary schools. To the period of the national struggle belong the revival. 1812, of the *Abiturientenexamen* (the school-leaving examination) which had fallen into abeyance, and the institution about the same time of the local authorities called *Schulvorstände* for the country and *Schuldeputationen* for the towns.

Though the period which succeeded the peace of 1815 was one of political reaction, the work of administrative organization was carried on by defining the duties of the *Provinzial-Schul-Kollegium* and the *Regierung.* In 1834 an important development was given to secondary education by making it necessary for candidates for the learned professions as well as for the civil service, and for university studies, to pass the leaving examination of the gymnasia. Thus through the leaving examination the state held the key to the liberal careers, and was thereby able to impose its own standard upon all secondary schools.

Administrative Machinery.— In connection with the *Kulturkampf,* or struggle between the state and the Roman Catholic church, the Schulaufsichtsgesetz of 1872 reasserted the absolute right of the state alone to the supervision of the schools. Nevertheless the Prussian system remained both for Catholics and Protestants essentially denominational. All schools, whether elementary or secondary, were Evangelical, Catholic, Jewish or mixed. In the elementary sphere, in particular, recourse was only had to the mixed school (Simultanschule or *paritätische Schule*), where the creeds were so intermingled that a confessional school was impracticable. In all cases the teachers were appointed with reference to religious faith; religious instruction was given in school hours and inspected by the clergy. Under the ministerium in Berlin stood the *Provinzial-Schul-Kollegium,* the chairman of which was the Ober-Prasident of the province, composed of four or five Rate or councillors, generally selected from the directors of Gymnasien. This body was concerned mainly with higher education.

Each province was divided for purposes of general administration into two *Regierungen* or governments, and in each government there was a section consisting of three or four *Schulräte,* which controlled the elementary schools. This council was usually recruited from the ranks of directors of training colleges and from the inspectorate. The Regierung was divided into *Kreise* or districts, and in each district an administrative officer, called the *Landrat,* represented the Government. The *Landrat* was concerned with the provision and repair of elementary school buildings; as regards internal organization, the elementary schools were under the *Kreisschulinspektor.*

In the Protestant districts the inspectors used often to be Evangelical clergymen but later inspectors with pedagogical qualifications and the status of full government officials were appointed. For every school there was a local inspector (*Ortsschulinspektor*), usually the clergyman of the parish, who discharged the duties of local manager and correspondent.

The official classification or grading according to the type of curriculum of secondary schools in Prussia (and throughout Germany) was very precise. The following were the officially recognized types of the pre-war period. I. Classical schools: (a) *Gymnasium,* with nine years' course; (b) *Progymnasium,* with six years' course. II. Modern schools: (a) with Latin (semi-classical)—(i) *Realgymnasium* (nine years' course), (ii) *Realprogymnasium* (six years' course); (b) without Latin (non-classical)—(i) Oberrealschule (nine years' course), (ii) *Realschule* (six years' course).

This system of educational administration still remained in force, with some modifications, in 1927. The differentiation between the types was the result of a natural educational development corresponding with the economic changes which transformed Prussia from an agricultural to an industrial state. The classical schools long retained their social prestige and a definite educational advantage in that their pupils were alone admissible to the universities. Since the foundation of the Empire (1871) the history of secondary education has been largely concerned with a struggle for a wider recognition of the work of the newer schools. The movement received a considerable impetus by the action of the emperor who summoned a School Conference in 1890, at which he criticised the Gymnasien as lacking a national basis. "It is our duty to educate young men to become young Germans and not young Greeks or Romans." New time-tables were framed in which the hours devoted to Latin were considerably reduced and no pupil could obtain a leaving certificate without a satisfactory mark in the mother tongue. The results satisfied neither party and the reform lasted only a single school generation. In 1900, after a second conference, equality of privileges was granted to three types of schools, subject to certain reservations—The theological faculties continued to admit only students from classical schools, the pupils of the *Oberrealschule* were excluded by their lack of Latin from the medical faculties, but in so far as Latin was required for other studies, such as law or history, it could be acquired at the University itself.

Although the official programmes were binding on the schools, their rigidity was not absolute; experiments were possible, but they were carefully supervised. It was thus that the modifications of the classical school programme known as the Frankfurter system came into being, after a similar experiment had been tried at Altona. The chief innovation—and here the two schemes agreed—was the postponement of the beginning of Latin to Untertertia and the introduction of French as the first foreign language. This enabled parents to defer their decision as to the form of their son's education until he was about 12 years of age.

A further instance of the willingness of the authorities to sanction reasonable changes was seen in the permission accorded to certain schools to vary the course of study in the top classes, as a preparation for the freedom of choice of the university.

Girls' Schools.—In Prussia, as elsewhere, the higher education of girls lagged far behind that of boys and received little attention from the State or municipality, except so far as the services of women teachers were needed in the elementary schools. Thus it came about that in Prussia secondary schools for girls were dealt with administratively as part of the elementary school system. After the establishment of the Empire a conference of directors and teachers of these schools was held at Weimar and put forth a reasoned plea for better organization and improved status. The advocates of reform, however, were not at unity in their aims; some wished to lay stress on ethical, literary and aesthetic training, others on intellectual development, and claimed an equal share in all the culture of the age. But even in the schools the women fought an unequal battle, for all the heads and a large part of the staff were men usually academically trained. The women con-

tinually demanded a larger share of the work, and this was secured by the establishment of a new higher examination for women teachers. University study though not prescribed was in fact essential and yet the women had not the right of access to the university in Prussia. They were allowed to take the *Abiturientenexamen,* for which private institutions prepared them, but their admission to the university rested with the professor.

Economic necessity and the growing strength of the women's movement at last brought the desired change. New programmes were issued in 1908, organizing the girls' schools in two degrees: — the *Lyceum,* a ten-class institution for girls from 6 to 16; and an *Oberlyceum* of three classes, of varying types, one of which might be a training department for teachers, another for home life. But apart from these normal courses, opportunity was given to girls to follow from their 12th or 13th year courses similar to those of the higher schools for boys. The form generally preferred was that of the *Realgymnasium.* At the same time a ministerial decree opened the Prussian universities to women on the same terms as men.

Elementary **Schools.**—In no sphere of public activity did the revolution of 1918 cause more far reaching changes in Germany than in that of education. The ultimate aims which these innovations envisaged have been clearly stated in the Weimar Constitution, and have led to a single system of national education. *(See* Leo Wittmayer, *Die Weimarer Reichsverfassung,* 1922.) It was recognized that this goal could only be reached by gradual steps and the responsibility for educational administration was left with the federated states. The State ministries, however, have to observe the principles enunciated in the Constitution and to conform to the Federal laws enacted to secure the realization of the Republic's ideals.

The elementary school, which under the old régime was a class-school, has become a national institution, serving all and used by all. It has no rivals and private elementary schools are forbidden in those early years for which the common school exists. The *Einheitsschule,* which the popular parties had demanded before the World War, has become an accomplished fact, as far as the first four years of the course are concerned. As a concession, reluctantly granted, specially gifted children may be allowed to complete the course in three years. A further regulation of the school service was promised in the Constitution, but has not proved easy of accomplishment, and. the bill of the Federal Government, brought before the *Reichstag* in 1928, met with considerable opposition on account of its wide concessions to denominational principles. In the main, the schools have remained "confessional" and the *Simultanschulen* or schools of mingled creeds have not so greatly increased in number.

When the *Grundschule* (basic school) has been passed the child may be transferred to a secondary school, which is organized to lead on to the university, or he may go to the *Mittelschule,* if he wishes to enter commerce or industry about the age of 16, or he may remain at the elementary school, if he must enter on employment at the earliest possible age. The bulk of the children accept the third alternative, but the number of pupils in all the higher types of general education have largely increased since 1918. Particularly is this true of the *Mittelschule,* an intermediate type similar in purpose and curriculum to the Central Schools of London. With the ending of compulsory military service there has ceased the unnatural thrust towards the higher school not for the sake of learning but to win the coveted social privilege of one year's military service. In point of fact the Realschule, which bore the greater part of this burden, has in some states practically ceased to exist and the greater part of its former clientele now frequent the Mittelschule.

New Types of Secondary Schools. — This does not imply any underestimation of the value of higher education nor of the national gain to be won by the transference of suitable pupils to the higher schools. The pre-war provision was inadequate but the interests of poor but gifted boys have since been well served. Two new types of schools cater for their particular needs. There is first the *Deutsche Oberschule,* in which, in harmony with the sentiment of the Weimar Constitution, the emphasis is laid on the training of a national spirit, and German history, literature and art are all studied from this national standpoint, though foreign languages are not excluded. These schools have replaced, to a large extent, the old institutions which prepared ex-elementary school pupils for admission to the Training colleges for teachers of primary schools.

The other new type is the *Aufbauschule* ("built-on" or supplementary school). As regards its place in the educational scheme it resembles the High School of the United States in that it only receives pupils who have completed the primary school course. In Saxony and Prussia pupils may leave the elementary school after the seventh class, that is at the age of 13 and attempt to achieve in six years what the ordinary secondary school pupils accomplish in nine. There has recently been opened in Berlin an evening gymnasium for adults, who propose in time to sit for the ordinary leaving examination of a classical secondary school, possibly with a view to a further study at a university.

The old types of the nine year schools have been maintained and it is probable that the pressure of modern studies will decrease the numbers of the *Gymnasien.* In the internal arrangement of the curriculum the schools have a larger measure of freedom to adapt the course to the qualities of their pupils, provided that the central subjects which give the colour to the school's curriculum are maintained at the prescribed level. The old ideal of *allgemeine Bildung,* or general culture, demanding equal service in many branches has been definitely abandoned, not without misgiving on the part of many teachers.

Training of Teachers. — The *Grundschule,* being a new institution, calls for a new race of teachers. The work of preparing these teachers has occasioned the greatest breach with the past. In the old days the elementary school teacher was educated, trained and served his course in isolation, without any contact with any other form of education, unless ambition drove him from the normal course. Under the Republic all is changed, the *Präparandenanstalt* and the *Seminar* alike are gone. For his general education the future elementary school teacher attends one of the recognized types of secondary schools. Both Prussia and the Free State of Saxony require the final leaving certificate of such a school, but while the Prussian candidate goes to a special institution, the *padagogische Akademie,* the Saxon future elementary school teacher proceeds directly to the university; the latter course is not without its dangers and it would seem that the open field is likely to leave the elementary school service with its requirements largely unsatisfied. The *padagogische Akademien* though not strictly university institutions are places of scientific study not in the sense that the students will all be preparing themselves to undertake original research but that they will be encouraged to envisage their work in a spirit of freedom and to build up their practice on a broad and scientific basis. Gone are the old days of *Dressur,* the training to mechanical obedience.

Within the schools too there is new life; in the elementary school the pupil is no longer a passive listener: but is a productive worker, for the principle of the *Arbeitsschule* has found wide acceptance. In the secondary schools more and more attention is given to physical development and many town schools have their country stations to which the pupils are taken in turn. The old one-sided emphasis on intellectual training has disappeared.

(A. E. Tw.)

ITALY

The basis of Italy's modern educational system was the Act of 1859. By the Act of 1908 religious instruction was made optional. It has been widely held that the aesthetic and physical side of education was unduly sacrificed to intellectual training. In 1922 Giovanni Gentile became Minister of Education, and by a series of decrees he transformed the educational system. More manual work, singing, drawing, and games were introduced. Efforts were made to brighten the atmosphere in the primary schools by flowers, pictures, more comfortable seats, and open-air lessons. In the secondary schools each teacher was required to teach more than one subject; a combination of mathematics and physics, for instance, was expected to lead to a more philosophical

and less technical treatment. Compulsory religious instruction was restored "in the form established by Catholic tradition," and exemption was granted only where parents undertook to impart it themselves.

Gentile tried to enforce attendance by warnings and fines. But a number of small schools in thinly populated districts were transferred to private hands, and others were closed. The private schools receive a State subsidy. Compulsion is nominally from six to 14, but Henri Goy, an ardent admirer of Gentile's work, declared that in practice the majority of schools are only organized for the four lower classes. The minister decreed a drastic revision of text books, and established a board of censors. There was also a change in the method of transfer from class to class. Whereas formerly pupils were examined by their class-masters to enable them to pass out of a lower class, they are now examined by State examiners to enable them to pass into a higher class or school. The partially elected local education authorities were replaced by regional inspectors and councils, appointed by the Government.

Secondary education, according to Henri Goy, aims at recruiting a limited élite and separating directors from workers. The number of secondary schools and places, therefore, is strictly limited. Special schools are provided for girls of the wealthier classes. There are also "complementary schools," providing a three-year course after the primary school, and the number of these is not restricted, as is that of secondary schools proper.

A State examination is required for admission to the professions, independent of the university doctorate. The universities are closed to primary teachers, but there are training colleges whose university status is recognized. Gentile retired in 1924, but his decrees remained in force.

In the early years of the present century a demand arose for the training of teachers of domestic economy, and for instruction in rural pursuits among peasant women, who in Italy care for silk-worms and fowls, while the men work in the fields. In 1902 an agricultural school with a domestic economy course was opened at Niguardia. Others followed, and in 1911 an infant welfare school was founded in Rome. These institutions were private, but received Government subsidies. Domestic economy is now a compulsory subject in primary schools. (See also MONTESSORI SCHOOLS.) (M. M. G.)

RUSSIA

Education in Russia is markedly less advanced than in Western Europe. Historical, geographical and economic factors have all helped to retard it. Two centuries of Tatar domination effectually checked intellectual progress and isolated Russia from the western world. Peter the Great made the first effort to organize education, but considered it merely as preparatory to a career in the public service, and this opinion dominated Russian thought until the latter part of the 19th century. Education of a scattered agricultural population is always difficult. In Russia, 90% of the population is agricultural, distances are great, communications are poor, and during the spring floods often cease to exist. Summer is brief and hot and demands exhausting and intensive work, so that the economic value even of a child's work is great, while the general poverty and poor cultural conditions make the long, severe winter a time of great hardship. Here, again, the child's help is valuable for the home industries by which the peasant supplements his income. An added difficulty has been the long serfdom of the agricultural labourer (until 1861). Local Zemstvos (founded 1864) and town councils strove to raise educational standards, but were hampered by poverty, by the fact that the village priest was often the only possible teacher and by the neglect of education on the part of the Imperial Government, which considered the higher grades essentially a class privilege. In 1914 the number of children attending school was 53% of those of school age.

War, foreign intervention and famine (1914–21) destroyed schools far and wide, and some 350,000 children from the devastated and famine stricken areas became homeless vagrants. The new Soviet government was thus faced with great difficulties in its efforts to improve education. Its budget was much less than that of 1913 and it was able to allow only 68% of the pre-war grant to education in 1925, the remaining funds being assigned by local budgets or raised from private funds or school fees. School fees for city children were introduced in 1922–23, though rural children paid no fee, and city schools provided not less than 25% of free places (for children of the soldiers of the Red Army, of the unemployed, the crippled, etc). The results of the financial stringency are difficulties in providing equipment and school buildings and the inadequate payment of the teachers. A large proportion of the education grant has to be set aside to maintain homes for destitute children, which, even so, cannot provide for all the child victims of the tragic 1914–21 years. Education is administered by the People's Commissariat for Education (Narkompros), which controls and administers all forms of education, including universities, museums, art centres and schools of music. This centralized government superimposed by a highly westernized and industrialized group upon a scattered and primitive agricultural population living in different regional conditions is a remarkable educational experiment. Outstanding features of the system are its encouragement of teaching in the vernacular, both for adults and children, among the national minorities, its introduction of politics even to the youngest children, its emphasis on the material side of life, its refusal to recognize spiritual values. These latter aspects are a reaction to the difficult material conditions of life for a very large percentage of the population. None the less, according to official reports, considerable progress in the liquidation of illiteracy has been made and a keen enthusiasm for better educational facilities aroused. Kindergartens, children's hearths and playgrounds are provided for a small but increasing percentage of children from three to seven years of age. First grade schools provide for the children of seven to 11 years, though many children of peasants leave school at 10 years to help their parents. In 1925, first grade schools were attended by 59 5% of the children at this age. Second grade schools provide for a general education up to 15 years, and vocational education from 15 to 17 years. In addition there are workers' faculties for children working in factories, some providing part-time day instruction and some providing evening instruction. The number of universities and higher polytechnics has markedly increased, and industrial undertakings must contribute to their support. Schools, clubs, cottage reading rooms and travelling libraries are provided for adults, and art, music and dramatic clubs are popular everywhere. Russian scientific work, notably Pavlov's neurological work and Glinka's soil survey, is of a very high standard, and the researches of the Russian Geographical Society have led to the publication of a remarkable series of regional monographs.

(R. M. F.)

AUSTRIA

The educational system of Austria in the 19th century was adapted to the training of obedient subjects of a nearly absolute monarchy, and an efficient and docile bureaucracy. After the World War and the collapse of 1918, Austria was transformed at one stroke into a small, impoverished, democratic republic, with some two-thirds of her school population in Vienna. Her first education minister, Otto Glockel, set himself the task of training responsible citizens, men and women capable of judgment and initiative. He was himself a teacher, and he based his reforms on three principles: (1) In the lower forms subject matter was not to be sharply divided, but all treated as part of a unit—the child's own experience. (2) The child's familiar world was, therefore, the point of departure: the geography and natural history of its home, local folk-songs and dances, traditions and history. (3) Education was to be creative activity rather than passive receptivity.

Glockel made plans for transforming the pre-war educational system, based on social distinctions, into the so-called *Einheitsschule,* in which the State primary school would be common to all classes, and access to higher education would depend on the child's aptitudes, rather than on his parents' income. He submitted his new primary scheme to the teachers, and in 1920 it

was adopted experimentally. In that year Glockel resigned, and subsequent Governments were hostile to many of his ideas. But he had taken every step in consultation with the teachers, and they showed remarkable initiative in working out his primary school reforms; in 1926 these were finally established for the first five years of school life.

Glockel realized that his secondary school reforms must be built upon the foundation of a reformed primary system. He contented himself, therefore, with sketching a general plan for the *Einheitsschule,* and transforming six former officers' training schools into experimental secondary boarding schools for children of exceptional ability, who were admitted free. Four of these are for boys and two for girls. The Secondary School Act of 1927 does not carry out Glöckel's scheme, but it provides facilities which approximate to the *Einheitsschule.*

SPAIN

Spain's compulsory education act was passed in 1909, but it was not enforced, and, moreover, the age of compulsory attendance was left blank. In 1910 59·35% of the population were illiterate, and in the years following rural schools were continually being closed for lack of funds.

Of recent years single-class primary schools have been giving way to better-equipped six-class schools, and there is a movement for the introduction of modern methods: activity in place of passive receptivity, school libraries. beauty in buildings and decorations. Particularly in Barcelona there has been a strong forward movement. A commission which reported to the city council in 1908 advocated far reaching reforms, which the council accepted, but the proposal to make religious instruction optional was ruled out as illegal. Barcelona, however, has established open-air schools and holiday colonies for delicate, under-fed children; an apprentices' school and continuation school for girls; and a domestic economy school with evening and Sunday classes. During the last five years (1929) 5,000 new schools have been built and the Government proposes to continue at the same rate till the supply is adequate. There are now 33,000 public primary schools; church schools number 17,000. Illiteracy has fallen, according to the latest official returns, to 40 per cent, and in Castile it is only 15 per cent.

In 1926 a series of decrees reorganized secondary education in all districts under the same authorities as the universities. Admission to the secondary school is by examination; after three years a second examination admits to a further three-years' course, leading to matriculation. One-quarter of the total places must be free. Religious instruction is compulsory, unless the parents expressly appeal. There is a State monopoly of school books, and these must be in Castilian Spanish: a severe blow to Barcelona, where the Catalan dialect is in general use, though Castilian is taught. (M. M. G.)

PORTUGAL

A legally regulated system of education was introduced in Portugal by the marquis of Pombal in 1772; a school was to be established in each locality; but the marquis's fall from power prevented the completion of his work. Under the law of 1881, which devolved authority on the localities, schools sprang up all over the country, but the Central Government resumed control in 1890. School attendance became free and compulsory from six to 12 years. After the proclamation of the republic in Oct. 1910 great educational developments were planned. By the decree of March 29, 1911, primary education became secular and compulsory. Each parish was to have at least one boys' and one girls' school, the cost to be shared between the State and the town councils. The disturbed state of the country, however, largely prevented the realization of these educational aspirations, and, according to the 1920 census, illiterates still numbered 1,838,419 men and 2,438,922 women out of a total population of 5,621,977 (excluding the islands and colonies), though efforts are made to enforce school attendance rigorously. In the year 1918-19 there were 7,007 primary schools with 170,415 pupils, and 32 secondary schools. There are also nursery schools (*q.v.*) for children between three and six years. Bursaries are granted for the two years' course at the teachers' training colleges. Portugal has three universities at Lisbon, Coimbra and Oporto, a technical school at Lisbon, and a higher school of agriculture, besides colleges of music and art at Lisbon and Oporto. (X.; C. Br.)

BELGIUM

It was not till 1914 that primary education became compulsory in Belgium. By the act of 1914 free primary education from six to 14 was made universal. Between the ages of 12 and 14 half-time was allowed. The communes may "adopt" and make grants to private schools which reach a required standard and which exempt pupils from religious instruction at their parents' wish. But 20 parents in any commune may demand the establishment of a public primary school. Schools recognized as qualified for adoption receive a State grant. The size of classes in primary schools is restricted to 50. There are special regulations for bilingual areas (Flemish and French).

An interesting feature in Belgian education is the treatment of the religious question. The law of 1842 obliged the communes to provide primary instruction, which was to be free in the case of poor children. Subject to a conscience clause, religious instruction was obligatory. The law of 1879 removed religious instruction from the curriculum, and provided for facilities to the clergy to give such instruction outside school hours. This law evoked a storm of opposition, and within eighteen months the Catholics founded private primary schools with 455,000 scholars. The law of 1884 gave liberty to the communes to provide for religious and moral instruction, subject to a conscience clause, and the law of 1895 made it obligatory. Under the present law, passed in 1914, it is still obligatory, subject to a conscience clause. It is controlled by the clergy, and all recognized denominations have equal rights in the public schools.

Another interesting feature is the development of *l'enseignement ménager*—instruction in domestic and rural pursuits—which is, perhaps, the best in Europe. It is regulated in the primary schools by the act of 1914. Private schools conforming to the required standard receive a Government grant. There are one and two year courses for girls of the well-to-do classes, and a Higher Normal College of Agriculture and Domestic Economy at Laeken, where women are trained, not only as teachers, but as leaders in agricultural activities. For 33 years Belgium has had itinerant agricultural instructors, and there is one itinerant school for each province, 18 in all.

HOLLAND

The outstanding feature of education in Holland is the strength of the private primary schools. The law of 1878 allowed communes to make grants to private schools on condition of their becoming neutral in the matter of religion. The law of 1889 allowed private denominational schools t o receive Government grants, but forbade further grants to such schools by the communes. Of late years there has been acute strife concerning the demand of religious bodies to maintain denominational schools wholly supported by the State, ending in the Act of 1920 which conceded the demand. The result, according to P. A. Diels, was to duplicate schools by denomination, with a frequent loss of efficiency, and to add to the expense incurred by the State. An outcry for economy followed, and teachers' salaries were lowered, while the size of classes, reduced under the Act of 1920, was again increased.

The 1920 act, further, created the Unitary School, and established parents' committees. Compulsory education is from the ages of seven to 13; the age was lowered to six in 1921, but raised again to seven for reasons of economy in 1924. The Government has now introduced a bill restoring the age of six. Child labour is illegal before the age of 14, so that there is a gap of one year in many cases between leaving school and starting employment. Pupils pass from the primary to the higher schools at 12. Admission to secondary schools is by certificate of capacity from the head of the primary school.

SWITZERLAND

Switzerland's education is based on a democratic system of local authorities. The central authority is the canton. The Federal Constitution states that primary instruction must be compulsory and gratuitous; that the public schools must be open to all without prejudice to freedom of faith and conscience, and religious instruction be optional; forbids the employment of child labour before the completion of the 14th year; and rules that all recruits for the Federal army (in which service is compulsory on a militia basis) shall be examined in their 20th year. The Federal authority also controls the entrance examinations for certain professional studies.

The commune is the unit for primary education, covering the years from six to 14. In the primary schools classes are still large; 70 is not uncommon, and nowhere is the maximum below 50. Several communes in combination form a district authority for the support of higher primary schools *(Sekundarsclzulen)*. The secondary schools are maintained by the cantonal authority. Religious instruction in the Swiss communal schools generally follows the faith of the majority; in a few cantons separate schools are provided for minorities if sufficiently numerous.

Attendance at continuation schools is compulsory for apprentices in most cantons; the cantonal authorities frequently delegate compulsory powers to the communes in the case of other children. It is usual to allow two years to elapse between leaving the primary school and entering the continuation school.

SCANDINAVIA

The three Scandinavian countries are closely akin educationally. All three can boast that State education has banished illiteracy. All three, with Denmark in the vanguard, have developed popular adult education in the form of residential people's high schools. The prevalence of co-education, in Scandinavia as elsewhere, is a measure of economy adopted by peoples resolved to secure educational efficiency in spite of limited means.

Denmark. — Denmark introduced compulsory primary education on paper as early as 1739, but the act was not strictly enforced. An act of 1899 limited the size of classes to 35 in the towns and 37 in the country.

The modern State educational organization is that of the Unitary school. Education is compulsory from the ages of seven to 14. Admission to the secondary school is secured by examination. Primary education in State schools is free. In the higher "examining" schools, fees are graded according to the parents' income. Denmark's woman minister of education, Nina Bang, has introduced two new bills: (1) dealing with the training of teachers; (2) limiting the power of the clergy on the local school committees and establishing joint committees of teachers and parents.

Denmark's great contribution to education, her people's high schools, were inspired by Bishop Grundtvig (1783–1872). The early years of the 19th century were a time of national humiliation and spiritual stagnation for the country. The people's high schools, as Grundtvig conceived them, were to give no vocational instruction, to prepare for no examinations; they were to deepen the moral and spiritual life of the students, and to open to them the treasures of national history and tradition, of poetry and thought, and to show them history as the slow fulfilment of a Divine purpose. They were to depend on the living force of the teacher's words rather than on book learning. In 1844 a successful beginning was made with such a school at Rödding by Prof. Flor. Seven years later Kristen Kold established a school at Funen on simpler and more popular lines. He is described in the English Board of Education *Special Reports* as "a sort of rustic blend of Socrates and Pestalozzi." The people's high schools receive State subsidies and are inspected by the State, but no attempt is made to dictate curricula or interfere with their freedom. They are open to both sexes between the ages of 18 and 25; the men as a rule attend in winter, the women in summer. Since Grundtvig's time there has been a departure from the rule of excluding vocational instruction, and much of the success of Danish agricultural co-operation is attributed to the high educational standard of the farming community, thanks to the people's high schools.

Norway.—Compulsory primary education was established by the act of 1889. The children attend from seven to 14 years of age. The size of classes is limited to 35. Norway, like Denmark, has the unitary school. Primary education is free, as also in many cases secondary education. Teachers' councils are consulted on questions of administration, text books, curricula. There is equality of work and pay between men and women. The act of 1927, passed under the pressure of a demand for economy, deals with the organization of schools in thinly populated areas, with salaries and with State subsidies.

Sweden.—The unitary school is not yet an accomplished fact in Sweden, but the royal commission which reported in 1922 recommended its adoption, and parliament has now sanctioned the scheme. Primary education is regulated by the act of 1921. It became compulsory under the act of 1852, and begins at the age of seven. Under the act of 1918 two years' attendance at a vocational continuation school is compulsory and free for children who do not proceed to secondary schools, and the local authorities may add two years more compulsory attendance at the free Apprentices' schools.

The new scheme sanctioned by parliament in 1927 provides for six years' compulsory attendance at the common primary school; and a four-years' secondary course followed by three years at the gymnasium, which leads to the university. The number of subjects studied is to be reduced and more team work on special research is to be encouraged.

CZECHOSLOVAKIA

Like Austria, the new Czechoslovak republic had to transform an absolutist, bureaucratic educational system into one adapted to train a democracy; like Poland, it had to weld provinces with widely different customs and cultural traditions. Besides Czechs, the republic includes German-speaking Bohemia, with a high cultural tradition, and Slovakia, which was more backward and more illiterate, as under the Magyar régime most Slovak-speaking schools had been suppressed.

School attendance is compulsory from the age of six; for Slovakia compulsion was at first imposed for six years only, for the rest of the republic for eight years; in 1928 the eight years' compulsion was legally extended to Slovakia. In the larger towns the primary course is divided into five years at the primary school proper and three at the higher grade school. Children are admitted by examination at the age of ten to the several types of secondary school, with a seven or eight years' course. The law provides for the establishment of compulsory continuation schools for pupils 14 to 16.

Provision has been made for a gradual reduction in the size of primary school classes; in 1933 a maximum of 60 is contemplated. Religious instruction is obligatory, subject to a conscience clause, and is controlled by the various churches. Private schools are recognized by the State, and in Slovakia there are a large number of denominational primary schools. Educationalists aim at transferring these to the State, since a locality is often less well served by two inferior denominational schools than it would be by concentrating all resources on a single efficient public school. Difficulties arose in Slovakia from the fact that many of the teachers were previously Hungarians who did not speak Slovak. All teachers are now required to learn Slovak, but there has been a shortage. only partially made good by Czech-speaking teachers.

In Prague the Czech university dates from 1348 and the German (added to it in the 18th century) was separated in 1882. The republic founded the universities of Czech Masaryk at Brno (Briinn) and the Slovak Comenius at Bratislava. (M. M. G.)

POLAND

When Poland became an independent State in 1918 she had to weld three provinces, with the widely differing administrative systems of three empires: Congress Poland (Russian), Posen (Prussian) and Galicia (Austrian). In Congress Poland education was rudimentary, and even in 1919–20 there was 50% absenteeism among children of school age. Galicia was accustomed to

far greater local autonomy. Posen had enjoyed efficient German administration and showed only 2% absenteeism before the World War; the fact that the rate had increased in 1919–20 was probably due to the effort at abrupt Polonization.

An act of 1920 brought all education under the control of the minister in Warsaw. The communes were responsible for school buildings and the State for teachers' salaries. Education was made compulsory from seven to 14, but the law was not in full operation in 1928. A public school may provide teaching in a language other than Polish where there is a sufficient number of children with a different mother tongue.

All public secondary schools are required by the Constitution to be free. Admission is open to all who pass a qualifying examination at the end of the sixth year at the primary school. Private schools which conform to Government requirements are given equal recognition with Government schools. Many inefficient schools have been compelled to close.

The new State found universities already established at Cracow, Warsaw and Lwow (Lemberg); it has founded new ones at Poznan and Vilna and a Catholic university has been founded at Lublin. (M. M. G.)

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EDUCATION, ARTICLES ON. The main article EDUCATION is divided into the following sections: (1) *Introduction.* (2) *History down to the 19th century.* (3) *Growth of National Systems,* with subheads: England; Wales; Scotland; Ireland; the United States; France; Germany; Italy; Austria; Spain; Portugal; Belgium; Holland; Switzerland; Scandinavia; Czechoslovakia; Poland. (4) *Bibliography.*

For the subject of its curriculum *see* SCHOOL AND CURRICULUM divided as follows: Introduction; Mother Tongue; History; Mathematics; Arithmetic; Science; Geography; Music; Art; Handicraft; Domestic Science; and Religion.

For other articles of a general and particular character *see:* SCHOOLS; UNIVERSITIES; ELEMENTARY EDUCATION; SECONDARY EDUCATION; CLASSICAL EDUCATION; POLYTECHNICS; PHYSICAL CULTURE; COMMERCIAL EDUCATION; EDUCATION AND INDUSTRY; TECHNICAL EDUCATION; WORKERS' EDUCATION; ADULT EDUCATION; EXAMINATIONS; TEACHERS, TRAINING OF; NURSERY SCHOOLS; KINDERGARTEN; MONTESSORI SYSTEM; CO-EDUCATION; BLIND, TRAINING AND WELFARE OF THE; DEAF AND DUMB, EDUCATION AND WELFARE OF THE; MENTAL DEFICIENCY, etc.

For specialized education, *see* AGRICULTURAL EDUCATION; JOURNALISM, SCHOOLS OF; LEGAL EDUCATION; MEDICAL EDUCATION, etc.

EDUCATION, BOARD OF: *see* GOVERNMENT DEPARTMENTS.

EDUCATION, THE UNITED STATES BUREAU OF, established by Congress as an independent department of the Government in 1867 and in 1869 as a bureau in the Department of the Interior, is the principal agency in the United States for educational research, statistics, investigation and general dissemination of information relating to schools. It has no administrative power over State school systems but exercises certain administrative functions in connection with the expenditure of funds appropriated by the Federal Government for the colleges of agriculture and mechanic arts in the States and Territories and is entirely responsible

for the administration of the schools, hospitals and other activities relating to the natives of Alaska. The Bureau of Education had completed (1928) more than 200 formal surveys of school systems, of which 11 have comprised entire States and a considerable number have been national in scope, such as the survey of negro colleges and universities in the United States and the one on land-grant colleges and universities. The most important of its publications is The *Biennial* Survey of Education, a comprehensive statistical and textual review of education in the United States. The bureau possesses the largest and most valuable purely educational library in the United States.

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EDUCATIONAL ASSOCIATIONS. Many educational and professional associations have been formed since the middle of the 19th century; these have done much to co-ordinate methods of education and to organize the teaching profession as a whole.

GREAT BRITAIN

University teachers of Great Britain are represented by The Association of University Teachers (founded 1919) which has a membership of 1,200 and publishes The Universities Review terminally.

In the sphere of secondary education, there are five important associations: The Head Masters' Conference (founded 1869); membership (187) is restricted to head masters of public schools and is revised periodically, regard being had to the measure of independence enjoyed by the school's governing body and the head master, and to the number of resident undergraduates at Oxford and Cambridge who have been educated at the school. The Association of Head Mistresses Incorporated (founded 1874); its membership is approximately 600 and its objects are to support and protect the status of women teachers and to safeguard professional and educational interests. The Incorporated Association of Head Masters (founded 1890), mainly represents the interests of publicly controlled secondary schools, with a membership of 900; like the Association of Head Mistresses, it has a wide influence on school administration; it issues a review terminally. The Association of Assistant Mistresses Incorporated was founded in 1884, to promote the discussion of educational questions and to improve professional status side by side with the cause of education; it has a membership of 8,300 drawn from 1100 schools. The Incorporated Association of Assistant Masters was founded in 1891; its membership, confined to masters in secondary and public schools, totals over 11,300. It is organized in a central body with 75 branches. Its objects are educational and professional. It publishes a monthly journal, *The* A.M.A., and a Year Book; it has also issued many memoranda on teaching methods.

The four major secondary associations set up a Joint Committee in 1916 under the title The Joint Committee of the Four Major Secondary Associations. This Committee, when united action is required, speaks with the authority arising from a combined membership of over 2,100 secondary school teachers.

Secondary teachers in Wales are mainly enrolled in one or other of the four major secondary associations, but there is also the Welsh County Schools Association (membership 148) for headmistresses and headmasters; this publishes The Welsh *County* Schools Review.

Two other associations connected with secondary education are The Association of Preparatory Schools, founded in 1892, with a present membership of 700, all of whom are or have been headmasters of preparatory schools, and an official organ The *Preparatory* Schools Review; and the Independent Schools Association, with a membership of 750 confined to proprietors; its official publication is The Independent School.

There are three main associations connected with technical education; The Association of Teachers in Technical Institutions was founded in 1904 for the advancement of technical education and the safeguarding of professional interests. It has a membership of 2,300 and issues monthly The Technical Journal. The Association of Technical Institutions includes representatives from 175 technical institutes in Great Britain. The Association of Principals in Technical Institutions has 170 members. There is also the Higher Education Section of the National Union of Teachers with a membership of over 4,000 men and women engaged in higher education.

Associations on the administrative side are: The Association of Education Committees representing 270 local education authorities; it publishes a weekly journal, Education, and organizes annually the North of England Education Conference. The County Councils' Association and the Association of Municipal Corporations also have education committees in constant relationship with the Association of Education Committees and these bodies have considerable influence with the Board of Education. The Association of Directors and Secretaries for Education has a membership of 250.

The more important subject associations are: The Classical Association (3,000 members), The English Association (6,000—English), The Geographical Association (4,400—*Geography*), The Historical Association (4,500 members—many local branches), The Mathematical Association (1,700 members—Mathematical Gazette), The Modern Language Association (2,000—*Modern* Languages), The Science Masters Association (1,650 members—School Science Review) and The National Society of Art Masters (1,130 members). Other subject associations are The Art Teachers' Guild, the Educational Handwork Association, the Music Teachers Association and the Secondary Schoolmasters Physical Education Association.

Bodies of a more general order include: The British Association for Commercial and Industrial Education, The British Association for the Advancement of Science, into which has been merged the British Science Guild (17 sections including educational science), the New Education Fellowship (2,000—New Era, with editions in English, French and German), The National Union of Scientific Workers, The Parents National Education Union, and the Workers Educational Association (27,000 members, over 2,000 affiliated associations and nearly 600 branches).

Most of the above associations are affiliated to the Annual Conference of Educational Associations presided over by distinguished educationists and first held in 1913. The Conference has supplied a rallying place for teachers and administrators of all categories and its comprehensive organization gives a free platform for full discussion of educational questions from all points of view. A full report of the papers and discussions is published yearly.

(G. D. D.)

National Union of Teachers. The National Union of Teachers was constituted in 1870. Its principal objects are to associate and unite the teachers of England and Wales; to provide means for co-operation and the expression of collective opinion upon matters affecting education and the teaching profession; and to secure the establishment of an efficient national system of education. In 1936 the Union achieved a record membership with a total of 159,500 teachers of all types and grades: university professors, secondary, primary and special school teachers, fully qualified instructors in handicraft, domestic science and other special subjects, and student members (6,500) in universities and training colleges.

The controlling body of the Union is an annual conference held at Easter, of about 2,000 delegates, representing 638 local associations which, for the most part, are grouped together in 60 county associations. The executive consists of 38 members, directing a large official and clerical staff.

The headquarters of the Union are situated at Hamilton House, Mabledon Place, London, and housed in the same imposing building are two other bodies which are independently constituted and governed, yet are integral parts of the Union. The Teachers' Provident Society, with accumulated funds of £5,750,000, and nearly 100,000 members, offers friendly society and insurance benefits expressly designed to suit teachers; the benevolent and

orphan fund raises about £50,000 annually for charitable purposes. Minor departments are the Union library, its War Aid fund, which raised £250,000 to assist ex-service men and their dependents, and the Thank-offering fund which was established to augment the small pensions of those teachers who retired under pre-war superannuation schemes. The Sustentation or Defence fund has investments worth £1,340,000. The Union publishes its own journal: *The Schoolmaster and Woman Teacher's Chronicle.*

In recent years successful efforts have been made to establish contact and co-operation with teachers in other lands for educational progress and international goodwill, and the Union is affiliated to the World Federation of Education Associations and to the International Federation of Teachers' Associations.

Working in friendly co-operation with the Union are the Educational Institute of Scotland, the associations of teachers in secondary and technical schools, the National Association of Head Teachers and the National Federation of Class Teachers. The two latter organizations include a large number of teachers in primary and central schools who are employed mainly in the principal urban centres of the country and are usually members of the Union. Both bodies hold annual conferences at which educational and professional policies are formulated, generally in harmony with those proposed by the National Union of Teachers. The relations between the Cnion and the Local Education Authorities are now on a very friendly basis, the change in attitude dating from the establishment of national committees to settle the question of scales of salaries for teachers.

(F. W. G.)

INTERNATIONAL CONFEDERATION OF STUDENTS

The International Confederation of Students (Confédération Internationale des Étudiants [C.I.E.]) was founded at Strasbourg in 1919, with the triple object of creating friendship and understanding between the university students of the world. of co-ordinating student activities in all countries, and of studying international questions relating to the material and intellectual life of the students. As its name indicates, it is a federation of the National Unions of Students in the various countries, and its work is carried on in complete independence of political and religious differences.

The Confederation has at present 32 members, the following countries being affiliated: Albania, Austria, Belgium, Brazil, Bulgaria, Czechoslovakia, Egypt, England & Wales, Estonia, Finland, France, Greece, Hungary, Irish Free State, Italy, Latin Americans abroad, Latvia, Lithuania, Luxemburg, Mexico, New Zealand, Palestine, Poland. Rumania, Scotland, Spain, Switzerland, Turkey, Ukrainians abroad, United States of America, White Ruthenians abroad, Yugoslavia.

The practical work of the Confederation is carried on by permanent Commissions, of which the most important are the office of the Secretary-General (Brussels); the international sports office (Paris); and the office for international relations and travel (London), which does valuable work in encouraging and facilitating student travel. Among its most useful activities are the publication of the *Handbook* of *Student Travel* and the control of the international student identity card.

The students of England and Wales are represented in the International Confederation of Students through the National Union of Students of the Universities and University Colleges of England and Wales, a national federation of the Student Unions and Guilds of Undergraduates in the universities. Since its foundation in 1922 the National Union of Students has developed with great success and rapidity and now occupies a position of no small importznce in the educational world. It has largely concentrated on international work of a strictly practical kind. such as the exchange of university students between different countries, the finding of positions "au pair" both in England and abroad, and the organization of educational travel on a very wide scale. In this way it has achieved a large measure of "intellectual co-operation" between members of the younger generation in different countries. Nationally it acts as a co-ordinating link between the various University Unions and promotes discussion on matters of educational interest.

(I. S. M.)

UNITED STATES

Educational associations of teachers for mutual improvement and for the advancement of the profession were formed very soon sfter education became an established policy of the United States snd a system of training instituted through the interest and vision of such leaders as Horace Mann and Henry Barnard.

The United States has no Federal system of education but does have a distinct American system. It has no governmental authority requiring standard courses of study, teacher training, management, methods or finance as in those countries where education is directed by the central Government. The American system, however, has grown up through the zeal and courage of teachers who have formed local educational associations and overstepped State boundaries to join with their co-workers in conference and in educational investigation. These associations have become clearing houses for educational procedure. Teachers have discussed methods, determined failures and successes, and catalogued educational experiences and results. They have listened to addresses from leaders of the profession and have formed investigating committees until educational methods and standards, materials, processes and attitudes have become greatly unified throughout the States and Territories of the Union.

Educational organizations in the United States are local, state, and national in scope. They may also be classified as general and special, according to their aims and purposes. There is scarcely one of the 3,072 counties of the United States which has not its organization and every city has from one to several. Each State and Territory is organized.

Local associations function in the solution of problems which concern their members in their local relationship. Their programmes vary widely—the nature and scope being determined by the size of the group, the extent of its territory, and the energy and initiative of its members and leaders. No single programme can be cited as typical. Professional improvement, teacher welfare, social betterment, and community service are common objectives to which the various types of local associations have found different avenues of approach. Most local associations are affiliated with the state associations and 588 were affiliated with the National Education Association in 1937.

The activities of State associations include: conventions; publications (every State with the exception of Maine and Maryland has an official organ); legislation; research; field service; public relations; teacher welfare; membership promotion; co-operation with the national organization. Every State association and Alaska, the District of Columbia, Hawaii, and Porto Rico are affiliated with the National Education Association. In this connection the States co-operate in national projects, lend counsel on national policies, assist in the enlistment of members in the national, and send official delegates to the conventions of the national.

The most outstanding and influential educational organization in the United States is the National Education Association, organized at Philadelphia, Pa., in 1857, under the title, The National Teachers' Association. It has held annual meetings since that time. The name was changed in 1870 to the National Educational Association and in 1907, by act of the U. S. Congress. the new charter was adopted designating the organization as the National Education Association of the United States. Its general purposes may be considered the objectives of all educational associations in America. "The purpose and object of the incorporation shall be to elevate the character, to advance the interests of the profession of teaching and to promote the cause of education in the United Stales." It includes the National Council of Education and the following departments: Administrative Women; Adult Education; Art Education; Business Education; Classroom Teachers; Deans of Women; Educational Research; Elementary School Principals; Kindergarten-Primary Education; Lip Reading; Music Education; Rural Education; School Health and Physical Education; Science Instruction; Secondary Education; Secondary School Principals; Social Studies; Special Education; Superintendence; Supervisors and Directors of Instruction; Supervisors and Teachers of Home Economics; Teachers Colleges; Visual Instruction; Vocational Education. Other departments may be cre-

ated by organization or consolidation, and departments already established may be discontinued.

Membership in the National organization is voluntary. Due to increased membership, the Delegate Assembly was created in 1921. Educational organizations — state and local — may have representation according to membership in the national body. These representatives participate in the business sessions and in establishing the general policy. Under this reorganization, the association undertook to carry its influence and its support to every teacher in the United States. The membership has been extended from 8,557 in 1918 to over 200,000 in 1937. There were in 1937, 5,700 life members.

The National Education Association is concerned with promoting teacher welfare, through the establishment of retirement systems for teachers, the assurance of tenure of position, and increased salaries. It stimulates beneficial legislation, research, and the general advancement of learning and culture. It has sponsored many of the most forward movements in education. Through its publications advances in educational procedure are given wide distribution. Under its direction, the first World Conference on Education was called in San Francisco in 1923, which resulted in the organization of the World Federation of Education Associations which now numbers in its enrolment about 1,000,000 of the 5,000,000 teachers of the world.

These associations stand as sponsors for the American public school as the foundation of American democracy. They believe in giving every child an opportunity to secure all the education he is capable of receiving and in making universal education a basic principle of the free institutions of the United States.

In addition to the organizations mentioned, there are many other national organizations representing chiefly special interests. Among the general organizations are the American Council on Education, Progressive Education Association, and the American Federation of Teachers. The latter is affiliated with the American Federation of Labor. Other groups include the Association of American Colleges, the National Council of Teachers of English, the National Catholic Welfare Conference, and many others. (O. C. P.)

EDUCATION AND INDUSTRY (including COMMERCE). The problem of the relations of the school to industry and commerce is only part of the wider question of vocational training (*q.v.*), namely that of co-ordinating the preparation for livelihood (specialized training) with the existing preparation for life (general education), and deciding how much or how little of the former should be given in the schools. The wide-spread neglect of the problem till recent time seems all the more surprising, considering the practical bent that has distinguished the English-speaking peoples. The neglect is mainly due to two reasons, both historical.

The first is the comparative eclipse of the idea of vocational training in the university sphere, an eclipse which lasted from the Renaissance till the closing years of the 19th century. In the middle ages the university was predominantly professional and vocational, its principal object being to turn out doctors in theology, law or medicine; the Latin and later the Greek authors studied were mainly regarded as providing the raw material for the technical equipment of the future graduate whatever his faculty. The Renaissance gave a great impetus to the gospel of the value of learning for its own sake, while in England the increasing resort of the aristocracy to the university that dates from the same period tended to overshadow and obscure the more strictly professional character of its work by the new ideal of its being the finishing school of the scholar and the gentleman. Yet in the case of the latter this seemingly general education was in a very real sense vocational. since the culture of the day and the power to handle his fellows (mancraft) acquired at the university were the indispensable stock in trade of a member of the ruling classes. On the other hand the ordinary mediaeval school, apart from certain monastic and a few other schools, was either preparatory to the university or gave a general education, all technical training in the then existing arts and crafts being provided outside the school by a very complete system of apprenticeship (*q.v.*).

It was just this very system of apprenticeship which explains in its turn the absence until recently of the vocational idea from the purview of education below the university. In fact it was only with the gradual decay of apprenticeship since the beginning of the 19th century, and the increased demand for more scientific training for the higher walks of industry towards the close of the same century that the question came to the fore and efforts were made by the technical Education Acts of 1889 and 1891 and still more by the Education Act of 1902 to deal with the problem on a national scale (see TECHNICAL EDUCATION). Today it is realized that it is no longer a problem of technical education pure and simple, to be dealt with as a separate department, but a much wider one of bringing national education in all its stages, primary, secondary and university, into closer touch with commerce and industry without injuring the general education they provide.

GREAT BRITAIN

The main headings under which the relations between the school and industry may be considered both as regards the present conditions and future developments are as follows: — (I) The contact between the two as at present furnished by official or other machinery for placing out the products of the school in industry and commerce. (2) The contact already set up by means of trade and technical schools and colleges. (3) The contact at present existing in establishments of general education.

On many of these points the report of the committee on education and industry (first part 1927, second part 1928) throws valuable light. For certain reasons however, the committee ruled out of consideration what may be called the counting house side of commerce as well as the university's share in the problem.

Official Machinery. — The first attempts to create official machinery for the placing out of pupils dates from the establishment in 1909 of labour exchanges, subsequently known as employment exchanges, some of which contained not only juvenile departments but also juvenile advisory committees. Various legislative modifications have since taken place, and today the work is either carried on by the Ministry of Labour through its local exchanges or else by local education authorities, where they have decided to undertake it through juvenile employment committees. These local authorities comprised in 1935 10 county councils, 49 county boroughs, 45 boroughs and urban councils, while the Ministry of Labour with 197 juvenile advisory committees is responsible for the rest of the country. The Board of Education assists through inspection and advice on buildings and curricula. Advice and information is furnished to boys and girls while still at school, through school conferences or individual interviews. In both cases particulars are collected from head-teachers on the character, ability and physical capacity of pupils on the leaving list. Other features of the work include the interviewing of applicants, the keeping in touch with employers in respect to vacancies. etc., the putting forward of juveniles for vacancies, the keeping in touch with those who have got jobs, generally known as "after care."

Every juvenile employment committee contains a member of the local education committee and normally representative employers, workers, voluntary social workers and teachers. The amount of after-care work by the committees is of considerable value and volume. The number of situations found in 1935 by the Ministry of Labour and the local authorities committees amounted to the impressive number of 764,000. In addition a large number of posts are found by individual elementary headmasters and headmistresses, especially by those of central schools, and the headmasters and headmistresses of secondary schools generally make a point of keeping in touch with employers. Those in or around London have also joint agencies for placing out boys and girls. Broadly speaking, a pupil completing the course in a secondary school has little difficulty in securing a job. In trade schools and technical institutes the finished products are readily absorbed by the business world. In the universities again appointment boards have been established. There is among certain big trading companies a growing demand for men of a university type, especially for posts abroad, where qualities of character and grit are often a paramount consideration. Increasing numbers of scientific and technically trained graduates such as chemists, en-

gineers, biologists, statisticians and the like are being taken on by the bigger firms in this country, though the intake is still far below that of Germany. This tendency is likely to be further fostered by the growing amalgamations and federations in industry, while still more recently the value of the university student (man or woman) has been appreciated by the larger stores where manners and ability to manage large masses of employees are recognized as a business asset. Mention may also be made of the work of the Institute of Industrial Psychology whose tests have proved to be of the greatest assistance in the sorting out of pupils and the prevention of industrial misfits. The Institute has also done some most valuable research with a view to systematizing the haphazard training given in the workshop or counting house and establishing the principle of a scientific technique. It also conducts courses in Industrial Psychology for London University. It provides classes for social workers, engineers and teachers, and trains business administrators and those in executive positions in the application of industrial psychology to their particular trade or industry. Sooner or later its work of scientific selection will doubtlessly be recognized as an indispensable branch of our educational machinery.

Co-operation **of** Education and Commerce.—For the direct contact already established with trade and commerce through trade schools, including those run by certain big firms, day and evening continuation schools, technical institutions and schools of art and agricultural institutes, *see* the appropriate articles on the subject. Reference should also be made to the juvenile unemployment-centres which were started as a sort of "ambulance" class for juveniles temporarily out of work. The need of some sort of compulsion soon made itself felt. The problem was largely insoluble as long as the school leaving age was 14 and the scheme of national insurance only started at 16. Today the gap no longer exists; the school age has been raised to 15, and even when the pupil has been exempted at 14 from attendance, he at once comes under the insurance scheme as the qualifying age has been reduced to 14 by the acts of 1934 and 1935. The raising of the compulsory age to 15, has by no means settled the problems of adolescence and it still seems that the part time continuation school provides the best solution for its problems. It would be far less costly than raising the compulsory age of the full time school to 16. It would bring the school and workshop into far closer and more fruitful contact than the full-time school can hope to do. It would certainly be more popular with employers (*see* below) and by combining earning and learning makes a special appeal to the young worker and his parents. At present a good deal of the commercial and technical (including artistic) equipment of the elementary or secondary ex-pupil is provided in the evening by the Junior and Senior Commercial Education and the Junior technical and Senior technical Institutes (*see* COMMERCIAL EDUCATION). Probably in no country in the world is there more evening work, ranging as it does from simpler courses in the rudiments of commerce and technology to preparation for the higher walks of commerce and industry, and including university work and even postgraduate research. But the whole is run on a voluntary basis and the leakage especially in the lower grades is, owing to various causes, considerable. It also leads to a good deal of overpressure owing to the long hours of business of many of the students, while in rural districts the problem is further complicated by the difficulties of travelling.

As regards its relations with the elementary school, criticism from the business world of the latter has certainly decreased. Taking the elementary school as it is, the main improvements that seem feasible appear to lie in the provision of more handicraft and domestic work and in some cases a closer relation of the school instruction to the pupils' environment in industrial or rural districts (*see* RURAL EDUCATION), with visits to factories, farms and places of business by the children still at school. One of the most promising developments in this respect has been the policy, especially in East Suffolk, Norfolk and Northumberland, of utilizing more fully the rural environment to provide a basis for the teaching of science and a bias to the curriculum generally, especially in senior and non-selective central schools. It is at long last being realized that of all the books at the disposal of the country child the book of nature is the best, while the slow-motion film of the seasons is most valuable.

The selective central school, especially in the towns, with its technical and commercial bias seems to have established a substantial contact with the business world, which is however capable of further extension. The secondary school, as pointed out elsewhere, incidentally gives in the English, Arithmetic, Geography and other subjects that it teaches a good deal of the technical equipment the pupil will require in commerce and to some extent in industry. Only 15·7% of its pupils enter industrial occupations, of whom only a fraction (1·7%) take up rural occupations as against 43.1% who select professional, commercial or clerical callings. From the point of view of industry and commerce it is clear that a widening of the present form of the school certificate is desirable especially in relaxing the two rigid conditions on which it can be obtained (*see* also EXAMINATIONS), but one is convinced that the necessary elasticity can alone be obtained, when a candidate will be obliged to take only two compulsory subjects (English and Arithmetic) and can select with the consent of his teachers any others on the prescribed list most suitable to his ability. At present a large number of pupils never reach the examination at all. The percentage of failures is exceedingly high, while of those who pass a good many only qualify through the misplaced charity of the examiners. These passes "of no par value" are of no real use to the pupil or to the business man who has been driven to demand the matriculation certificate which does not always test the knowledge he requires from those who desire to enter his office. Ultimately the examination should be so reconstructed and enlarged as to be capable of being taken in their stride, not only by the ordinary secondary pupils but by those of the remodelled central and the newly projected secondary technical schools (*see* below).

Recurring to the secondary schools, it is interesting to note that there is a growing tendency for pupils who have passed the certificate to enter trade and technical schools, and this should increase in the future, while as regards commerce, not only many secondary schools but public schools, like Mill Hill and Rugby, have introduced an element of commercial education into their higher classes and the movement is growing. It is worth noting in this connection the foundation of a Public Schools Business Society in London for helping the public schoolboy to adapt himself to the often unfamiliar conditions of commerce. There is plenty of room for creating similar societies for other types of schools. It has been already indicated that the universities are sending an increasingly larger number into commerce and industry. In some universities the training for the future entrants into the higher walks of commerce is insufficient, especially in usefulness to those who are to specialize in modern languages with a view to going abroad later on. These courses are organized on a narrow linguistic basis rather than the broad cultural one which such candidates really require.

Conclusion.—In spite of much progress in the past, much still remains to be done. While the value of the school has steadily risen in the opinion of the more enlightened members of the business world, a large number of industrialists and traders are still largely unacquainted with the work of the school. To bring the two parties closer together the Ministry of Labour appointed in 1928 two national advisory councils (one for England and Wales and another for Scotland), which have also produced several valuable reports, notably one on courses for the unemployed. Help has likewise been given in the matter by the United Chambers of Commerce. Valuable work has also been done by the British Association for Commercial and Industrial Education, an amalgamation in 1934 of two Societies which were severally interested in industry and commerce. They have either separately or together made some very valuable enquiries, especially into the question of instruction in modern languages (report 1935), and into vocational education after general education up to the age of 16 (report 1936). One very important point emerged from this latter enquiry. A questionnaire which was sent out to the business world elicited some 348 replies. Nearly 50% favour

part-time vocational courses for all classes of workers against about 8% who preferred full time courses—a highly significant indication of the employers' belief in this type of vocational education. Thanks to the Association and other bodies a certificate of efficiency has been established by the Board of Education in the various branches of technology. It has been distinctly successful in the engineering and electrical trades, but less in the chemical and building industries for the simple reason that the possession of a certificate does not exempt a successful candidate from any of the examinations of these latter bodies. The remedy is obvious.

Further Outlook.— Probably one of the most potent ways of furthering commercial and technical education would be to regard the selective central school and the proposed improved trade school (suggested title—technical secondary) as equally important parts of the intermediate state (11+ to 16+) in the national system of education. This would involve the gradual raising of the selective central school in staffing, amenities and salaries to the status of the ordinary secondary school and the extension of the school life and curriculum of the present trade school, (1) by starting the course two years earlier at 11+ and prolonging it to 16+, (2) by reinforcing the proportion of general education, making the instruction in the first two years of the course general and increasing and combining the general subjects more closely with the technical instruction. Instances already exist. The Walthamstow Central School has had its status raised in this fashion. The new Technical Institute at Dagenham contains a day school for pupils from 11+ to 16+ in which the curriculum fulfils the conditions enumerated above, while the Gate House School at Leicester is largely organized on these lines.

The prospects of commercial and technical education have never been brighter, especially in view of the present boom in trade and the intense demand for skilled workers, but there is one lion in the path which has yet to be faced,—the colossal cost of providing adequate technical training for all the various groups of industry and commerce throughout the country. Great as has been the advance of technical education in the past, there are obviously a large majority of business callings which are only imperfectly if at all catered for under the existing provision of technical education. Possibly the cost can only be satisfactorily met if all the main trades and industries of the country both from the side of employers and of trade unions arrange to make some definite financial contribution to the national exchequer in return for the benefits received by their own particular industry.

(C. BR.)

THE UNITED STATES

A study of the educational literature of the last half century reveals that the evolution of American education is rapidly tending toward a proper balance of the cultural and vocational objectives over which there has been so much strife in past decades between the proponents of general and practical education. Progressive leaders in the general education field now insist upon adequate provision for the practical education of all persons seeking occupational preparation, and the ablest vocational educators with equal emphasis insist that all persons seeking vocational preparation should first secure the most thorough fundamental general training which the capacities and resources of the trainees will permit. This balance is being accepted uith a full recognition of the principle that educational adjustments must be made to fit individual needs to the extent that these do not conflict with society's interest in that general education which is essential for the common good of all citizens.

Occupational statistics for the United States indicate clearly that population is shifting from rural to urban centres and that the number of workers in industrial occupations is greatly increasing. This new economic development has brought with it a vigorous demand for industrial education. This demand is being met by both public and private agencies and is resulting in the industrial enlightenment of the general population along two lines, (1) consumption and (2) production.

Education for consumption is largely supported financially through the advertising campaigns of manufacturers who make products of commercial value which satisfy popular wants. In the best elementary and some secondary schools, however, school children are now being taught in carefully prepared lessons the true value of products offered the public to satisfy the desire for food, clothing, shelter, recreation, transportation and other necessaries. This early education in the grades also serves to introduce children to certain general aspects of industrial life and is further strengthened in later grades by handwork courses which develop muscular skill. Interest is also stimulated in the study of occupations through formal courses in the junior high school years and in the practical work of try-out laboratory courses which provide experiences typical and representative of community occupations to adolescents who, in many cases, are seeking early induction into industrial occupations. The steady discharge of juveniles 14 years of age and older from the schools into industry, whether caused by necessity or lack of interest in school work, has led to the further provision for a public guidance and placement service in many American cities, in order that working children may make better occupational adjustments than would be possible for them were they to seek work unassisted. In such communities continuation schools (q *v.*) usually exist to give young workers 14 to 16, 17 or 18 years of age (as the State laws may require) further vocational and civic training on a part-time "learning while earning" programme, which calls for four to eight hours attendance weekly at these schools. This schooling aims to make economic and civic adjustment more satisfactory and certain than is possible when such children drift about in juvenile jobs without any educational guidance whatever.

Great variety characterizes training for productive efficiency. Public senior, technical and co-operative high as well as continuation schools give both trade preparatory and trade extension courses in their day and evening classes for the more well defined trades of industry. While public secondary schools for both part and full time pupils have shops in which to give practical training in the more common occupations, it is, nevertheless, an accepted principle of vocational education, that the most effective practical instruction is given on the job in industry. Such practical training may embrace any practical instruction, requiring in some instances only a few days or even hours to master, as in highly and narrowly specialized operations, or as much as five years in some of the very complex all-round trades. Industry provides the short-time training in vestibule schools and the all-round trade training through apprenticeship under indenture agreements with the trainee. The public day and evening vocational schools give such trainees the necessary related theoretical training.

Private industrial initiative, however, since 1916, has greatly extended educational opportunity in industry. In the larger industrial corporations of international reputation extensive industrial training of workers and executives (see also EMPLOYEES, TRAINING OF) has been undertaken in the form of foreman training classes and corporate trade and engineering schools. One of these, the General Motors Corporation, has established the Institute of Technology at Flint, Mich., to which co-operative engineering students from the many units of the corporation are sent in alternate months for engineering training to supplement the practical instruction received by them in the shops of the units sending them. So great is the need for industrial education on all levels of maturity that even the units of this corporation make use of available training agencies other than their own. Thus, the Frigidaire Corporation, a General Motors unit at Dayton, O., for example, sends co-operative students not only to the institute at Flint, but also to the University of Cincinnati and Antioch college in Ohio and augments this effort further by co-operative relations with the technical high school of the city of Dayton. The Ford Motor Company and the Westinghouse Electric Manufacturing Company are other notable examples of the many other large corporations which have established training organizations to meet their own industrial needs. Industrial requirements are further satisfied by absorbing engineering and technical graduates from State and private universities, where the entire training effort is confined to the class and laboratory work at the univer-

sities. Such graduates, however, seldom find their places in industry without first serving supplementary apprenticeships following their graduation from the universities. Such apprenticeships usually run from one to two years. Students at these universities are usually recruited from the graduates of technical high schools.

Finally, it may be said that the educational opportunities in the United States have been extended and developed to that point where, through public, private and corporate schools, a flexible system now obtains which meets the nation's demand for a citizenry well grounded both in the common essentials and those specialized occupational skills or abilities which ensure economic efficiency. (W. F. R.)

EDUCATION IN ANIMALS. In some birds and mammals it has been observed that the young receive parental education. This varies in its detail in different cases, for it may be little more than the supplying of a liberating stimulus or an incentive to action, while in more complicated expressions the education amounts to careful training in the way in which certain things should be done. It is advantageous in lessening the time required for learning by individual experiment, and in lessening the risks of this self-education. Moreover, there is some profitable handing-on of the gains of parental experience—a simple form of extra-organismal heritage.

To begin with simple cases, we may notice how a dabchick, with its young ones on its back, depresses itself in the stream and thus forces them to begin to learn to find their way about in the water. A grebe has been seen ducking one of its offspring, as if accustoming it to immersion. The great crested grebe often dives after fish while carrying the young ones on its back, and they soon learn their lesson. Although young birds do not require to be taught to fly, the parents may force or encourage them to make a beginning, sometimes tempting them with food. A guillemot may push its young one off the brooding-ledge on to a slope leading steeply to the sea. T. A. Coward notes that "a more usual method is for the old bird to seize the unfortunate by one wing, and, flying out with it until clear of surf and rocks, let it drop." The young bird opens its wings and flutters. It takes its first flight, diagonally down to the sea, where it also takes its first, somewhat compulsory, dive, and follows this by beginning to swim. It is waited on by its parents or by one of them, and gets some help with its meals until it is able to fend for itself. There are several similar cases well authenticated.

Some kinds of education take the form of graduated meals, as has been observed in birds of prey. From prepared pieces of flesh, to begin with, the nestlings are gradually trained to tackle more or less intact booty. L. J. Hobhouse refers to the expertness shown by some young woodpeckers in getting at the seeds of fir-cones, but he points out that the parent woodpeckers bring their young ones first the seeds themselves, then partly opened cones, and finally intact ones. "The method of preparing the family dinner is at least as much a tradition as an instinct." It is the outcome of both teaching and learning.

Among mammals the instruction is almost always on the mother's part. The carnivore often brings a living captive to the den and sets it free in presence of the young ones. This serves as a liberating stimulus to instinctive capacities, but it also affords some training. In many cases, *e.g.*, foxes and stoats, the mother takes her offspring with her on her hunting expeditions, and they gradually learn their business. The instinctive basis is, of course, present, but its exercise under maternal control may continue for months. Tregarthen describes circumstantially the detailed instruction given by the mother otter to her cubs. It includes the long alphabet of country-sounds, the fit and proper ways of diving and lying perdu, the methods of capturing different kinds of booty, and the recognized ways of eating trout, eel and frog. It may be safely said that too little attention has been given to the factor of education in developing animal behaviour. *(See* also PSYCHOLOGY, COMPARATIVE.) (J. A. TH.)

END OF SEVENTH VOLUME

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